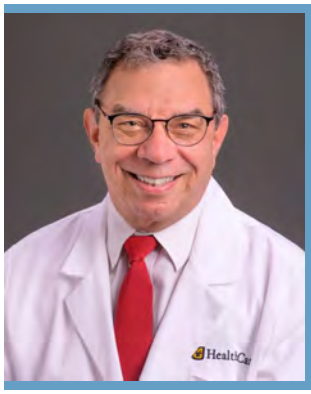
Missouri Health

Volume 1:2

September 2024

Editorial Leadership

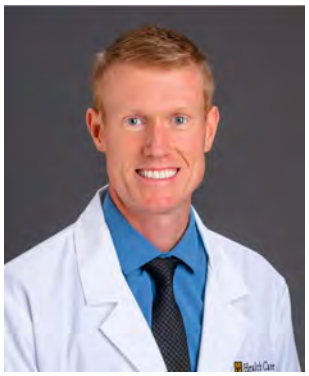
University of Missouri-Columbia
School of Medicine



Founding Editor
Richard J. Barohn, MD

Executive Vice Chancellor,
Health Affairs

Hugh E. and Sarah D. Stephenson
Dean of School of Medicine



Editor-in-Chief
W. David Arnold, MD

Executive Director,
NextGen Precision Health Initiative

Professor of Physical Medicine and Rehabilitation, Neurology and Medical Pharmacology and Physiology

Associate Editor
Bettina Mittendorfer, PhD

Director, NextGen Precision Health Clinical and Translational Science Unit

Senior Associate Dean for Research

Associate Editor
R. Scott Rector, PhD

Director, NextGen Precision Health Building

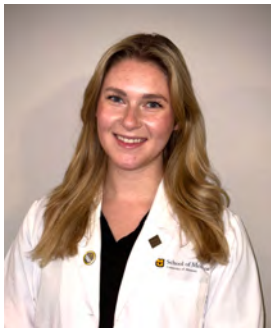
Associate Dean,
Basic Sciences and Research Infrastructure

Managing Editor
Jay Devineni

4th year medical student
Class of 2025

Managing Editor
Sabrina Genovese

3rd year medical student
Class of 2026



Managing Editor
Anne Marker

3rd year medical student
Class of 2026

Managing Editor
Daniel Cho

2nd year medical student
Class of 2027

Managing Editor
Ayan Farah

2nd year medical student
Class of 2027

Editorial Review Board

University of Missouri-Columbia
School of Medicine

Table of Contents

About the Cover

Marie Nau Hunter

Deputy Director
Museum of Art and Archaeology
University of Missouri-Columbia

On front, from the permanent collection of the Museum of Art and Archaeology, University of Missouri: Keith Crown (American, 1918-2010), Jesse Hall Dome in Scaffolding, ca. 1982, Etching on paper, Gift of Patricia Dahlman (94.11)

Jesse Hall Dome in Scaffolding depicts the renovation of Jesse Hall's dome that began in 1981. The renovation included new slate for the dome, installation of tempered windows and reinforced beams, a fresh paint job, and a new ball atop the cupola. Known mainly for his brightly colored abstract watercolor paintings, artist Keith Crown demonstrates his artistic range as well as his interest in scenes of Columbia and campus in this etching. Crown retired in Columbia along with his wife, Pat, who taught for years in MU's art history and archaeology department. The Museum of Art and Archaeology holds several works and many sketchbooks by Crown in its permanent collection.

More information about the Museum of Art and Archaeology, located in the heart of MU's campus with regular hours and free admission, is at maa.missouri.edu.

About this Issue

Jay Devineni

Managing Editor
Medical Student Editorial Board
Missouri Health

On April 10, 2024, we published the inaugural issue of *Missouri Health*, a new open-access medical journal dedicated to showcasing high-quality student research and decreasing barriers to publication. In that issue, we published the abstracts that were accepted to the 2022 Health Sciences Research Day, an annual research symposium that is organized by the MU School of Medicine Research Council, in conjunction with the MU School of Medicine and MU Sinclair School of Nursing.

The second issue of this journal has been a decidedly more ambitious effort. In addition to featuring the abstracts from the 2023 Health Sciences Research Day, this installment will showcase accepted submissions from six other research symposiums that were organized by the University of Missouri or heavily featured the work of students from the University of Missouri. This includes the inaugural NextGen Pathways Symposium in 2024, Ellis Fischel Cancer Center Research Day 2024, the 2024 Annual Dialysis Conference, the 2024 CoxHealth Annual Research Conference, the 2024 Annual Mercy Research Colloquium, and the 2024 Rural Scholars Community Integration Project Poster Showcase. We are also honored to have the organizers and supporters of these events each contributing an editorial to introduce the abstracts that will be featured.

But before we dive into all of the phenomenal work that has been presented at MU over the past year, we'd be remiss if we did not first take a step back to reflect on why the presenters being featured entered the fields of medicine and research in the first place. To that end, we are proud to begin this issue with the words of our founding editor, Dr. Richard Barohn, whose speeches to the incoming first-year medical students, the incoming first-year residents, and the incoming PhD students entering the MU School of Medicine's Translational Biosciences Graduate Program are featured on the next several pages.

Stethoscope Ceremony for incoming medical students, Class of 2028
University of Missouri School of Medicine
July 31, 2024

Comments by Richard J. Barohn, MD

Executive Vice Chancellor for Health Affairs
Hugh E. and Sarah D. Stephenson Dean, MU School of Medicine

Let me say a few words about the symbolism of the stethoscope ceremony. The stethoscope is a tool. (Dr. Barohn takes out his stethoscope). It is a tool that you will have the opportunity to become an expert in using as a physician. It is a sign of your potential technical skills as a physician. You will get much better at using it every day of your training and throughout your career. You will be taught how to use it optimally, and then you will come up with your own ways to become proficient at using it!

Stethoscopes have evolved from the early ones developed by Rene Laennec. (Dr. Barohn shows an antique stethoscope). Here is an early version that looks very little like the modern stethoscope you will receive today. I used a modern stethoscope a lot early in my career (not the Laennec version!), and then when I became a neurologist, it was important to use it in evaluating stroke patients to listen for carotid bruits and heart murmurs. But now, I do not use a stethoscope very much. In my subspecialty as a neuromuscular neurologist, it is not as useful. The tools that I use on nearly every patient I see for neuromuscular disorders is a reflex hammer and a 128hz tuning fork (Dr. Barohn shows a reflex hammer and tuning fork). I am really good at using these tools thanks to years and years of practice and experience. I even wrote a textbook on how to use them!

As you progress through your training and career, you will find an area of technical expertise that you enjoy and are good at. It could be the use of a scalpel, or how to read an MRI image, or how to use a laryngoscope to intubate patients, or how to use a dialysis machine. The point is that you are now entering a profession where you have a unique opportunity to become a technical expert in a health care area and the tools associated with that area. For me, this is one of the major points

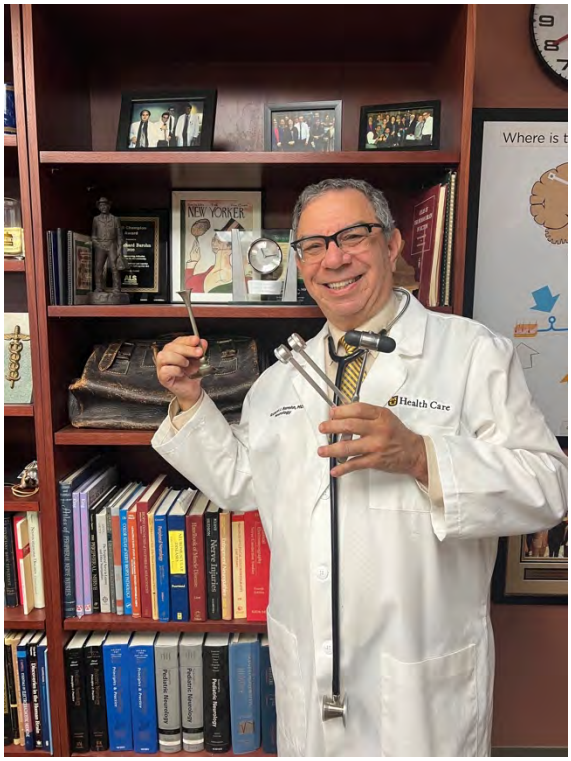
I want you to think about during today's stethoscope day ceremony: the stethoscope is your first tool you learn how to use on your way to becoming physicians.

However, being technically proficient in a health care area is only one part of becoming a physician. It is not the only part. Another part is to develop the ability to become empathetic with your patients and their families. Empathy and compassion are at the forefront of our patient-centered care curriculum. I really believe that, beyond the knowledge and skills you will learn during your training, what will be most important is the **empathy and compassion** you show patients in every encounter. Having empathy and compassion will not only make you a better physician, but also make your journey a rewarding labor of love.

The White Coat Ceremony, which will happen on Friday afternoon, I believe is a symbol of that empathy and compassion needed to be a successful physician.

The white coat signifies a compact, a contract, an agreement, a commitment – to knowledge, mutual respect, and shared humanity. The white coat also represents the compassion and respect a physician must have for each and every patient. Let me emphasize: The white coat symbolizes the humanity and compassion that you have in your approach to your role as a physician. I have loved my medical journey over the last 50 years. I wear my white coat with pride, and I know you will, too. I truly hope that you will cherish this opportunity and embrace the medical profession as I have, and as have many of your future teachers and our alumni who are here today to see the launch of your medical careers.

I look forward to watching your journey over the next four years and celebrating with you as you walk across the stage in Jesse Hall in 2028. Best wishes!



Dr. Richard Barohn (right), holding the medical instruments (also featured above) that he referred to in his speech.

Class of 2028 White Coat Ceremony
University of Missouri School of Medicine
August 2, 2024

Comments by Richard J. Barohn, MD

Executive Vice Chancellor for Health Affairs
Hugh E. and Sarah D. Stephenson Dean, MU School of Medicine

Welcome, Class of 2028 to the 2024 White Coat Ceremony!

Welcome also to family members and guests. This is an exciting day that you will long remember. At the stethoscope ceremony earlier this week, I emphasized that the stethoscope is a tool that symbolizes your technical competence. I also told you that as a neurologist, I often don't use the stethoscope as much as I used to, but use other tools, such as the tuning fork and reflex hammer. Each field of medicine has its own technical skills that one needs to acquire, such as the use of a scalpel, how to read an MRI image, how to use a laryngoscope to intubate patients or how to use a dialysis machine.

I believe the significance of the white coat ceremony is very different from the stethoscope ceremony.

The white coat signifies a compact, a contract, a commitment – to knowledge, mutual respect, and shared humanity. The white coat also represents our compassion and the respect that a physician must have for each and every patient. The white coat symbolizes the humanity and compassion that you have in your approach to your role as a physician.

This reminds me to mention how *I* see the difference between empathy and compassion.

Empathy is the ability to be *aware* of and having deep feelings about another's situation. When we are empathetic, we actually feel the person's pain. Compassion builds on empathy and is actually doing something about it. Compassion builds on empathy—in addition to feeling another

individual's suffering, when you are compassionate, you step back and you consider how you can actually help that individual and you act on it. As a physician, every day, you should be experiencing empathy and performing acts of compassion.

I wear my white coat with pride, and I know you will, too.

What are the origins of the white coat ceremony? Dr. Arnold Gold was a teacher and pediatric neurologist at Columbia University's College of Physicians and Surgeons in New York. In 1991, he and his wife created commencement awards at Columbia for faculty members and students who best demonstrated humanistic care and clinical excellence. Today, the White Coat Ceremony is repeated across the country in more than 100 medical schools.

Its purpose? To provide medical students with guidelines regarding the expectations and responsibilities appropriate for the medical profession as they embark on their journey to become physicians.

Dr. Arnold Gold died in January 2019, at the age of 92. As part of his legacy, the Arnold P. Gold Foundation established the White Coat Ceremony to highlight the importance of humanism as the core of health care, providing an important emphasis on compassionate, collaborative, and excellent care from the very first day of your training. As part of this ceremony, each of you will be taking the Oath of Geneva; Dr. Gold felt the most important element of this ceremony was to take the oath and acknowledge your obligation of caring for the patient.

I encourage each of you to acknowledge the historical role of the physician: to respond to human need. No matter how good our science, the human need will still remain. Even with the best technology, technique, and pharmacology, physicians will always be responsible for responding to human need.

I learned during medical school and residency training that what I enjoyed most was caring for all ages of people who had a variety of neurology-related problems. I found meaning in addressing the challenges of my patients and the value I could offer to help them navigate, in some cases, extremely difficult health situations. My career has been enriched so much by knowing that the care I provided to these patients and families, coupled with my quest to find better therapies as a researcher, has made a difference. I am proud to say that even today, as a busy administrator and dean, I still find time to see patients in clinic and even make occasional house calls to patients so ill or weak that they cannot come to the medical center to see me. I learned long ago, and you will be learning over the next decade of your career, that the healing and comfort you can offer makes a world of difference to your patients. And it makes a world of difference to how you feel about being a physician.

New resident orientation
University of Missouri School of Medicine
June 24, 2024

Comments by Richard J. Barohn, MD

Executive Vice Chancellor for Health Affairs
Hugh E. and Sarah D. Stephenson Dean, MU School of Medicine

Good morning. I am thrilled to be here to offer my congratulations on reaching this pivotal milestone in your medical education journey. As you begin your residencies here at the University of Missouri, let me share some thoughts with you.

In the day-to-day grind of being a first-year resident, it is easy to lose track of what it means to be a physician. Therefore, don't forget that being a physician is truly an important, service-oriented profession. Yes, it is a big deal to be a doctor. I know your parents tell you that all the time! But you need to believe it, too. The purpose in your residency is to learn how to help others.

Your residency marks a significant shift in your medical training. You are officially a physician, immersing yourselves in the clinical environment and gaining hands-on experience in the care of patients. This transition from medical school to residency is exciting, but also can be overwhelming. The patient-care encounters you will have in your residency will have an immense impact and shape you into the physician that you will become.

Let me tell you about an experience I had as medical student that was influenced by an intern I was working with.

One of my first patients, Mr. Fasone, had lung cancer. He was a heavy smoker, and he did not have long to live. I have this vivid memory that when he was discharged from the hospital, he had no way to get home. I was working under a wonderful intern, Dr. Barbara McKirnen. I don't know what happened to Dr. McKirnen after her training. But I remember that she drove the patient home

to his house in downtown Kansas City, and I rode with her. He got out and was greeted by his wife and children. They had no car. As we left, the children said "Goodbye, Dr. McKirnen!" I remember thinking, "WOW. This is a big deal—to be helping this family in this way."

Therefore, I guess the message I want to give you from this story and from my career as a physician is to embrace three key principles: humility, curiosity, and compassion.

Humility is so important because it reminds you that you as a physician do not have all the answers. You need to be receptive to guidance from your mentors and peers.

Curiosity is the fuel that drives progress in medicine. I suspect many of you chose the path of medicine—like I did—because you had this idea that medicine would lead you to pathways for discovery of new things. By actively engaging in your patients' care, you will hopefully become extremely curious about everything involved in the patient encounter—from pathophysiology, to why a particular drug is effective, to how do we arrive at our medical decision-making process. You will be involved in high-level discussions on rounds and in conferences—and simply in the hallways with other residents and your faculty, and—yes—your medical students. Take advantage of these opportunities to think big.

And finally, compassion, I believe, is at the heart of medicine. It is the ability to see beyond the illness and recognize the humanity in each patient. As you interact with individuals from diverse backgrounds, remember that behind every diagnosis is a unique story. Compassion and empathy have the power to make a significant difference in the lives of those you care for. The gesture of compassion that Dr. McKirnen showed to drive Mr. Fasone home to his wife has remained with me for 50 years. It is a great example of the point I am trying to make. This reminds me to mention how I see the difference between empathy and compassion.

Empathy is the ability to be *aware* of and have deep feelings about another's situation. When we are empathetic, we actually feel the person's pain. Compassion builds on empathy and is actually doing something about it. Compassion builds on empathy—in addition to feeling another individual's suffering, when you are compassionate, you step back and you consider how you can actually help that individual and you act on it. As a physician, every day, you should be experiencing empathy and performing acts of compassion.

In addition to these guiding principles, I want to offer this practical suggestion to help you thrive during your residency: Be organized and be on time. With numerous patients, responsibilities and deadlines, effective time management is critical. Do not be late for conferences and rounds. It gets noticed if you are. Develop a system that works for you to make the most of your time.

Also, don't forget to read, read, read. I know you don't read from physical textbooks as much as my generation did. But from whatever online source you are using, read as much as you can, and as deeply as your time allows on each patient that you encounter. While you do learn an incredible amount simply from the act of caring for a patient, it has to be supplemented with written information. Find time to read non-medical books—novels and non-fiction. I still make this a daily habit, and I believe it makes me a better physician and a better human being.

Finally, I know you are prepared for a year in which you will be working very hard. I want to emphasize this. It has been my experience that when moving into a new role, that is the hardest you have ever worked in your life. You experienced that in your first year of medical school. You will experience that in your first year of residency. I know I did as a PGY-1 medicine intern at the large Air Force training hospital in San Antonio before I did my neurology residency. I felt like everyone was smarter than me and that I was not prepared. Even though I was—and you are, too. You will experience it again when you get your first job after completing your training.

I have always thought the hardest I ever worked in my life was the first year I became a department chair. But that was before I became a dean!

But the hard work is the most rewarding work. Along with it comes a huge sense of not only satisfaction, but personal development and growth. So please make the most out of this year and learn all you can from your daily experiences. At the end, you will become a better physician.

Best wishes on your journey.

Welcoming comments to incoming PhD students
MU School of Medicine Translational Biosciences Graduate Program

Comments by Richard J. Barohn, MD

Executive Vice Chancellor for Health Affairs
Hugh E. and Sarah D. Stephenson Dean, MU School of Medicine

You have chosen an outstanding program in the Translational Biosciences Graduate Program.

This is a very important educational program, housed within the School of Medicine. The program is unique in several ways.

Traditional PhD programs train students in one specific area of expertise and are often based within individual departments.

Our program is not based at the department level, but instead leverages all 23 academic departments in the School of Medicine.

In addition, our program is truly translational. Translational research is often divided into at least four types of research:

- T1 research usually refers to preclinical research, in-vitro or in-vivo, often with animal models.

- T2 research is research in humans. This can include first-in-human clinical trials and later phase clinical trials with drugs and devices. It also can include observational and natural history studies.
- T3 research is outcomes research. It takes the findings from T2 translational research, often from randomized controlled trials, and leverages that data to assess actual outcomes. Often,

this can be in the form of clinical effectiveness research studies, which compare one type of health care intervention to another that had previously been studied at the T2 phase.

- Then there is T4 research, which is population-based research.

- Sometimes two additional translational research categories are referred to: T0 research often refers to very basic research that does not have any potential clinical applicability.

- Finally, T5 research is often used to refer to world health and international research. The goal is to move scientific discoveries along the translational science spectrum, and each level informs the other. Often, after a discovery has reached the T2, T3 or T4 level, it raises new basic and preclinical biology questions that can initiate more T0 and T1 research.

So, what we are doing in our program is training students across multiple disciplines, such as microbiology and physiology, and multiple categories of translational research and putting students in a comprehensive environment where you will learn from each other and also learn to collaborate.

We want to promote team science within and across disciplines and translational research categories.

At the end of your program, you will be familiar with all of the stages of translational research, and you will be an expert in your chosen discipline.

The goal is to make you an expert in a particular research area with familiarity in multiple other areas and types of research, too. Of course, our overall goal as health care scientists is to accelerate and move our discoveries, so that we can improve the lives of Missourians and beyond.

So that is the challenge I am giving you today: Not only to become an expert in your chosen field, but also to improve health care, and thus, improve the lives of Missourians and beyond.

I know this is no small task for your EVC and dean to put on your plate at orientation, but nevertheless, that is the challenge and opportunity I am giving you today.

Best wishes on your journey as you become experts in your chosen discipline and in translational bioscience.

Health Science Research Day: Celebrating accomplishments, embracing the future

Editorial by Bettina Mittendorfer, PhD

Director, NextGen Precision Health Clinical and Translational Science Unit
Senior Associate Dean for Research

I am delighted about the opportunity to publish the abstracts from Health Sciences Research Day in the new *Missouri Health* journal. What a great way for our students to officially publish their often first piece of scientific literature!

Health Sciences Research Day is an annual event that showcases original research and educational innovations that involve undergraduate, graduate, medical, nursing, and health professions students, post-doctoral trainees, residents and fellows who work with faculty in the Schools of Medicine, School of Nursing, and the College of Health Sciences at the University of Missouri. This year, Health Sciences Research Day will take place on Friday, November 15 and is expected to attract over 300 presentations. A crew of people, including the School of Medicine Research Council members and administrative staff, has been hard at work organizing the upcoming event since, well, the day after last year's Health Sciences Research Day. An enormous amount of planning and hands-on work goes into this day, and it is very rewarding to see the hard work pay off. The research projects that will be presented span a variety of topics that focus on treating numerous diseases but also disease prevention and early detection, and include basic science/"bench" research, clinical research, and data science projects that provide a glimpse into the breadth of health sciences research conducted at the university.

A highlight of Health Sciences Research Day is the keynote presentation by an esteemed scientist who will inspire our students and trainees. This year, we are excited to welcome Dr. Arul M. Chinnaiyan, MD, PhD to our campus. Dr. Chinnaiyan, M.D., Ph.D. is a Howard Hughes Medical Institute Investigator, an American Cancer Society Research Professor, and the S.P. Hicks

Endowed Professor of Pathology and Urology at the University of Michigan. He also serves as the inaugural Director of the Michigan Center for Translational Pathology which is comprised of a multi-disciplinary team of investigators focused on translating "-omic" technologies to patient care in terms of biomarkers and novel therapeutics. He has co-authored over 350 manuscripts and has been designated an A. Alfred Taubman Medical Research Institute Scholar, which represent senior level physician-researchers and thought leaders in discovery-driven science. He is an elected member of the American Academy of Arts and Sciences, the Institute of Medicine of the National Academy of Sciences, the Association of American Physicians, and the American Society for Clinical Investigation, and serves on the Board of Scientific Advisors for the National Cancer Institute.

The culminating event of Health Sciences Research Day is the awards ceremony. Attendees gather to hear the announcement of numerous awards, including best poster presentation in basic science, best poster presentation in clinical research, Dean's awards for presenters from the School of Medicine, School of Nursing, and College of Health Sciences, and so on. There is suspense, then enormous excitement for those who are selected, including their mentors, and some disappointment, of course, because the number of awards is limited to a few after all.

A first and certainly not last this year was the Health Sciences Research Day logo competition. All faculty, staff, and trainees were invited to submit a logo design that should be inspired by the keynote speaker's research and must be an original, "hand-drawn" creation without aid of any artificial intelligence platform or inclusion of the University of Missouri trademarks or logos. Nine logos were submitted, and I was impressed by the creativity they showed. The Research Council members used a ranked choice voting system to select the three top choices which have been sent to Dr. Chinnaiyan to make the final selection. I look forward to the reveal of the winning entry. An award certificate will be presented at the Health Sciences Research Day Awards Ceremony by the keynote speaker.

On the heels of Health Sciences Research Day, the School of Medicine Research Council and the Dean's Student Advisory Research Council host another big, and relatively new event at our medical school: ForMUlation. ForMUlation is a networking research get-together designed to give students (mostly rising M2s) an opportunity to interact with principal investigators who participate in the student summer research program. The goal of the event is that prospective students match with prospective mentors during several speed-dating sessions. This year's ForMUlation will only be the 3rd and I expect it to continue to be popular among our students. Last year, we celebrated a roughly 90% participation rate from students giving rise to the largest cohort of summer students (n=75) since the program started. We look forward to seeing the outcomes of this year's matching, and I hope the new cohort of students will be inspired by their older peers and the science they showcase during the upcoming Health Sciences Research Day.

In my closing remarks, I would like to thank the Research Council members and staff who worked tirelessly throughout the year for their dedicated effort to make Health Sciences Research Day happen and to the presenters, their mentors, and all attendees, which make Health Sciences Research Day a highly intellectually stimulating event to look forward to every year.
I hope you enjoy the abstracts and get a sense of the energy that pulses through Health Sciences Research Day.

Nano ayurvedic medicine approaches using ginkgo biloba-phytochemicals functionalized gold nanoparticles against breast and prostate cancers

Nya Hall,[1] Velaphi Thipe[4], Kavita Katti[1-3], Kattesh Katti[1-3]

[1]University of Missouri-Columbia
[2]Department of Chemistry, Institute of Green Nanotechnology
[3]Department of Radiology
[4]Saint Louis University

Cancer is the major public health problem worldwide and is the second leading cause of death in the United States. Estimated deaths attributed by breast and prostate cancer are 15% and 11%, respectively. Mortality rate of these cancers on African American populations are disproportionately high because these disparities are based on socioeconomic status and access to expensive treatments. Around 80% of the world's population relies on traditional medicine (TM; such as Ayurvedic Medicine) and 40% of approved pharmaceutical products are derived from natural substances (such as leaves, herbs, barks and various plant-derived species); thus, exemplifying prominence of TM in the treatment of various diseases. Our laboratory has pioneered on the application of green nanotechnology in transforming ayurvedic medicine as a scientifically rigorous and a credible new medical modality. US Patents and Trademarks office has recently issued the first ever patent on our discovery of a new medical modality referred to as Nano-Ayurvedic Medicine [1]. We report, herein, an innovative nano-ayurvedic medicine approach using phytochemicals from Ginkgo biloba to produce biocompatible gold nanoparticles which are stabilized by the strong corona from a plethora of phytochemicals found in abundance in this medically relevant plant species. Gingko biloba extract was used to transform gold salt into G. biloba phytochemicals encapsulated gold nanoparticles (GB-AuNPs). Full characterization of GB-AuNPs was performed and anticancer activity was evaluated against prostate (PC-3) and breast (MDAMB-231) cancer cell lines. Full characterization revealed that GB-AuNPs are spherical and possess optimum in vitro stability through high zeta potentials of -20 mV and core size of GB-AuNPs of 19 nm, allowing for penetration into tumor cells through both EPR effects as well as receptor mediated endocytosis. Antitumor efficacy of these nano-ayurvedic medicine agent has revealed strong antitumor effects of GB-AuNPs towards both PC-3 and MDAMB-231. It is important to recognize that the antitumor efficacies of GB-AuNPs agent are comparable to the FDA approved cancer therapy agent cisplatin. Overall, our investigations have demonstrated that nano-ayurvedic medicine approaches present new and attractive opportunities for use in treating human cancers and many other debilitating diseases and disorders.

Craniosynostosis associated with novel TUBG1 mutation (C.821 C > T; P.THR274ILE): literature review and case report

Angela S. Ash,[1] Kevin M. Klifto DO PharmD,[1-3] Thomas D. Willson MD[1-3]

[1]University of Missouri-Columbia
[2]Department of Plastic Surgery
[3]Division of Plastic and Reconstructive Surgery

Introduction

TUBG1 is a member of the tubulin gene family. This highly conserved gene plays a role in microtubule formation and brain development. Mutations in TUBG1 lead to cortical malformations, microcephaly, epilepsy, and neurodevelopment issues including motor and speech impairment. As of 2023, 14 published cases of the TUBG1 mutation with 10 different mutations were reported. We describe the 15th variant, with a novel 11th mutation (c. 821C>T p. T274I).

Case Presentation

This patient was born prematurely at 34.1 weeks gestation. She presented with similar features reported in other patients with TUBG1 mutations including microcephaly, upslanting palpebral fissures, epilepsy, intellectual disability, speech and motor delay, and agyria on magnetic resonance imaging of the brain. However, this patient also presented with unique characteristics not previously reported including trigonocephaly, tethered frenulum, scoliosis, and nystagmus. This patient was also found to have a concurrent FBXW7 mutation and is the first reported case of a TUBG1 mutation co-occurring with a FBXW7 mutation.

Conclusion

We described the first published description of a patient with the novel TUBG1 mutation (c. 821C>T p. T274I). This case expands our breadth of knowledge on TUBG1 genotypic and phenotypic variation. Further work is needed to fully understand this rare genetic mutation and associations between TUBG1 and FBXW7 mutations.

Comparative analysis of goniotomy and omni surgery for intraocular pressure reduction in glaucoma patients

Nadine A. Abdeljabbar,[1] Joshu T. King MD[2,3], Sandra M. Johnson MD[2,3]

[1]University of Missouri-Columbia
[2]Mason Eye Institute
[3]Department of Ophthalmology

Abstract

This study aims to evaluate the safety and efficacy of two surgical procedures—KDB Goniotomy (New World Medical) and OMNI (Site Sciences)—in combination with phacoemulsification for the treatment of primary open-angle glaucoma (POAG) at a 12-month follow-up. Conducted at the University of Missouri-Columbia, the retrospective chart review analyzed data from 30 patients in each surgical group, examining pre- and post-operative measures such as visual acuity, intraocular pressure (IOP), and the use of glaucoma medications. Additionally, any post-operative complications or adverse events were recorded. Preliminary results indicate that both the KDB-Phaco and OMNI-Phaco groups began with comparable baseline IOPs of 19.41 mmHg and 19.45 mmHg, respectively. However, the KDB group showed a more substantial mean IOP reduction of 29.35% at 12 months post-operation, compared to 21.78% in the OMNI group. Furthermore, the KDB group experienced a significant reduction in medication usage by 63.73%, whereas the OMNI group only saw a 1.28% reduction. Although the study is ongoing, it holds the potential to offer evidence-based recommendations that may favor the simpler surgical technique as the optimal approach for managing glaucoma. Challenges in patient recruitment underscore the need to broaden the recruitment strategy to achieve a sufficiently large sample size.

Refining a novel approach to progressive resistance training in mouse models and investigating the neurological impact of short-term training

Charles Brennan,[1] Zachary Williard,[1] Anna Roshani Dashtmian,[1] Fereshteh Babaci Darvishi,[1] W. David Arnold MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine and Rehabilitation

Introduction
Testing motor function is a critical aspect of preclinical neuromuscular research but approaches such as grip strength, while valuable, often are inherently variable, dependent operator-related factors, and insensitive. The goal of this project was to investigate a novel preclinical method of strength testing.

Methods
A ramp system was fabricated with a track length of 100 cm and a "rest house" at the top. A weighted cart was attached to the tail of each mouse and was progressively loaded until the mouse could no longer traverse the ramp. The mice were familiarized with the process of moving up the ramp tied to the cart before weight is progressively added on subsequent runs. Between runs, the mice were allowed two minutes of rest. To analyze the ability of this test to detect age-related weakness, we compared middle aged (9 month, n=10, 50% female) to old mice (21 months, n=10, 50% female).

Results
Mice showed a natural inclination to run up the ramp with minimal stimulation (light prodding). Maximum weight pulled normalized to body mass was significantly less in old (8.76, 0.988) versus middle aged mice (11.9, 1.38) (unpaired t-test, $p<0.0001$).

Conclusion
Currently, methods for preclinical strength testing are often insensitive and operator dependent. Our study suggests that the weighted cart test may be a valuable adding for phenotyping and detecting therapeutic effects in models of neuromuscular disease and aging. Future studies will analyze ways to optimize this model using different grips and weight regimens

The effects of anterior cruciate ligament and synovial tissue on responses of patellar and quadriceps tendon to inflammatory stimulation

Kelsey Atteberry,[1] Maria Hinkamp,[1] Luke Annin,[1] Chance Strickler,[1] Gillian Hark,[1] Hailee Coleman,[1] James Cook DVM, PhD, OTSC,[1,2] Aaron Stoker PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction
Rupture of the ACL is often treated by ACL reconstruction (ACLR) using patellar (PT) or quadriceps tendon (QT) autografts. Tendon autograft metabolic responses to the pro-inflammatory and pro-degradative environment in the injured joint during "ligamentization" may be key in ACLR success or failure. This study was designed to evaluate the effects of ACL and synovium on the inflammatory responses of PT and QT.

Methods
With ACUC approval, ACL, SYN, QT and PT tissues were recovered from research hounds euthanized for reasons unrelated to this study. PT and QT explants were cultured alone (MONO) or co-cultured with ACL (COA) or SYN (COS) with or without IL-1B for 6 days. After culture, media was used for biomarker analysis and tissues were used for gene expression analysis. Significant differences ($p<0.05$) between PT or QT tissue groups (cytokine treatment, MONO vs CO, PT vs QT) were determined using a Mann-Whitney rank sum Test.

Results
IL-1B stimulation significantly increased the pro-inflammatory and pro-degradative responses of the PT and QT, but co-culture with ACL and SYN did not significantly affect these responses by the PT and QT during culture. The PT had lower pro-inflammatory responses, and higher COL I expression, compared to QT tissues without IL-1B stimulatio

Conclusion
The data from this study indicated that ACL and SYN had minimal effects on the metabolic responses of the PT and QT explants to IL-1B in this model, suggesting that these tissues may not significantly impact inflammatory and degradative responses of tendon autografts after ACLR

Cotinus coggyria-phytochemicals functionalized gold nanoparticles anti-cancer properties: nano ayurvedic medicinal approach

Eyram Dumor,[1] Velaphi Thipe PhD,[1,2] Kavita Katti,[1,2] Kattesh Katti PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Radiology

Introduction

We report, herein, innovative green nanotechnology using electron-rich cocktail of phytochemicals from *Cotinus coggygria*, without the use of any external chemical reducing agents, to create biocompatible gold nanoparticles stabilized by the strong corona from a plethora of phytochemicals found in abundance in this medically-relevant plant species

Methods

Cotinus coggygria extract, containing a cocktail of phytochemicals, was prepared, and further used as a reservoir of electrons to transform gold salt into *C. coggygria* phytochemicals encapsulated gold nanoparticles (CC-AuNPs) stabilized using gum arabic to enhance in vitro/in vivo stability. Full characterization of CC-AuNPs were performed using spectrophotometry, dynamic light scattering (DLS), confocal microscopy, and transmission electron microscopy (TEM). Anticancer activity was evaluated against prostate (PC-3, LNCaP, and C4-2) and breast (MDAMB-231, MCF-7, and SK-BR-3) cancer cell lines.

Results

Full characterization of CC-AuNPs revealed the particles are monodispersed and possess optimum in vitro/in vivo stability as elucidated through high zeta potentials of -27 mV, as well as long term stability in biologically relevant media. The core size of CC-AuNPs at 40 nm, is optimum allowing for penetration into tumor cells through both EPR effects and receptor mediated endocytosis. Extensive investigation of antitumor efficacy of CC-AuNPs have revealed strong antitumor effects towards both prostate and breast tumors with IC50 (the concentration of a drug or inhibitor needed to inhibit a biological process or response by 50%) comparable to the FDA-approved cancer therapy agent cisplatin.

Conclusion

Overall, our investigations have resulted in the development of a new class of biocompatible C. coggygria phytochemicals functionalized gold nanoparticles, showing selective toxicity toward cancer cells—thus opening up new opportunities in herbal as well as in Nano Ayurvedic medicines for use in treating human cancers. Our investigations have further shown that CC-AuNPs have selective toxicity toward cancer cells while sparing normal cells.

Effects of chlorine exposure to the corneal cells

Will Dunscombe,[1] Rajiv R. Mohan PhD[1-6]

[1]University of Missouri-Columbia
[2]Department of Ophthalmology
[3]College of Veterinary Medicine
[4]Veterinary Health Center
[5]Department of Biomedical Sciences
[6]Harry S. Truman Memorial Veterans' Hospital

Introduction

Chlorine (Cl2) is widely used in household cleaning and was also used as a warfare agent during world wars. Ocular exposure of Cl2 damages cornea and causes vision impairment. This study investigated the toxicological effects of Cl2 on growth, viability, and proliferation of human corneal epithelial, fibroblasts, and endothelial cells using an *in vitro* model.

Methods

Methods: Primary human corneal stromal fibroblasts (hCSF) isolated from cadaver human corneas, immortalized human corneal epithelial (HCE) and immortalized endothelial cells (HCN) were used. Cells were grown in 6 well dish up to 70% confluence and exposed to the bleaching agent, sodium hypochlorite (NaOCl), a surrogate to Cl2 gas (NaOCl: 0.0%, to 0.01%) for 72h under serum-free conditions in a humidified CO2 incubator at 37°C. Cultures were fed with fresh medium and NaOCl every 24h and observed under a phase-contrast microscope. After 72h of exposure, cells growth, viability, and proliferation were measured using MTT, trypan blue, and Click-iT™ EdU Proliferation assays, respectively, and validated via flow cytometry using PO-PRO™-1 and 7-Aminoactinomycin D staining.

Results

All three major corneal cells, epithelium, fibroblast, and endothelium, showed significantly decreased cellular growth ($p<0.0001$), viability ($p<0.0001$), and proliferation ($p<0.0001$) in vitro in a dose- and time-dependent manner. Studies are underway to investigate impact of impaired cellular properties on corneal homeostasis and function.

Conclusion

Chlorine exposure to eye modifies corneal cell properties in vitro. More studies are warranted to understand toxicity of chlorine to eye and vision loss.

Biomechanical comparison of Nitinol compression staples versus fully threaded lag screws for talonavicular arthrodesis following 24-hour incubation at body temperature

Ashwin R. Garlapaty,[1] James L. Cook DVM PhD OTSC,[1] Kyle Schweser MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedics

Introduction

Arthrodesis of the talonavicular joint is indicated for injury- and arthritis-related pain. The standard treatment for talonavicular arthrodesis is lag screw fixation. Despite favorable results using lag screw fixation, it is associated with significant effects on foot biomechanical motion, and suboptimal complication rates. Nitinol staples have been used for talonavicular arthrodesis for their potential to address shortcomings of lag screw fixation. This study tested the null hypothesis that nitinol staples would not be significantly different from fully threaded lag screws based on biomechanical properties.

Methods

Cadaveric feet (n=10) were acquired from 5 donors. Either nitinol staples or two cannulated lag screws were used to perform surgical arthrodesis of the talonavicular joint. Samples were incubated for 24-hours. Biomechanical motion analysis was conducted. Specimens were loaded to 445N and held for 1 minute. A continuous compressive load of 445N was applied while cycling between plantarflexion to dorsiflexion for 10 cycles and then inversion to eversion for 10 cycles. Data were recorded along the X, Y, Z planes. Rotation data were recorded for roll, pitch, and yaw. Significant ($p<0.05$) differences were determined.

Results

No statistically significant differences in functional biomechanical testing properties were noted between nitinol compression staple fixation and lag screw fixation for talonavicular arthrodesis

Conclusion

Based on clinically relevant biomechanical properties measured during robotic testing, nitinol staples can be considered an appropriate option for talonavicular arthrodesis.

Do patients living in rural areas report inferior 1-year outcomes after total knee arthroplasty? A matched cohort analysis

Ashwin R. Garlapaty,[1] Kylee Rucinski PhD,[1,2] Emily Leary PhD,[1,2] James L. Cook DVM PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedics

Introduction

Rural status has been associated with poor outcomes for several health problems, but the relationship between rural status and outcomes following total knee arthroplasty (TKA) has not been fully characterized. As patient-reported outcomes (PROs) are key measures of success following TKA, this matched cohort study was designed to test the hypothesis that patients who live in rural settings will report significantly worse PRO scores one year after TKA when compared with TKA patients who live in urban or suburban settings.

Methods

Patients undergoing TKA at our institution were categorized into urban, suburban, and rural cohorts based on Rural Urban Commuting Area (RUCA) score using reported living setting zip codes. Cohorts were matched for body mass index classification. Demographic data were extracted from the medical records, and PRO data (Knee Injury and Osteoarthritis Outcome Score, Joint Replacement (KOOS JR), Patient-Reported Outcomes Measurement Information System (PROMIS) Global Health and Mental Health, UCLA Activity Score, and Visual Analog Scale (VAS) Pain) were collected pre- and 1-year post-operatively. Comparisons across living settings were made using ANOVA tests or Chi-square tests.

Results

A total of 882 TKA patients (n=294 per cohort) were analyzed. Patients living in urban areas had significantly lower pre-operative pain scores compared to suburban and rural residents. All measured PROs significantly improved from pre-operative levels at 1-year post TKA with no significant differences among living setting cohorts.

Conclusion

In cohorts matched for BMI, living in a rural setting was not associated with inferior patient-reported outcomes 1-year after TKA.

2-Vessel occlusion hypoperfusion animal model with encephalomyosynangiosis

Sabrina Genovese,[1] Ravi Nunna MD,[1,2] Farhan Siddiq MD,[1,2] Rishi Sharma PhD[1,3], Mahesh Thakkar PhD[1,3]

[1]University of Missouri-Columbia
[2]Department of Neurosurgery
[3]Department of Neurology

Introduction

Ischemic stroke, Moyamoya disease, and normal aging result in progressive cerebral hypoperfusion leading to neurocognitive decline. Encephalomyosynangiosis (EMS) a form of indirect bypass has been a safer and more successful form of cerebral revascularization as compared to direct bypass, but clinically can be insufficient in overcoming hypoperfusion. This study aims to establish a two-vessel occlusion (2VO) with EMS model for further investigation on improving angiogenesis and stabilization of new blood vessels.

Methods

Three rats underwent 2VO of bilateral common carotid arteries one week apart. At the time of second occlusion, two animals underwent EMS while one animal received a sham surgery. The hypoperfusion model was considered successful if the cerebral blood flow dropped to 40% of baseline. Six weeks post-op, reperfusion outcomes were assessed.

Results

ur results revealed a successful hypoperfusion model. The animals who received EMS showed no neurological deficits according to the Longa model and contextual memory was intact during the novel object Recognition test. The sham animal show moderate neurological deficits and contextual memory was not intact. Angiogenesis was visualized on the brain tissue of the animals who underwent EMS, whereas no new vessel formation was seen for the sham animal.

Conclusion

Establishing a 2VO and EMS rat model has provided us with the foundation to continue our research in identifying ways to improve neovascularization with indirect bypass. Next steps of this study are to assess adeno-associated virus as a gene delivery for vascular endothelial growth factor in hopes of improving angiogenic anastomosis and clinical outcomes.

Reducing waste in the plastic surgery operating room

Kameron Haake,[1] Benjamin Kirby MD,[1,2] Stephen Colbert MD[1,2]

[1]University of Missouri-Columbia
[2]Division of Plastic Surgery

Introduction

The operating room is a focal point in hospital waste reduction. Studies have shown that instrument reduction in surgical trays has led to cost savings both in sterilization and in total OR time. This study aims to validate benefits other institutions have seen by reducing the surgical tools in plastic surgery breast surgery trays at the University of Missouri-Columbia hospital.

Methods

Surgical tool use and total OR time during 10 breast reductions and 11 breast reconstructions were recorded. Rhe frequency of surgical tool use was analyzed. A “simple breast tray” was recommended wherein tools used less than 6% of the time were eliminated. A cost savings estimate was achieved by multiplying total tool reduction by $0.51- the estimated cost of tool sterilization.

Results

39/70 tools were used 0% and 8/70 tools were used less than 10% of the time during breast reduction cases. 17/70 tools were used 0% and 29/70 were used less than 10% of the time during breast reconstruction cases. The combined total tool reduction resulted in suggested elimination of 17 tools. Cost savings per surgical tray was estimated to be $12.75/tray.

Conclusion

This study aimed to identify ways to reduce waste within the Plastic Surgery operating room via consolidation of the plastic surgery breast tray. Analysis of tools used indicated that 17 tools are used less than 6% of the time and could be removed, resulting in a cost savings of up to $12.75/tray. Future research will include implementation of these recommendations.

Cellular property of endometrial epithelial stem cells

Mia Hackworth,[1] Jinyu Zhou,[1,2] Shiying Jin PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology, and Women's Health

Introduction

Cyclical regression and regeneration of the uterine endometrium is the foundation of female reproductive function and health in women. Adult epithelial stem cells in mouse uterus were first identified by our group to support homeostasis and regeneration of uterine endometrium. Studies of diverse mouse organs found their epithelial stem cells share some common cellular properties. Here, we hypothesize that epithelial stem cells in the mouse endometrium and small intestine have conserved intracellular features based on organelle distribution. The intestinal stem cells contain few lipid droplets and reside between lipid-rich Paneth cells. With that, we applied multiple solutions to determine the lipid drop distribution in the endometrial epithelial stem cell and its progenies in mice.

Methods

Uteri at four stages (diestrus, proestrus, estrus, metestrus) of reproductive cycle from 2-month-old C57BL/6 mice were collected for electron microscopy (EM) or LipidSpot™ stain to assess the lipid droplet distribution of endometrial epithelial cells.

Results

Both electron microscopy (EM) and LipidSpot™ stain analysis of adult C57BL/6 uteri observed some epithelial cells in the endometrium that contain less lipid droplets compared to their neighboring lipid-rich cells. Further analysis is being performed to locate the endometrial epithelial cells with less lipid droplets in the intersection zone where stem cells live.

Conclusion

Lipid droplets, the primary energy storage depot in most cell types, may regulate epithelial stem cell proliferation and differentiation to support cyclical regeneration of endometrium in mouse uterus.

Side of facial steroid injections in dermatology

Osaigbokan Paul Ahie,[1]
Nkanyezi Ferguson MD[1,2]

[1]University of Missouri-Columbia
[2]Deparment of Dermatology

Introduction

Facial steroid injections are utilized as therapy for several medical conditions including chalazion, thyroid associated ophthalmopathy, keloids, uveitic cystoid macular edema and hemangiomas.[12345] Despite the many benefits of this treatment, steroid injections have potential risks. One serious risk is blindness due to retinal artery occlusion. This complication occurs due to the face having a rich vascular supply, increasing the probability of injected steroids flowing retrograde from distal branches of the ophthalmic artery or anastomoses with branches of the external carotid artery to enter the ophthalmic circulation.[67]

Methods

Park and Barmettler performed the first systematic review to determine the prevalence of vision loss secondary to steroid injection and elucidate the injection sites and method, steroid type and particle size, and treatment and outcomes related to steroid associated vision loss.[7] Steroid injections are widely used in dermatology and these intralesional medications have gained popularity for the treatment of lesions on various parts of the body including the face.

Results

This paper highlights the risks of blindness from intralesional steroid injections on and around the face. We further describe the likely lesions, facial sites, and volume of steroid injections most likely to cause this complication through a review of the literature using PubMed, Embase and Medline.

Conclusion

This work will educate the dermatologist about this risk and allow a more nuanced approach in the choice of therapy for facial and perifacial lesions when there are several treatment options. More importantly, this work would lead to increased caution when intralesional steroids are selected as the treatment of choice.

The effects of stimulated activity levels on cellular metabolic responses of the acl and extensor tendon autografts used for ACL injury

Gillian Hark,[1] Hailee Coleman,[1] Kelsey Atteberry,[1] Maria Hinkamp,[1] Luke Annin,[1] James L. Cook DVM PhD,[1,2] Richard Ma MD,[1,2] Aaron Stoker, PhD[1,2]

[1]University of Missouri-Columbia
[2]Thompson Laboratory for Regenerative Orthopaedics

Introduction

Anterior cruciate ligament (ACL) reconstruction (ACLR) with extensor-based autografts is a common treatment of ACL injuries. Patient activity level is an important risk factor for ACL injury and ACLR failure, but the metabolic responses of these tissues are poorly understood. The study was designed to determine metabolic responses of tissue fibroblasts to activity level. It was hypothesized that lower activity levels would significantly increase pro-inflammatory and pro-degradative metabolic responses of cells compared to higher activity level.

Methods

With ACUC approval, ACL, posterior cruciate ligaments, patellar, and quadriceps tendons were recovered from dogs euthanatized for reasons unrelated to this study. Cell lines from each tissue were cultured for 6 days using a tension loading system to mimic a sedentary lifestyle (5775 steps), an active lifestyle (10,500 steps & 5K run), or no load based on number of cycles per day. Response to activity was evaluated using media biomarker concentration and relative gene expression level. Significant ($p<0.05$) differences between cell types for each activity level, and between activity level within each cell type were determined using a one-way ANOVA with Tukey post-hoc test.

Results

There were significant differences in media biomarker content and relative gene expression level pro-inflammatory, pro-degradative, and extracellular matrix molecules identified based on activity level and tissue cell source.

Conclusion

The data from this study indicate that ligament and tendon fibroblasts may have clinically relevant differences in their responses to activity levels of patients, which could influence risk of ACL injury as well as outcomes after ACLR

Effect of patellar and quadriceps tendon on the metabolism of anterior cruciate ligament and synovium in response to inflammatory stimulation

Maria Hinkamp,[1] Kelsey Atteberry,[1] Luke Annin,[1] Hailee Coleman,[1] Gillian Hark,[1] James L. Cook DVM PhD OTSC,[1,2] Richard Ma MD,[1,2] Aaron Stoker, PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Anterior cruciate ligament (ACL) rupture is commonly treated by surgical ACL reconstruction (ACLR) using tendon (TEN) autografts. The ACL remnant and synovium (SYN) are potential sources inflammation in the ACL injured joint that may contribute to poor integration of the TEN autograft and poor patient outcomes. However, the TEN autograft could also affect the inflammatory metabolic responses of the ACL and SYN. This study was designed to determine if TEN tissues affect the responses of the ACL and SYN to inflammatory stimulation. It was hypothesized that co-culture of the ACL and SYN with TEN tissue would significantly affect the pro-inflammatory and pro-degradative gene expression levels of the tissues compared to mono-cultured tissues.

Methods

With ACUC approval, ACL, SYN, quadriceps tendon (QT), and patellar tendon (PT) were recovered from research hounds (n=5) euthanatized for reasons unrelated to this study. Tissue explants were created, and ACL and SYN were either mono-cultured or co-cultured with QT or PT tissues for 6 days with or without IL-1β. Media was changed and collected on day 3 and 6 for protein analysis, and mRNA was extracted from the tissues on day 6 for gene expression analysis. Significant ($p<0.05$) differences in between mono-culture and co-culture groups were determined using Mann-Whitney Rank Sum test.

Conclusion

Data analysis are ongoing and will be presented on the poster.

The effect of multimodal neurologic enhancement on length of respiratory support required for premature infants in the neonatal intensive care unit

Aderonke Igbekele MPH,[1] Emily Pivovarnik MM MT-BC NICU-MT,[1-3] Ellyn H. Evans PhD LPMT MT-BC NICU-MT,[1-3] Olugbemisola Obi, MD, FAAP[1-4]

[1]University of Missouri Columbia
[2]University of Missouri Healthcare Children's Hospital
[3]The National Institute for Infant and Child Medical Music Therapy
[4]University of Georgia

Introduction

With advances in medical care, the age of viability for premature infants is decreasing with many requiring increased lengths of time on respiratory support (LOTRS) and many ultimately developing bronchopulmonary dysplasia (BPD). Prior evidence shows that music therapy interventions like MNE assist with improved daily weight gain, reduced hospitalization stays, and improved general wellbeing of infants born younger and smaller in the NICU. In this study, the effects of MNE on LOTRS for premature infants was determined.

Methods

Medically stable infants born less than 34 weeks Post Menstrual Age (PMA) were included and matched based on PMA, sex, and neurologic injury. 52 subjects were enrolled with 26 in each group. The experimental group received at least 8 sessions and the control group received none. A Wilcoxon Signed Rank test, t-test, and Chi-Square test were used to analyze the PMA at transition to room air (RA), LOTRS, and a BPD diagnosis respectively.

Results

While no significant differences were found ($p > .05$), more in the experimental group transitioned to RA before 36 weeks PMA and spent about 10 days less on oxygen than the control group. Furthermore, 42% of individuals in the experimental group had a diagnosis of BPD compared to 54% of the control group.

Conclusion

While the current results may not be statistically significant, non-significant findings can provide valuable insights. Further investigation, especially with a larger sample size, is needed to determine the therapeutic effects of MNE among infants in the NICU who commonly experience respiratory distress.

The role of specific CD36 (ECCD36) in western diet induced arterial stiffening and cardiovascular related diseases

Aderonke Igbekele,[1] Javad Habibi Ph.D,[1,2] Vincent G. DeMarco Ph.D,[1,2] Dongqing Chen RN,[1,2] Adam Whaley-Connell Ph.D,[1,2] Michael A. Hill Ph.D,[1,2] James R. Sowers Ph.D,[1,2] Jia Guanghong, Ph.D[1,2]

[1]University of Missouri Columbia
[2]Department of Medicine- Endocrinology

Introduction

The consumption of a Western Diet (WD) i.e., high fat high sugar diet, has been shown to increase the prevalence of obesity and promote insulin resistance which are important risk factors for arterial stiffening and other cardiovascular diseases. Prior studies show that CD36 is associated with having excessive circulation of lipids, insulin resistance and arterial stiffening. In this study we investigated if endothelial cell (EC) specific CD36 (ECCD36) contributes in WD-induced lipid accumulation, aortic insulin resistance, fibrosis, and stiffening.

Methods

Six-week-old female mice control ($ECCD36^{-/-}$) and wild type ($ECCD36^{+/+}$) mice were fed with either a western diet (WD) or a standard chow diet (CD) for 16 weeks. Aortic stiffness and activity were determined by pulse wave velocity and wire myograph respectively. The protein expression, lipid content and aortic remodeling were determined by western blot, oil red O staining and immunostaining respectively.

Results

The experiment shows that increased aortic stiffening is associated with vascular insulin resistance, increased lipid disorders, aortic remodeling and reduced insulin metabolic signaling via phosphoinositide 3-kinases/ protein kinase B. The $ECCD36^{-/-}$ mice did not have WD-induced increases in pulse pressure and there were reduced aortic vasorelaxation, vascular insulin resistance and remodeling.

Conclusion

These findings show that enhanced ECCD36 signaling mediates aortic stiffening, insulin resistance, increased lipid accumulation, fibrosis, and remodeling. This is a significant finding because obesity is a risk factor to many chronic illnesses like hypertension, hyperlipidemia, obesity related insulin resistance, DM II, and metabolic syndrome.

The role of IRF1 in diabetic retinopathy pathogenesis through retinal Müller cells

Varun Jeevan,[1] Logan Mays,[1] Fazle Elahi PhD,[1,2]Hu Huang, PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Ophthalmology

Introduction

Diabetic retinopathy (DR) is a common complication of diabetes, causing vision loss. Retinal Müller cells (RMC) are key contributors to DR pathogenesis, but the underlying mechanisms remain unclear. Interferon regulatory factor 1 (IRF1) is a transcription factor that regulates gene expression of multiple immune response pathways, including iNOS, interferon, 2-5A synthetase, and TLR. IRF1 is also involved in various cancers, infections, and inflammatory disorders.

Methods

Single-cell RNA sequencing (scRNA-seq) data analysis revealed that IRF1 is primarily expressed in RMC of the mouse eye. IRF1 expression changes in diabetic vs. non-diabetic conditions were observed in vitro in human RMC (MIO-M1) cultures and in vivo in WT C57BL/6 mice using western blot and immunohistochemistry.

Results

Increased IRF1 expression in RMC under diabetic conditions suggests a role in DR pathogenesis likely by regulating mitochondrial metabolism. MIO-M1 cells were evaluated for mitochondrial function and energy metabolism with a mitochondrial stress test on a Seahorse XF96 instrument. The oxygen consumption rate (OCR) and extracellular acidification rate (ECAR) of MIO-M1 cells were both reduced in the WT diabetic condition. Whether IRF1 is involved in OCR and ECAR of RMC is under investigation. Furthermore, a sodium iodate model of retinal degeneration comparing WT and IRF1 knockout mice was also explored using fluorescent angiography and optical coherence tomography (OCT). The data analysis is ongoing.

Conclusion

In summation, these findings indicate IRF1's potential role in DR pathogenesis through RMC mitochondrial dysfunction, offering promise as a therapeutic target. Ongoing research will further illuminate these connections.

Optimization of a novel tissue preservation system for point-of-care storage of nerve allografts

Danna Jenkins,[1] Bryce Fletcher,[1] Stephanie Choo MD,[1,2] Chantelle Bozynski DVM MSc,[1,2] Aaron Stoker PhD,[1,2] James L. Cook, DVM PhD,[1,2] Julia A.V. Nuelle MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedic Surgery

Introduction

Outcomes after contemporary surgical repair and reconstruction techniques for peripheral nerve injuries are inconsistent. A novel method for peripheral nerve reconstruction (PNR) being developed through preclinical studies involves polyethylene glycol-mediated nerve fusion (PEGf) which provides immune privilege to fresh nerve allografts such that functional outcomes are improved. One effective system is MOPS (MTF Biologics)®, which is currently in clinical use. This preclinical study aimed to determine if standard MOPS and/or two optimized MOPS-N solutions could also maintain sufficient cell viability (>100 cells/mm^2) of rat sciatic nerve allografts for 60 days after recovery.

Methods

Three MOPS solutions were prepared: standard MOPS; MOPS-N-GDNF using glial-derived neurotrophic factor; and MOPS-N-B12, using vitamin B12. Rat sciatic nerves were recovered, sectioned as explants, and randomly assigned to solution and storage duration (0-day, 30-day, or 60 day). Explants were maintained at room temperature for assigned duration. At assigned time, each explain was assessed for compound action potentials (CAPs) and viable Schwann cell density (VCD).

Results

All explants produced CAP at all time points. All three MOPS solutions were associated with maintenance of at least 100 cells/mm2 at 30- and 60-days. No significant differences between baseline and 30-day VCD for any solutions. There was significant decrease between 30-day and 60-day VCDs for MOPS and MOPS-N-GDNF. MOPS-N-B12 had a significantly higher mean VCD than MOPS and MOPS-N-GDNF at the 60-day timepoint.

Conclusion

Optimization of MOPS can maintain function (stimulated action potentials) and sufficient cell viability in sciatic nerve allografts for at least 60 days at shelf-stable conditions.

Understanding the role of the balbiani-body in a murine primary ovarian insufficiency model

Sooah Ko,[1] Edgar Miranda Diaz, PhD.,[1] Kerem Yucebas,[1] Lei Lei, PhD[1,2]

[1]University of Missouri-Columbia
[2]Obstetrics, Gynecology, and Women's Health

Introduction

Occurring in 1% of women, primary ovarian insufficiency (POI) causes infertility, along with a decreased quality of life. POI is characterized by premenopausal depletion of quiescent ovarian primordial follicles (PF). Mutant models of genes related to POI etiology, such as spermatogenesis and oogenesis specific basic helix-loop-helix 1 (Sohlh1), have been used to study POI, allowing for the investigation of PF loss. Our previous study demonstrated that the Balbiani-body (B-body) is involved in PF quiescence through organelle organization-mediated RNA storage in mice. Therefore, it is important to understand cellular and molecular defects in the Balbiani-body in POI. This study aims to identify these cellular features for early POI detection.

Methods

Neonatal Sohlh1 mutant mouse ovaries were fixed in 4% paraformaldehyde and immune-stained with antibodies to DDX4 and GM130 to visualize oocytes and Golgi, respectively. Stained ovaries were imaged by confocal microscopy and the percentage of the PF containing a B-body was quantified using Image-J software.

Results

On average, in the wildtype ovary, 58.3 ± 9.6% of PF contained an intact B-body, compared to 42.2 ± 13.3% in the Sohlh1 heterozygous mutant ovary and 20.8 ± 4.3% in the Sohlh1 homozygous mutant ovary.

Conclusion

PFs in the Sohlh1 mutant have defects in B-body integrity, suggesting that loss of Sohlh1 gene disrupts B-body organelle organization. Future studies will be conducted to identify how Sohlh1 as a transcription factor affects organelle organization in mouse oocytes and whether similar defects of B-bodies are associated with PF loss in humans.

Relationship between tissue biomarker concentration and histology scores in the osteoarthritic knee

Corder E. Lehenbauer[1], Grace S. Brentlinger,[1] Harjeev Singh,[1] Luke B. Marx,[1] Owen M. D' Amour,[1] Gabe J. Keeton,[1] Chantelle C. Bozynski DVM,[1,2] James A. Keeney MD,[1,2] James L. Cook DVM PhD OTSC,[1,2] Aaron M. Stoker, PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedic Surgery

Introduction

Osteoarthritis (OA) is a degenerative whole joint disease characterized by the progressive loss of cartilage tissue across the surface of the joint. Variation in the clinical progression, as well as the location and extent of cartilage degeneration across the surface of the joint, vary by patient. This study was designed to determine if there are significant differences for the concentration of relevant biomarkers in OA cartilage tissue based on histological changes to the tissue related to OA. It was hypothesized that significant differences in cartilage tissue biomarker concentrations would be identified based on the histological score of the tissue.

Methods

Femoral condyle and tibial plateau articular surfaces were recovered from patients undergoing total knee arthroplasty for OA. Osteochondral explants were created from the weight bearing center and distant region of each surface. The explants were processed for histological assessment and tissue protein extraction. The protein content of the lysate was determined, along with the concentration of MMP-1, MMP-2, MMP-3, MMP-9, MMP-13, TIMP-1, TIMP-2, TIMP-3, TIMP-4, GRO, MCP-3, IL-6, IL-8, MCP-1, MIP-1a, VEGF, LEPTIN, ADIPONECTIN, ADIPSIN, CRP, OPG, OPN, SOST, DKK-1. Each cartilage explant was evaluated by one blinded pathologist using a modified OARSI system. Significant differences ($p<0.05$) between samples grouped based on OARSI histological scores were determined.

Results

There were numerous significant relationships identified between tissue protein concentration and histology scores.

Conclusion

The data indicates potentially important relationships between changes in OA cartilage tissue biomarker concentrations and changes in the histology scores of the tissue related to OA.

Development of novel ophthalmic drops to treat mustard gas induced corneal blindness in vivo

Payton Lujin,[1] Rajiv R. Mohan[1,-3]

[1]University of Missouri-Columbia
[2]Departments of Ophthalmology
[3]Harry S. Truman Memorial Veterans' Hospital

Introduction
Sulfur mustard (SM) gas exposure to the eye causes severe toxicity to the cornea called mustard gas keratopathy (MGK). This study investigated the safety and efficacy of a novel topical eye drops (TED) and evaluated the clinical manifestations until 4 months in rabbit eyes in vivo exposed to SM.

Methods
The study was approved by the IACUC and followed ARVO guidelines. Eyes of New Zealand White Rabbits were divided into 6 groups: Naïve, TED, SM-vapor, and SM+TED 3 regimens (2 drops twice a day for 7, 14, and 28 days). Clinical eye examinations and tests in live rabbits were performed with slit-lamp, confocal, specular microscopes, fluorescein dye, Schirmer's tests, pachymetry, applanation tonometry, and optical coherence tomography. At the endpoint, rabbits were euthanized, and corneas were collected for histological, molecular, and cellular analyses.

Results
SM-exposed rabbit corneas showed a significant corneal haze ($p<0.0001$), central corneal thickness ($p<0.0001$), tear flow ($p<0.0001$), and corneal edema, decreased keratocyte and endothelial cell density ($p<0.01$) and increased corneal neovascularization (NV) compared to naïve corneas up to 4-month. All regimens of TED significantly reduced the corneal haze, central corneal thickness, tear flow, and NV ($p<0.001$) and increased keratocyte and endothelial interiority and density ($p<0.01$or $p<0.001$). A comparative analysis of 3 regimens is underway. H&E, immunostaining and qRT-PCR showed rescue of MGK and structural, cellular, or functional responses in TED-treated eyes.

Conclusion
Ocular mustard gas exposure causes severe corneal injury, and topical TED therapy reduces MGK symptoms in rabbits in vivo. Additional studies are ongoing.

Improving patient education materials for total hip & knee arthroplasty patients

Samuel Marshall,[1] John Baumann,[1] John O'Malley,[1] Steven DeFroda MD[1,2]

[1]University of Missouri-Columbia
[2]Harry S. Truman Memorial Veterans' Hospital

Introduction
Orthopaedic Patient Education Materials (PEMs) related to total hip and total knee arthroplasty have repeatedly been shown to not meet American Medical Association and National Institutes of Health recommendations for readability. PEMs that are written with too much complexity limit the ability of readers to comprehend the material. These complex PEMs also limit the health literacy of patients, a key determinant in health status and outcomes. The purpose of this study is to improve the readability of total hip and total knee arthroplasty-related PEMs by limiting the use of sentences with > 15 words and limiting the use of words with > 3 syllables.

Methods
The readability of all 26 PEMs in this study was assessed before and after editing. Editing of articles included limiting the use of sentences with > 15 words and limiting the use of words with > 3 syllables while preserving PEM content.

Results
A total of 26 PEMs were available for use in this study after the application of inclusion and exclusion criteria. The percentage of original PEMs at or below the sixth-grade reading level was 0% (0 out of 26), while the percentage of edited PEMs at or below the sixth-grade reading level was 50% (13 out of 26).

Conclusion
Using this standardized method of reducing sentence length to < 15 words and limiting the use of words with > 2 syllables, while preserving key content, significantly improved the readability of PEMs related to total hip and total knee arthroplasty.

Phenotypic evaluation of natural killer cells in hepatocellular carcinoma for CAR-NK cell development

Katina Massad,[1] Ming Yang PhD,[1] Kevin Staveley-O'Carroll MD PhD,[1-3] Guangfu Li PhD[1-3]

[1]University of Missouri-Columbia
[2]Department of Surgery
[3]Department of Molecular Microbiology

Introduction

Hepatocellular carcinoma (HCC), the most common type of primary liver cancer, is the fourth leading cause of cancer-related death nationwide. However, few efficacious treatment options exist, and many patients develop therapy resistance, limiting survival benefit. Chimeric antigen receptor natural killer cell (CAR-NK) therapy shows novel promise in cancer treatment with few toxicities in early development. Therefore, the aim of our project was to screen HCC-specific antigens and cytokines for the design and cytotoxic enhancement of CAR-NK against HCC.

Methods

Primary NK cells were isolated from wild-type C57BL/6 mice, cultured, and stimulated in vitro with different doses of cytokines, including IL-2, IL-7, IL-15. IL-2 stimulated human NK cells were co-cultured with human HCC cell lines (HepG2, Huh7, SK-hep1) to evaluate NK cell killing ability and response to tumor cell stimulation. Phenotypic changes of co-cultured NK cells were analyzed via flow cytometry and qPCR. Furthermore, cytokine array was applied to test immune regulators in co-cultured media.

Results

IL-2 and IL-15 successfully stimulated primary mouse NK cell activation and maturation in a dose-dependent manner via upregulation of cell surface markers CD11b, CD27, CD56, and NK1.1. Phenotypic changes of human NK cells co-cultured with tumor cells showed an upregulation of activation markers CD56, IL-7, and IL-15, in conjunction with the downregulation of KLRg1, an NK cell inhibitor. Finally, cytokine array, qPCR, and flow cytometry revealed that growth differentiation factor 15 (GDF15) functioned as an NK cell inhibitory factor to decrease their cytotoxic activity against tumor cells, and its expression levels in tumor cells was positively associated with inhibitory activity of tumor cells to NK cell activation

Conclusion

This study confirmed that cytokines IL-2 and IL-15 can successfully stimulate NK activation and maturation, and cancer cell-derived GDF-15 inhibits NK cells function, serving as CAR for improving NK cytotoxic activity to HCC cells.

Sex Difference in Aortic Contractility and Protein Expressions in Response to LPS Treatment

Bwaar Omer, Feng Chen, Jingshu Chi, Thao Nguyen, Hong Hao, Zhenguo Liu, MD

[1]University of Missouri-Columbia
[2]Department of Cardiology

Introduction

Sepsis is associated with significant dysfunction of multiple organs including the cardiovascular system. Studies have shown that males may have a less favorable outcome than females with sepsis with the mechanism(s) largely undefined. Lipopolysaccharide (LPS) is recognized as a key player in the initiation and progression of sepsis. Thus, the present study aims to test the hypothesis that a significant sex difference exists in vascular response and vascular protein expressions in an LPS-induced sepsis mouse model.

Methods

Both male and female wildtype C57BL/6 mice (8-12 weeks old) were injected with LPS+saline or saline as control. Blood pressure (BP) and heart rate (HR) were recorded at baseline and 6 hours after LPS injection. Aorta was collected and prepared 6 hours after LPS injection for evaluation of contraction to phenylephrine and proteomic analysis.

Results

BP decrease was dramatic in LPS-treated males, while changes in BP and HR were mild in females after LPS injection. Aortic contraction to phenylephrine was abolished in LPS-treated males, while relatively preserved in females with LPS treatment. A significant sex difference in protein expressions existed between males and females at baseline and in response to LPS treatment.

Conclusion

The data from the present study demonstrated that LPS induced reduction of aortic contraction to phenylephrine was more prominent in males than in females. There was a significant difference in mouse aortic protein expression with and without LPS treatment. Further studies are needed to determine the specific protein(s) critical to sex difference in LPS-induced vascular dysfunction.

Adjunctive Dorsal Spanning Plate Fixation in the Stabilization of Perilunate Dislocations

Evan Reeves,[1] Bradley Vivace,[1,2] Ashwin R. Garlapaty,[1] Will Bezold,[1] Daniel London, MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedics

Introduction

Perilunate injuries exhibit concomitant hand and wrist injuries in high-energy polytraumas. Dorsal spanning plate (DSP) fixation facilitates quicker weight-bearing compared to conventional K-wire fixation. This study aims to understand the biomechanical advantage of DSP fixation vs. K-wire fixation.

Methods

14 fresh-frozen cadaveric wrists underwent simulated perilunate injury. Specimens were randomly allocated to K-wire fixation vs. K-wire and DSP fixation. K-wire fixation was performed with one scaphocapitate wire, two scapholunate wires, and two lunotriquetral wires. K-wire constructs were loaded with 50N of compressive force for 100 cycles of 10° extension to 15° flexion. Cyclical loading was carried out with a maximum of 3Nm of torque in both flexion and extension when 10° of extension and/or 15° flexion could not be obtained. Fluoroscopic images were obtained of specimens prior to simulated injury, after fixation, after 10 and 100 loading cycles, and at construct failure. Failure was defined as CL subluxation, hardware failure, and/or fracture. Differences in SL and LT intervals, SL and capitolunate angles, were compared using t tests between constructs after fixation and after application of forces.

Results

There were no significant differences between the two group's carpal alignment after fixation. K-wires and DSP fixation required significantly higher loads to achieve construct failure. The only significant difference between the two groups' carpal alignment parameters was SL interval change at failure. Other parameters suggested better maintenance of alignment with the DSP construct.

Conclusion

DSP fixation may be useful in the polytraumatized patient with a perilunate injury where providing an extra weight-bearing limb would be beneficial.

Relationships among patient demographic factors and biomarkers in synovium recovered from osteoarthritic knees

Kayla R. Schweitzer,[1] Cole C. Stevens,[1] Kathleen Harris,[1] Ahmed S. Fouad,[1] James A Keeney MD[1,2] James L Cook DVM PhD OTSC,[1,2] Aaron Stoker, PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedics

Introduction

Osteoarthritis (OA) is a significant cause of disability in patients, characterized by pain, effusion and dysfunction of the affected joints. The synovium (SYN) plays a significant role in knee OA by releasing pro-inflammatory and pro-degradative biomarkers. It remains unclear if patient demographic factors influence SYN biomarker concentrations. It was hypothesized that as pain, age, and BMI increase, the levels of biomarkers in the SYN of OA patients would significantly increase. Further, it was hypothesized that the concentration of these biomarkers in the SYN of female patients would be significantly greater than in male patients.

Methods

Tissue collection: With IRB approval and informed patient consent, knee SYN tissues were recovered from OA patients undergoing TKA. The protein content of the tissue samples was extracted and tested by BCA and Luminex assays. Patients were divided into groups based on age, sex, BMI and VAS pain, and differences were determined using one-way ANOVA and Tukey post-hoc test. Differences between sexes were determined using a T- test.

Results

Significant differences were found in targeted biomarker concentration in the OA SYN based on patient sex and BMI. These demographic factors were observed to have a significant effect on the differences in OA SYN protein content based on VAS pain.

Conclusion

These results highlight the significant affect that patient demographic factors can have on the changes in inflammatory and degradative responses of joint tissues related to OA. Understanding these relationships may allow for the development of novel treatment and assessment strategies for OA.

Effects of nicotine and cotinine levels on intervertebral disc health and inflammation in an ex vivo rat tail model

Connor A. Sierra, Jacob S. Kramer PhD, James L. Cook DVM PhD OTSC, Aaron M. Stoker PhD MS, Theodore J. Choma MD

[1]University of Missouri-Columbia
[2]Department of Orthopedics

Introduction

Intervertebral disc degeneration (IVDD) usually progresses morphologically with age and is variably associated with clinical symptoms. While the drivers of symptomatic IVDD remain incompletely understood, tobacco use has been implicated to contribute significantly to IVDD and increase the incidence of neck and back pain. However, few studies directly assess the biochemical and cellular effects of tobacco related metabolites (nicotine and cotinine) on IVD tissues. Therefore, this study was designed to determine the dose dependent effects of nicotine and cotinine on inflammation-related responses of the IVD using an ex vivo rat tail IVD culture model. It was hypothesized that IVDs treated with higher doses of nicotine and cotinine would demonstrate significantly reduced IVD cell viability and release significantly higher levels of pro-inflammatory cytokines compared to untreated controls.

Methods

With ACUC (#9435) approval, caudal IVDs were recovered from skeletally mature Sprague Dawley rats (n=10) euthanized for reasons unrelated to this study. Caudal IVDs from each animal were cultured for 6 days in media with or without nicotine (40µg/mL or 10µg/mL) or cotinine (400µg/mL or 100µg/mL). Media was collected on day 3 and 6 for biomarker analysis, and IVD tissue cell viability was assessed on day 6.

Results/Conclusion

Data analyses are ongoing and will be presented on the poster. The data from this study using an ex vivo rat caudal tail IVD model may provide insight into potential roles of smoking for the development and progression of IVDD.

Phantom Limb Pain Management: A Review of Current Concepts

Mia Spezia,[1] David Brogan MD MSc[2]

[1]University of Missouri-Columbia
[2]Washington University

Abstract

Complications of limb loss affect a significant, and ever increasing, portion of the population the United States: there are about 2 million major limb amputees living in the US and this rate is expected to increase to nearly 3.6 million by the year 2050 (Peters et al., 2020; Varma et al., 2014). While the loss of a limb is accompanied by an undeniable set of physical, emotional, and financial stressors, a major source of distress is the development of phantom limb pain (PLP), which often becomes chronic and occurs in 40% to 80% of amputees (Urits et al., 2019). A variety of recent surgical and non-surgical treatments have been proposed to manage this challenging condition. In this review we will seek to highlight the current evidence for these different treatment techniques to include the following general categories: Surgical techniques; Pharmacologic Options; Noninvasive Treatment Modalities; Invasive Neuromodulation; Psychiatric Methods

Potential nutraceutical management and treatment of polycystic ovarian syndrome with american elderberries

Lara Stefani,[1] Aaron Stoker,[1] Clayton Kranawetter,[1] Lloyd W. Sumner PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Biochemistry

Introduction

Polycystic Ovary Syndrome (PCOS) is a major endocrine disorder affecting 8-13% of women worldwide. American elderberries possess antioxidant, anticarcinogenic, and immune-stimulating properties. The project goals were to establish a cell culture model for PCOS using human ovarian epithelial carcinoma cells (OVCAR3) and evaluate the effects of varying berry extracts concentrations on cell survival and proliferation.

Methods

American elderberries were freeze dried, ground to a powder, and metabolites were extracted using 80% ethanol:20% water. OVCAR3 cells were seeded onto 6-well plates (100,000 cells/well) and cultured overnight at 37°C with a 5% CO2 atmosphere in RPMI-1640 media supplemented with 20% fetal bovine serum and 1% insulin. After 24 hours, existing media was exchanged for fresh culture media containing 0, 5, 12.5, 50, 100 or 500 µg/mL of the elderberry metabolite extract (n=6/group). Cells were cultured for 24 hours, followed by media collection for nitric oxide assay and cell viability determination using Alamar Blue cell viability assay.

Results

No significant difference was observed between NO and cell viability in negative and untreated control groups. However, the 12.5 µg/mL concentration demonstrated significantly higher cell viability and significantly lower NO levels, compared to the control group.

Conclusion

The data from this study indicate that the 12.5 µg/mL treatment resembles a PCOS profile, thus this concentration was not favorable as a potential biochemical approach for the syndrome. Future efforts will include repetition of these experiments to maximize accuracy and validity of the data.

Assessing the xenoantigenicity of matrix-bound nanovesicles

Connor Stevenson,[1] Leigh Griffiths PhD[2,3]

[1]University of Missouri-Columbia
[2]Mayo Clinic
[3]Department of Cardiovascular Medicine

Introduction

The use of native extracellular matrix (ECM) in tissue engineering has many advantages, but the xenoantigenicity of native tissue must be eliminated for clinical translation to avoid immune rejection. The discovery of matrix-bound nanovesicles (MBVs) within native ECM has raised questions, as the extent to which their cargo mediates detrimental adaptive immune rejection responses remains unknown. We sought to isolate MBVs from native and antigen removed (AR) bovine pericardium (BP) in order to define the xenoantigenicity of native tissue MBVs and assess the efficacy of AR in eliminating such MBV-related antigens.

Methods

Bovine Pericardium Antigen Removal (BP-AR)
Antigens were removed from tissue by various wash solutions. Following antigen removal, BP samples were washed to remove residual material.
Matrix-Bound Nanovesicle Extraction and Isolation
Samples were homogenized and subsequently solubilized. Digested BP was then centrifuged and the resulting pellet was resuspended.

Results

Histological staining of native and AR samples confirmed successful scaffold production. Electron microscopy visualized MBVs within the matrix, and confirming removal in AR samples. Isolation of MBVs from native samples were visualized with a nanoparticle analyzer, supporting successful isolation. Protein assays were ran on both samples, exhibiting the protein cargo subset present in MBVs, and their associated antigenicity.

Conclusion

Native BP-derived MBVs were shown to contain xenoantigenic protein cargo. Our group's BP-AR protocol eliminated MBVs from BP-AR ECM scaffolds, simultaneously removing their antigenic vesicular cargo.

Mustard gas keratopthy involves changes in corneal stromal architecture and fibrotic genes in vivo

Laila A. Suleiman,[1] Rajiv R Mohan, PhD[1-3]

[1]University of Missouri-Columbia
[2]Department of Opthomology
[3]Harry S. Truman Memorial Veterans' Hospital

Introduction

Sulfur mustard gas (SM), a chemical weapon, has been used in many wars and most recently in Syrian conflict. SM exposure to disrupts the corneal stroma that constitutes 90% of the cornea. The characteristic collagen fibrils arrangement is necessary for corneal transparency and clear vision. This study evaluated changes in stromal collagen fibrils arrangement in post SM in rabbit eyes with transmission electron microscopy (TEM) and its impact on vision in live rabbits with 2D and 3D clinical eye imaging.

Methods

Fifty-four New Zealand White Rabbits divided into three groups (Naïve, Vehicle, SM-Vapor) were exposed to SM. At day-3, day-7, and day-14, eyes were examined/imaged in vivo with stereomicroscopy, slit-lamp, optical coherence tomography and confocal microscopes. Post euthanasia, H&E and Picrosirius Red staining to determine stromal integrity and collagen levels and TEM analysis were conducted at 50,000x to quantify collagen size and distance.

Results

Clinical eye exams of SM exposed rabbit eyes demonstrated significantly increased corneal haze ($p<0.0001$), thickness ($p<0.0001$), and debris ($p<0.1$) in stroma and significantly reduced stromal cell density ($p<0.0001$) compared to naïve corneas at all tested timepoints. TEM showed significantly altered arrangement of collagen fibrils in stroma of SM-exposed eyes at tested times ($p<0.0001$ or $p<0.001$). H&E and Picrosirius Red staining supported clinical findings with notable damage to the corneal epithelial stromal barrier at tested times.

Conclusion

Acute vision loss from mustard gas occurs via alterations in characteristic collagen fibrils arrangement in corneal stroma and changes in key fibrotic markers, TGFB and collagens.

The expression of CDH17 in different tissues in mice with diet-induced metabolic disorders

Ethan Vanderwert,[1] Ming Yang PhD,[1-4] Eric Kimchi MD,[1-4] Kevin Staveley-O'Carroll MD PhD,[1-4] Guangfu Li PhD[1-4]

[1]University of Missouri-Columbia
[2]Department of Surgery
[3]Ellis Fischel Cancer Center
[4]Department of Molecular Microbiology

Introduction

Liver-intestine cadherin (CDH17) is a cellular surface protein commonly found in epithelial cells lining the colon. As an important member of the cadherin superfamily, CDH17 plays a key role in cell adhesion, which has been shown to function as a diagnostic marker for colorectal and pancreatic cancers. However, the expression and function of CDH17 have not been studied in other tissues, such as liver tissues. This project is to compare the expression of CDH17 in different tissues in normal mice and mice with diet-induced metabolic disorders.

Methods

A choline-low high fat and high sugar diet (CL-HFS) was used to induce murine obesity and NASH model. Healthy mice fed with a normal diet (ND) were used as the controls. Some parts of liver, pancreas, intestine, spleen, lung, and kidney tissues were harvested and frozen at -80 ℃ for RNA using TRI reagent. The cDNA was synthesized using the reverse transcription kit and used for qPCR tests to evaluate the mRNA expression levels of CDH17 in normal and CL-HFS mice. The rest parts of the tissues were fixed with 10% formalin for the preparation of slides, which were applied for immunohistochemistry (IHC) staining to test the protein expression levels of CDH17 in tissue samples.

Results

The qPCR results displayed that CDH17 was consistently downregulated in the tissues of CL-HFS mice compared to the tissues of ND mice,IHC staining results showed that the expression of CDH17 protein was higher in the intestine tissue ($p < 0.05$) than in other tested tissues of the body, which was suppressed by CL-HFS treatment. CDH17 was highly expressed in liver tissues with high infiltration of inflammatory cells.

Conclusion

The expression of CDH17 is downregulated in tissues such as intestinal tissues by CL-HFS treatment, indicating its roles in metabolic disease is tissue-dependent.

Identification of endometrial cancer stem cells

Kerem Yucebas,[1] Sooah Ko,[1] Jinyu Zhou,[1] Mark Hunter MD,[1,2] Shiying Jin PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology and Women's Health

Introduction

Endometrial cancer (EC) is the most common gynecologic malignancy in the United States. It typically presents with abnormal vaginal bleeding and pelvic pain, dramatically compromising quality of life for women. Thus, prevention or treatment of endometrial cancer is of importance to women's health. Cancer Stem Cells (CSCs) with self-renewal capacity have been identified in diverse cancers as the origin of carcinogenesis. Here, we hypothesize that Endometrial Cancer Stem Cells (ECSCs) initiate and support tumorigenesis and tumor expansion in the human uterine endometrium. ECSC identification will provide a novel understanding of EC and promote developing targeted therapies against ESCSs, reducing endometrial cancer-associated tumor burden and mortality.

Methods

Cryosections of endometrial cancer tissue, collected from hysterectomies at the University of Missouri, were stained with hematoxylin and eosin (H&E) revealing EC histology. Next, sections were immunofluorescent stained with epithelial cell marker CD326, cancer cell marker COX2 and cell proliferation marker MKI67 to determine the growth pattern of endometrial cancer. Staining was visualized and imaged with fluorescent microscopy and quantified to characterize expression levels and distribution.

Results

H&E staining showed expansion into the lumen, high cellular density, and a significantly thicker endometrium in EC, compared to non-cancerous control samples. The epithelial identity of cancer cells was confirmed by expression of CD326 and COX2. Expression of MKI67 constructed a dynamic growth map of EC across the basal and the functional zones

Conclusion

The unique morphology and growth pattern of EC in humans, supported our hypothesis that ECSCs may initiate and support tumorigenesis and tumor expansion in human uterine endometrium.

Opportunistic vertebral bone density measurements via computed tomography hounsfield units in patients with and without scheuermann disease

Zohaib Abro,[1] Rown Parola MD,[1,2] Lauren Pringle MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Radiology

Introduction
Diagnosis of Scheuermann Disease is indicated by increased kyphosis of the thoracic spine with sequential anterior wedging of vertebral segments. Some evidence suggests vertebral osteoporosis correlates with the disease; however, this remains inconclusive. Scheuermann Disease has also been associated with increased height, weight, and BMI. Computed Tomography (CT) has only sparsely been utilized to explore these associations. In this preliminary retrospective study, we predict that decreased vertebral bone attenuation in Hounsfield Units (HU) and larger body habitus, determined via opportunistic CT analysis, will positively correlate with the presence of Scheuermann Disease compared to controls of a similar age

Methods
CT of the thoracic spine and CT chest images of 99 patients were retrospectively analyzed from the University of Missouri Healthcare System with IRB approval. Variables measured include thoracic kyphotic angle, multilevel vertebral bone attenuation (in HU), anterior vertebral body wedging, anteroposterior (AP) thickness of subcutaneous fat at T1, and demographic data. Chi-Squared Tests, Paired T-Tests, and Mann-Whitney U Tests were utilized for data analysis.

Results
Our preliminary results indicate no statistically significant differences in bone attenuation with Scheuermann Disease compared to controls. AP thickness produced the greatest association with Scheuermann Disease in our data set but did not yet reach statistical significance (p-value: 0.077).

Conclusion
Thoracic vertebral bone attenuation has slightly (nonsignificant) lower average HU in Scheuermann Disease patients compared to patients without Scheuermann Disease. A more robust sample size may produce a statistically significant relationship, in addition to uncovering significant correlation with AP thickness.

Comparing conservative and surgical treatment for acute non-displaced fractures of the scaphoid based on fracture location: a systematic review and meta-analysis

Yazan Al-Kharabsheh,[1] Samuel D . Hawkins,[1] Jinpu Li MA,[1,2] Emily Leary PhD,[1,2] Julia A. Nuelle MD,[1,2] Daniel A. London MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedic Surgery

Introduction
Treatment of non-displaced scaphoid fractures with either conservative or surgical methods should involve shared decision making. To date, no meta-analysis has explicitly reported on differences in outcomes between different fracture locations. We aimed to report the risk of non-union in minimally displaced scaphoid fractures when divided by both treatment type and fracture location.

Methods
Meta-analyses were considered for the pooled proportion of those with scaphoid fracture non-unions, separately for those treated with either surgical or conservative approaches. To determine the pooled proportion, the variances of the raw proportions from each publication reviewed were stabilized using a Freeman-Tukey-type arcsine square root transformation. Random effects models were chosen if the Q test was significant, otherwise, fixed effects models were applied.

Results
We screened 2033 potential articles of which 29 were included in final data analysis. The proportion of non-unions in the surgical group divided by fracture class were: Proximal (0.11, PI 0.01-0.55), Medial (0.02, PI 0.01-0.55), and Distal (0.0, PI 0.0-1.0). Prediction intervals of non-unions in the conservative treatment group were: Proximal (0.10, PI 0.04-0.25), Medial (0.06, PI 0.01-0.26), and Distal (0.01, PI 0.0-0.12).

Conclusion
Our data indicates that surgical treatment results in less non-unions than conservative treatment. We found that regardless of treatment method, proximal fragment fractures have the highest rate of non-union. Our review of data highlights a distinct lack of literature on scaphoid fractures of the distal pole. Results of this study can be used to inform shared decision making when selecting a treatment for a scaphoid fracture.

Assessing treatment preferences for distal radius fractures in participants aged 65 and older

Zayd Al Rawi,[1] Elizabeth Graesser MD,[1-3] Summer Roberts MA,[1-3] Lindley Wall, MD[1-3]

[1]University of Missouri-Columbia
[2]Washington University
[3]Department of Orthopedic Surgery

Introduction

Clinical outcomes one year after surgical and non-surgical treatment of distal radial fractures in patients 65 and older are reported to be similar. This provides an opportunity for shared decision making between patient and physician to decide the best treatment option which aligns with the patient's preferences. To provide guidance for these conversations, it is important to understand what patients value when deciding between surgical and non-surgical treatment interventions.

Methods

An online survey aimed towards participants aged 65 and older was published on Amazon Turk. Participants were presented with a scenario in which they break their wrist, then educated on the two treatment options. Participants responded with their level of agreement (Likert scale) to 12 statements regarding treatment attributes, followed by a choice between surgery or cast if they received treatment.

Results

82% of 393 respondents prefer to undergo surgery over a cast. Interestingly, participants strongly agreed (SA) more with non-surgical treatment attributes. Underlying drivers related to non-surgical treatment included avoiding the risk of surgery (39% SA), and willingness to accept a longer time in a cast (36% SA), versus surgical treatment attributes of earlier wrist function (30% SA), and earlier wrist movement (27% SA). Participants do believe surgery would lead to better results (79% strongly or somewhat agreed).

Conclusion

While most participants preferred surgery, they showed stronger agreement with underlying attributes aligning with non-surgical treatment. This could be because participants believe surgery leads to a better result or uncovers a disconnect between participants values and their choice.

Social determinants of health in audiology screening compliance

Laith Almashharawi,[1] Mady Williams,[1] Destri Eichman,[1] Meridith Schoening,[1] Jacob Hercules,[1] Jennifer Hanford NNP,[1,2] Akshaya Vachharajani MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Child Health

Introduction

The Joint Committee on Infant Hearing (JCIH) endorses early detection and early intervention for all infants who are at risk of being or becoming, deaf or hard of hearing such as those admitted to the neonatal intensive care unit (NICU) for more than five days who undergo additional screening at 9 months of age. This study aims to evaluate the follow-up compliance rate for infants discharged from the NICU and scheduled for a repeat hearing screen at the WCH, as well as possible social determinants affecting compliance.

Methods

This is an IRB approved retrospective study of electronic medical records of infants born more than 34 weeks gestational age and admitted to the neonatal intensive care unit (NICU) at the University of Missouri Women's Hospital in Columbia, Missouri (WCH) for more than five days. Exclusion criteria included death and premature birth less than 34 weeks. Categorical data were analyzed using Chi square test & p values were significant if <0.05.

Results

Between May 2022 to August 2023, 63/127 (48.7%) scheduled hearing screens for NICU infants at the WCH were completed. Infants living less than 30 miles from WCH and with less than 2 siblings were more likely to be compliant. Race and type of health insurance were not a factor in compliance.

Conclusion

Audiology screening appointments for NICU infants who are at risk of hearing loss were more likely to be complied if families lived closer to WCH and came from smaller families.

Impact of restraint systems on maternal-fetal outcomes in pregnant patients involved in motor vehicle accidents: A retrospective analysis

Alexander Alvarado,[1] Cody Thornburgh MD,[1,2] Nanda Thimmappa MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Radiology

Introduction

Motor vehicle accidents (MVA) contribute significantly to pregnancy-related trauma. This retrospective study investigates the correlation between trauma, restraint use, and maternal-fetal outcomes following motor vehicle accidents.

Methods

A total of 38 patients, identified through Picture Archiving and Communication System (PACS) using the search terms "pregnancy" and "trauma" with a CT scan filter, underwent various imaging procedures. Detailed chart reviews enriched our understanding of accident categorization by action mode, restraint status, and documented fetal and maternal outcomes.

Results

Of the 38 patients, 34 were confirmed to be pregnant, three self-reported patients were assessed as non-pregnant on admission workup, and one had a molar pregnancy. Using restraints was associated with improved outcomes, notably reducing injury severity and fatality rates for both mothers and infants. Conversely, unrestrained passengers faced elevated risks, including fatal fetal outcomes, especially when ejected during accidents. Four fetal fatalities occurred among unrestrained ejected passengers (two during rollovers, one in unspecified mode, and one in a head-on collision). Additional trauma-related findings, such as fractures, will be presented in a table format during the formal presentation, along with Pertinent images.

Conclusion

This study emphasizes the critical importance of appropriate restraint systems in reducing injury severity in pregnancy-related MVA. These findings contribute significantly to our understanding of trauma during pregnancy. Further research involving larger cohorts is imperative to validate and expand upon these findings, ultimately leading to evidence-based guidelines to decrease the impact of trauma in pregnant patients involved in MVA.

A systematic review of paho and who documents for neurological disease burden

Shreya Anand,[1] Kiran Thakur MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Neurology

Introduction

The availability and distribution of neurological treatment and intervention vary greatly around the world. To address these issues, the World Health Organization (WHO) introduced the Intersectoral Global Action Plan that aims to improve and prioritize neurology implementation globally. The Pan American Health Organization (PAHO) is a specialized international health organization for the Americas (composed of 52 countries. It works to advance and defend public health by combating communicable and noncommunicable diseases and their causes.

Methods

A comprehensive search on neurodegenerative diseases was conducted by three reviewers through the Institutional Repository for Information Sharing (IRIS) database, PAHO and World Health Organization (WHO) websites.
The articles were then thoroughly reviewed and categorized by:

- Disease (Stroke and Traumatic Brain Injury (TBI)
- Scope/Type of Article (Guidelines, Epidemiological data, Plan/strategy, Educative, Meeting Summary, or Observational/experimental studies)
- Target Population (Healthcare Professional, Public Health Professional, General Population, Researchers/ Academics, or Other Profession)
- Gaps in Literature (Inadequate and/or Unreliable Data, Timeliness, Quality of Studies/information/data, or Not Found)

Results

A total of 7 publications found on Stroke and 7 publications specific to TBI across the PAHO/WHO databases. The publications were categorized by scope, gaps in literature, and target population

Conclusion

The result of the study revealed gaps in the following categories quality of studies published, inadequate/ unreliable data and unknown burden of disease. These gaps contribute to the Global Burden of Neurological Disorders need to be addressed in future studies.

Human metabolic responses of the acl extensor autografts to the acl remnant and the synovium

Luke M. Annin,[1] Kelsey R. Atteberry,[1] Chance D. Strickler,[1] Gillian M. Hark,[1] Maria L. Hinkamp,[1] Hailee C. Coleman,[1] Richard Ma MD,[1,2] James L. Cook PhD DVM,[1,2] Aaron M. Stoker PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction
Anterior cruciate ligament (ACL) reconstruction (ACLR) using quadriceps tendon (QT) and patellar tendon (PT) autografts is a common treatment for individuals after ACL tears. This study was designed to determine the effects of the torn ACL and synovium (SYN) on the PT or QT autograft from patients undergoing ACLR. It was hypothesized that co-culture of PT and QT with the ACL or SYN would significantly increase the pro-inflammatory and pro-degradative metabolic responses of the tissue compared mono-cultured tissues.

Methods
With IRB approval and informed patient consent, normally discarded QT, PT, ACL, and SYN were recovered from patients undergoing ACLR. Tissue explants were created from each tissue and cultured alone (MONO) or co-cultured with the ACL (COA) or SYN (COS). The explants were cultured for 6 days and then tissue protein content was extracted analyzed for inflammatory and degradative proteins. Significant ($p<0.05$) differences between groups were determined by Mann-Whitney or Kruskal-Wallis test.

Results
When comparing monocultured and co-cultured Tendons, the concentration of specific inflammatory and degradative proteins were significantly higher in the PT when cultured with ACL, and in the QT when cultured with SYN. The concentration of specific degradative enzymes were significantly higher in the ACL and SYN when cultured with QT than when cultured with PT.

Conclusion
The data from this study indicates that human PT and QT tissues have different responses to, and effect on, the ACL and SYN during culture.

Measuring the autonomic function after spinal cord injury

Andrew Apostol, Bradley Ferguson PhD, Ifeoma Anunoby BSc, Casey Sevy DO, Carmen M Cirstea MD PhD FAHA

[1]University of Missouri-Columbia
[2]Department of Physical Medicine & Rehabilitation

Introduction
Spinal cord injury (SCI) disturbs several physiological systems, including the autonomic system. Such disturbance results in severe complications and even death. Unfortunately, reliable, quantitative measures of the autonomic function are lacking in these patients. Due to the most recent technological advancements, we can now address this vital issue. We recently started a prospective cohort study of SCI patients to methodically examine autonomic function in real-world settings using a novel monitoring platform (Empatica Health)

Methods
Heart rate variability (root mean square of successive differences between normal heartbeats, RMSSD; estimates vagus-mediated control of the heart) and skin conductance (a sympathetic marker) data were collected for 48 hours at admission to a hospital-based rehabilitation program and repeated monthly for six months. Respiratory rate and skin temperature were also documented. Empatica is comprised of a non-invasive biosensor wristband and a Bluetooth mobile application that transfers data from the wristband to a secure cloud. Neurological/mental status was recorded for six months. Because data collection is an ongoing process, we presented data for one patient at admission evaluation.

Results
A 69-year-old patient with incomplete SCI (ASIA D) at the cervical level (C5-C7) and no anxiety/depression symptoms was recruited 36 days after the accident. The range of RMSSD was abnormal (5.0-304.3ms vs. 20-89ms=normal), suggesting autonomic dysfunction. The skin temperature was lower (32.5-34.7C vs. 36.1-37.2C=normal), reflecting thermal dysregulation. The pulse (61.8±6.1 beats/min) and respiratory rate (16.0±1.5) were normal.

Conclusion
We hope to demonstrate the utility of this platform for diagnosis, progression, or treatment monitoring of SCI-related dysautonomia.

Impact of demographics of head and neck cancer patients in mid-Missouri on staging at diagnosis

Elsie Barry,[1] Carson Gates,[1] Laura Dooley MD,[1,2] Stephanie Knollhoff PhD CCC-SLP[3]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology – Head and Neck Surgery
[3]Speech, Language, and Hearing Services

Introduction

Identifying the demographics and disparities of social determinants of health is important for personalized care, advances in research, and investigation targets for head and neck cancer. We aimed to identify such factors in head and neck cancer patients at the University of Missouri – Columbia (UM) and their impact on stage at diagnosis.

Methods

A retrospective review of 817 patients treated from 2018-2021 at the University of Missouri – Columbia was conducted. Patients with unstageable tumors, lesions not diagnosed as tumor on final pathology report, primary treatment through VA, and those with cancer recurrence were excluded from primary analyses. Demographic data regarding gender, age, and county of residence was obtained.

Results

599 patients fulfilled inclusion criteria. 43% of patients lived within 50 miles of UM, and 20% lived more than 100 miles away. 44% and 21% of patients from Boone County presented at stage 1 and stage 4 of disease, respectively. On the other hand, 30% and 37% of patients 101-150 miles away presented at stage 1 and stage 4 of disease, respectively. Females were more likely than males to present at stage 1 (53.46% vs. 33.07%, $p < 0.001$) and less likely than males to present at stage 4 (20.28% vs. 28.57%, $p = .053$).

Conclusion

Patients traveling from father distances and males may present at later stages of disease. When providing patient care, head and neck surgeons should be mindful of their patients' background and anticipate possible barriers to care to personalize care and improve outcomes.

Protein content of intervertebral disc tissues recovered from symptomatic patients and asymptomatic donors

Abigail F. Baumann,[1] Jacob S. Kramer,[1] Theodore J. Choma MD,[1,2] James L. Cook DVM PhD,[1,2] Aaron M. Stoker PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedic Surgery

Introduction

Intervertebral Disc (IVD) Degeneration (IVDD) is a significant source of disability in patients. It is not known why some patients develop symptomatic (SYM) IVDD and others remain asymptomatic (ASYM). This study was designed to identify differences in SYM and ASYM IVD tissue biomarker concentrations. It was hypothesized that IVD tissues from SYM patients would have significantly higher levels of pro-inflammatory and pro-degradative biomarkers compared to tissue from ASYM donors. Further the number of significant differences between SYM and ASYM tissues would increase as the level of IVDD increases.

Methods

With IRB approval and informed patient consent IVD tissues were recovered from SYM patients undergoing surgery for IVDD and qualified ASYM tissue donors without reported history of back pain. Level of IVDD was determined for each ASYM and SYM IVD and the protein content of tissue explants for SYM patients and ASYM donors was extracted from recovered IVD tissues. Significant ($p<0.05$) differences between groups were determined a Mann-Whitney Rank Sum test or Kruskal-Wallis test.

Results

SYM IVDs had significantly higher MCP-1 RANTES PDGF-AA VEGF MMP-1 MMP-7 MMP-8 MMP-9 and MMP-13 compared to ASYM IVDs when all samples were assessed together and when samples were grouped based on level of IVDD.

Conclusion

The characterization of IVD protein profiles performed in this study delineated significant differences between symptomatic patients and asymptomatic donors that may be related to development and severity of symptomatic IVDD. Understanding factors may allow for the development of novel diagnostic preventative and treatment methodologies for patients.

Differences in osteoarthritic cartilage biomarker content based on biomechanical properties of the tissue

Grace S. Brentlinger,[1] Gabriel J. Keeton,[1] Harjeev Singh,[1] Owen M. D'Amour,[1] Luke B. Marx,[1] Corder E. Lehenbauer,[1] Chantelle C. Bozynski DVM,[1,2] James A. Keeney MD,[1,2] James L. Cook DVM PhD OTSC,[1,2] Aaron M. Stoker PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Osteoarthritis (OA) is a multifactorial disease of the entire joint organ characterized by significant changes to the structure protein content and biomechanical properties of articular cartilage. This study was designed to characterize differences in OA cartilage biomarker content based on the aggregate modulus (Ha) and permeability (K) of the cartilage. It was hypothesized that OA cartilage tissue biomarker concentration would change significantly based on the biomechanical properties of the cartilage.

Methods

With IRB approval and informed patient consent osteochondral tissues were recovered from patients undergoing TKA for OA. Osteochondral explants were created from the tissues. A confined creep compression test was used to determine Ha and K of the tissue. Half of the explant was used for histological analysis and the other half for protein extraction and biomarker analysis. A Pearson correlation was used to identify relationships between biomechanical properties and tissue biomarker content. Significant differences between biomechanical property groups for each biomarker were determined using a T-test one-way ANOVA and Tukey post-hoc test or two-way ANOVA.

Results

The data from this study found significant differences in OA cartilage tissue degradative enzyme related (MMP-2 MMP-13 TIMP-1 TIMP-4) and inflammation related (MCP-1 adiponectin) biomarkers related to biomechanical properties of the cartilage.

Conclusion

This study suggests that relationships among OA cartilage tissue biomechanical properties and biomarker tissue content are multifaceted and complex. Ongoing studies in our lab are aimed at expanding this data set toward the goal of determining clinically relevant relationships that govern the development and progression of OA.

MRI in the evaluation and management of tibial plateau fractures

Samuel Brown,[1] Mauricio Kfuri MD PhD,[1,2] James P. Stannard MD,[1,2] Gregory J. Della Rocca MD PhD,[1,2] Kyle A. Schweser MD,[1,2] Brett D. Crist MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Tibial plateau fractures require thorough preoperative planning to ensure adequate fixation. Commuted tomography (CT) is commonly considered the standard of care for evaluating fracture morphology during preoperative planning although the use of magnetic resonance imaging (MRI) has been shown to increase identification of related soft tissue injuries it remains a topic of debate. Therefore the objective of this study is to evaluate the effectiveness of MRI in evaluating tibial plateau fractures for occult bony injuries change in fracture classification and articular depression.

Methods

Retrospective study of 426 tibial plateau fractures identified 141 fractures with MRI. Radiology reports and images were independently reviewed to compare the role of MRI to CT and x-ray in changing fracture classification quantifying articular depression and identifying radiographic occult tibial plateau fractures.

Results

MRI changed Schatzker classification of tibial plateau fractures in 18% (26/141) of cases. Of all cases where MRI changed classification 54% (14/26) changed from unicondylar to bicondylar fractures with Schatzker II à V and IV à V the most common. In addition MRI revealed an additional 4.2% (-64% - 250%) of articular depression compared to CT. Regarding identification of radiographic occult fractures MRI agreed with CT in identifying occult fractures in 96% (25/26) of cases and identified 3 fracture lines not visualized on CT or x-ray while CT revealed one occult fracture not seen on MRI.

Conclusion

MRI is near equivalent to CT in estimating articular depression and more sensitive than CT in detecting radiographic occult tibial plateau fractures. In a minority of cases MRI even reveals fractures not seen on CT resulting in change to fracture classification and subsequent treatment plan. Therefore given our results the lack of radiation exposure and ability to detect soft-tissue pathologies MRI may be the better imaging modality for preoperative planning of tibial plateau fractures.

Modulation of alloreactive responses by controlled dual delivery of Fas and IL-2R agonists using a coacervates platform

Mebrahtu G. Tedla,[1,2] Nathaniel Wright,[3,4] Mohammad Tarique,[1,2] Vahap Ulker,[1,2] Kathleen Yee-Flores,[1,2] Esma S. Yolcu PhD,[1,2,5] Yadong Wang PhD,[3,4] Haval Shirwan PhD[1,2,5]

[1]University of Missouri-Columbia
[2]Department of Pediatrics
[3]Cornell University
[4]Meinig School of Biomedical Engineering
[5]Department of Microbiology and Immunology

Introduction

An imbalance between T effector (Teff) and T regulatory (Treg) cells ratio is the underlying cause of type 1 diabetes and allogeneic islet graft rejection. Teff cells upregulate Fas following activation and become sensitive to FasL-mediated apoptosis. Meanwhile Treg cells are relatively refractive to apoptosis and expand in response to IL-2. Therefore, combinatorial use of a novel FasL (SA-FasL) and IL-2 has significant immunomodulatory potential by affecting Teff and Treg populations, respectively. We sought to establish a treatment platform through the sustained delivery of SA-FasL and IL-2 from lipocoacervate to modulate alloreactive T cell responses in favor of Treg cells, as a biomarker for tolerance.

Methods

A novel coacervate & lipocoacervate formulation was established for controlled dual delivery of SA-FasL and IL-2. The release kinetics and activities of FasL and IL-2 were assessed *in vitro* using Jurkat and CTLL-2 cell lines, respectively. The efficacy of lipocoacervate loaded with proteins in modulating alloreactive responses was assessed *in vivo*.

Results

IL-2 and FasL proteins showed a steady release over 30 days. IL-2 released from coacervate on day 14 had minimal activity loss, whereas FasL tested on day 9 showed ~20% activity loss. Treatment with SA-FasL and IL-2 loaded lipocoacervate modulated in vivo alloreactive T cell responses, resulting in an increased Treg/Teff cell ratio.

Conclusion

Lipocoacervate is an effective platform for controlled and sustained release of SA-FasL and IL-2 with significant potential in modulating allo and autoreactive T cell responses with therapeutic outcomes.

A child with HHV-6 and Bell's palsy: Case report and review of the literature

Loren Adler,[1] Avery Schroeder,[1] Paul Carney MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Pediatrics

Introduction

Bell's palsy, or peripheral cranial nerve VII palsy, is a rare occurrence in the pediatric population, with reported incidence around 6.1 per 100,000 children aged 1-15 per year. CNVII palsy is frequently idiopathic but is known to have infectious etiologies. In the adult population, the most common viral cause is HSV-1, with lesions often found at the time of presentation. The role of herpes simplex and other viruses in pediatric CNVII palsy remains to be fully elucidated. We report a 17-month-old child who presented with unilateral facial weakness and without evidence of etiology at the time of symptom onset who had a history of HHV-6 exanthema subitum 5 months prior to her presentation.

Methods

A focused literature review was conducted, including papers that described HHV-6 or Roseola in concurrence with CNVII palsy, pediatric CNVII palsy, and viral etiologies of CNVII palsy. The patient was seen in clinic for follow-up.

Results

In the literature, HHV-6 has been shown to be present in facial nerve ganglia and has also been associated with CNVII palsy following exanthema subitum. No viral testing was performed on the patient at the time of presentation.

Conclusion

While it is not possible to confirm that this child's CNVII palsy was due to HHV-6, this case represents a possible iterance of CNVII palsy related to HHV-6. This concurrence has only been reported a handful of times in the literature, and further suggests a possible causational relationship between the two.

Ovarian cyst in a 12-year-old pre-menarchal female: a case study

Sara Beaudoin,[1] Janie Leathers,[1] Keven Cutler MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Pediatric Emergency Medicine

Introduction
Abdominal pain as a chief concern is frequent in the pediatric emergency department. Ovarian cysts as the underlying cause are rarely diagnosed in premenarchal patients, but they are not uncommon. Most are less than 3 cm, asymptomatic, and occur after menarche. This case report details the presentation of a 12-year-old premenarchal female who presented with intermittent and worsening abdominal pain and was found to have an ovarian cyst. Current literature describing masses of this size in pre-menarchal patients is limited, which may complicate the diagnosis.

Methods
This case information is from a patient who presented to the University of Missouri Columbia Emergency Department.

Results
The patient was found to have a mass measuring 34x18x11cm in her right adnexal area. Laparoscopy was performed, six liters of serous cystic fluid was drained, and a partial cystectomy was performed. The patient recovered without complications.

Conclusion
In pre- and peri- menarchal patients with abdominal pain: if CT/MRI have ruled out the presence of acute appendicitis, clinicians should be aware of the limitations of radiologic imaging if ovarian cyst or torsion are suspected. Pelvic ultrasound may be more beneficial in distinguishing ovarian cysts from other causes of abdominal pain. Ultrasound alone is not definitive in discerning whether or not an ovarian anomaly exists and surgical consult is recommended if the clinical findings remain highly suggestive of ovarian pathology.

Scared of survey bots and insincere participants?

Abigail Beavers,[1] Elena Noetzel,[1] Erin Dannecker[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Therapy

Introduction
Artificial intelligence and survey bots increasingly threaten data integrity. An online survey of ours about pain elicited responses unexpectedly rapidly. Thus, we asked: What survey elements differed between suspected sincere or insincere participants?

Methods
We grouped participants into “sincere” or “insincere” cohorts based on verification of their email addresses and a minimum survey completion time. We wondered if additional survey elements could then distinguish the cohorts. We coded correct and incorrect participant responses to one closed-ended question. We also verified participants’ phone numbers and cross-checked their mailing addresses against a national database. Furthermore, we completed open-coding of participants’ responses to two open-ended questions.

Results
22.5% and 77.6% of participants were sincere and insincere, respectively. Sincere participants were 43.95 years old (±17.42 years), 50.0% women and 45.5% White. Insincere participants were 43.47 years old (±17.42 years), 56.6% women and 59.2% White. Survey completion times were longer for the sincere than insincere cohort (t_{89}= 2.14, p=.04, and Cohen’s d=.78). A correct response to the closed-ended survey question did not distinguish cohorts (p=.56). We coded phone numbers and mailing addresses with 100% agreement. More phone numbers were verified in the sincere than insincere cohort (p<.01). Mailing addresses did not distinguish cohorts (p=.32). We ultimately achieved 100% agreement on the open-coding. Codes for both open-ended questions distinguished between cohorts (p<.01).

Conclusion
Surveys must be constructed to protect data integrity. Our data support that some survey elements (e.g., completion times, email addresses, phone numbers, and question responses) may differentiate sincere participants from insincere participants.

You definitely don't want my thoughts on the pandemic!

Amy Brandt,[1] Robin Vanderbeck,[1] Alexandra Marko,[1] Yuhao Wang,[1] Kassandra Maturino MPH PhD,[1] Kayla Spence,[1] Jamie Smith MS,[1] Lynelle Phillips MPH RN,[1] Jane McElroy PhD,[1,2] Kevin Everett PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Family and Community Medicine

Introduction

Understanding beliefs and attitudes associated with COVID-19 vaccine hesitancy is vital toward informing health promotion strategies. Collecting these data requires strategies to ensure inclusivity and diversity of participant opinions. Implementing a tailored refusal conversion strategy is of particular importance for COVID-19 research.

Methods

Our team engaged participants at events throughout Missouri to complete either 2-page (19 question) or 4-page (44 question) surveys from June – August, 2023. Both surveys included perceptions about COVID-19, vaccine uptake, and demographic questions. Our survey collection teams had multiple strategies to enhance participation. Teams used booths with signage and offered promotional items which encouraged completion. To improve participation proportion, we underwent innovative 'sales' strategy trainings, solicited engagement at our booth and while circulating among attendees.

Results

We engaged with approximately 6,100 people at 31 events and obtained 3,747 surveys (~61% response rate). We found that when engaging participants, particularly those that refused, adapting our responses by using sales and customer service trainings turned 'Nos' to 'Yeses.' These strategies included adapting our mannerisms, body language, word choice, and inflection. Nonconfrontational rebuttals such as, "Actually, we just want your honest answers," or "I need your answers most of all," improved participation.

Conclusion

Documenting the viewpoints of event attendees who are rarely the subject of research allows for comparison with other data. Using successful approaches implemented in sales and customer service roles were tailored to populations such as COVID-19 skeptics who say, "Oh, you don't want to hear my opinion on COVID!" providing a rich dataset to further develop health promotion strategies.

Development and evaluation of a novel hospital discharge smartphone application for vascular surgery patients

Terrell Christian,[1] Chase Schlesselman MPH,[1,2] Maraya Camazine MD,[1,2] Iris Zachary PhD,[1,2] Tiffany Meller APRN,[1,2] Anne Sales PhD,[1,2] Todd R. Vogel MD MPH[1,2]

[1]University of Missouri-Columbia
[2]Depart of Surgery, Division of Vascular Surgery

Introduction

Vascular surgery, notably open lower extremity bypass (LEB), exhibits high unplanned 30-day readmission rates. To address this, the VAscular Surgery Discharge Application (VASDA) was developed, aiming to boost patient satisfaction, and communication, and curtail readmissions. We assess VASDA's feasibility and user experience.

Methods

In a single-center study, LEB patients received VASDA at discharge. VASDA features mobility, pain, health, wound questionnaires, follow-up schedules, "open chat," and wound photos. Low scores triggered alerts for immediate intervention. Usability was gauged via System Usability Scale (SUS) and Mobile Application Rating Scale (MARS).

Results

Among 20 LEB patients, 15 (75%) used VASDA consistently for 30 days post-discharge. The average age was 62; 64.7% were male, 88.2% white, with 47.1% having diabetes, 76.5% hypertension, and 58.8% hyperlipidemia. Users rated VASDA highly (Figure 1), with acceptability at 4.3 and impact at 4.8. Alerts related to pain scores (n=8), wound issues (n=6), and elevated depression scores (n=2). "Open chat" discussions covered wound complications, supplies, and medications. Alerts prompted early clinic visits for 8 patients (53.3%), and VASDA facilitated 3 necessary hospital readmissions due to surgical wound complications.

Conclusion

VASDA proves feasible, with robust usability, acceptability, and impact among vascular surgery patients. The app was effective in identifying problems that occurred at home via questionnaires and wound photographs. It identifies post-discharge issues, enhancing communication, satisfaction, and recovery while curbing unplanned readmissions and facilitating necessary ones. Multi-center studies are warranted to extend VASDA's effectiveness for post-discharge vascular surgery care.

Examining prehospital procedures in rural trauma care

Terrell Christian,[1] Jaycee Mudd,[1] Jennifer Randolph RN,[1,2] Chase Schlesselman MS[1,2] Jeffrey Coughenour MD,[1,2] Rushabh Dev MD,[1,2] Amy E. Liepert MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Surgery, Division of Acute Care Surgery

Introduction

Individuals residing in urban areas tend to be situated closer to trauma centers, facilitating quicker and more convenient access to essential healthcare services. This is in contrast to rural patients who may live a significant distance away from the nearest trauma center, facing an increased transport time to the hospital. This study assesses the relationship between pre-hospital procedure (PHP) intervention by emergency medical services (EMS), transport method and time, and the impact on mortality in rural trauma patients.

Methods

We conducted a retrospective analysis using the University of Missouri - Columbia Trauma Database, focusing on patients transported to the Frank L. Mitchell, Jr. Trauma Center from April 2022 to March 2023. Data included age, gender, race, injury type (blunt, penetrating), trauma category (e.g., fall, gunshot wound), transportation time, method (ambulance, helicopter), and discharge status (alive, deceased). Analyzed procedures encompassed IV placement, needle decompression, chest tube insertion, endotracheal intubation, tourniquet use, blood transfusions, CPR, C-Spine Immobilization, backboard usage, splinting, medication administration, and blood product transfusions.

Results

The study covered 822 patients, with EMS transport averaging 26.4 minutes (range: 0-96 minutes). Ambulances transported 73% of patients, while helicopters transported 27% of patients. The most commonly administered PHPs were C-spine immobilization (31%), backboard usage (24%), and IV placement (22%), with an overall patient mortality rate of 6.32%.

Conclusion

When comparing individuals who received PHPs administered by EMS with transport time and method, there are no notable variations in mortality rates. These outcomes may be influenced by injury severity and the amount of procedures performed.

Social and demographic predictors of hepatitis a and hpv vaccination among U.S. Immigrants

Claire Lynn,[1] Olumayowa 'Nike Odemuyiwa[1,2]

[1]University of Missouri-Columbia
[2]Sinclair School of Nursing

Introduction

The resurgence of previously eliminated vaccine-preventable diseases has raised concerns about vaccine hesitancy. Although most studies focus on personal and religious exemptions on declining rates, lack of education and access to healthcare may also contribute. Immigrants, who may face difficulties in navigating a new country's culture and healthcare system, constitute one growing vulnerable population. We examined the factors associated with hepatitis A (HAV) and human papillomavirus (HPV) vaccination among immigrants.

Methods

Vaccination and demographic data from the 2017-2018 National Health and Nutrition Examination Survey was analyzed for immigrants over 18. We used logistical regression to examine the association between demographic variables, such as income and health insurance, and HAV/HPV vaccination status.

Results

A total of 1764 respondents (mean age = 49.9 years) were analyzed. HAV vaccination was significantly associated with living in the U.S. at least 20 years, higher education level, being insured, and being male ($p<.001$). Similarly, increased time living in the U.S., higher income, and higher level of education were significantly associated with HPV vaccination. However, Black males and those over 50 were much less likely to be vaccinated for HPV.

Conclusion

This study indicates an association between increased time living in the U.S. with increased vaccination rate, suggesting that vaccine uptake may occur with adaptation to a new country. However, immigrants with a low educational level and without health insurance may constitute a high-risk group for low vaccination rates. Educational programs that target these groups may increase vaccine uptake and reduce the incidence of vaccine-preventable diseases in the United States.

Race and beta blocker use in stroke rehabilitation

Elizabeth Cremer,[1] Ifeoma Anunoby,[1] Carmen Cirstea MD PhD FAHA[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine & Rehabilitation

Introduction

Black stroke patients face worse outcomes and a higher risk of cardiovascular events than White patients. Stroke can increase sympathetic activity, a condition associated with poor recovery and severe cardiac complications. Inhibiting sympathetic overactivity (beta-blockers, BB) might be beneficial. The current study aimed to determine whether BB use is different between Black and White patients and how this impacts the length of stay (LOS) in the rehabilitation ward.

Methods

A retrospective chart review was performed on patients admitted to a hospital-based rehabilitation program between January 1, 2021, and December 31, 2022. Outcomes of interest included race, gender, age, stroke history/type/severity, information regarding BB usage both before and following the stroke event, and LOS.

Results

A total of 251 (23 Black) stroke patients were analyzed. Compared to the White patients, Black patients were significantly younger (57.7±9.7 vs. 68.8±12.2 years, $p<0.001$) and received higher doses of BB during rehabilitation (average dose eq, 29.3 vs. 20.2, $p=0.04$). No significant differences were found in sex composition, stroke type or severity, BB uses at any point during their pre- and post-stroke acute care, and LOS ($p>0.05$ for all). However, for White patients, BB use pre-stoke was associated with a decreased LOS (19.3±11.9 vs. 21.8±15.3 days in BB non-users pre-stroke, $p=0.039$) but this effect did not reach statistical significance in Black patients (20.8±9.3 vs. 16.5±7.2 days, $p=0.13$).

Conclusion

Our preliminary data suggest that BB use and LOS in the rehabilitation ward did vary based on race. More studies with larger samples are needed.

Regional differences in femoral condyle cartilage biomarkers related to histological degradation severity in the osteoarthritic knee

Owen M. D'Amour,[1] Grace S. Brentlinger,[1] Gabe J. Keeton,[1] Luke B. Marx,[1] Corder E. Lehenbauer,[1] Harjeev Singh,[1] Chantelle C. Bozynski DVM,[1,2] James A. Keeney MD,[1,2] James L. Cook DVM PhD OTSC,[1,2] Aaron M. Stoker PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopedic Surgery

Introduction

The femoral condyles (FC) are the articulating surfaces in the knee with the highest reported prevalence of symptomatic articular cartilage lesions. This study was designed to characterize relationships among OA-related changes in cartilage structure with the concentrations of clinically relevant protein biomarkers in the FC. It was hypothesized that FC OA cartilage with more severe histological degradation would be associated with significantly higher levels of inflammation-related, degradation-related, and bone turnover-related biomarkers.

Methods

With IRB approval and informed patient consent, FC were recovered from patients undergoing TKA for OA. Osteochondral explants were created from specific regions of the medial and lateral FC. One half of each explant was evaluated histologically by a blinded pathologist using the OARSI system. Protein extracted from the other half was assessed for various biomarkers. Significant differences were determined using a T-Test, one-way ANOVA and Tukey post-hoc test, or two-way ANOVA.

Results

It was found that there are significant differences in biomarker concentrations when utilizing the histology sum score groups. These data indicated that there are significant differences in the regional biomarker concentrations due to OA progression.

Conclusion

The data from this study indicate potentially important relationships among regional differences in FC OA cartilage protein biomarker concentrations and severity of histologic degradation of the tissue. Ongoing studies in our lab are aimed at determining mechanistic relationships between changes in OA cartilage architecture and protein composition which may serve as biomarkers for disease development and progression.

Characteristics of loxoscelism-induced anemia: a clinical retrospective analysis

Timothy Dillinger,[1] Kenlee Jonas,[1] Jon A. Dyer MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Dermatology

Introduction
Hemolytic anemia is an infrequent complication of brown recluse spider bites (BRSB). This study aims to better understand the characteristics of patients with brown recluse spider associated hemolytic anemia

Methods
We performed a retrospective chart review in the University of Missouri-Columbia healthcare system's electronic medical record (EMR) from October 2015 through June 2023 using ICD codes for BRSB. We excluded all patients without evidence of anemia or who had clinical features not consistent with a BRSB.

Results
Thirty-seven patients met the inclusion criteria. Sixty-one percent of patients were discharged and then returned with worsened symptoms. Eighty-one percent of patients developed constitutional symptoms. Severe anemia was associated with systemic symptoms, darkened urine, and typical hemolysis laboratory findings. Increased transfusion requirements were associated with higher nadir LDH. Of note, there was an increase in total bilirubin and/or LDH one day prior to a significant drop in Hgb (>= 2.0 g/dL) in 75% and 83% of patients, respectively. Forty-one percent of patients required blood transfusions.

Conclusion
Patients who developed hemolytic anemia commonly had multiple visits prior to the detection of their hemolysis. Constitutional symptoms, typical hemolysis lab findings, increased LDH levels, and an increase in total bilirubin and/or LDH should raise concern for the development of severe anemia even if Hgb levels are presently normal or mildly decreased. Early testing of LDH and total bilirubin may help risk stratification in these patients.

Acute localized exanthematous pustulosis caused by systemic loxoscelism: a case report

Timothy Dillinger,[1] Kenlee Jonas,[1] Jon A. Dyer MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Dermatology

Introduction
Acute Localized Exanthematous Pustulosis (ALEP) is a rare, benign cutaneous eruption characterized by localized pustules on an erythematous base. Typically, ALEP occurs as an adverse reaction triggered by specific medications, most notably B-lactam and macrolide antibiotics. However, in this case report, a 15-year-old female presented with presumed ALEP secondary to developing systemic loxoscelism, the systemic effects of a brown recluse spider bite (BRSB).

Methods
Retrospective chart review of a patient presenting at the University of Missouri Hospital with a history of a BRSB. Data collected on the patient included demographics, lesion descriptions, clinical presentation, laboratory findings, and management.

Results
A 15-year-old female was admitted to the hospital with systemic symptoms including a peak fever of 38.1°C, fatigue, malaise, chills, nausea, hypotension, and diffuse erythematous blanching rash with pustules located on the dorsum of the left foot. Other abnormal lab values seen in our patient included leukocytosis with granulocyte predominance, elevated CRP, and anemia with normal LDH and haptoglobin (possible extravascular hemolysis).

Conclusion
ALEP is a cutaneous adverse reaction that is typically caused by certain medications. Proper identification, cessation of the offending agent if applicable, and appropriate supportive measures remain crucial in ALEP management. Because this case report is one of few systemic loxoscelism-linked cases of ALEP, we hope this report will help provide some insight into this poorly understood condition.

Tigers connected: a novel social determinant of health (SDOH) screening and intervention program in the pediatric emergency department

Destri Eichman,[1] Danielle Lee,[1] Isabella McCartney,[1] Mariana Mendoza Castro,[1] Liz Kendrick,[1] Janisha Eubanks,[1] Lily Stidham,[1] Jennae Reken MD,[1-3] Alexandra James MD,[1-3] MaryBeth Bernardin MD[1-3]

[1]University of Missouri-Columbia
[2]Department of Emergency Medicine
[3]Department of Pediatric Emergency Medicine

Introduction

Social determinants of health (SDOH) have significant impacts on children's immediate and long-term health outcomes.1In the University of Missouri Healthcare System, these determinants are screened for and addressed in the pediatric primary care setting through a program entitled "Tigers Connect". However, many families utilize the emergency department (ED) rather than primary care for their children's healthcare needs. This study aims to determine the feasibility and effectiveness of an ED-based framework for screening and addressing SDOH.

Methods

This prospective cohort study assessed 10 social domains of families presenting to the ED with a child under age 18. This assessment was conducted with an online validated screening tool that was presented to caregivers during their child's ED stay. Families who screened positive for a SDOH were contacted remotely (ie text, phone call) and provided community services to meet their specific needs.

Results

Of the 95 families surveyed, 42.1% screened positive for a SDOH. Positive SDOH screens included 65% food insecurity, 43% lack of childcare, 30% lack home utilities, 17.5% lack of healthcare, and 17.5% housing instability. 40% of participants with positive screens requested services, and remote resource assistance was performed successfully with 75%. Demographically, we found that most caregivers were employed full time (76%), only 19% had received social services previously, and 52% of children were insured through Medicaid.

Conclusion

A significant proportion of families presenting to the ED are coping with SDOH. These findings establish the ED as a healthcare setting in which SDOH can be effectively identified and addressed with subsequent remote follow up.

Short educational intervention increases subjective knowledge of head and neck cancer and human papillomavirus amongst Missouri state fair attendees

Emma Elbert,[1] Ryan Akin MD,[1,2] Tabitha Galloway MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology – Head and Neck Surgery

Introduction

Human papillomavirus (HPV) related oropharyngeal cancer is the most common HPV related malignancy in the United States. The public lacks knowledge regarding head and neck (HN) cancer, its association with HPV, and its preventability with vaccination. Providing educational intervention from medical professionals is an important step toward increasing public knowledge and intention to vaccinate.

Methods

A HN cancer screening event at the Missouri State Fair was utilized to assess and increase HN cancer and HPV knowledge. A pre-educational questionnaire, which included demographic data and attitude toward the HPV vaccination, was followed by a short educational intervention before screening. A post-educational questionnaire assessed subjective knowledge gain on a Likert scale and changes in attitude toward HPV vaccination.

Results

71 participants completed pre- and post-education surveys. Subjective knowledge of HPV increased from 2.2 to 4.1 ($p < 0.001$) and from 2.0 to 4.1 ($p < 0.001$) for HN cancer. 16 (22.5%) participants reported a positive attitude change towards vaccination and 58 (80.6%) would recommend the vaccine after our educational intervention. Surprisingly, only 16 (22.5%) participants reported a provider had ever mentioned HPV, and only 6 (8.5%) had mentioned a connection between HPV and throat cancer.

Conclusion

Our short educational intervention increased subjective knowledge of HN cancer and HPV as well as improved attitude toward and willingness to recommend HPV vaccination.

Donor site morbidity in head and neck reconstructive limbs: anterolateral thigh and fibula free tissue transfers

Emma Elbert,[1] Kelly Schmidt MD,[1,2] Elena Doctor NSCA-CSPS,[1,2] Patrick Tassone MD,[1,2] Tabitha Galloway MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology – Head and Neck Surgery

Introduction
Free tissue transfer is the standard of care for complex head and neck reconstruction. Despite the widespread use of free flaps, donor site morbidity and functional change remain understudied. The objective of this study is to identify morbidity and functional change associated with lower extremity donor sites among patients undergoing free flaps for head and neck reconstruction.

Methods
Demographic information, mobility status, rehabilitation service utilization and donor site outcomes were collected on all anterolateral thigh (ALT) and fibula free flap patients from 2015-2022. Morbidity was defined as donor site complications such as infection, seroma, or graft failure. Functional changes to the operative limb were independently captured.

Results
12 (14.8%) of the 81 ALT patients and 23 (39.0%) of the 59 fibula patients developed any donor site complication. At discharge, further outpatient physical therapy (PT) was recommended to 11 of the PT-evaluated ALT patients (14.1%) and 12 (20.3%) of the fibula patients.

Conclusion
Donor site morbidity related to wound complications affects a meaningful number of patients undergoing lower extremity free flap reconstruction of head and neck defects. Future studies should investigate patient factors associated with donor site morbidity as well as functional changes in donor limbs to allow for directed interventions that will improve donor site functionality and patient postoperative quality of life.

Importance of histopathologic Evaluation in the diagnosis of aneurysmal fibrous histiocytomas

Rebecka Ernst,[1] Allison Sindle MD FAAD[1,2]

[1]University of Missouri-Columbia
[2]Department of Dermatology

Introduction
Cutaneous fibrous histiocytomas are benign dermal proliferations comprised of primarily fibroblastic and histiocytic cells. There are multiple histologic variants of fibrous histiocytomas, including atypical, epithelioid, cellular, hemosiderotic, and aneurysmal fibrous histiocytomas. Of the histologic variants, aneurysmal lesions are the rarest variant, with a reported incidence of 1.7% of cutaneous fibrous histiocytomas. These lesions can mimic vascular neoplasms, malignancy, and cystic lesions due to their dermal nature, rapid growth, and painful presentation. Histopathologic evaluation is of utmost importance for diagnosis. Here we report a case of an aneurysmal fibrous histiocytoma which was clinically concerning for a traumatized cyst versus a vascular neoplasm.

Methods
A case report of a 40-year-old male with no chronic medical conditions and no personal or family history of skin cancer presented to the dermatology clinic with concerns of a bothersome lesion on his left upper back determined to be aneurysmal fibrous histiocytoma was preformed along with a review of the literature.

Results
Pathologic evaluation showed a spindle and epithelioid proliferation most consistent with an aneurysmal variant of a fibrous histiocytoma. Immunohistochemical stains were positive for D2-40, Fascin, and CD99. The lesion was negative for smooth muscle actin, CD34, CD117, desmin, CD31, EMA, Melan-A, HMB45, OSCAR keratin, SOX10, and S-100.

Conclusion
The clinical differential diagnosis of a lesion of this sort is broad. Including traumatized epidermal cyst, vascular neoplasm, and other malignancies such as melanoma. Histopathologic evaluation is of utmost importance in solidifying this diagnosis.

Disorder of sexual development and considerations in pediatric forensic autopsy

Rebecka Ernst,[1] Emily Lager,[1] Keith Norton MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Pathology and Anatomic Sciences

Introduction
Ovotesticular Difference of Sexual Development (ODSD) commonly presents in the newborn period with ambiguous genitalia and has been diagnosed in an age range of patients from the newborn period up to 60 years of age, with only 25% of patients being diagnosed before age 20. ODSD is estimated to have an incidence of 1/100,000 live births.

Methods
This is a case report of an incidental finding of ovotestis in an outwardly appearing female infant during forensic autopsy for suspected SIDS versus child abuse case.

Results
An 8-week-old female child was put in a swing by her mother and a couple hours later she was found unresponsive in the swing. On autopsy, one of the ovaries was abnormal in shape and had entered the inguinal canal. Microscopically, an abnormal combination of tissues was found bilaterally. Histology consistent with epididymis, fallopian tube, ovary, and testis was present-- solidifying a disorder of sexual development (DSD). This patient specifically had a more rare disorder: ODSD. The cause of death was stated to be potential asphyxia. The manner of death was natural.

Conclusion
This case emphasizes the importance of thorough gross and histologic evaluation in pediatric autopsy cases, especially in establishing the incidence of DSD in infants as well as further understanding the potential mechanisms proposed to induce ODSD.

Physical therapists perspectives on physician prescriptions

Adam Fehr DPT,[1] Mark Drymalski MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine & Rehabilitation

Introduction
Physicians often refer to physical therapist yet communication between professions is frequently limited to the initial prescription. Evaluating how therapists perceive physician prescriptions may identify opportunities for improved communication.

Methods
Descriptive electronic RedCap survey. Subjects recruited through Facebook and Instagram flyers posted by author.

Results
52.0% of respondents (N=175) felt physician prescriptions contain too little information (28.6% the right amount, 19.4% too much.) 41.1% reported information on the prescription only rarely changing treatment (36.0% occasionally, 6.3% often, 3.4% very often.) 33.7% feel physician prescriptions are “mostly out of date” with the MSK/rehab evidence (25.1% “sometimes out of date.”) 36.0% reported their clinical findings often conflicting with the physicians diagnosis (15.4% “very often,” 44.6% occasionally, 4.0% rarely, 0% never) 4.0% “always follow” the specific treatment instructions listed on the prescription. 21.7% “rarely” follow, 34.3% sometimes, 7.4% never, and 16.6% “most of the time. 42.3% find specific treatment instructions to be detrimental (52.0% neutral, 5.7% helpful.) When asked to rate importance of including imaging findings on a 0-5 scale with 5 being “extremely important” 37.7% selected 4/5 and 24.0% 5/5. When asked the same regarding precautions/contraindications 63.3% selected 5/5.

Conclusion
Disconnect may exist between how physical therapists and referring physicians view therapy prescriptions. Perceptions of what constitutes “evidence-based” practice may also differ between professions. Direct communication should occur between professions to establish expectations and optimize prescription structure. A potential initial step may be inclusion of imaging findings and precautions/contra-indications on prescriptions sent.

How do laypeople decide who to see for their pain complaints?

Adam Fehr DPT,[1] David Arnold MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine & Rehabilitation

Introduction

Approximately 20% of US adults report chronic pain and, in 2003, an estimated 22% of primary care visits were for pain. Exploring how non-medical professionals select when and who to see for pain may enable practitioners to better meet patient expectations, identify targets for public outreach, and opportunities for cost-reduction.

Methods

Descriptive electronic survey conducted through RedCap. Subjects were recruited through Facebook and Instagram flyers posted by author.

Results

When asked the "single most important thing when deciding which professional to see first", 33.7% (N=74) selected insurance coverage, 25.6% time to be seen, 16.1% treatment supported by research, and 13.5% cost. When asked "what role does insurance coverage play in your decision", 18.9% were only willing to see professionals fully covered by insurance, 54.1% willing to pay copay/coinsurance, 37% willing to pay fully cash. 54.8% felt comfortable seeing a PT without first seeing a MD/DO. 31.5% were comfortable seeing a Chiropractor first, 35.6% massage therapist. 32.9% had previously seen a chiropractor first, 24.7% massage therapist, 28.8% PT. 55.4% seek care within two weeks of symptoms, 13.5% wait a month, 17.6% 1-2 months, 5.4% 3-4 months, 5.4% 6+ months.

Conclusion

Non-medical professionals have heterogenous priorities and physicians may benefit from adapting communication and marketing accordingly. Need for public education may exist as over half of respondents seek care well in advance of the natural recovery timeframe for most pain conditions. Physicians should reassess their role and messaging as over half of respondents felt comfortable bypassing physicians to see another professional first.

Positive ANA referrals to rheumatology clinic: utility of triage system into telemedicne clinics

Lauren Flowers[1] Chen-Chung Steven Liu MD,[1,2] Benjamin Schroeder MD,[1,2] Celso Velazquez MD,[1,2] Chokkalingam Siva MD MS FACP[1,2]

[1]University of Missouri-Columbia
[2]Department of Medicine, Division of Rheumatology

Introduction

A significant shortage of rheumatologists exists at MU Healthcare nationwide, with positive antinuclear antibody (ANA) being the most common reason for referrals to rheumatology. However, most of these patients do not have inflammatory rheumatic disease. To address this issue, the MU Rheumatology Clinic implemented a triage system, involving prescreening medical records and scheduling most of the positive ANA referrals for telemedicine appointments. This study assesses the triage system's effectiveness in assigning new patients with low likelihood of rheumatologic disease to telehealth visits.

Methods

This study records of patients referred for positive ANA results and scheduled for telemedicine appointments at our clinic between January 1, 2022 and March 31, 2022. We recorded eventual diagnoses made at the rheumatology clinic and whether the patient required in person follow up.

Results

A large majority of the patients (33 out of 37, 89%) were found to have non-inflammatory conditions that are not necessarily managed by rheumatologists and do not require immunosuppressive therapy. ANA values ranged from 1:40 to 1:1280, showing no clear correlation between higher ANA and increased risk of inflammatory rheumatic disease. Additional data for the entire calendar year 2022 will be included in the final poster.

Conclusion

Our results indicate the high accuracy of the MU rheumatology triage system in assigning new patient referrals with a low risk of inflammatory rheumatic disease to telehealth appointments. Adoption of universal rheumatology clinic triage systems for new patient referrals may reduce inappropriate utilization of clinic resources and physician burden.

Integration of objective, precision-based technologies into ENT clinical practice

Diego Gamoneda,[1] Teresa Lever MD,[1,2]
Laura Dooley MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology – Head and Neck Surgery

Introduction

Dysphagia is a non-specific symptom broadly characterized by difficulty swallowing. Currently, the evaluation of dysphagia is largely subjective and treatment options are predominantly behavioral based. To bridge this clinical gap, the Lever Lab is focused on developing precision-based medicine approaches for objective dysphagia diagnosis and targeted treatment. Here, we report our initial efforts with three ENT-based technologies: SwallQuest (digital health questionnaire website), LARyTrack (software for tracking laryngeal motion in endoscopic videos), and Transcutaneous Electrical Neuromuscular Stimulation of the Superior Laryngeal Nerve (TENS-SLN; a novel electrical stimulation approach to increase swallowing rate).

Methods

Participants (n=42) visiting the MU Ellis Fischel Cancer Center completed several standard-of-care self-administered health questionnaires via SwallQuest during scheduled outpatient ENT appointments. SwallQuest's custom analytic features automatically computed and compared patient scores to published normative reference values. A subset of participants who reported symptoms of dysphagia (n=33) underwent standard-of-care video-recorded rhinolaryngoscopy for subsequent quantitative analysis of laryngeal dysfunction using LARyTrack. Healthy participants (n=2) were recruited for TENS-SLN protocol optimization, in preparation for a future study with dysphagic patients.

Results

Only 32/42 (76%) participants successfully completed the SwallQuest surveys due to clinic time constraints. Standard-of-care endoscopic laryngeal videos proved challenging for LARyTrack analysis, mainly due to poor image resolution and/or laryngeal structures outside the field of view. For TENS-SLN, swallowing was consistently evoked in both healthy participants.

Conclusion

Efforts are underway to remove identified procedural barriers to facilitate integration of our ENT-based technologies into clinical practice.

Effects of propranolol on semantic word fluency in autism spectrum disorder

Pias Malaker,[1,3] Nanan Nuraini,[1,2] David Q. Beversdorf MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Neurology
[3]Tom and Anne Smith MD-PhD Program

Introduction

Prevailing symptoms of autism spectrum disorder (ASD) include impairments in social communication and presentation of stereotyped interests and repetitive behaviors early in life. Yet, most pharmacotherapeutic interventions target the comorbid psychiatric conditions that constitute ASD (i.e., atypical neuroleptics for aggressive behavior and various anxiolytics for anxiety), and not the core features. Though some studies have targeted the core features, they remain unsuccessful. Previously we demonstrated that propranolol, a beta-adrenergic antagonist, was beneficial during performance of tasks involving flexibility of access to networks in ASD, including semantic fluency on single dose psychopharmacological challenge studies. However, this has not yet been explored with sustained doses in a clinical trial. We hypothesized that propranolol would increase semantic cognitive abilities among ASD

Methods

Thirteen individuals with ASD (20.31 ± 3.71 years old) underwent assessment with semantic fluency measures at baseline. Participants then underwent double blind randomization to a single dose of placebo or propranolol at 6-week and 12-week follow-up with reassessment of semantic fluency measures.

Results

Initial comparison of total semantic fluency words did not differ between ASD individuals who were administered propranolol or placebo at 6 weeks, and 12 weeks following the initial visit ($p>0.05$).

Conclusion

The limited size of our study restricts our ability to draw any firm conclusions currently. In future extensions of this study, we plan to increase the number of subjects and include neuroimaging scans as well as cognitive and behavioral measures to identify the underlying mechanisms of propranolol's effect more directly on semantic fluency in ASD.

Oral cavity squamous cell carcinoma: Exploring adjuvant therapy adherence and outcomes

Carson Gates,[1] Patrick Tassone MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology – Head and Neck Surgery

Introduction

Oral Cavity Squamous Cell Carcinoma (OCSCC) is the most common type of cancer within the oral cavity. Adjuvant therapy (AT) is indicated for intermediate and high-risk cancers. Although survival outcomes are improved in these patients, ¼ of patients do not receive radiation therapy (RT), and 1/3 of patients do not receive adjuvant chemotherapy (AC). This study aims to understand factors associated with University of Missouri (UM) patients not receiving indicated AT for OCSCC.

Methods

A retrospective review of UM patients treated with surgery for OCSCC with indications for adjuvant therapy was performed. Information about staging and treatment, follow-up, driving distance from UM, area deprivation index (ADI) was obtained. Patients were identified based on whether AT was indicated and if indicated treatment was initiated and completed.

Results

92 patients with OCSCC and indications for AT were identified. 67 patients completed RT and fully or partially completed AC while 25 patients did not initiate or complete RT or AC. Patients who completed RT and fully or partially completed AC had greater overall survival compared to those who did not initiate or complete AT (847.7 vs 462 days), decreased driving distance (70 vs. 90 miles), and decreased average age (59.3 vs 66.7 years).

Conclusion

Patients treated for OCSCC at UM followed through AT more often than the national average, but there were differences in outcomes for patients who did not follow through. It is important to identify social determinants of health and provide patient-centered care to ensure patients pursue treatment that is best for them.

EMR dermoscopy image and social determinants of health data retrieval for AI algorithm development

Josie Giefer,[1] Lauren Flowers,[1] Mirna Becevic PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Dermatology

Introduction

Dermoscopy is a non-invasive technique used to evaluate suspicious skin lesions with a high magnification lens that allows users to assess structures in the reticular dermis. Our goal is to utilize dermoscopic images to train an artificial intelligence (AI) algorithm to recognize patterns and diagnose skin lesions as benign or malignant. Herein, we discuss our data collection strategy and results that were used to train the algorithm.

Methods

Chart review of patients at the University of Missouri occurred from 2021-2023. A total of 696 distinct dermoscopic images were collected, each tied to a diagnosis confirmed via biopsy. Information on age, gender, race, and the county was also recorded.

Results

Preliminary data suggests that the average patient age was 69. Patients consisted of 52.9% males and 47.1% females. When evaluating patients by race, 98.6% were white and 1.4% were black. Of the 14 counties represented, most patients resided in Boone (68.6%), Callaway (5.7%), and Randolph (5.7%). Of the 33 diagnoses evaluated, the top three were basal cell carcinoma (11.8%), dysplastic nevus (8.6%), and melanoma in situ (8.2%). When all the images were compared to biopsy results, 60.9% of diagnoses were benign and 39.1% were malignant.

Conclusion

Recognition of subtle dermoscopic patterns takes years of training, which limits its use outside of dermatology. By using this data to train an AI algorithm, we hope to increase ease of access to this technology to help rural physicians and primary care providers triage skin lesions and spare patients from unnecessary biopsies.

Determining the impact of surgical scissor type on patient experience during Mohs micrographic surgery: A randomized control trial

Josie Giefer,[1] Ghaith Alrahawan MD,[1] John Wuennenberg MD,[1] Nicholas Golda MD[1]

[1]University of Missouri-Columbia

Introduction

Environmental factors during dermatologic surgery can exacerbate anxiety and affect patient experience. Previous studies have evaluated the impact of smells and sounds on patient experience during Mohs micrographic surgery (MMS), but no study has evaluated how the metallic clipping sound generated by surgical scissors impacts patient experience.

Methods

We conducted a prospective, single-blinded, randomized controlled trial including 148 adult patients presenting for MMS to evaluate how the clipping sound generated by surgical scissors impacts patient experience. Patients were randomized into one of three groups: 1. A control group with traditional curved Iris scissors, 2. An intervention group with modified curved Iris scissors, 3. A comparative arm where patients experienced both the traditional and modified scissors and were asked in a blinded fashion during surgery which scissor they preferred.

Results

The metallic clipping noise was noticed less by the modified group ($p = 0.3747$). The metallic clipping noise was less bothersome to patients in the modified group ($p = 0.2258$). In Group 3, of the 38 patients that selected a preference 60% chose the modified and 40% chose the traditional ($p=0.2559$).

Conclusion

While there was no significant difference between the two groups in terms of noticing the clipping noise and being bothered by the clipping noise, there may be some clinical significance to draw from this study. Patient preference tended toward the modified scissors and these quiet instruments may improve patient experience, especially for those who are extra sensitive to sensory stimuli or for those who have never undergone dermatologic surgery before.

Restrospective study of pierre robin at the university of missouri

Carlye Goldenberg,[1] Benjamin Kirby MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Plastic Surgery

Introduction

Pierre Robin Sequence (PRS) is a clinical triad of glossoptosis, micrognathia, and upper airway obstruction. Micrognathia and glossoptosis affect the formation of the palate during fetal development, which often leads to cleft palate. These oral and maxillofacial malformations result in short-term complications, including desaturations, difficulty feeding, aspiration events, and long-term consequences due to hypoxic injury and difficulty feeding. Physicians treat severe disease with mandibular distraction osteogenesis. This surgical intervention advances and elongates the jaw, increasing oropharyngeal depth and removing the obstructing tongue from the airway. Patients often remain intubated after this procedure, but there is no set protocol for the duration of intubation. This study aimed to determine the characteristics of patients with PRS and the features that impact the duration of intubation after surgery. We hypothesized that premature patients are more likely to require longer-term intubation after mandibular distraction to treat airway compromise than their term counterparts.

Methods

Charts from sixty-four patients with PRS treated at the University of Missouri over the last two decades were retrospectively reviewed.

Results

The average intubation length for distracted patients born prematurely was 4.4 days versus those born term at 6.32 days. Gestational age did not impact whether a distraction procedure would be required. However, when comparing the requirement of a G-tube for patients who underwent distraction procedure, 83% born prematurely required a G-tube versus 30.4% born at term.

Conclusion

In conclusion, there was no significant difference in the duration of intubation between distracted patients born prematurely and at term.

Re-irradiation after osteocutaneous free flap reconstruction for locally recurrent head and neck cancer

Suma Gondi,[1] Kaitlyn Reichl MD,[1,2] Patrick Tassone MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology

Introduction

Recurrent head and neck cancer (HNC) poses difficult management. Salvage surgery is often used in these situations. However, even after salvage surgery, many patients are still considered high-risk for further recurrence and benefit from re-irradiation. Free flaps not only enable reconstruction following salvage surgery, but there have also been limited studies suggesting free flap reconstruction may reduce the amount of re-irradiation complications. However, there are no studies specifically examining the effects of osteocutaneous free flap reconstruction upon re-irradiation toxicity. We hypothesize that the rate of local adverse events after re-irradiation is low in the setting of bony free flap reconstruction.

Methods

Patients with recurrent HNC that received salvage surgery with osteocutaneous flaps were identified. Those who had a history of HNC radiation prior to salvage surgery and then underwent adjuvant re-irradiation were included. Descriptive statistics was performed to assess outcomes.

Results

Seven HNC patients met criteria for inclusion. The type of flap was fibula in six and radial forearm in one. Wounds present following re-irradiation included plate exposure in two (28.6%). No patients had osteoradionecrosis following re-irradiation, fistula, plate removal, or site infection greater than 6 months after surgery. Diet at 12 months post op was PO in two (28.6%), partial PEG-dependence in three (42.9%), and complete PEG-dependence in two (28.6%). Trach at 12 months post op was present in two (28.6%) patients.

Conclusion

In this cohort of patients undergoing re-irradiation after bone free flap reconstruction, most patients avoided local adverse events related to re-irradiation.

Virtual reality as a non-pharmacologic intervention for the management of pain among cancer patients

Suma Gondi,[1] Shaminy Manoranjithan,[1] Chase Schlesselman MPH,[1] Steven Cheung MD,[1,2] Todd R. Vogel MD MPH,[1,2] Jonathan Bath MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Vascular Surgery

Introduction

Endovascular aortic repair (EVAR) approaches its third decade of use. We sought to evaluate our experience with EVAR over the past two decades.

Methods

Patients (2000-2022) undergoing EVAR were identified at an academic institution. Chi-square and Kaplan-Meier (KM) analysis were used to evaluate outcomes.

Results

500 patients undergoing EVAR were included with 397 men (79.4%) and 103 women (20.6%) with a mean age of 71. Indication was aneurysm/pseudoaneurysm in 443 patients (88.6%) with aortic dissection, thrombus, trauma and PAU/IMH in the remainder. Compared to women, men had larger endografts placed (28 vs. 27 mm;p=0.03), larger iliac graft sizes (15.9 vs. 15.2 mm;p=0.07), fewer deaths (9.7 vs. 3%;p=0.003), less limb ischemia (3.9 vs. 0.8%;p=0.04) and fewer wound infections (7.8% vs. 3.3%;p=0.04) at thirty days. Overall, rates of endoleak and reintervention did not differ between sexes. Outcomes by symptomatic status revealed that MACE (5.4 vs. 2.1;p=0.05), mortality (8.9 vs. 2.1%;p=0.0004), pulmonary failure (5.9 vs. 1.2%;p=0.007), leg ischemia (3.6 vs. 0.3%;p=0.007) and other complications (15.5 vs. 8.1%;p=0.01) were associated with symptomatic patients. Outcomes by graft size revealed MACE (6.9 vs. 1.9%;p=0.007), renal failure (4.8 vs. 0.9%;p=0.01) and open reinterventions (2 vs. 0;p=0.03) were associated with larger (>28 mm) grafts.

Conclusion

In this two-decade series of EVAR, excellent overall outcomes are seen with low mortality, reintervention rate as well as endoleak. Patients with endografts with a diameter > 28 mm fared much worse than smaller sized endografts which suggests that hostile neck aneurysms may be more malignant than those with normal neck morphology.

Stop The Bleed kits on University of Missouri-Columbia campus: A five-year follow-up

Savannah D. Groves,[1] Amy Price RN,[1,2] Stephen Barnes MD,[1,2] Jeff Coughenour MD[1,2] Amy E. Liepert MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Surgery, Division of Acute Care Surgery

Introduction

Uncontrolled hemorrhage is a common cause of preventable traumatic death, with approximately half of deaths occurring in the prehospital environment. Early action of bystanders contributes to improved morbidity and mortality. The Stop the Bleed (STB) campaign aims to train the public in identification of life-threatening bleeding, basic bleeding control techniques, and placement of bleeding control kits to decrease deaths from traumatic hemorrhage. In 2018, the Frank L. Mitchell, Jr. MD Trauma Center received a donation to place STB kits across the University of Missouri – Columbia campus. This study assesses the accessibility, utility, and sustainability of STB kits on a university campus 5 years after placement.

Methods

As STB kits were co-located with automated external defibrillators, the cardiac arrest notification application PulsePoint was utilized to locate each kit on the University campus. A 5-item email-based survey was sent to each kit's point of contact for information regarding its accessibility, utilization, quantity, and maintenance.

Results

125 kits were initially placed, of which 79 (63.2%) locations were registered in PulsePoint. 57 (45.6%) of those had a point of contact that was surveyed. 45 responded, yielding a response rate of 78.9%. None of the kits surveyed had reported being utilized, and 44 (97.8%) of them had limited public access.

Conclusion

In this five-year follow-up of placement of STB kits on a university campus, we found none were utilized and many had limited or no public access. Follow-up data for STB kits should continue to be analyzed for return on investment.

Mastery learning for chest tube placement: Application to surgery and emergency medicine interns

Warren Haralson,[1] Rushabh Dev MD,[1,2] Amy E. Liepert MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Surgery, Division of Acute Care Surgery

Introduction

Mastery learning is an educational method that utilizes deliberate practice and supervised remediation to ensure that trainees meet proficiency in required skills. Especially in surgical and procedural training, this form of learning may be superior to traditional medical education, which typically allows for one opportunity to demonstrate proficiency. A previous study demonstrated that skills-level-appropriate mastery learning led to higher performance and increased confidence compared to a traditional education method for chest tube placement in 4th year medical students. We sought to demonstrate skills-level-appropriate mastery learning can be replicated and achieved in general surgery and emergency medicine interns.

Methods

Interns in the surgery and emergency departments at the University of Missouri participated in an elective course for level-appropriate chest tube placement skills. Learners completed a mannequin-based pretest, a didactic session, supervised deliberate practice, and a mannequin-based posttest. Remediation was provided if the mastery standard was not achieved on the posttest. Evaluation was scored using a chest tube procedure checklist validated by faculty trauma surgeons at the University of Missouri.

Results

17 interns participated in the pretest. 12 interns completed the entire course (70%). No learners (0/17) achieved mastery on the pretest. All (12/12) course completers achieved the mastery standard. Half (6/12) of the learners required remediation to achieve mastery on the posttest.

Conclusion

The mastery learning method is feasible in achieving skills-level-appropriate mastery of chest tube placement in interns. Future work will include better learner capture.

Relationship between patient demographic factors and the protein content of infrapatellar fat pad tissue recovered from osteoarthritic knees

Kathleen A. Harris,[1] Kayla R. Schweitzer,[1] Cole C. Stevens,[1] Ahmed S. Fouad,[1] James A. Keeney MD,[1,2] James L. Cook DVM PhD,[1] Aaron M. Stoker PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Osteoarthritis (OA) is an irreversible disease that affects the entire "joint organ". The infrapatellar fat pad (IPFP) may have a significant role in the progression of OA. This study was designed to identify potential relationships between patient BMI, age, sex, and visual analog scale (VAS) pain levels and the concentration of inflammatory and degradative proteins in the IPFP of OA patients. It was hypothesized that significantly higher IPFP pro-inflammatory and pro-degradative tissue protein concentrations would be observed in patients with higher BMI, age, and VAS pain, as well as patients with female sex.

Methods

With IRB approval and informed patient consent, IPFP tissues were recovered from OA patients undergoing TKA. The protein content of an explant of the IPFP was extracted and tested for protein biomarkers using Luminex assays. Significant ($p<0.05$) differences in IPFP tissue biomarker concentration based on demographic groups were determined using one-way ANOVA and Tukey post-hoc test or a T-test.

Results

Tissue MMP-3 was significantly higher, and adiponectin was significantly lower, in older patients. Tissue resistin, MMP-2, MMP-9, GRO-α, MCP-3, MIP-1α, MIP-1β, and VEGF were significantly higher, and IL-6 was significantly lower, in female patients. Tissue MMP-3 was significantly higher in patients with a VAS pain score of 2.

Conclusion

The data from this study indicates the importance of considering patient demographics when assessing metabolic changes in tissues of the OA joint. Unraveling the relationship between patient demographic factors and OA may allow for the development of novel treatment and assessment strategies for patients with OA.

Anterior vertebral body tethering: a single center cohort study with 5+ years of follow-up

Samuel Hawkins, [1] Daniel G. Hoernschemeyer MD,[1,2] Nicole M. Tweedy PNP,[1,2] Melanie E. Boeyer PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Vertebral Body Tethering (VBT) is a new surgical technique for the treatment of Adolescent Idiopathic Scoliosis where limited data for mid-to long-term outcomes exists. We aimed to fill this critical gap by evaluating outcomes in a cohort of patients with 4-7 years of post-operative follow-up.

Methods

We performed a retrospective review of clinical and radiologic data from our first thirty-one consecutive patients treated with VBT, all of whom had at least four years of follow-up (mean: 5.7±0.7 yrs.). We assessed various parameters related to deformity correction, suspected broken tethers, and surgical revisions at all available timepoints. A successful postoperative outcome was defined by a residual deformity of ≤ 30° at latest follow-up without conversion to Posterior Spinal Fusion (PSF).

Results

Of the patients who met the inclusion criteria, two were lost to follow-up, seven required revisions, sixteen exhibited at least one suspected broken tether, and two were converted to a PSF. Only two broken tethers were identified more than four years postoperatively (mean: 2.68 years). The average main thoracic and thoracolumbar deformities were 22° and 23° at latest follow-up. A successful postoperative outcome was observed in 64% of patients despite an average increase of 4° in main thoracic and 8° in thoracolumbar deformities.

Conclusion

Although some deformity correction was lost, we remain optimistic regarding outcomes as 93% of patients avoided PSF and only two new suspected broken tethers were identified beyond four years. Additional long-term follow-up data will be required to continue to elucidate the efficacy of VBT.

Reduced need for confirmatory radiographs after gastrostomy tube replacement in the emergency department

Callyn Heavin,[1] Christopher Sampson MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Emergency Medicine

Introduction

Gastrostomy tube malfunction and need for replacement is a common presenting complaint for patients presenting to the emergency department (ED). Patients needing long-term percutaneous feeding tubes often have mature tracts making replacement uncomplicated. A previous retrospective study in a pediatric ED found a very low complication rate (1.2%) due to misplacement and it was hypothesized that post-procedural radiographs are not needed and only add to length of stay (LOS).

Methods

A retrospective chart review was done in a large urban ED that also serves a surrounding rural population for those with a diagnosis of gastrostomy tube problem or other tube replacement. Records of 50 patients meeting inclusion criteria between 2019 and 2023 were reviewed.

Results

Of the fifty patients that met inclusion criteria, thirty-four were adults (68%) and sixteen were pediatric (32%). The feeding tubes replaced in the ED included 47 gastrostomy tubes, 2 gastrostomy-jejunal tubes, and 1 jejunal tube, each followed by a radiograph to confirm placement. Only one patient (2%), the youngest in the study at 7 months old, required a change of position, simply needing their tube advanced two centimeters. The other forty-nine patients (98%) had imaging that necessitated no further action but added a mean additional LOS of ninety-one minutes.

Conclusion

Replacement of gastrostomy tubes in the ED is a routine procedure most often achieved without complication. The addition of a post-procedural radiograph is unnecessary in adults and significantly increases LOS. To reduce costs and expedite care, the post-procedural radiography should be considered for omission.

A case series: The potential relationship between polycystic ovarian syndrome and obstructive sleep apnea, and their effects on fertility outcomes

Lauren Henry,[1] Rene Cortese PhD,[1,2]
Albert Hsu MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Obstetrics and Gynecology

Introduction

The goal of this case series is to review the clinical relationship between women diagnosed with both polycystic ovarian syndrome (PCOS) and obstructive sleep apnea (OSA). A high rate of dual diagnosis was observed in the REI clinic the summer of 2023. PCOS affects approximately 6-8% of all women and is linked to diabetes, high cholesterol, anxiety, depression, twins, and preterm births. Our hypothesis is women diagnosed with PCOS are at higher risk for OSA, which contributes to chronic fatigue, unintentional weight gain, and infertility.

Methods

The number of patients with suspected PCOS (using Rotterdam criteria) was recorded. Patients with suspected PCOS were administered the STOP-BANG questionnaire to screen for OSA. Women with suspected OSA were referred for a sleep study, and if OSA was confirmed, the treatment plan was recorded. Ovarian reserve markers for women with OSA were recorded before and after treatment to assess any changes in these markers.

Results

Based on animal models, we anticipate improvement in ovarian reserve after treatment of OSA: specifically, we anticipate “normalization” of high antral follicle counts and Anti-Müllerian hormone levels, as well as correction of the high LH:FSH ratio seen in PCOS.

Conclusion

The goal of this case series is to screen women with PCOS for OSA using STOP-BANG. Most importantly, if treatment of OSA improves ovarian reserve markers and efficacy of fertility treatments, this work should encourage other providers to screen PCOS patients for OSA.

Lichen planus: Opportunities for continuing education through dermatology ECHO

Mollie Kate Henry,[1] Mirna Becevic PhD FAMIA[1,2]

[1]University of Missouri-Columbia
[2]Department of Dermatology

Introduction

Lichen planus is an idiopathic inflammatory disease of the skin and mucous membranes which may be linked to conditions such as anxiety, depression, hepatitis C, and cancer. It is commonly seen initially by primary care clinicians (PCCs). The aim of this study was to describe three patient cases with lichen planus or lichen planus mimics presented in Dermatology Extension for Community Healthcare Outcomes (ECHO) tele-mentoring project for PCCs, to determine typical presentations in primary care settings and dermatologists' recommendations for timely and accurate recognition and management.

Methods

This was an observational retrospective case series utilizing Dermatology ECHO cases submitted between 2020 and 2023 with a provisional or final diagnosis of lichen planus. Data reviewed included the deidentified Dermatology ECHO case ID, date of presentation, presenting physician name, initial diagnosis and treatment, final diagnosis and treatment, and ECHO session recording notes.

Results/Conclusion

Five lichen planus cases were presented during the study period and three were selected for this study based on availability of information and complexity of the case. The dermatologist hub team provided guidance and mentoring in diagnosis of lichen planus in the primary care setting by offering recommendations for follow up tests and their own insight based on the case presentations. If the diagnosis of lichen planus was confirmed, the hub team recommended a topical steroid ointment for initial treatment. The dermatologist hub team also advised the PCCs to review any medications, supplements, or stimulants the patients may be taking which could exacerbate a lichenoid appearing lesion.

Restarting anticoagulation after head & neck free flaps: Implications for flap survival and complications

Dylan Hood,[1] Patrick Tassone MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology

Introduction

Flap viability following free flap reconstruction is dependent upon hemodynamic stability. Antiplatelet medications and hematoma related events are correlated. Data regarding postoperative resumption of Warfarin following free flap reconstruction is limited. The objective is to identify the local practice pattern for resuming Warfarin following head and neck free flap construction and bleeding and thrombotic events associated with resumption.

Methods

This retrospective observational study evaluated bleeding and thrombotic events related to resuming Warfarin following free flap reconstruction between April 2005 and July 2022. Key measured outcomes were bleeding and thrombotic events following resumption of Warfarin. Bleeding events included: hematoma, hemorrhage, and need for transfusion. Thrombotic events included: deep vein thrombosis, pulmonary embolism, flap arterial thrombosis, and flap venous thrombosis.

Results

Of the 470 patients who underwent free flap construction, 29 were on an anticoagulation regimen (6%) with 19 of those patients on Warfarin (4%) and 10 on other anticoagulants (2%). Among the patients on anticoagulation, there were 4 flap failures (14%), 2 VTE events (7%), and 1 bleeding event (3%). Among the 441 patients not on anticoagulants, there were 29 flap failures (7%) and 27 bleeding events (6%). There is no apparent correlation between the resumption of Warfarin and other anticoagulants and flap failure.

Conclusion

There is a lack of consistent practice pattern and guidelines regarding the resumption of Warfarin and other anticoagulants following flap reconstruction. Further research is needed to properly assess the relationship between post-operative anticoagulation re-initiation and free flap complications following head and neck free flap reconstruction.

Total hip arthroplasty outcomes following reduction in post-operative admission period

Vladislav A. Husyev,[1] Samuel D. Hawkins,[1] Ravi N. Patel,[1] Brett D. Crist MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Hospital stays following Total Hip Arthroplasty (THA) have been decreasing over the past couple decades. In 2020, Centers for Medicare & Medicaid Services (CMS) removed THA from the inpatient only list, and the Covid-19 pandemic forced many procedures to be done on an outpatient basis. These events led to a rapid reduction in post-operative stay for primary THA patients. The purpose of this study is to evaluate quality of patient care during a transition to shorter post-operative hospital stays at the Missouri Orthopedic Institute (MOI).

Methods

We retrospectively collected clinical and surgical data from 626 primary THA patients. Patient-reported outcomes (PROs) included PROMIS Hip, HOOS JR, and Visual Analog pain scores at standardized intervals (Pre-op, 6wk, 3mo, 6mo, 12mo). Patients were grouped by surgery date (2017-2019 and 2020-2021). Variables were analyzed with Two-Sided T-test or Chi-Square Test ($\alpha \leq 0.05$).

Results

We observed significant difference between post-operative hospital stay duration between groups 2017-2019 and 2020-2021 ($p = < 0.001$) and found that the 2017-2019 group had a higher pre-operative physical health score ($p = 0.048$). All other collected PROs were not statistically significant at any timepoint. Surgical complications did not vary significantly between groups.

Conclusion

Our results indicate that the substantial decrease in hospital stays post-THA did not negatively influence the quality of care received at MOI. The successful transition to a shorter LOS is partly owed to pre-existing patient education programs at MOI. These findings support the continued use of shortened hospital stays for THA surgeries at MOI.

The ophthalmologist's attire and patient perception of quality care at an academic institution

Alexander Intagliata,[1] Varun Jeevan,[1] Lea Khoukaz,[1] Jared Alt,[1] Alexander Miller MD,[1,2] Geetha Davis MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Ophthalmology

Introduction

Quality of care (QOC) measured by conventional metrics and patient perceptions of QOC are often incongruent. Here, we determine whether there is a patient-preferred ophthalmologist's attire and an association between how ophthalmologists dress and the perception of QOC at a large academic facility.

Methods

A convenience sample of individuals scheduled for an ophthalmology outpatient clinic visit were randomly given the opportunity to complete a brief survey in the waiting room, using validated images of different dress attire.

Results

Nearly all 34 respondents were between 60-80 years old. 56% were female. 88% were white, while the remaining 12% were African-American, Hispanic/Latino, or Asian-American. 53% had a college/advanced degree, 26% high school/GED, and 21% with some college. 65% of respondents preferred a white coat be worn to the clinic. Respondents overall rated the importance of wearing a white coat as 2.59 on a 5-point scale. 57% believed a physician in a white coat is more knowledgeable, with 65% reporting a physician in a white coat would better address ophthalmic concerns in an office setting. A white coat was preferred by a 3-1 margin for friendliness, professionalism, and trustworthiness

Conclusion

The results in our study illustrate that a white coat is much preferred to other forms of attire. Other studies found similar findings. Although a physician who wears a white coat is preferred in our clinic at this institution, our conclusion may be influenced by unmeasured unique factors and not necessarily be applicable to other settings.

Show-me dermatology echo: Understanding diagnostic patterns through missouri medicaid claims data analysis

Travis Jackson,[1] Karen Edison MD,[1,2] Tracy Greever Rice PhD,[1] Mirna Becevic PhD[3]

[1]University of Missouri-Columbia
[2]Department of Dermatology
[3]University of Missouri, Missouri Telehealth Network

Introduction
Nearly 2/3 of individuals with skin conditions seek care with their primary care provider (PCP) rather than a dermatologist. This trend becomes more pronounced in rural areas, where access to specialized care can be limited. Together, these issues place a significant responsibility for the maintenance of skin conditions on the PCP. This study aims to analyze the nature and frequency of dermatologic diagnoses by PCPs participating in Missouri Dermatology ECHO.

Methods
To evaluate the diagnostic patterns of PCPs before and after ECHO intervention, Missouri Medicaid claims data was utilized using ICD9 and ICD10 codes for 20 dermatologic conditions. Medicaid claims data was collected within a 12-month period both before and after PCPs attended their first ECHO intervention.

Results
Our analysis illustrated a strong positive correlation between the number of ECHO sessions attended and the percent increase in Medicaid claims for dermatologic conditions. PCPs who attended ECHO once saw a 49% increase in Medicaid claims the following year. In comparison, PCPs who attended nine or more ECHO sessions saw over a 500% increase in Medicaid claims the following year. During the study period, ECHO participants also accounted for nearly 6% of Missouri's total Medicaid claims for certain dermatologic conditions.

Conclusion
Following ECHO intervention, PCPs were more likely to diagnose certain dermatologic conditions when compared to before intervention. The most substantial increase in claims occurred among PCPs who frequently attended ECHO programs. Overall, through Dermatology ECHO, participating PCPs are equipped with the knowledge and support needed to positively impact patient outcomes.

Lepromatous leprosy: A case report of type II reaction erythema nodosum leprosum

Kenlee Jonas,[1] Syed Naqvi MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Infectious Disease

Introduction
Leprosy, caused by the obligate intracellular pathogen Mycobacterium leprae, manifests as a chronic infectious disease predominantly affecting the skin and peripheral nerves. Immunological reactions in response to Leprosy are typically divided into two categories (1) a cell-mediated response and (2) a delayed immune-complex mediated response. Drug adherence is crucial, but often difficult for each patient facing this condition.

Methods
A 25-year-old male from originally from Micronesia, moved to Hawaii in 2020 and then to Springfield, MO, in 2021 for a construction job. He presented to urgent care with a 2-week history of a diffuse erythematous rash with hypopigmented macules, nodules, and plaques distributed across his extremities, trunk, and face. The patient also had tender nodules and peripheral neuropathy of his left index and middle finger.

Results
A newly studied regimen was initiated including once monthly dose of Rifampin, Moxifloxacin, and Minocycline. In addition to the antibiotics, methotrexate and prednisone was added weekly for the management of inflammation for a total of 12-24 month duration of treatment.

Conclusion
Multidrug therapy recommended by the World Health Organization includes daily doses of rifampicin and dapsone and monthly doses of clofazimine for 6-12 months. Rather than continuing to use a 40 year old regimen, the development of personalized treatment should be prioritized due to the different needs, ages, co-morbidities, and issues with non-compliance while using new, more modern medications.

Systemic loxoscelism – a unique cause of acute generalized exanthematous pustulosis: A case series

Kenlee Jonas,[1] Timothy Dillinger,[1] Luke Witte MD,[1,2] Mike Bohnert MD,[1,2] John A Dyer MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Dermatology

Introduction

Acute Generalized Exanthematous Pustulosis (AGEP) is a rare, severe cutaneous eruption characterized by the numerous pustules on an erythematous base. Typically, AGEP occurs as an adverse reaction triggered by specific medications, most notably antibiotics, hydroxychloroquine, and diltiazem. However, in this case series, six patients presented with presumed AGEP secondary to developing systemic loxoscelism, systemic effects of a brown recluse spider bite.

Methods

Retrospective chart review in University of Missouri-Columbia healthcare system's electronic medical record (EMR) analyzing each case for pertinent information regarding patient demographics, medical history, presenting symptoms, clinical findings, diagnosis, and management.

Results

In all six cases, patients presented with systemic symptoms including peak fevers ranging from 39.3°C to 40.8°C, malaise, chills, hypotension, a widespread erythematous pruritic rash with pustules and signs and symptoms of hemolytic anemia, which can be seen in severe cases of systemic loxoscelism. Other abnormal lab values see in our patients included leukocytosis with granulocyte predominance and an elevated CRP.

Conclusion

AGEP is a cutaneous adverse reaction that may manifest with systemic symptoms in severe cases. Although not inherently life-threatening, AGEP can cause secondary complications such as bacterial infection, psychological distress or can exist as a sequela of a life-threatening condition such as systemic loxoscelism. Proper identification, cessation of the offending agent if applicable, and appropriate supportive measures remain crucial in AGEP management.

Identifying the incidence of post-intensive care syndrome among acute care patients in the surgical ICU

Klaudia A. Joost,[1] Grace Holloran,[1] Rafid Rahman MD,[1,2] Claire Finkel MD,[1,2] Salman Ahmad MD,[1,3] Amy Liepert MD FACS[1,3]

[1]University of Missouri-Columbia
[2]Division of Physical Medicine and Rehabilitation
[3]Division of Acute Care Surgery

Post-Intensive Care Syndrome (PICS) traditionally describes a constellation of physical, cognitive, or psychological symptoms developed among intensive care unit survivors, independently of the disease process. PICS presents as long-term effects that endure after hospital discharge and contribute to diminished patient's quality of life despite medical recovery from the disease or curative intervention. While current literature addresses the prevalence and complexities of diagnosing PICS in the ICU setting, the diagnostic criteria are not universal and there is spare literature describing the contributing factors and occurrence of PICS among Surgical ICU patients. The objective of this pilot study is to retrospectively identify the incidence and diagnostic factors contributing to PICS in acute surgery care patients admitted to the Surgical ICU at a level 1 trauma center and later discharged to a rehabilitation center between 2021-2023.

Loadsol weight-bearing and gait patterns in healthy controls

Miranda Kaleel,[1] Ifeoma Anunoby BSc,[1] Carmen Cirstea MD PhD FAHA,[1,2] Chrissa McClellan MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine and Rehabilitation

Introduction

A reliable and objective biomarker of functional outcomes post-surgical hip fracture fixation is lacking in current literature. Using a state-of-the-art device (FDA-approved Loadsol pro wireless force monitor) we measure weight-bearing and gait patterns within 72 hours after hip fracture fixation and then investigate their predictive value of functional outcomes three-month post-surgery. To this end, we performed a pilot study to quantify the "normal" weight-bearing and gait patterns obtained with this device.

Methods

Twelve healthy controls participated in a standardized "timed up and go test" using Loadsol devices inserted into their shoes. Data on peak force, loading rate, steps/minute, and factor of imbalance (FOIB) were averaged for three trials. Demographic data and medical history were also collected. Recruitment is an ongoing process.

Results

All participants were right-handed, aged 23-67 years, with no orthopedic or neurological conditions. For the entire group, the peak force of the left and right feet described as a percentage of body weight was 1.05±0.16% (mean±SD) and 0.99±0.09% respectively ($p=0.3$), and the loading rates for the left and right feet were 4180.6±1984.9 N/s and 4216.7±1291.2 N/s respectively ($p=0.9$), showing similar peak force and loading rate between the left and right foot. The average number of steps per minute was 83.9±15.0. The FOIB was -0.03±0.06, suggestive of equal load on both feet.

Conclusion

Our preliminary data demonstrated a symmetrical pattern for weight-bearing and gait in healthy controls. Detailed quantification of these patterns is essential for understanding the metrics obtained with the Loadsol devices in patients with hip fracture fixation.

The relationship between psychophysiological markers and sensory profile in individuals with Autism

Himavarsha Kancharla,[1] Nanan Nuraini,[1,2] Carrina Appling,[1,2] Bradley Ferguson,[1,2] David Beversdorf MD[1,2]

[1]University of Missouri-Columbia School of Medicine
[2]Department of Psychological Sciences

Introduction

Sensory Processing Disorders, such as autism spectrum disorder (ASD), are a group of developmental disorders in which children and adults vary in neurological thresholds and behavioral responses. Delay in diagnosis and treatment leads to the inability to properly processes sensory information affects development, which impacts later performance. As such, evaluation tools are necessary to detect sensory processing disorders early on. The purpose of this study is to determine whether psychophysiological markers can be used to predict AASP scores with the goal of developing precision medicine for individuals with ASD.

Methods

To determine if there is a correlation between AASP scores and psychophysiological markers (SCL and HRV), 12 individuals who were previously diagnosed with ASD were selected. These markers were measured via electrocardiogram and the results were compared with AASP scores.

Results

When considering AASP overall and quadrant scores, we did not find any statistically significant correlation with psychophysiological markers.

Conclusion

Based on these results, we can conclude that, at this sample size, there does not appear to be any correlation between ASD and autonomic function. These findings contribute to the growing number of studies that have disproven previous findings of autonomic dysfunction being a key characteristic in individuals with ASD. However, because some associations are close to having p-values <0.05, further studies with larger sample sizes are necessary.

Laser assisted permanent greenfield filter removal with ileocaval stent reconstruction following filter thrombosis, a case report

Sarabjit Kaur,[1] Pranav Suri,[1] William Bryan M.S.R.S. RRA RT(R)(VI),[1,2] Charles Kitley MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Radiology

Emerging literature supports removal of chronic indwelling IVC filters when they are contributing to complications for a patient and are no longer indicated. We present an interesting case of an elderly patient who had a history of DVT and underwent spinal surgery, which required cessation of his anticoagulation and placement of an IVC filter pre-operatively. Approximately 15 years later the patient presented to our institution with chronic occlusion of his IVC at the level of his filter which had never been removed, with bilateral lower extremity DVT and symptoms of phlegmasia cerulea dolens. Despite a previous unsuccessful attempt at DVT thrombectomy at an outside institution, interventional radiology was consulted, and he subsequently underwent successful laser sheath assisted removal of his 15-year-old permanent Greenfield filter with bilateral lower extremity DVT thrombectomy and venous stenting with significant improvement in his presenting symptoms. Clinical presentation, diagnostic workup, case findings, and outcomes are described.

Despite classic literature suggesting that permanent Greenfield IVC filters cannot be removed, we present a case in which advanced techniques were successfully used to remove an indwelling permanent infrarenal Greenfield IVC filter and reconstruct the IVC and iliac veins. As presented, multiple attempts are often necessary to remove indwelling IVC filters, and IVC and iliac vein reconstruction are often lifesaving in patients who present with symptoms of phlegmasia cerulea dolens.

Regional differences in tibial plateau cartilage biomarkers related to histological severity in the osteoarthritic knee

Gabriel J. Keeton,[1] Grace S. Brentlinger,[1] Luke Marx,[1] Owen D'Amour,[1] Corder E. Lehenbauer,[1] Harjeev Singh,[1] Chantelle C. Bozynski DVM,[1] James A. Keeney MD,[1,2] James L. Cook DVM PhD OTSC,[1,2] Aaron M. Stoker PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Osteoarthritis (OA) is a disease of the entire joint organ, characterized by articular cartilage degradation. The development of OA is highly variable across the knee joint, resulting in significant variation of cartilage tissue structure of the tibial plateau (TP). This study was designed to identify relationships between changes in cartilage structure due to OA and concentration of TP biomarkers. It was hypothesized that higher histological grades would have significantly higher levels of inflammatory and degradative biomarkers.

Methods

With IRB approval and informed patient consent, tissues normally discarded after surgery was recovered from patients undergoing TKA for OA. Osteochondral explants were created from regions of the medial and lateral TP. One half of each explant was evaluated histologically by a blinded pathologist using the OARSI system. Protein extracted from the other half was assessed for various biomarkers. Significant differences were determined using a T-Test, one-way ANOVA and Tukey post-hoc test, or two-way ANOVA.

Results

Significant differences in biomarker concentrations were identified based on regions of the TP, histology sum score groups, and the interactions region and histology sum score groups of the TP.

Conclusion

The data from this study indicated important regional differences in biomarker levels related to severity of cartilage degradation. Ongoing studies in our lab are aimed at determining mechanistic relationships between changes in OA cartilage architecture and protein composition which may serve as biomarkers for disease development and progression.

Epigenetic profile trajectories during gestation in fetal growth disorders

Joey Khoukaz,[1] René Cortese PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology and Women's Health

Introduction

Fetal growth disorders can be classified by the gestational age of the fetus. It is estimated that in 8.6% of pregnancies, the fetus is small for gestational age (SGA, <10th percentile), 80.9% appropriate for gestational age (AGA, 10-90th percentile), and 10.5% large for gestational age (LGA, >90th percentile). These growth disorders are associated with epigenetic changes. Abnormal DNA methylation of certain genes can have a negative effect on intrauterine fetal growth.

Methods

Participants were recruited during first obstetric visit and maternal blood and placenta samples were collected at each trimester and at birth, respectively. Participants were separated in three groups (SGA, AGA and LGA) according to weight and gestational age at birth. DNA was isolated and underwent enzymatic digestion using methylation-sensitive restriction enzymes. PCR methods were then used for quantifying DNA methylation at 14 different loci. DNA methylation differences were calculated as fold changes in amplification between the candidate and reference loci.

Results

In placenta samples, we observed that differential methylation in SGA and LGA compared with AGA. Furthermore, correlation analysis revealed that DNA methylation in some loci in placenta at birth corresponded with those registered in circulating DNA in maternal blood in the first trimester, suggesting alterations in fetoplacental epigenetic plasticity in fetal growth disorders.

Conclusion

Fetal growth disorders show a trend in fold changes across a variety of epigenomic markers. Observing these trends can be clinically useful. This research paves the way for the development of epigenetic-based interventions (i.e., dietary supplementation) to treat/mitigate fetal growth disorders.

Redicting postoperative refractive outcomes of intraocular lens fixation with the Yamane technique

Lea Khoukaz,[1] Eric Zhang MD,[1,2] Matt Hirabayashi MD,[1,2] Alex Intagliata,[1] Megan Sweeney,[1] Dean Hainsworth MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Opthamology

Introduction

An operative technique for intrascleral fixation of an intraocular lens (IOL) without sufficient capsular support was described by Yamane et. al. in 2017. The sutureless technique uses 30-gauge needles to exteriorize haptics through two angled incisions while remaining parallel to the limbus.

Methods

This is a retrospective case series from electronic chart review. We examined refractive outcomes in ten eyes of ten patients who underwent Yamane technique scleral fixation of secondary IOLs using Barrett Universal II prediction formula. We calculated average mean difference between the spherical equivalent of actual postoperative refraction and spherical equivalent of the predicted refraction of our cases. A negative difference is a myopic difference and a positive difference is a hyperopic difference. Then, using a 1-sample t test, we evaluate whether the difference was statistically significantly different from zero. Finally, we calculated the percentage of refractive miss greater than .5D SE or 1.00D SE from predicted by Barett II.

Results

Using 1 sample t-test, the outcome spherical equivalent difference using the Barrett II formula was –0.45 +/- .29 D (p-value is 7.3x10^-4). Using Barrett formula, 40% of cases had refractive miss post-op SE > 0.5 D away from predicted 0% of cases had refractive miss of post-op SE > 1.0 D.

Conclusion

Preoperative predictive refractive outcomes using Barrett II calculator for Yamane technique are slightly more myopic than predicted, but similar to in-the-bag placement calculations and can be used to predict post-operative outcomes in settings of complicated cases. There were no hyperopic surprises.

Postnatal outcomes of monochorionic-diamniotic twins versus dichorionic-diamniotic twins

Morgan Kluge,[1] Lindsey Ellis MD,[1,2] Jean Goodman, MD,[1,2] Akshaya Vachharajani MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Child Health

Introduction

Few studies describe the short- and long-term outcomes of monochorionic diamniotic (Mo-Di) as compared to dichorionic diamniotic (Di-Di) twins. This study aims to evaluate short-term postnatal outcomes among Mo-Di and Di-Di twins admitted to the NICU.

Methods

A retrospective chart review of Mo-Di and Di-Di twins delivered at the University of Missouri between 2019 and 2022 was conducted following International Review Board approval. Maternal data collected includes demographic information, prenatal health data, receipt of antenatal steroids or magnesium sulfate, reason for and mode of delivery, and ultrasound findings. Twins' postnatal outcomes data includes gestation age at birth, postnatal growth parameters using Fenton charts, congenital anomalies, intraventricular hemorrhage, spontaneous intestinal perforation, necrotizing enterocolitis, gastrostomy tube placement, tracheostomy, and bronchopulmonary dysplasia. Continuous and binomial variables were analyzed via Kruskal-Wallis and Chi-Square tests, respectively. A p-value of <0.05 was used to define significance. Linear regression analysis was performed using SPSS version 28 (IBM SPSS Statistics, IBM Corporation, Armonk, NY).

Results

Mo-Di twins had a mean length of stay (LOS) in the NICU of 44 days versus 39 days for Di-Di twins (p 0.007). Mo-Di twins also had a longer need for respiratory support than Di-Di twins (p 0.002). Mortality and other morbidities are similar among Mo-Di and Di-Di twins.

Conclusion

Mo-Di twins were younger, lighter, had longer NICU stays, and required respiratory support for longer compared to Di-Di twins admitted to the NICU.

Understanding the effects of vitamin d on infertility: A retrospective chart review of patients at MU's reproductive endocrinology and infertility clinic

Kavita Krell,[1] Lauren Henry,[1] Albert Hsu MD[1-3]

[1]University of Missouri-Columbia
[2]Department of Reproductive Endocrinology/Infertility
[3]Department of Obstetrics and Gynecology

Introduction

Low serum 25-hydroxyvitamin D (25OHD) is linked to lower pregnancy rates in women of reproductive age. Recent studies note a correlation between vitamin D and BMI in infertile women. Since BMI is known to contribute to infertility and vitamin D is strongly related to obesity, it is difficult to understand their relative impacts on pregnancy rates and outcomes.

Methods

We conducted a retrospective chart review of 107 consecutive patients presenting for initial fertility consultation at the University of Missouri REI clinic between 2017-2020, with at least one clinic appointment between June-October 2020. Vitamin D, supplementation, baseline demographics, and pregnancy status as of August 2023 were evaluated. Patients were categorized by initial consultation vitamin D level (deficient ≤ 20; insufficient 20-30; normal ≥ 30.0 ng/mL).

Results

8 patients had unknown vitamin D status, 25 had vitamin D deficiency, 29 had vitamin D insufficiency, and 45 had normal vitamin D. Pregnancy rates were lower in vitamin D deficient patients (36%) compared to others (44.8% for insufficiency, 42.2% with normal vitamin D). Average BMI negatively correlated with vitamin D status (deficient = 36.52 kg/m2, insufficient = 30.76 kg/m2, normal = 27.2 kg/m2).

Conclusion

This preliminary analysis suggests both vitamin D and obesity may influence infertility, raising the question of whether this is an independent effect of vitamin D or not. This research project is ongoing, to investigate vitamin D, BMI, and pregnancy trends over time in a larger sample.

Comparative outcomes for covered versus non-covered stenting for femoropopliteal occlusive disease

Margaret Kurop,[1] Andrew Bedford,[1] Joseph Buelter,[1] Jennifer Huffman MD,[2] Caroline Chung MD,[2] Todd R. Vogel MD MPH,[3] Steven Cheung MD,[3] Jonathan Bath MD[3]

[1]University of Missouri-Columbia
[2]Department of General Surgery
[3]Department of Vascular Surgery

Introduction
The ideal endovascular treatment of femoropopliteal disease is still unknown. We report outcomes of patients undergoing covered (CS) and non-covered stents (NCS) for femoropopliteal disease.

Methods
Patients undergoing CS and NCS placement for femoropopliteal disease were identified at an academic institution (2017-2021). Chi-square, Fisher's exact, 2-sided t-test and Kaplan-Meier analysis were used to evaluate outcomes.

Results
In total 153 patients were selected with 91 NCS (59%) and 62 CS (41%) placed in 51 women and 102 men. Mean age of the cohort was 64. In the NCS cohort, 17 patients (18.6%) had previously undergone femoropopliteal intervention (SFA) compared to 28 patients in the CS cohort (45%). Mean preoperative ABI for CS was 0.47 and for NCS 0.52. Most CS interventions were performed for acute/chronic limb threatening ischemia (55%) whereas the majority of NCS interventions were performed for claudication (47%). In the CS cohort there were 6 patients who underwent amputation (10%) compared to 12 patients in the NCS cohort (13%). Reinterventions were undertaken to 10 patients (16%) in the CS group compared to 20 patients in the NCS group (47%) over a mean follow-up period of 20 months.

Conclusion
Although cohorts slightly differed in preoperative features, amputation rate was similar between groups. Reinterventions appeared to occur more frequently in the NCS group than CS cohort over similar mean follow-up periods. This may suggest a benefit to covered stenting in terms of reintervention and severe pathologies, although further research including propensity score matching of cohorts will provide more homogenous comparisons.

Identifying social determinates of health experienced by individuals with food insecurity

Taylor A. La Valle,[1] Natalie A. Long MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Family and Community Medicine

Introduction
In October 2021, Missouri began enrollment for the Adult Expansion Group of Medicaid, MO Health Net. This expansion allowed over 300,000 uninsured individuals to be enrolled. Now that individuals have access to insurance it excludes them from community-based health programs like MedZou. To assess the impact on our population we surveyed individuals to determine insurance status, material security, health care access and other social drivers of health.

Methods
201 individuals completed the PRAPARE survey to assess Social Drivers of Health. Additional data was provided by the 2022 Community Health Assessment conducted by the Boone/Columbia Health Department.

Results
While only 14% of people reported that they were uninsured, 34% of people reported that in the last year they were unable to obtain medicine or any HealthCare related needs. 307 of 1798 (17%) of community survey respondents could not get medical care in the past 12 months. When asked the reasons they could not get medical care, the top two responses were waitlists are too long and cost of health care/doctors visits. Respondents also indicated that medical bills were among the top 3 bills they skipped paying because they could not afford their basic needs.

Conclusion
Respondents had on average 5 or more factors that create barriers to accessing care and managing their health. This demonstrates that insurance status alone does not determine access to care. These findings drive the need for a community health program that helps insured individuals navigate complex health and social needs.

Endometriosis misinformation on social media

Emily Lager,[1] Albert Hsu MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology, and Women's Health

Introduction

Endometriosis affects 6-10% of reproductive-aged women and up to 50% of women with pelvic pain or infertility. For many women, hormonal management (such as with birth control pills) can be highly effective for pain management. As a chronic disease, endometriosis often requires a lifelong multidisciplinary management plan to avoid unnecessary repeat surgical intervention(s). With increasing and pervasive mistrust in medical and public health interventions, we are concerned about misinformation regarding birth control pills, pelvic pain, and endometriosis on social media.

Methods

We have been collecting and characterizing misinformation on endometriosis, pelvic pain, menstrual health, and reproductive hormones on social media platforms using search terms including "endometriosis", "birth control", "endometriosis treatment".

Results

"Birth control is classified as an endocrine disruptor which means it damages your hormones long-term."
"Endometriosis and PCOS affect the reproductive organs. Both are very very painful. Those organs are removed with a hysterectomy…It is the cure for the pain."
"Introducing Endo Soothing Tea – the natural solution for Endometriosis pain relief."
"Things that may help break down your adhesions and thus reduce your pain…Working with a great osteopath and/or pelvic floor physiotherapist to manually release the adhesions…High intensity laser therapy."
"My two favorite natural medicines that help break down scar tissue are proteolytic enzymes and serrapeptase."

Conclusion

Given established treatments for endometriosis-related pain including progestin-based hormonal therapies and multimodal pain management approaches (with a limited role for surgery), there is substantial misleading information on social media regarding alternative endometriosis treatments that should be addressed by the healthcare community.

Knowledge gaps in fertility at the University of Missouri – Columbia

Emily Lager,[1] Albert Hsu MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology, and Women's Health

Introduction

Unfortunately, the peak career-building years correspond with the peak family-building years for women. The decision of when to begin childbearing is a very personal one, and women have been increasingly delaying family-building until later in life. Although stories in the media may lead women and their partners to believe they will be able to use fertility treatments to get pregnant at almost any age, a woman's age affects the success rates of fertility treatments. It is important for those who delay childbearing to understand how increasing age may impact reproductive success. Prior studies have shown that graduate students have significant knowledge gaps in reproductive aging and its effects on family building; these studies also show that education can increase fertility knowledge and fertility awareness may also modify future reproductive outcomes.

Methods

After submitting IRB approval, a RedCap survey was created. The survey link was sent to MU School of Medicine students via email to assess knowledge of fertility decline with age, plans/barriers for family-building, and attitudes on oocyte cryopreservation.

Results

Of 37 students who have completed the survey so far, only 29% of respondents correctly estimated the prevalence of individuals that experience infertility, while 62% of respondents correctly estimated the age at which female fertility declines significantly. 89% of respondents would find formal fertility education to be helpful.

Conclusion

Among medical students, knowledge of age-related fertility decline is lacking, and further education is needed.

An examination of broadband internet access limiting the utilization of teledermatology in Missouri

Janie Leathers,[1] Sara Beaudoin,[1] Kara Braudis MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Dermatology

Introduction

Telemedicine is an effective method for increasing access to care and teledermatology has become increasingly integrated into dermatology practices. An examination into the availability of broadband internet access was conducted to determine how the utilization of teledermatology could be limited in Missouri.

Methods

Missouri county level data was analyzed for broadband internet access between the fiscal years of 2020-2022 from exploreMOhealth. The Health in Rural Missouri Biennial Report 2020-2021 was utilized for rural/urban county classification. Missouri statewide data was analyzed for broadband coverage from the American Community Survey 2017-2021. Data from the Federal Communications Commission was utilized for definitions of broadband internet.

Results

Teledermatology includes the store-and-forward technique and the live-interaction technique. Only the live-interaction technique requires broadband internet access. Four Missouri counties have under 65 percent of households with broadband internet connection while only 29 Missouri counties have over 80 percent. The 16 urban Missouri counties have greater percentages of households with broadband internet connection compared to the 99 rural Missouri counties.

Conclusion

Roughly 20 percent of Missouri residents lack access to broadband internet. Patients in rural counties would benefit from increased utilization of teledermatology due to the increased distance to dermatology clinics. However, utilization of the live-interaction teledermatology technique may be limited for patients in rural counties distanced from large cities due to a lack of broadband internet connection.

A quality improvement initiative to increase knowledge and improve access to resources about sun safety in mid-Missouri

Janie Leathers,[1] Evadne Rodriguez,[1] Kari Martin MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Dermatology

Introduction

First Chance for Children is committed to providing mid-Missouri families with resources to facilitate healthy outcomes. The program is working to cultivate more resources and information on various topics to encourage parents to take an active step in protecting their child's health. The lack of information available about sun safety and the importance of protecting children's delicate skin was identified as an area of improvement within the program.

Methods

A baseline investigation was conducted to look for resources available at the facility. A pre-intervention survey was conducted to analyze families' knowledge of sun safety and their access to resources. Information about sun safety was compiled with a specific focus on children aged 0 to 5 years. Sun safe activity kits containing handouts and activities were distributed to families. Additional information was provided via blog post on the program's website.

Results

The investigation found two handouts at the facility. The pre-intervention survey demonstrated families primarily utilize sunscreen and protective clothing for sun protection but eighty-one percent of families do not use/lack sunglasses for their children. A total of six informational handouts were created.

Conclusion

Providing parents with resources to teach their children protective measures and habits during childhood can encourage life-long maintenance of sun safe behaviors and could reduce their child's risks of skin cancer later in life.

SGLT-2 inhibitors and diabetic ketoacidosis: A case report and review of literature

Marcus B Mallen,[1] Philip J Fracica MD MBA FACP[1,2]

[1]University of Missouri-Columbia
[2]Department of Internal Medicine

Introduction

SGLT-2 inhibitors were introduced and FDA approved for glycemic control in Type 2 Diabetes Mellitus (DM) and have been shown to reduce cardiovascular complications and all-cause mortality in patients with Heart Failure with Reduced Ejection Fraction (HFrEF).This class of drugs is indicated specifically at AHA stage C (NYHA Stage II-IV) which denotes patients with symptomatic heart failure or imaging that indicates structural damage to the heart. One rare adverse effect of SGLT-2 inhibitors is the precipitation of Diabetic Ketoacidosis (DKA) both patients with Type 1 and Type 2 DM.

Case Report

A 94-year-old man with past medical history of HFrEF, Type 2 DM, and Dementia presented with ketoacidosis, hyperglycemia and sepsis with an epidural abscess identified as source of infection. He was started on broad-spectrum empiric antibiotic therapy and was admitted for further management. It was later concluded that he was in hyperglycemic DKA. A review of his medication history revealed that he was prescribed the SGLT-2 inhibitor empagliflozin. Due to advanced age, reduced baseline quality of life, and the invasive nature of curative treatment, his daughter, acting as his DPOA, decided it was in his best interest to pursue comfort measures. His metabolic derangements ultimately lead to his demise.

Discussion

While DKA is a well-recognized feature of Type 1 DM, it is uncommon with Type 2 DM. Following release of SGLT-2 inhibitors there have been reports of DKA and an FDA safety communication5. While there are multiple reports of euglycemic DKA in patients with Type 2 DM with SGLT-2 inhibitor therapy, hyperglycemic DKA, although less well described, is also a complication of therapy. SGLT-2 inhibitors reduce glucose reabsorption in the proximal renal tubule. This leads to downstream effects of decreased blood glucose, increased glucagon levels, and stimulation of hepatic ketogenesis which appears to be the mechanism of euglycemic DKA in these patients. Postulated mechanisms of cardioprotective effects include evidence that ketone bodies may be a preferred substrate for energy metabolism and ATP generation in cardiac myocytes. This case challenges prevailing evidence and brings to light that DKA can occur in the setting of hyperglycemia provoked by SGLT-2 inhibitor therapy.

Conclusion

SGLT-2 inhibitors are effective drugs for reducing cardiovascular death and all-cause mortality in HFrEF but have a rare association of precipitating DKA.1 Given the broad range of AHA class C additions to management recommendations, an alternative medication or device therapy could have been chosen.2 Other therapy, if chosen, could have potentially saved this patient from metabolic derangement and death.

Metastatic Papillary Thyroid Carcinoma Discovered by Paramalignant Effusion

Marcus Mallen,[1] Dan Woolery DO[1,2]

[1]University of Missouri-Columbia
[2]Department of Internal Medicine

Introduction

Papillary thyroid carcinoma is the most common malignancy of the thyroid, comprising ~80% of neoplasms. It also carries the best prognosis, with a 5-year survival rate of 99%. Furthermore, 10% of patients present with metastatic disease at initial presentation. Paramalignant effusions are collections of fluid in the pleural space found in patients with solid tumors no direct pleural involvement and no evidence of malignant cells in pleural fluid.

Case Report

A 56-year-old female with history of hypertension, hyperlipidemia, diabetes mellitus type 2, class II obesity, anxiety, and depression presented to her primary care physician with complaints of upper respiratory symptoms. Exam revealed diminished left lower lobe breath sounds and dullness to percussion. Her symptoms were refractory to Azithromycin, amoxicillin/clavulanate, and methylprednisolone. A chest x-ray revealed a large left pleural effusion. Thoracentesis yielded 1500 mL of green tinted fluid with benign cytology and a follow up chest x-ray showed resolution of effusion. Over the next 4 weeks the effusion returned twice, evidenced by radiographic imaging, and subsequent thoracenteses yielded 1500mL and 800mL respectively of serosanguinous fluid with negative serology. An extensive workup to elucidate the etiology of her effusion was performed. Echocardiography and autoimmune panel were benign. Abdominal ultrasound revealed a 30cm complex, septate, cystic mass with internal vascularity. CT imaging was consistent with ultrasound findings with suspected ovarian malignancy and revealed the effusion had once again returned. Referral to GYN/ONC was made. Initial evaluation revealed the tumor was CA-125 positive, and CEA/CA-19-9 negative. A plan to treat with surgical resection was made. The patient underwent an uncomplicated total abdominal hysterectomy with bilateral salpingo-oophorectomy, omentectomy, pelvic lymph node dissection, and ovarian cancer staging. Pathology report of surgical specimens signified the final diagnosis of metastatic papillary thyroid carcinoma of the ovary with 2/5 right pelvic lymph nodes positive for metastatic disease. The patient subsequently underwent thyroidectomy for removal of primary tumor.

Discussion

The diagnosis of papillary thyroid carcinoma was unexpected in this patient with unexplained pleural effusions and no appreciable thyroid mass on exam. While papillary thyroid carcinoma is the most common thyroid malignancy, it is an extremely rare cause of a pleural effusion. In addition, of the 51 reported cases of papillary thyroid carcinoma leading to a pleural effusion, none have featured ovarian metastasis.

Conclusion

This case exhibits a rare case of papillary thyroid carcinoma leading to an exudative pleural effusion.

Analysis of cannabis use in sexual and gender minorities compared to heterosexual festival participants

Alexandra Marko,[1] Amy R Brandt,[1] Robin N Vanderbeck,[1] Kayla Spence,[1] Yuhao Wang,[1] Kassandra Maturino MPH,[1] Jamie Smith MA,[1,2] Lynelle Phillips RN MPH,[3] Jane McElroy PhD,[1,2] Kevin Everett PhD[1,2]

[1]University of Missouri-Columbia
[2]Family and Community Medicine Department
[3]Department of Public Health

Introduction

Numerous states have passed laws making marijuana legal for medical and/or recreational use, but the potential therapeutic benefit to users is poorly understood1. Medical providers will benefit from a better understanding of their patients' cannabis use. The present study aims to analyze the reasons for cannabis use in sexual and gender minorities (SGM) and heterosexual participants.

Methods

A cross-sectional observational study design was used to assess community health behaviors and perspectives, inclusive of frequency of medical and recreational marijuana use. A survey was administered at five PRIDE festivals throughout Missouri between June and August 2023. 2519 participants completed the survey, and data was analyzed using SAS 9.4.

Results

Over one quarter (28%) self-identified as cisgender heterosexuals, while the remaining 72% identified as sexual and gender minorities (SGM). About one half (48%) reported using cannabis with 10% using for medical purposes only, 12% for both medical and recreational purposes, and 78% for recreational use only. Of the 93 unique medical conditions reported, anxiety was the most frequent condition reported (n=296; 56%), and a range of pain conditions (n=99; 28%) were frequently reported. Among cannabis users in this sample, SGM used cannabis more than cisgender heterosexuals (63% vs 37%).

Conclusion

This study finds anxiety and pain as top medical reasons for medical marijuana use. These results reinforce the need for patient-provider discussions about cannabis use to form optimal treatment plans. Additional studies are needed to examine the continued controversy about the safety and efficacy of therapeutic marijuana use.

Differences in cartilage biomarkers related to histologic degradation severity in the osteoarthritic knee

Luke B. Marx,[1] Grace S. Brentlinger,[1] Owen M. D'Amour,[1] Gabe J. Keeton,[1] Corder Lehenbauer,[1] Harjeev Singh,[1] James A. Keeney MD,[1,2] James L. Cook DVM PhD,[1] Aaron M. Stoker PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Osteoarthritis (OA) is a multifactorial disease often progressing from an initial insult or injury to whole-joint degeneration causing pain and dysfunction. This study was designed to identify changes in OA cartilage biomarker concentrations related to histological changes in cartilage structure. It was hypothesized that there would be significant differences in cartilage pro-degradative and pro-inflammatory biomarker concentration based on severity of histological tissue degradation.

Methods

With IRB approval (IRB #1208392) and informed patient consent. Excised femoral condyle and tibial plateau surfaces were recovered from patients undergoing TKA for OA. One half of each explant was evaluated histologically by a blinded pathologist using the OARSI system. Protein extracted from the other half was assessed for various biomarkers. Significant differences were determined using a one-way ANOVA and Tukey post-hoc test.

Results

Samples with low summed scores typically had significantly higher Leptin, MMP-1, Gro-α, IL-6, IL-8, MIP-1α and OPN, and significantly higher MMP-9, MMP-13, and DKK-1, compared to samples with higher scores.

Conclusion

The data from this study indicate that inflammatory, degradative enzyme, and bone metabolism-related biomarker concentrations have important and potentially clinically relevant associations with histological assessments of cartilage degradation.

Acute esophageal perforations in a rural academic center

Bethany Mather,[1] Cesar Reategui MD FACS,[1,2] Brycen Ratcliffe MD MBA,[1,2] Ryan Jobe,[1] Jussuf Kaifi MD PhD,[1,2] Sebastian Wiesemann MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Cardiothoracic Surgery

Introduction

Esophageal perforations present a significant mortality rate of 7.5-20.3%. Etiology can be divided into iatrogenic and non-iatrogenic causes. The location of perforation can be cervical, thoracic, or abdominal, leading to various presenting symptoms and varying mortality rates. However, the most important modifiable factor is the time from diagnosis to treatment. It has been shown that delay in treatment greater than 24 hours is associated with a twofold increase in the overall mortality rate.

Methods

In this retrospective study from 2017-2022, we reviewed all cases of esophageal perforation that presented to our rural academic center through chart review. We identified 31 patients with esophageal perforations from non-malignant etiologies.

Results

31 cases of esophageal perforations were identified. The median age of patients was 65 (23-91) with 75% being male. Boerhaave syndrome was identified as the most common cause at 45%. Distal esophagus represented 87% of perforations compared to thoracic (6%) and cervical (6%). We identified many presenting symptoms with the most common including vomiting (48%), chest pain (32%), and dysphagia (22%). The average time from symptom onset to diagnosis was 4.6 days (1-21) days. The overall mortality rate was 16%.

Conclusion

Esophageal perforation is a complex surgical problem requiring timely diagnosis and treatment to mitigate morbidity and mortality risk. At this rural academic center, no single symptom occurred in the majority of patients, therefore a high index of suspicion is necessary. As evidenced in the literature, prompt recognition and treatment can be lifesaving, hence symptom recognition is of critical importance.

Low and high energy sacral fractures: A literature review

Nick McGhee,[1] John Baumann,[1] Rown Parola MD,[1,2] Brett Crist MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Finding the most effective treatment for sacral fractures poses a significant difficulty for both spine surgeons and traumatologists. The relative rarity and diverse characteristics of sacral fractures make it challenging for orthopaedic surgeons to gain sufficient experience with such injuries. Moreover, existing studies on sacral fractures have primarily been retrospective and involved nonhomogeneous or small treatment groups, further limiting the availability of reliable insights from the current literature in this domain.

Methods

Finding the most effective treatment for sacral fractures poses a significant difficulty for both spine surgeons and traumatologists. The relative rarity and diverse characteristics of sacral fractures make it challenging for orthopaedic surgeons to gain sufficient experience with such injuries. Moreover, existing studies on sacral fractures have primarily been retrospective and involved nonhomogeneous or small treatment groups, further limiting the availability of reliable insights from the current literature in this domain.

Results

Our search identified 46 publications from the PubMed database for literature review. After evaluating the inclusion and exclusion criteria, a total of 10 articles were included in the review.

Conclusion

Effective treatment options and outcomes differ depending on the mechanism of injury. Conservative management is often effective for low-energy sacral fractures. Rest, including cessation of offending and high-impact activities, analgesia, modified weight-bearing exercises with activity modification and gradual return to activity over several weeks with a physical therapist frequently resulted in symptom resolution. High-energy sacral fractures present a stark contrast, as they often demand immediate surgical interventions.

Allergic fungal rhinosinusitis in a 12-year-old male resulting in remodeling of cribriform plate with protrusion into the anterior cranial fossa: A case report

Nick McGhee,[1] Savannah D. Groves,[1] Carlton Homan,[1] Christine Franzese MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology

Introduction

Allergic fungal rhinosinusitis (AFRS) in the pediatric population is a rare pathologic entity characterized by a Type I hypersensitivity reaction to sinus fungi promoting the development of eosinophilic inflammation and thickened mucin. AFRS often manifests clinically as: nasal discharge, nasal obstruction, nasal polyps, anosmia and headaches. However, in the pediatric population patients with AFRS often present with the manifestation of facial and ocular symptoms such as sinus pain and proptosis. Early clinical suspicion is essential for diagnosis to prevent the dissemination of disease.

Methods

We report a case of a 12-year-old African American male who presented with the gradual onset of asymptomatic proptosis and seasonal allergy symptoms resulting in unilateral relative afferent pupillary defect, who was ultimately diagnosed with allergic fungal rhinosinusitis with bony expansion and dehiscence.

Results

The patient's condition improved after surgical intervention and post-operative debridement, and he was discharged with recommendations for regular use of Flonase, daily nasal saline irrigation, and future consideration of oral steroid regimens.

Conclusion

Early recognition and diagnosis of AFRS, is essential to prevent systemic disease progression and support favorable outcomes. Clinicians should be aware that anti-fungal and anti-allergy therapies alone are not sufficient for the resolution of infection, and successful treatment relies on surgical intervention and at-home pharmacologic treatments.

Maintenance of response to transcranial magnetic stimulation (TMS) in major depressive disorder (MDD) using monthly TMS treatment

Jane McKelvy,[1] Ejike Nwokwor MD,[1,2] Crestin Andrews DO,[1,2] Ila Durkin MD,[1,2] Muaid Ithman MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Psychiatry

Introduction

Transcranial Magnetic Stimulation (TMS) is a non-invasive procedure approved by the FDA for treatment of Major Depressive Disorder (MDD) in adults who have not responded to antidepressant medications. Large, randomized sham-controlled trials and almost two decades of clinical use have proved TMS to be safe and effective. There is growing interest in using TMS for maintenance of response, but existing research has not yet demonstrated conclusive efficacy.

Methods

We conducted an open-label study in patients who previously completed a full acute TMS course for MDD at UMHC Neuromodulation clinic to evaluate the efficacy of 12 months of theta-burst maintenance dose TMS therapy in maintaining remission of depressive symptoms as measured by PHQ9 and QIDS scores before and after monthly treatments.

Results

The mean pre-treatment PHQ9 was 6.7 on month 1 and 6.8 on month 12. The mean post-treatment PHQ9 was 6.6 on month 1 and 5.3 on month 12. The mean pretreatment QIDS was 7.6 on month 1 and 8.71 on month 12. The mean post-treatment QIDS was 6.3 on month and 5.4 on month 12.

Conclusion

This study demonstrates that 12 months of theta-burst maintenance dose TMS maintained remission of depressive symptoms. While the power of this study is limited by the small sample size of n=7, these results lend further support to the need for continued research in maintenance dose TMS as a promising future option for MDD maintenance therapy.

Norepinephrine-mediated vasoconstriction during hypoxia and the role of β-adrenergic receptors

Haylen McKnelly,[1] Dain Jacob,[1] Brian P. Bostick MD PhD,[1,2] Natasha G. Boyes PhD,[1,3] Jacqueline K. Limberg PhD[1,3]

[1]University of Missouri-Columbia
[2]Department of Cardiology
[3]Department of Nutrition and Exercise Physiology

Introduction

Norepinephrine (NE) binds to α-adrenergic receptors on the vascular smooth muscle to cause vasoconstriction. Exposure to low oxygen (hypoxia) produces peripheral vasodilation despite increased release of NE from sympathetic nerve terminals ("hypoxic sympatholysis"). The mechanism by which hypoxic sympatholysis occurs is unclear but may involve β-adrenergic receptors. We examined the effect of NE and βblockade on forearm blood flow (FBF) during hypoxia. We hypothesized that (1) hypoxia would attenuate NE-mediated vasoconstriction, and (2) β-blockade would blunt hypoxic sympatholysis.

Methods

FBF (venous occlusion plethysmography) was measured in five healthy young adults (1F/4M, 25±7 years) while pharmacological infusions were administered locally through a brachial artery catheter. Participants completed 4 trials: (1) NE during normoxia, (2) NE during hypoxia (80% arterial O2 saturation), (3) NE + β-blockade (propranolol) during normoxia, (4) NE + β-blockade during hypoxia. NE-mediated vasoconstriction was calculated as the relative decrease in FBF (%FBF) from baseline with NE and was compared between normoxia and hypoxia (ΔFBF = %FBFhypoxia – %FBFnormoxia). The effect of β-blockade on ΔFBF was assessed.

Results

NE-mediated vasoconstriction was observed during normoxia (-64±8%) and this response was attenuated during hypoxia (-42±10%, p=0.019). β-blockade tended to blunt hypoxic sympatholysis (ΔFBF 21±13% vs 5±9%, p=0.059).

Conclusion

Hypoxia attenuates NE-mediated vasoconstriction, indicating hypoxic sympatholysis; this may be due, in part, to the β-adrenergic receptors. Together, these preliminary data suggest a role for β-adrenergic receptors in regulating blood flow under conditions of low oxygen and elevated sympathetic outflow that may occur in environmental or pathological conditions.

Ambulation rehabilitation: A retrospective analysis on the efficacy of body-weight support gait training in post-stroke inpatient

Sarah McLeod,[1] Jenna Ludwig,[1] W. David Arnold MD,[1,2] Joseph Burris MD[1,2]

[1]University of Missouri-Columbia
[2]Physical Medicine and Rehabilitation

Introduction

Body weight support training (BWST) is increasingly used for rehabilitation and has been shown to have impact gait speed, balance, and stride length in patients with neurological impairments. However, there are limited studies investigating the real-world impact of BWST during inpatient rehabilitation (IR) in stroke.

Methods

Chart review of patients with stroke undergoing IR was performed to determine the real-world impact of BWST on ambulation. Mixed effects analyses were used to investigate the effects of rehabilitation, treatment (BWST or non-BWST), and interaction between rehabilitation and treatment. Multiple comparisons were also performed to compare groups at baseline and discharge.

Results

162 patients (BWST: n=69 males and females aged 31-89, non-BWST: n=93 males and females aged 31-92) admitted to inpatient rehabilitation at a single center were compared using data from the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF PAI). Ambulation of 10, 50, and 100 feet showed significant improvement during IR ($p<0.0001$), and improvement was similar between BWST and non-BWST (insignificant Interaction time x treatment). At admission, the BWST group showed worse ambulation for 10, 50, and 100 feet, statistically significant for 10 feet ($p<0.05$). Climbing 1, 4, 12 steps showed similar patterns.

Conclusion

This study showed improvements of ambulation following IR which were similar between patients treated with BWST and non-BWST rehabilitation. Patients that underwent BWST generally showed more severely ambulatory impairment at admission but showed similar rehabilitation progress supporting a possible benefit of BWST. Future studies could include case control or prospective randomized studies.

Carotid blowout syndrome: A case report

Aaron Meers,[1] Kenlee Jonas,[1] Anya Anokhin MD,[1,2] Parker Keith MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Dematology

Introduction
Carotid blowout syndrome (CBS) is a rare and life-threatening complication primarily associated with head and neck cancer, particularly in patients who have undergone radiation therapy. It involves the spontaneous or traumatic rupture of the carotid artery, leading to arterial bleeding in the neck region. This case report presents a comprehensive overview of the clinical presentation, diagnostic workup, and management of a 76-year-old male patient diagnosed with CBS.

Methods
Clinical data was collected with informed consent from the patient.

Results
A 76-year-old male with a history of oropharyngeal squamous cell carcinoma was treated with chemoradiation therapy, presented with spontaneous bleeding from an existing chronic wound on the left lateral neck. Conservative measures were taken, and dermatology was consulted for the incessant oozing neck wound. Before a biopsy could be performed the following day, the patient had to be rushed for surgery since his wound transformed from oozing to a brisk pulsatile bleeding. This case discusses the critical importance of timely recognition and multidisciplinary intervention in CBS to prevent potentially fatal outcomes.

Conclusion
CBS is a dangerous and potentially rapidly-fatal diagnosis that necessitates immediate attention and intervention. Recognition of early signs of impending CBS including cutaneous manifestations is crucial for reducing morbidity and mortality associated with this condition. A multidisciplinary team is needed for stabilization and repair of this potentially catastrophic complication. Autologous vein graft reconstruction, the use of endovascular techniques, such as arterial stenting, coupled with vigilant postoperative care, can lead to favorable outcomes and prevent catastrophic consequences such as an infection or stroke.

Impact of Medicaid expansion on maternal mortality rates

Sydney Miles,[1] Xing Song PhD,[1] Albert Hsu MD,[1-3] Karen Florio DO[1-2, 4]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology, and Women's Health
[3]Reproductive Medicine and Fertility Center
[4]Division of Maternal Fetal Medicine

Introduction
U.S. maternal mortality rates have been rising with considerable state-to-state variation. In 2012, the U.S. Supreme Court ruled that states could not be forced to expand Medicaid programs and that each state could decide whether or not to participate in matching of federal funds offered by the Affordable Care Act. Since South Dakota's Medicaid expansion in July 2023, there are now 11 states which have not yet expanded Medicaid. Our hypothesis is that Medicaid expansion is associated with lower maternal mortality rates by state, despite demographic differences, due to increased access to care.

Methods
Maternal Mortality Review Committee (MMRC) data from each state was reviewed systematically. For states missing critical information in their publicly-available online database, the lead author contacted MMRCs to request missing data. The focus of the study was pregnancy-related mortality. To maximize the number of states with available data, the year 2017 was chosen for analysis. On initial analysis, all Medicaid expanded states and Washington D.C. (n=40) and all non-Medicaid expanded states (n=11) with available data were grouped together and mean mortality rates were collected. On sub-analysis, odds ratios were adjusted for age, race, ethnicity, BMI, insurance status, cause of death, and timing of death by relationship to pregnancy.

Results
Medicaid expansion status is/is not associated with higher rates of maternal mortality.

Conclusion
Access to care, partly addressed by Medicaid expansion, may be a significant driver of maternal mortality. Causes of maternal mortality remain multifactorial, encompassing patient, provider, hospital, health care system, and policy level factors.

Esketamine nasal spray for treatment-resistant depression in a transgender veteran with borderline personality disorder

Lydiah Fridah Maxmilliam Mpyisi,[1] Michael B. Bodenhausen,[1] Sarah Canoy MD[1-3]

[1]University of Missouri-Columbia
[2]Department of Psychiatry
[3]Harry S. Truman Memorial Veterans' Hospital

Introduction

Depression with suicidality is rampant in the military. Unfortunately, appropriate treatment is complicated by treatment-resistant depression (TRD), a subset of major depressive disorder (MDD), that does not respond to at least two trials of appropriate antidepressants at appropriate doses and duration. In 2019, intranasal esketamine (IE), the s enantiomer of ketamine - an N-methyl-D-aspartate antagonist, was approved for TRD. Though IE has proven to be a rapid-acting antidepressant (RAAD) for TRD, its FDA-approved indication is limited to MDD with acute suicidality and excludes comorbid mental health concerns such as bipolar disorder (BD) and borderline personality disorder (BPD).

Methods

Our patient is a 29-year-old transgender female veteran on hormone replacement therapy with a long-standing history of PTSD, BPD, MDD and two menacing suicidal attempts. In conjunction with 100 mg of Sertraline, intranasal esketamine was initiated at 56 mg twice weekly for four weeks, followed by 56 mg once weekly, and titrated to 84 mg once weekly.

Results

Several months into treatment, patient reported greater than 50% improvement in her symptoms. She held employment for more than one year and rarely experienced thoughts of self-harm. This case report highlights the RAAD effects of IE in at-risk patient.

Conclusion

The positive outcome of the off-label use of IE in a veteran at risk for the life burden of TRD and BPD, accentuates the need to expand FDA-approved indications for the use of IE. We recommend a trial to investigate the effectiveness of IE in veterans with TRD and comorbid BPD or BD.

Rural prehospital tourniquet placement: A retrospective analysis

Jaycee Mudd,[1] Terrell Christian,[1] Jennifer Randolph RN,[1] Chase Schlesselman MS,[1] Jeffrey Coughenour MD,[1-3] Rushabh Dev MD,[1-3] Amy E. Liepert MD[1-3]

[1]University of Missouri-Columbia
[2]Department of Surgery
[3]Division of Acute Care Surgery

Introduction

Tourniquets have historically been used by the military and more recently in the civilian population to treat uncontrolled hemorrhage. We evaluate the effectiveness and safety of tourniquets as a method of hemorrhage control in the setting of a Level I trauma center serving a large rural population base.

Methods

A retrospective review of the University of Missouri Trauma Data Bank and medical records of patients admitted to the University of Missouri Frank L. Mitchell Trauma Center between June 2018 and May 2023 was utilized. Information collected included patient demographics (age, gender), type of injury (blunt, penetrating, Injury Severity Score (ISS)), prehospital tourniquet use and indications, and immediate complications. The indications for tourniquet use, effectiveness, and complications were analyzed.

Results

161 patients were identified consisting of 129 males and 32 females aged 3 to 84 years. A total of 182 tourniquets were placed. ISS ranged from 4 to 57 with a median of 10. Admission median SBP was 130 with the low and high interquartile ranges 106.5 and 149. Median heart rate was 96 with a low and high interquartile range of 77 and 118. Potential immediate complications related to tourniquet application included one extremity compartment syndrome and two patients with acute kidney injury.

Conclusion

Prehospital tourniquet application is being used as a method for hemorrhage control in rural settings by EMS providers with long transport times. We did not identify significant adverse effects in this initial investigation.

Spinopelvic parameters in the standing & sitting positions on lateral eos radiograph

Muhammad-Amin Habib Munshi,[1]
Nikhil Jain MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction
Understanding spino-pelvic and hip motion, and its change from standing to sitting posture is important as it can guide optimal operative strategies in dual hip and spine pathology. Our aim was to describe spino-pelvic and hip radiographic parameters and examine changes between standing and sitting postures.

Methods
A retrospective analysis was done in a cohort of patients presenting to the Missouri Orthopaedic Institute. We studied demographic parameters, and various spinopelvic/hip measurements in the standing and sitting position using EOS full spine lateral imaging. The inter-relationship of changes were studied using multivariate regression analysis.

Results
There were 229 patients with mean age of 52.7 years and 60.1% were males. Age and BMI were not significantly associated with a change in spinopelvic parameters. Pain score was significantly associated with Δ thoracic kyphosis (p=0.004, 95% CI: 0.129, 0.680). Δ L4-S1was positively associated with ΔT1 slope (p=0.015, 95% CI: 0.021, 0.199) slope and inversely associated with Δ cervical lordosis (p=0.017, 95% CI: -0.155, -0.015). Δ Lumbar lordosis was positively associated with Δ thoracic kyphosis (p <0.001, 95% CI: 0.167, 0.402) but not associated with Δ cervical lordosis (p=0.804, 95% CI: -0.093, 0.072).

Conclusion
Δ L4-S1 seems to inversely relate with Δ cervical lordosis, indicating compensatory association of segments with inherently more range of motion to facilitate upright posture. Reduction in lumbar lordosis (L1-S1) on sitting is associated with reduction in thoracic kyphosis to facilitate upright posture, instead of increased cervical lordosis. Transitioning from standing to sitting reveals intricate associations in spinopelvic parameters.

Is virtual reality the solution for social isolation in elderly individuals?: A literature review

Nisha Naseer,[1] Ashish Sarangi MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Psychiatry

Introduction
One of the growing problems of our aging population is an increased frequency of anxiety, depression, and feelings of social isolation. Old age is associated with limited levels of social engagement, and this has only risen since the COVID-19 pandemic. Individuals experiencing social isolation suffer from an increased incidence in various physical and mental illnesses and increased rates of mortality, so discovering ways to improve social connection is a vital part of geriatric research. With recent advancements of technology, many individuals have turned to virtual reality (V.R.) for their entertainment and therapeutic needs. While V.R. has been used for physical rehabilitation, social anxiety, depression, and more, its potential use in social connection has not been widely studied in elderly individuals.

Methods
We conducted a literature research and reviewed 4 articles that assessed parameters such as psychosocial impact, loneliness, and quality of life in a sample that included participants over the age of 50, following V.R. usage.

Results
The results varied among studies, some finding positive associations between V.R. and well-being and others collecting positive qualitative feedback from participants. However, none of the studies reviewed found significant differences between experimental and control groups while measuring metrics of social connection.

Conclusion
At this time, these studies do not support that V.R. would provide any added benefit to individuals experiencing social isolation. Additional preliminary research is needed to explore the potential benefits of virtual reality within the geriatric population.

Vulnerable road user (VRU) safety assessment

Kaylie Nichols,[1] Julie Stilley PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Emergency Medicine

Introduction

Vulnerable Road Users (VRUs) are nonmotorized road users, such as pedestrians and bicyclists, who do not have the protection of a vehicle shell. VRU injuries and fatalities have increased, leading to various efforts to assess and improve VRU safety. The VRU safety assessment involves a combination of systemic analysis with high-crash location analysis using data provided by police reports and MoDOT roadway data, but traditionally lacks input from healthcare providers. Our objective was to explore health outcomes of VRU who presented to the Emergency Department.

Methods

A retrospective review of patient diagnosis codes indicating VRU-type injury was performed from ED patients between January 2019 – June 2023. Descriptive statistics were used to describe patient demographics, injury location and diagnosis, acuity of care, and presence of risk factors, such as alcohol use suspicion from EMS records.

Results

A total of 2,840 patients were included for VRU injury diagnosis inclusion. Demographics and injury information differed by VRU diagnosis code. Patients requiring extensive care were most commonly categorized with "Ped on foot injured pick-up truck, pk-up/van in traf, init" diagnosis code. VRU risk factors occurred commonly when considering pedestrian vs. car in traffic, but not others. The most frequent injury overall was radial fracture

Conclusion

Incorporating medical data into the VRU safety assessment expands upon existing data to provide insight into event severity and injuries sustained by VRUs. VRU injuries and level of care differed among VRU modality. These differences should be considered when planning safety enhancements for VRUs traveling on our roadways.

Napping's role unfolds with age: Cognitive gain or memory drain?

Lauren M. Nowakowski,[1] Amy N. Costa,[1] Ashley F. Curtis PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Psychiatry

Introduction

Previous research has shown that napping benefits cognition in young adults but not in middle-aged and older adults. This study examined the association between napping behaviors and cognition across the adult lifespan, investigating whether age moderates these associations.

Methods

Cognitively healthy adults aged 18-82 (N=200, Mage=37.85, SD=21.27, 176 females) completed assessments of their napping habits over a 7-day period and subjective cognition [Cognitive Failures Questionnaire (CFQ), sub-scores for memory, distractibility, and blunders]. A subset of 135 participants completed objective cognitive tasks, including Stroop, Posner Cueing, Sternberg, and Wisconsin Card Sorting tests. Multiple regression and Johnson-Neyman analyses evaluating age moderation were conducted, controlling for sex, anxiety and depression symptoms, sleep efficiency, sleep apnea, and sleep and pain medication usage.

Results

Age moderates the links between nap duration and CFQ-total (p=.04), CFQ-memory (p=.01), and CFQ-blunders (p=.004). Longer naps related to fewer cognitive complaints in young adults, more memory complaints at age 62 and above, and more blunder complaints at age 43 and above. Moreover, age moderates the nap duration-working memory relationship, with longer naps associated with poorer working memory at age 33 and above.

Conclusion

The findings suggest longer naps are associated with better subjective cognition in younger adults, worse subjective cognition in older adults, and poorer working memory in those age 33 and above. Further research is needed to understand the disruption of napping's cognitive benefits in older adults and whether napping could predict cognitive decline, thus guiding interventions for age-related cognitive decline.

Endometriosis and obesity: A narrative review

Odinaka Onuigbo,[1] Albert L. Hsu MD,[1,2] Jae-Wook Jeong PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology, and Women's Health

Introduction

Often causing pain and infertility, endometriosis is characterized by endometrial tissue outside the uterus; it affects 6-10% of reproductive-aged women, with a 2002 global economic burden estimated at $22 billion. The impact of obesity on endometriosis remains unclear: many associate low BMI with higher endometriosis risk, others propose chronic pain may reduce appetite, so low BMI is actually a side effect. Emerging research also suggests a connection between endometriosis severity and higher adiposity.

Methods

A literature search on PubMed focused on manuscripts with "endometriosis" and "obesity" in titles/abstracts. After restricting to English-language only, 192 abstracts were considered, followed by full-text review of 32 articles. Thirteen papers met inclusion/exclusion criteria.

Results

Of 13 manuscripts, six indicated that low BMI correlated with increased endometriosis risk, while two conversely suggested a link between high BMI and endometriosis. Four manuscripts linked endometriosis with high-fat diets. Three demonstrated a connection with high leptin levels, with the direction of causality remaining unclear. One manuscript proposed that endometriosis influenced hepatic expression of leptin, leading to high leptin levels and low BMI. Two papers found no link between BMI and endometriosis, with one reporting that obesity did not affect expression of endometrial genes.

Conclusion

The literature on endometriosis and obesity is inconsistent. Some studies suggest low BMI is a risk factor for endometriosis, possibly due to elevated leptin levels; other studies link endometriosis to high BMI and higher dietary fat intake. This highlights the need for further research to unravel the complex relationship between endometriosis and obesity.

"Her brother wants her sent to the ER": Exploring how 'what matters' influences avoidable nursing home-to-hospital transfer of residents with dementia

Debora Paez Perez,[1,2] Kimberly Powell[1,2]

[1]University of Missouri-Columbia
[2]Sinclair School of Nursing

Introduction

Reducing avoidable hospitalizations for nursing home (NH) residents is a national priority due to various negative effects. The purpose of our study was to investigate factors contributing to avoidable NH-to-hospital transfers of residents with dementia.

Methods

Advanced practice registered nurses used an adapted acute care transfer tool to document details about NH-to-hospital transfers from 16 Missouri Nursing Homes. We analyzed a random sample of (n=90) residents who had a diagnosis of dementia and had an avoidable transfer. We utilized a priori categories based on the Age-Friendly Health Systems 4Ms (what matters, medications, mobility, mentation) framework to begin the analysis. Dedoose qualitative software was used to help organize and visualize data.

Results

Factors contributing to avoidable NH-to-hospital transfer of residents with dementia were organized into two overarching themes: changes in condition and unavailable resources. Changes in condition included three sub-categories and unavailable resources includes two sub-categories. Among these, what matters, and mentation were the most frequent influential factors across all avoidable transfers regardless of CPR status.

Conclusion

Understanding the influence of 'what matters' to residents and family members for the decision to transfer NH residents to the hospital could help reduce avoidable transfers. NHs should consider interventions to improve documentation and communication of patient and family preferences regarding transfers. Additionally, NH staff could benefit from training to help them differentiate between changes in mentation caused by disease process (i.e., dementia) vs. an acute episode for which hospitalization is necessary.

From inpatient rehabilitation facility to skilled nursing facility to home: A retrospective study of functional recovery

Alexis Philippe,[1] Reza Farid MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine and Rehabilitation

Introduction
Inpatient Rehabilitation Facility (IRF) care has an inherent goal of discharging patients back into the community. Some patients do not progress sufficiently and require discharge to alternate facilities. No prior studies have examined outcomes for patients requiring Skilled Nursing Facility (SNF) placement after their stay at an IRF. Our goal was to identify functional outcomes of patients who receive combined rehabilitation from IRF and SNF.

Methods
This is a retrospective observational study. A semi-structured phone call questionnaire evaluated for living situation and aid requirement at 2 time points: prior to acute hospitalization and following discharge from SNF.

Results
Forty-three adults completed the study. 58.2% of respondents returned to baseline independence following stay at IRF followed by SNF. 63.4% of respondents who lived at home prior to acute hospitalization returned home following IRF and SNF stay.

Conclusion
Our findings indicate that those patients who receive further rehabilitation at a SNF following discharge from an IRF have the potential to return to baseline functioning and subsequently return home. This data suggests that utilizing IRFs in conjunction with SNFs might be an effective, patient-centered option for rehabilitation. However, further investigation is required to explore whether these findings may be generalized to a larger population are warranted.

Sex mismatched knee osteochondral allografts do not affect cumulative graft survival rates

Josh Pridemore,[1] Jonathan Williams,[1] James Cook DVM PhD,[1,2] James P Stannard MD,[1,2] Aaron Stoker, PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction
Osteochondral allograft (OCA) transplantation is one treatment option to treat osteochondral injuries of the knee. While improvements to surgical technique and graft preservation have led to improved outcomes, survival rates are still lower than desired. Emerging evidence suggests sex-mismatched grafts can lead to lower survival rates. This study was designed to compare graft survival rates in sex-matched vs sex-mismatched OCA patients.

Methods
With IRB approval and informed patient consent, OCA transplantation patients were enrolled in an outcome registry. Donor information was collected from organ transplant networks. Failure was defined as the need for a revision OCA surgery or conversion to arthroplasty. A Kaplan-Meier Survival Analysis was performed to compare survival rates between groups. A Cox-Hazard multivariate analysis was used to determine if patient demographics significantly contributed to cumulative survival rates.

Results
Of 162 patients included in this study, 57 were sex-mismatched. Patients receiving sex-mismatched grafts did not have a significantly different cumulative survival rate than patients receiving sex-matched grafts ($p=0.2521$), and patient BMI, age, sex, or donor age did not have a significant effect on survival rates.

Conclusion
The data from this study indicates that patient donor sex matching is not required for OCA transplant surgery. Ongoing studies are aimed at determining factors that affect clinical outcomes for patients after OCA transplantation.

The efficacy of the Hydrus® Microstent versus the OMNI® Surgical System alone and in combination in the treatment of open angle glaucoma

Anya A. Rahman,[1] Laurence Ducker MD,[1,2] Sandra M. Johnson MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Ophthalmology

Purpose

To compare efficacy of the Hydrus® Microstent versus the OMNI® Surgical System alone and in combination in the treatment of open angle glaucoma.

Methods

A retrospective study of eyes with mild to moderate stage open angle glaucoma, that were treated with cataract surgery in combination with the Hydrus® Microstent, the OMNI surgical System, or both with up, to 12 months of follow up at a single academic eye center.

Results

Twenty-two eyes were treated with OMNI alone, thirty-one eyes with Hydrus alone and twenty eyes were treated with both devices combined were included. Preoperative IOP was 8-40 mmHg. At the 12-month time point, mean IOP was reduced from 20.05 to 14.5 mmHg (27.7% reduction) in the combination group, and from 18.7 to 16.8 mmHg (10.5% reduction) in the Hydrus group and from 19.5 to 15.2 mmHg (21.8% reduction) in the OMNI alone group. Mean number of medications was reduced from 2.9 to 1 in the combination group, from 1.3 to 0.94 in the Hydrus group alone, and increased from 2.4 to 3 in the OMNI group alone. Surgical failure was assessed between the three groups. Overall failure was 11 eyes (35%) in the Hydrus group, 7 eyes (31%) in the OMNI group and 4 eyes (20%) in the combination group at different time points.

Conclusion

At 12 months, the combination of the OMNI Surgical system with the Hydrus microstent at the time of cataract surgery achieved greater reduction in IOP than either system alone. The combination of the two procedures also achieved a lower surgical failure rate than either device on its own.

Perivascular infiltration of rocuronium in patient with chronic renal disease

Shelby Y. Salisbury,[1] Noah J. Timko,[1,2] Boris Mraovic MD FASA[1,2]

[1]University of Missouri-Columbia
[2]Department of Anesthesiology and Perioperative Medicine

50-year-old female (ASA-4, 61 kg, BMI 24 kg/m2) with AKI s/p CKD (Cr 2.5), T2DM, morbid obesity, venous insufficiency, anemia, and metabolic acidosis presented for debridement of abdominal wound. Anesthesia induction (fentanyl 25 mcg, propofol 200 mg, rocuronium 30 mg) failed due to IV infiltration. Mask induction was performed with sevoflurane 8%, followed by intubation. Surgery was short (55 minutes). Although there was 4-twitches on train-of-four at surgery-end, duration of perivascular administration of rocuronium could be unpredictably long. Despite CKD (Cr 2.5), we chose to reverse rocuronium with sugammadex 160 mg. She was extubated with no residual blockade postoperatively.

Approach to pacemaker placement in the context of rare hypercoagulable state with obstructive right atrial thrombus and superior vena cava syndrome (SVC)

Sam Schaeffer,[1] Evan Carlen,[1] Indrajeet Mahata MD FACC FHRS[1-3]

[1]University of Missouri-Columbia
[2]Mercy Hospital Springfield
[3]Department of Cardiac Electrophysiology

Introduction

Obstructing thrombus poses a major roadblock to safe pacemaker placement. Long term dual chamber epicardial pacing provides an effective alternative to vascular access in a patient with the very rare disorder of pediatric onset polycythemia vera with concomitant MTHFR mutation. This case report is intended to provide strategies to physicians in the circumstance that SVC access is prohibited, and a right atrial thrombus is present.

Case Report

A 34-year-old male presented with recurrent syncope. He was found to have periods of bradycardia in the 30s. ECHO showed a large right atrial (RA) thrombus which complicated the recommendation of dual chamber pacemaker placement. A second obstructing thrombus was found in the SVC during surgical removal of the RA thrombus and closure of a patent foramen ovale (PFO). Due to the chief concern of sick sinus syndrome, pacing was indicated, but pacing wires could not be placed through the SVC thrombus without disrupting it. The patient ultimately was managed using an epicardial dual-chamber pacemaker, which bypassed vascular access and avoided the RA thrombus.

Conclusion

Epicardial pacing provides an effective alternative to traditional pacemaker in the extremely rare circumstance of occlusive thrombus in the setting of PV and MTHFR mutation while providing significant embolic risk reduction. In addition to avoiding disrupting SVC and RA thrombus, it also allowed for preservation of IVC filter integrity in a patient with recurrent DVT and PE despite anticoagulation. We feel this patient provides a basis on which there can be established risk stratification strategies for hypercoagulable patients requiring a pacemaker.

Oral feeding in infants born to mothers with diabetes

Meridith Schoening,[1] Destri Eichman,[1] Mady Williams,[1] Laith Almashharawi,[1] Stephanie Allred MD,[1,2] Jean Goodman MD,[1,2] Jacob Hercules,[1] Jennifer Hanford,[1,2] Akshaya Vachharajani MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Pediatrics

Introduction

Infants born to mothers with diabetes (IDM) are perceived to feed poorly compared to infants born to mothers without diabetes. This study aims at evaluating differences in time to achieving oral feeds in infants born to mothers with and without diabetes.

Methods

This is an IRB approved retrospective cohort study of electronic medical records of infants born more than 34 weeks gestational age and admitted to the neonatal intensive care unit (NICU) at the University of Missouri Women's Hospital in Columbia, Missouri. Exclusion criteria included death, premature birth less than 34 weeks, chromosomal anomalies, conditions affecting ability to feed orally or transferred to another hospital for further care. Continuous variables were analyzed with Kruskal Wallis test and categorical data were analyzed using Chi square test. p value was significant if <0.05.

Results

Infants in the groups born to mothers with (N=150) and without diabetes (N= 348) were comparable and had no significant differences in gestational age, sex, birth weight, length of stay, and APGAR scores. The mean difference in time to achieving oral feeds was 2 days, which was significant (p=0.01). Two babies in each group needed a gastrostomy feeding tube (p=0.8).

Conclusion

Infants born to mothers with diabetes took 2 days longer to achieve oral feeds than infants born to mothers without diabetes. This is a statistically and clinically significant difference that would be meaningful to families and increase health care costs.

Xen gel stent outcomes in open angle glaucoma patients: Comparision of open conjunctiva vs closed conjunctiva at 36 months

Justin Shanklin,[1] Gurpal Virdi MD,[1,2] Sandra Johnson MD,[1,2] Aaron Webel MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Ophthalmology

Introduction

The purpose was to compare the safety and efficacy of open conjunctiva (OC) and closed conjunctiva (CC) XEN gel implantation for both ab-externo and ab-interno approaches at 36 months. Using a retrospective study, 147 eyes (78 OC and 69 CC) of 147 adult patients with refractory open angle glaucoma who received a XEN gel stent via an ab-externo or ab-interno approach were analyzed. Success of the stent was established by examining postoperative intraocular pressure (IOP) and parameters were set at <14, <18, and >18 IOP. The reduction of glaucoma medication was also evaluated. Eyes requiring any additional IOP lowering procedures including bleb revision in the operating room or eyes with any postoperative complications were considered a failure.

Methods

Patient demographics, diagnoses, preoperative and postoperative data, outcome measures including surgical success, intraocular pressure (IOP), number of glaucoma medication, bleb revision or needling, additional IOP lowering procedures and complications were collected.

Results

Mean preoperative IOP was 20.36 for the OC and 22.09 for the CC group. The mean preoperative number of glaucoma medications was 3.07 for the OC group and 3.14 for the CC group. 72.7% of eyes achieved an IOP under 14 in the OC group and 54.35% in the CC group.

Conclusion

Our study demonstrates that an open conjunctiva approach in both ab-externo and ab-interno has superior IOP lowering outcomes, superior glaucoma medication lowering, and a similar safety profile to the closed conjunctiva technique at 36 months.

Documented cues in the use of physical restraints within the emergency department

Erika Shock,[1] Christopher Sampson MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Emergency Medicine

Introduction

Workplace violence in healthcare has continued to increase. Documented escalation cues for restraint use are often categorized into physical, verbal, or other. We sought to investigate the cues documented and evaluate common themes.

Methods

A retrospective cohort investigation was conducted with patients requiring physical restraints in the Emergency Department (ED) within the University of Missouri Health Care System from June 2018 to June 2021. Primary outcome was the presence of a restraint order documented in the electronic health record. Key variables integrated into our analytical model encompassed demographic attributes including age, race/ethnicity, gender, insurance status, substance use, and residential status.

Results

183 ED visits were evaluated during the study, 182 involved physical restraints. Patients were ages 11 to 81 years. Patient demographics of those requiring physical restraints were significantly different than baseline patients in the ED. 66% males (p= <0.001), 19% black (p = <0.001), 59% 20-39 (p= <0.001). Of patients subjected to restraints, 65.6% exhibited physical cues, 47% verbal cues, and 38.3% demonstrated other escalation cues. A statistically significant difference was found in the rate of physical escalation cues used between the age groups (p = 0.029). The difference appears to be driven by a decreased use of physical escalation cues in the 60 to 89 age category.

Conclusion

Our study revealed that patient age, race, and sex categorization may play a significant role in the use of physical restraints in the emergency department. Further evaluation is needed to identify additional factors impacting treatment and use of escalation cues.

Flow cytometry use of CD81 and CD24 in acute leukemia

Christine Sholy,[1] Amanda Wheeler,[1] Richard D. Hammer MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Pathology and Anatomical Sciences

Introduction

Distinguishing leukemic cells from hematogones using flow cytometry analysis of cell surface antigens is an important concept in the diagnosis of B-cell acute lymphoblastic leukemia (B-ALL). This is particularly useful in establishing measurable residual disease (MRD), which may be challenging due to overlapping morphologic and phenotypic features. Few studies have examined CD81 and CD24 expression together in B-ALL and acute myeloid leukemia (AML). Using flow cytometry, we evaluated expression patterns of CD81 and CD24 in leukemic cells and hematogones.

Methods

We prospectively analyzed flow cytometry cases of acute leukemia and hematogone hyperplasia with CD81 and CD24 from bone marrow and peripheral blood samples at University Hospital from 2022-2023. The sample (n=34) included 13 B-ALL, 10 AML, and 11 hematogone hyperplasia. Data was collected/gated via FACSCantoII/FACSDiva and FACSLyric/FACSuiteRuov1.5 (BD Biosciences). Mean fluorescence intensity (MFI) of CD81 and CD24 was analyzed for target populations. Cases were deidentified and MFI comparison was performed using unpaired t-tests.

Results

CD81 MFI was significantly higher in stage 1 and 2 hematogones in comparison to pre/post-treatment B-ALL and AML ($p<0.05$). CD24 MFI was significantly higher in stage 1 and 2 hematogones compared to pre-post-treatment AML ($p<0.05$), but only stage 2 hematogones demonstrated significantly higher MFI than pre/post-treatment B-ALL ($p<0.05$).

Conclusion

CD81 and CD24 exhibit differential expression patterns in hematogones vs B-ALL and AML and may thus be useful in improving diagnostic accuracy. These markers can be particularly valuable in verifying MRD. Further studies are needed to confirm their overall utility.

The role of CD3+ CD56+ regulatory T lymphocytes in myeloid neoplasms

Christine Sholy,[1] Rory Dellamano,[1] Amanda Wheeler,[1] Richard D. Hammer MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Pathology and Anatomical Sciences

Introduction

The pathogenesis of myeloid neoplasms includes genetic aberrations and immune dysregulation, including alterations in regulatory T-cells (Tregs). A novel population of Tregs, CD3+CD56+Tregs, has been proposed to influence pathogenesis and be of diagnostic utility in myelodysplastic syndromes (MDS) and acute myeloid leukemia (AML). While recent studies found increased CD3+CD56+Tregs in high-risk MDS and AML, none has examined these in chronic myeloid leukemia (CML) or chronic myelomonocytic leukemia (CMML).

Methods

We retrospectively analyzed flow cytometry cases of myeloid neoplasms with CD3 and CD56 at University Hospital from 2014-2023. Our sample (n=136) included 32 low-risk MDS, 41 high-risk MDS/AML, 26 CML, 17 CMML, and 20 non-myeloid neoplasm (control) cases. Data was collected/gated via FACSCantoII/FACSDiva and FACSLyric/FACSuiteRuov1.5(BD Biosciences). Cases were deidentified. CD3+CD56+Treg populations were compared using unpaired t-tests.

Results

A trend-increase of CD3+CD56+Tregs percentages was observed. Controls demonstrated the least followed sequentially by low-risk MDS, high-risk MDS/AML, CML, and CMML (mean±SD,9.12±3.70,11.47±6.73,14.38±12.67, 16.53±11.08,17.09±11.68). CD3+CD56+Tregs were significantly higher in CML and CMML versus controls and low-risk MDS ($p=0.01,0.01,0.04,0.04$), however, significance was not demonstrated when compared to high-risk MDS/AML ($p=0.48,0.45$). Significance was not observed in controls versus low-risk MDS or high-risk MDS/AML, although a trend towards significance was apparent with the latter ($p=0.16,0.07$).

Conclusion

CD3+CD56+Tregs appear to be associated with advanced myeloid diseases. For the first time, this study demonstrates increased CD3+CD56+Tregs in CML and CMML. Whether this population serves to promote or control disease progression in various myeloid disorders remains unknown. Further studies are required to elucidate the role and diagnostic utility of CD3+CD56+Tregs.

Improving refractive outcomes of cataract surgery and benchmarking toric intraocular lens implantation rate in an all-comers population

Jayce Simoncic,[1] Samuel Barry MD,[1-3] Timothy Ritchie MD,[1-3] Nathan Hesemann MD[1-3]

[1]University of Missouri-Columbia
[2]Department of Ophthalmology
[3]Harry S. Truman Memorial Veterans Hospital

Introduction

Toric intraocular lenses (IOLs) have been shown to be effective in managing astigmatic error following cataract surgery [1-5]. Financial concerns revolving around toric lenses are removed in Veterans Affairs hospitals. The purpose of this study was to benchmark the rate of toric IOL implantation in an all-comers population and measure and improve the rate of successful refractive outcomes following cataract surgery.

Methods

In this multi-year interventional study at Harry S. Truman Veterans Affairs Hospital (HSTVA), data of veterans who underwent cataract surgery from June 2019 to May 2020 (Control) and June 2020 to May 2022 (Intervention) were collected. The primary outcome was postoperative manifest refraction (MR). Success was determined by spherical equivalent within 0.5 diopter (D) of target (SEQ) and the combination of SEQ and cylinder within 0.5D of target (SEQ-CYL). Preoperative optical biometry measurements of corneal astigmatism and axis were collected for all patients.

Results

A total of 1553 eyes were included: 380 in Control and 1173 in Intervention. Comparing Control to Intervention, the frequency of toric IOL implantation increased from 14% to 39%. Additionally, the primary outcomes of SEQ and SEQ-CYL increased significantly from 77% - 88% and 41%-72% respectively.

Conclusion

An increase in utilization of toric IOLs to better address the epidemiology of corneal astigmatism resulted in a significant improvement in refractive outcomes. The use of toric lenses to address corneal astigmatism should be encouraged, as they provide the best chance for patients to reach optimal postoperative refractive outcomes.

Assessment of serum biomarkers for determining severity of knee osteoarthritis based on two different radiographic scoring systems

Harjeev Singh,[1] Anna N. Sullentrup,[1] Cristi R. Cook,[1,2] James A. Keeney MD,[1,2] James L. Cook PhD,[1,2] Aaron M. Stoker PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Osteoarthritis (OA) is a degenerative joint disease that commonly occurs in knees. Current assessments of OA consider patient-reported symptoms and x-ray radiography. The clinical standard for evaluating knee OA radiographically is the Kellgren-Lawrence (K-L) grading system. However, the K-L system's narrow grading scale (0-4) results in significant inter-reader variability in knee radiograph grades. A novel Composite system developed in our laboratory provides a broader score range (0-29). We hypothesize that serum biomarkers can effectively delineate knee OA severity for both the K-L and Composite scoring systems.

Methods

With IRB approval (IRB#1208392) and informed patient consent, bilateral anteroposterior standing knee radiographs, skyline radiographs, and knee serum samples were collected from patients (n=93) undergoing total knee arthroplasty for treatment of symptomatic OA. Radiographs were graded using the K-L and Composite systems by a blinded musculoskeletal research radiologist. Serum samples were tested for a panel of OA biomarkers. Statistical analyses were performed to identify significant ($p<0.05$) differences between biomarker concentrations in cohorts created by each scoring system.

Results

Biomarkers that distinguished OA severity based on K-L grades were significantly different from those that distinguished OA severity based on Composite scoring. Further, biomarkers that distinguished OA severity in the operated knee were significantly different from those that distinguished OA severity in the non-operated knee and in both knees combined.

Conclusion

Using a more comprehensive radiographic scoring system that considers a broad range of parameters linked with OA may allow for a more accurate classification of patients into cohorts for future research projects.

Assessment of urine biomarkers for determining severity of knee osteoarthritis based on two different radiographic scoring systems

Harjeev Singh,[1] Anna N. Sullentrup,[1] Cristi R. Cook DVM MS,[1,2] James A. Keeney MD,[1,2] James L. Cook DVM PhD OTSC,[1,2] Aaron M. Stoker PhD MS[1,2]

[1]University of Missouri-Columbia
[2]Deparment of Orthopedic Surgery

Introduction

Osteoarthritis (OA) is a degenerative joint disease that commonly occurs in knees. Current assessments of OA consider patient-reported symptoms and x-ray radiography. The clinical standard for evaluating knee OA radiographically is the Kellgren-Lawrence (K-L) grading system. However, the K-L system's narrow grading scale (0-4) results in significant inter-reader variability in knee radiograph grades. A novel Composite system developed in our laboratory provides a broader score range (0-29). We hypothesize that urine biomarkers can effectively delineate knee OA severity for both the K-L and Composite scoring systems.

Methods

With IRB approval (IRB#1208392) and informed patient consent, bilateral anteroposterior standing knee radiographs, skyline radiographs, and knee urine samples were collected from patients (n=297) undergoing total knee arthroplasty for treatment of symptomatic OA. Radiographs were graded using the K-L and Composite systems by a blinded musculoskeletal research radiologist. Urine samples were tested for a panel of OA biomarkers. Statistical analyses were performed to identify significant ($p<0.05$) differences between biomarker concentrations in cohorts created by each scoring system.

Results

Biomarkers that distinguished OA severity based on K-L grades were significantly different from those that distinguished OA severity based on Composite scoring. Further, biomarkers that distinguished OA severity in the operated knee were significantly different from those that distinguished OA severity in the non-operated knee and in both knees combined.

Conclusion

Using a more comprehensive radiographic scoring system that considers a broad range of parameters linked with OA may allow for a more accurate classification of patients into cohorts for future research projects.

Links in DNA isolated from first trimester maternal urine to gestational size at birth

Grace Smith,[1] Rene Cortese PhD[1-3]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology, and Women's Health
[3]Department of Pediatrics

Abstract

This project investigates the relationship between DNA isolated from first trimester maternal urine and a newborn's gestational size at birth. We aim to establish the physical and epigenetic profiles of isolated DNA as a way to infer whether a fetus will be large, average, or small for gestational age. Two types of DNA were isolated from maternal urine samples. The cellular and fluid fractions were separated for each urine sample, then DNA was isolated from each fraction independently. Isolated DNA was evaluated for concentration, fragmentation, and methylation using qPCR technology. No significant differences ($p>0.05$, two-tailed T test) were observed in the supernatant fraction. In the pellet fraction, all gestational sizes showed comparable results in their fragmentation profiles. Three methylation markers showed differences in full changes ($p<0.05$, two-tailed T test). These results show the potential for the use of DNA isolated from maternal urine as a marker to predict a fetus' gestational size as early as the first trimester of pregnancy. Further research is necessary to determine the performance for the reported differences individual markers and molecular signatures.

Clinic flow spreadsheet with timestamp functionality

Parker Smith,[1] Natalie Long MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Family and Community Medicine

Introduction

MedZou's live edited clinic flow spreadsheet in Microsoft Teams had functional limitations and a lack of clarity that contributed to unnecessarily lengthy patient visits. Additionally, MedZou had no data on how long teams were in patient rooms, time spent transitioning between teams, or lobby wait times.

Methods

We redesigned the clinic flow spreadsheet by making it easier to interpret visually and by adding time stamp functionality. Teams are now shown in a color-coded, sequential order and conditional formatting now automatically color-codes unseen patients, completed visits, telehealth appointments, and no-shows. A second sheet time stamps when the "Tracking Board" is changed and calculates the time of each clinic flow step.

Results

Implementation led to a clearer clinic flow with more seamless communication between volunteers. More than 200 visits were tracked in 2022 with a mean length of 108.2 minutes. 52% of 2424 time stamps were properly recorded. The largest contributors to visit length were time with the student team, time with the physician, and time with the intake team.

Conclusion

The new clinic flow spreadsheet helps facilitate better communication in clinic and expands the amount of collectible temporal data. Further areas of improvement were identified – data quality is limited by changes in clinic flow order and user error as changes to the spreadsheet can alter time stamp functionality. Data collection will prompt future research projects to further improve clinic flow and reduce visit length.

Brucella discitis osteomyelitis

Parker Smith,[1] Suha Abu Khalaf MD,[1,2] Andres Bran MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Medicine

Introduction

A 60-year-old woman presented with 6 months of abdominal pain radiating to her flanks and 4 months of bilateral lower extremity weakness, hypertonia, and numbness. She reported fatigue, weight loss, and night sweats. She was admitted for evaluation of spinal cord compression. She immigrated from Mexico and returned in early 2022. While there, she was exposed to many domestic animals and consumed possibly unpasteurized dairy. She had no significant medical history.

Methods

On admission she was afebrile, and CBC and CMP were unremarkable. ESR, and CRP were within normal limits. Cultures, tuberculosis, HIV, Hepatitis B/C, and Coccidioides were negative. MRI and biopsy were consistent with discitis osteomyelitis at T7-T8. Brucella antibody titers and IgM and IgG ELISA were positive and confirmed the diagnosis of Brucella osteomyelitis.

Results

Initial treatment was 6 weeks of rifampin and doxycycline. Mobility had not improved upon 2-week follow-up. 1-week of gentamicin was added. An echocardiogram was ordered to rule out infective endocarditis. On 2-month follow-up clinical and imaging findings were stable and a 12-week course of antibiotics was completed, so medications were discontinued.

Conclusion

Brucellosis is often difficult to identify. Serology is the cornerstone of diagnosis, but there are additional diagnostic challenges. Risk factor knowledge and a high suspicion is needed for earlier diagnosis and treatment to prevent complications. Treatment for osteoarticular brucellosis generally includes 6-12-weeks of doxycycline and rifampin plus a third antibiotic.

Got a light? Not anymore: A comparative analysis of sexual and gender minorities and cisgender heterosexual pride attendees

Kayla Spence,[1] Kassandra Maturino MPH,[1] Amy R. Brandt,[1] Alexandra Marko,[1] Robin N. Vanderbeck,[1] Yuhao Wang,[1] Jamie Smith MA,[1] Lynelle Phillips MPH RN,[1] Jane A. McElroy PhD,[1,2] Kevin Everett PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Family and Community Medicine

Introduction

The sexual and gender minority (SGM) community historically has higher rates of combustible tobacco (cigarettes) use than the general population. The proliferation of electronic nicotine delivery devices (ENDS) may have affected rates of cigarette use and quitting. This study compares cigarette and ENDS use in sexual and gender minority and cisgender heterosexual populations.

Methods

A cross-sectional survey assessed community health behaviors and perspectives, inclusive of frequency of cigarettes and ENDS use. Participants self-identified sexual orientation (heterosexual, bisexual, gay/lesbian, or some other term) and gender identity with two questions; the first asked gender identity at birth (male or female) and then current gender identity (male, female, genderqueer/non-binary, trans, some other term). Sexual and gender minority was defined as not cisgender-heterosexual individuals. Surveys were collected at five PRIDE festivals throughout Missouri (June - August 2023). Collected data was analyzed using SAS 9.4.

Results

Of the 2,515 surveys collected, 11% of SGM and cisgender heterosexuals were current cigarette users and 22% were current e-cigarette users (25% SGM vs 13% cisgender heterosexuals). The sample had 5% of dual use of these two products (4% SGM vs. 1% cisgender heterosexuals). Models to predict nicotine use will be presented.

Conclusion

In this sample SGM and heterosexual cigarette use is equivalent, but more SGM are using ENDS. SGM are also engaged in more dual use which will likely contribute to higher nicotine dependence and more nicotine and tobacco use problems for this community.

Do intra-articular corticosteroid and platelet-rich plasma injections differentially regulate clinical and biochemical responses in osteoarthritic knees?

Anna N. Sullentrup,[1] Caleb J. Bischoff,[1] Emily V. Leary PhD,[1] James A. Keeney MD,[1,2] James L. Cook DVM PhD OTSC,[1,2] Aaron M. Stoker MS PhD[1,2]

[1]University of Missouri-Columbia
[2]Deparment of Orthopedic Surgery

Introduction

Osteoarthritis (OA) is a leading cause of disability worldwide. Intra-articular corticosteroid (CSI) injection has been considered the “gold standard” for joint-specific non-surgical management, but platelet-rich plasma (PRP) has emerged as a viable alternative. While clinical outcomes associated with CSI and PRP injections have been reported, significant variability exists in the magnitude and duration of effects for each. Measuring serum and/or urine biomarkers for catabolic, anabolic, and inflammatory processes involved in OA may provide a valid method for determining patients’ responses to CSI or PRP injection. Therefore, this prospective, randomized, double-blind clinical trial was designed to characterize fluid biomarker concentrations and patient-reported outcome measures following CSI or PRP injection in knee OA patients.

Methods

With IRB approval (IRB#2092036) and informed patient consent, knee OA patients (n=16) were randomized into either the CSI or PRP treatment cohort and treated with a single injection of the respective type. Serum (s) and urine (u) samples were collected at time of injection and 4 weeks post-treatment and assessed for inflammatory, catabolic, and anabolic mediators. VAS pain, KOOS JR, and UCLA activity score were collected at time of injection and 2, 4, 8, and 12 weeks post-treatment. Significant ($p<0.05$) differences between time points within each cohort, and between treatment cohorts using change in value from baseline to four weeks, were determined.

Results

Data collection and analysis for this study are ongoing and will be presented on the poster.

Conclusion

Data collection and analysis for this study are ongoing and will be presented on the poster.

Back pain in adolescents and young adults: Looking beyond the usual suspects

Pranav Suri,[1] Amanda Tomanek,[1] Zohaib Abro,[1] Julia Crim MD,[1,2] Lauren Pringle MD[1,2]

[1]University of Missouri-Columbia
[2]Deparment of Radiology

Introduction

Back pain accounts for a significant number of medical complaints in the adolescent and young adult population. After viewing images, cases are most commonly attributed to scoliosis and disc herniation. Many less common causes of back pain warrant further inspection when developing a differential diagnosis. Through a radiological lens, this project will cover findings and manifestations of ring apophysis abnormalities, Scheuermann's Disease, spinal injuries secondary to overuse, back pain due to physiological changes seen during pregnancy and postpartum, and inflammatory spondyloarthropathies. Although not the most common etiologies of back pain, we hope this discussion will expand the breadth of clinical decision-making in adolescent and young adult back pain cases and show indication for radiological imaging.

Methods

We performed a literature review looking beyond the usual suspects of back pain focused on pediatric and adolescent patients. CT and MRI images showing diagnostic considerations of patients with the chief complaint of back pain were also analyzed and used to exhibit considerations for diagnoses beyond the usual suspects.

Conclusion

Various diagnostic considerations should be considered in adolescents and young adults with back pain beyond the common causes. These conditions are researched and compared in this review.

Anatomic variations by MRI of superior extensor retinaculum anatomy

Amanda Tomanek,[1] Lauren Pringle MD[1,2]

[1]University of Missouri-Columbia
[2]Deparment of Radiology

Introduction

The anterior tendons of the ankle are encapsulated by the superior extensor retinaculum which provides stability to the anterior tendons of the foot and ankle. The anatomy of the ankle is complex and requires a detailed understanding to identify abnormalities present. It also requires a deep understanding to recognize normal variations in anatomy which have not yet been fully described. Documenting normal variations could aid in the setting of trauma to this region as normal variation could simulate retinacular injuries. An understanding of this anatomy would allow for improved outcomes in patients and enhance clinical decision making when anatomical variations in the retinaculum are encountered.

Methods

We reviewed consecutive MRIs of patients, excluding those with a history of ankle trauma. We categorized each exam by variability present in the superior and inferior extensor retinaculum by delineating anatomy relative to the tibialis anterior tendon using the physeal scar as the boundary between the superior and inferior retinaculum. We also aim to perform imaging on cadavers to obtain high-resolution images due to the absence of motion to further analyze the structures and possible variations.

Results

The findings thus far have shown variations in patient's tibialis anterior with respect to the extensor retinaculum. Of the consecutive MRI's analyzed, there have been findings of tibialis anterior coursing anterior, deep, and through both the superior and inferior extensor retinacula.

Conclusion

Variations in anatomy have been identified in the extensor retinaculum using consecutive MRI images.

Attempting to increase rural ems recruitment and retention using a distributed ems outreach program

Anna K. Vaclavek,[1] Julie A.W. Stilley PhD,[1,2] Jessica Kampeter BSN NRP,[1,2] Joshua Stilley MD FACEP FAEMS[1,2]

[1]University of Missouri-Columbia
[2]Department of Emergency Medicine

Introduction
A redesigned hybrid EMT-B course model was implemented to foster rural EMS education. Previously, the Emergency Medical Technician – Basic (EMT-B) course required students from surrounding areas to drive to Columbia, MO. Resulting time and financial burdens contributed to low course completion rates and little encouragement to work in rural EMS facilities.

Methods
Hybrid EMT-B courses were held in-person concurrently at Audrain, Chariton, and Mid-Mo Ambulance Districts, with lectures given by a single instructor virtually in two classrooms and on-site in the third. This lecturer traveled weekly between sites. Local rural EMS providers oversaw relevant hands-on skills training. Applicable information was obtained via course completion data, in-person interviews, and an anonymous Qualtrics survey.

Results
Only 56% of enrolled students attended the first day of instruction, and of those students only 61% were present on the final day. Only 9% fulfilled all necessary course requirements following the curriculum's end. As of the date of this writing, 1 student has reported passing the national licensing exams; however, it is still early after the end of the course. On the Qualtrics survey, students reported feeling moderately connected to their local rural EMS agency.

Conclusion
A distributed and hybrid educational model did not significantly increase retention or completion rates in a university-level EMT-B training program. It remains to be seen if connections to rural EMS were fostered because of this course. Limitations of this study include low response rates to the Qualtrics survey and interviews held at one teaching location on one occasion.

The sensitivty of anterior hyaloid separation sign as a predictive factor for posterior vitreous detachment

Peeradol Wattanasirakul,[1] Matthew Hirabayashi MD,[1,2] Ahmed Elkeeb MD MBA[1,2]

[1]University of Missouri-Columbia
[2]Department of Ophthalmology

Introduction
Posterior vitreous detachment (PVD) is the separation of posterior vitreous cortex from the retinal membrane. Under slit lamp examination, the presence of Weiss Ring aids in the diagnosis of PVD but can be difficult to detect. Another sign that can be visualized in PVD is the "anterior hyaloid separation sign" which is seen anteriorly as "veil of vitreous." Establishing connection between anterior hyaloid separation sign and PVD may prove useful for PVD detection.

Methods
A retrospective chart review evaluated the presence of anterior hyaloid separation sign in patients with established PVD, confirmed with the presence of a Weiss ring. Charts of PVD patients at the Mason Eye Clinic (Columbia, Missouri) were reviewed. A total of 195 PVD cases were seen dating back to 1 February 2023. Patients with the anterior hyaloid separation sign either had an established history of PVD or new diagnosis of the vitreous detachment.

Results
Preliminary data suggests that over 90% of patients with PVD exhibit anterior hyaloid separation sign. Further investigations are necessary to understand common factors among PVD patients without anterior hyaloid separation sign. Data is pending.

Conclusion
Pending.

Mighty mice: Refining a novel approach to progressive resistance training in mouse models and investigating the neurological impact of short-term training

Zachary Williard,[1] Charles Brennan,[1]
Azam Roshani Dashtmian,[1,2]
Fereshteh Babaei Darvishi,[1,2]
W. David Arnold MD[1,2]

[1]University of Missouri - Columbia
[2]Department of Physical Medicine and Rehabiliation

Introduction
Preclinical approaches for progressive resistance exercise (PRE) are more limited as compared with aerobic exercises such as wheel running or treadmill training. We aimed to refine an approach for PRE and apply this to assess the neural contributions to strength enhancement following short term training.

Methods
Weighted Cart (WC) and Weighted Pulley (WP) training systems were compared using a crossover study in 10 C57BL/6 male mice and analyzed using the number of pokes and time it took to perform each 100 cm trial. Next, 20 mice (~10 months, 50% female) were randomized to weighted cart or unweighted cart (control) training 3X/week for 4 weeks. Maximum strength, muscle size/contractility, body composition, and neural function were tested at baseline and 4 weeks.

Results
WC cart showed less variability across sessions (mean coefficient of variation: WC: mean 11% (7-17%), WP: mean 14% (3-37%) and required fewer number of pokes: WC mean 2.7 (1-3.7) versus WP: mean 3.5 (2.3-4.7). During 4 weeks of PRE, trained mice showed ~30% increased weight pulled compared with untrained mice ($p<0.0001$). Measures of neuromuscular junction (NMJ) transmission were improved in trained mice ($p<0.001$). Otherwise, assessments of muscle size/contractility, body composition, and neural function showed no significant difference between trained and untrained mice.

Conclusion
Our refined PRE approach showed significant impact on muscle strength. We found NMJ transmission as one potential mechanism for strength increase. The WC method can be used to simulate PRE in mouse models of aging and other disorders.

Using travel time and distance to quantify access to dermatologic specialty care in rural northwest Missouri

Claire N. C. Wright,[1] Rebecka M. Ernst,[1]
Megan Lent MD FAAD,[1] Kathleen Quinn PhD[1,2]

[1]University of Missouri - Columbia
[2]Department of Family and Community Medicine

Introduction
One-fifth of the U.S. population lives in a rural community. These populations face decreased healthcare access and increased morbidity/mortality. Rurality and increased travel distance to care are associated with worse malignancy outcomes in dermatological care. In 2022, U.S. Dermatology Partners (USDP) opened a full-time dermatology clinic in a rural northwestern Missouri community, where prior to opening, the nearest full-time dermatology clinic was over 60 miles away. This study seeks to quantify how distance and time traveled is reduced with the presence of a rural dermatology clinic in order to demonstrate its efficacy in improving specialty care access.

Methods
Participants completed one-time questionnaires detailing dermatologic care prior to becoming USDP patients. Home and prior healthcare provider zip codes were collected. Drive times and miles traveled for care were calculated. More questionnaires are in progress, with a large participant number increase expected prior to HSRD.

Results
Of 14 participants, seven different home zip codes were reported. The longest distance to receive care after clinic opening was 55 miles. The largest reduction in travel was 107 miles and 103 minutes. For patients who had previously seen a dermatologist in another city, travel distance was reduced by an average of 70 miles and 67 minutes.

Conclusion
Increased distance to healthcare access is associated with poorer outcomes, and dermatology specialty care in rural communities decreases the time and miles traveled for skin condition patients. Bringing specialty care access to rural communities has the potential to improve both access and outcomes to rural citizens.

An analysis of MedZou community health clinic's increasing impact on food security

Leanna Zelle,[1] Jay Devineni,[1] Aidan Jacobsen,[1] Whitney LeFevre MD[1,2]

[1]University of Missouri Columbia
[2]Department of Family and Community Medicine

Introduction

MedZou Community Health Clinic (MedZou) partners with The Food Bank for Central & Northeast Missouri (the Food Bank) to provide food packages to uninsured community members experiencing food insecurity. In 2022, MedZou's Food Security Team (FST) expanded outreach by attending specialty clinics in addition to primary care clinics.

Methods

The 2022 FST collected data on the food MedZou received using the Food Bank's monthly sales orders and year-end reports. Data on the food MedZou provided to community members was collected using the FST's weekly nutrition screens and monthly reports. Data from 2022 was compared to that of 2021 using Microsoft Excel.

Results

The 2022 FST clinic expansion resulted in 22 additional patient encounters compared to 2021. The 2022 FST provided 25 meals per package compared to 23 meals per package provided by the 2021 FST. Food packages were provided to 32.7% of patients in 2022 compared to 12.4% in 2021. The 2022 FST received less fruits/vegetables and grains, but more meat/protein, dairy, and complete meals compared to the 2021 FST. Of the foods received, 52.9% were "foods to encourage" in 2022 compared to 73.8% in 2021, although the total poundage of "foods to encourage" was 1350.9 in 2022 compared to 669.4 in 2021. The total value of food received by MedZou was $5097.02 in 2022, compared to $1650.38 in 2021. Overall, the 2022 FST had a 181.6% increase in the poundage of food received and a 179.2% increase in the number of food packages provided from 2021 to 2022.

Conclusion

Despite only modest increases in the number of patient encounters and the size of food packages from 2021 to 2022, the 2022 FST provided nearly three times as many meals and food packages as the 2021 FST, with a dollar value that was three times as high. Reasons for this may include less stringent screening standards and greater patient advocacy. To further broaden the impact of the FST at MedZou, outreach and sourcing of nourishing foods should continue to expand.

Female sex protects cerebral arteries from mitochondrial disruption and cell death induced by reactive oxygen species

Safa,[1,2] Rebecca L. Shaw,[1,2] Charles E. Norton PhD[1,2]

[1]University of Missouri - Columbia
[2]Department of Medical Pharmacology and Physiology

Introduction

Injury to the brain results in the production of reactive oxygen species (ROS) which induce cell death in neurons and vascular cells. Females have greater resilience towards cell death compared to males and mitochondria play an important role in ROS-induced apoptosis. Therefore, we hypothesized that oxidative stress induced by H_2O_2 exposure to smooth muscle cells (SMCs) and endothelial cells (ECs) of posterior cerebral arteries (PCAs) will have more detrimental effects on mitochondrial function in vessels from male vs female mice.

Methods

Isolated PCAs (~80 μm diameter) from male and female mice (4-6 months of age) were isolated cannulated, and pressurized to 80 cm H_2O at 36°C. PCAs were treated with 200 μM H_2O_2 for 50 min and cell death was quantified with Hoechst 33342 (labels all nuclei) and propidium iodide (labels dead nuclei). PCAs were loaded with tetramethylrhodamine methyl ester (TMRM) to record changes in mitochondrial membrane potential ($\Delta\Psi m$) during exposure to H_2O_2 for 30 min. To evaluate how acute oxidative stress alters mitochondrial respiration, unpressurized cerebral vessels, and brain tissues (~2 mg) were exposed to H_2O_2 for 50 min to measure oxygen consumption rate (OCR) during a Seahorse assay.

Results

SMCs from male mice exhibit greater cell death compared to female mice following 50 mins exposure to H_2O_2. Endothelial cell death did not differ between sexes. Depolarization of $\Delta\Psi m$ in response to H_2O_2, measured by the loss of TMRM fluorescence, was greater in male PCAs than in females. Furthermore, our preliminary findings suggest that H_2O_2 may elicit a reduction in OCR in male cerebral vessels and brain tissues that does not occur in females.

Conclusion

Mitochondria of cerebral vessels and tissues from female mice have greater resilience to H_2O_2 compared to males. This resilience may limit cell death in females during injury by acute oxidative stress.

Rare N4-acetyl-sulfamethoxazole stone induced by trimethoprim-sulfamethoxazole

Wendy Zhang,[1] Eliza DeFroda MD[1,2]

[1]University of Missouri - Columbia
[2]Department of Urology

Introduction

Trimethoprim-Sulfamethoxazole (TMP-SMX) is an antibiotic commonly used for treatment and prophylaxis of urinary tract infections, as well as for conditions like Pneumocystis pneumonia. The main active metabolite of Sulfamethoxazole is N4-acetyl-sulfamethoxazole, and nephrolithiasis composed of this compound is exceedingly rare. We present the case of a patient who presented with renal calculi containing 70% N4-acetyl-sulfamethoxazole, 20% uric acid, and 10% calcium oxalate. This report also includes a review of literature on N4-acetyl-sulfamethoxazole kidney stones.

Methods

We describe the case of a 59-year-old Caucasian male who initially presented to Urology clinic with inability to urinate after Foley catheter placement post-surgical repair for multiple traumatic fractures. Neurogenic bladder was diagnosed after urodynamics and the patient continued using an indwelling urinary catheter with monthly changes until non-urologic procedures related to his traumatic injury were completed. Four months later, the patient presented with a clogged urinary catheter, during which cystoscopy identified a significant stone burden. Prior to this, the patient took TMP-SMX 800mg-160mg oral tablets BID for 42 days. A search of major research databases was performed to identify articles with specific reference to N4-acetyl-sulfamethoxazole kidney stones.

Results

The patient's N4-acetyl-sulfamethoxazole nephrolithiasis was removed via cystoscopy with cystolitholapaxy.

Conclusion

This case illustrates the workup and diagnosis of a renal calculi of N4-acetyl-sulfamethoxazole composition, and adds an additional data point for this rare phenomenon. Literature review examines how factors such as indwelling urinary catheter and length of TMP-SMX prescription may be related to formation of this rare renal calculi.

A patient-derived xenograft (PDX) model of non-small cell lung cancer (NSCLC) to evaluate immunotherapies, targeting human T cells

Christa Cheatham DVM,[1]
Vijay Radhjakrishnann PhD,[1]
Onyekachi Juliet Okpasuo,[1,4]
Chandrashekara Puthanapura Mahadevappa,[1,4]
Jussuf T, Kaifi MD PhD,[1-3] Adam G. Schrum PhD,[1,2,4,5]
Diego M. Avella MD,[1-3] Diana Gil PhD[1,2,4,5]

[1]University of Missouri - Columbia
[2]Department of Surgery
[3]Harry S. Truman Memorial Veterans Hospital
[4]Department of Molecular Microbiology and Immunology
[5]Department of Biological and Biomedical Engineering

We developed a patient-derived xenograft model of non-small cell lung cancer (NSCLC) by implanting surgically resected tumors subcutaneously in NOD scid gamma (NSG) mice. The PDXs retained expression of NSCLC-diagnostic pathological markers over multiple generations and retained tumor-associated human T cells. We used a metastatic PDX model to test the efficacy of a novel T cell targeting molecule, anti-human-CD3ε monovalent Fab fragment (mono-OKT3-Fab) and compared tumor growth results with those of anti-human PD-L1 mAb therapy. We observed that PDX-NSG mice treated with either showed significantly reduced tumor burden and prolonged survival over control treated mice. However, 40% of mice treated with the combination treatment developed bilateral hindlimb paralysis after 35 day. These animals had metastasis to the brain, lung, and spinal cord and had tumor-infiltration lymphocytes in the brain. NSG mice receiving the control treatment were implanted with the PDX tumor, then had the tumor resected once it reached 700mm3 in size to extend their survival beyond the time point of euthanasia observed in prior experiments. All three mice in this experiment developed hindlimb paralysis after 40 days. Overall, our study shows that PDXs implanted in NSG mice retain T cells sufficient for preclinical evaluation of novel T cell-targeting immunotherapies but there remains a question as to why mice are becoming paralyzed: due to metastasis and/or immune responses of human lymphocytes against mouse tissues. We will evaluate whether hind paralysis is due to toxicity of immunotherapy treatment, due to metastasis, due to an immune-complex reaction, or a combination of these.

Surfactant protein a enhances lipid accumulation and hepatic fibrosis in non-alcoholic fatty liver disease

Ayobami Dare PhD,[1] Skylar D. King PhD,[1] Shiyou Chen DVM PhD[1,2]

[1]University of Missouri - Columbia
[2]Division of Surgical Research

Introduction
Surfactant protein A (SPA) is a structural protein that reduces surface tension in lung and a major component of the innate immune system. Previous studies have shown that SPA binds to phospholipids and promotes pulmonary and renal fibrosis. However, it is unclear if SPA plays a role in non-alcoholic fatty liver disease (NAFLD).

Methods
Age-matched wild-type (WT) and SPA deficient (SPA-/-) mice were fed a western diet for 8 weeks to induce NAFLD. Serum and liver samples were analyzed via RT-qPCR, Western blotting, biochemical, histological and immunostaining techniques to evaluate biomarkers of NAFLD and the underlying mechanisms.

Results
SPA was upregulated in the fatty liver of western diet fed mice. SPA deficiency reduced western diet-caused steatosis, hepatocyte degeneration, inflammation and liver injury along with decreased expression of CD36 and peroxisome proliferator activated receptor-gamma (PPARγ). In addition, there was a significant decrease in macrophage infiltration and fibrosis associated with stellate cell inhibition and reduced collagen deposition in SPA-deficient liver.

Conclusion
These results suggest that SPA promotes liver injury and hepatic fibrosis by increasing fatty acid uptake via the PPARγ/CD36 pathway. Thus, targeting SPA may represent a potential therapeutic regimen for the management of NAFLD and related metabolic disorders.

Sperm-specific regulation of oviductal region-specific responses during establishment of pregnancy in mice

Ryan M. Finnerty PhD,[1] Daniel J. Carulli MS,[1] Wipawee Winuthayanon BSN PhD[1,2]

[1]University of Missouri - Columbia
[2]Department of Obstetrics, Gynecology, and Women's Health

The oviduct comprises 4 main regions: infundibulum (oocyte pick-up), ampulla (fertilization), isthmus (sperm capacitation and reservoir, preimplantation embryonic development), and uterotubal junction (UTJ; sperm and embryo transport). Evidence in livestock and rodents suggest that gametes alter gene expression in secretory and ciliated epithelial cells of the oviduct. To elucidate whether adaptive interactions between the oviduct and gamete/embryo exist, we performed bulk RNA-sequencing on oviductal tissues collected from infundibulum+ampulla (IA) or isthmus+UTJ (IU) at various developmental stages (0.5, 1.5, 2.5-, and 3.5-days post coitus (dpc) and pseudopregnancy (dpp)) in mice. Presence of sperm at 0.5 dpc induces DEGs involved in pro-inflammatory responses in the IU region with an enrichment of biological processes for inflammatory cytokines, macrophage, neutrophil recruitment. At 1.5 dpc we observed a strong shift to an anti-inflammatory condition in the IU region. These observations were absent in 0.5 and 1.5 dpp, suggesting the observed inflammatory responses during pregnancy were induced by the presence of sperm. scRNA-seq analysis revealed that inflammatory responsive genes were likely produced by secretory epithelial cells, compared to other cell types in the oviduct. Additionally, multiple DEGs involved in pyruvate and glycolysis were enriched in the IU region, which could provide metabolic support for developing embryos. Lastly, proteomic analysis of oviductal luminal fluid reinforced bulk and scRNA findings, revealing enrichment of multiple proinflammatory biological processes including neutrophil degranulation, neutrophil activation, and neutrophil immunity. In conclusion, our findings indicate that the oviduct is adaptive and responsive to the presence of sperm and embryos in a spatiotemporal manner.

Pharmacological inhibition of HDAC6 had no effect on Angiotensin II + β-aminopropionitrile -induced abdominal aortic aneurysm in normolipidemic mice

Ana Clara Frony PhD,[1,2] Nithya Ramesh,[1,2] Venkateswaran Subramanian PhD[1,2]

[1]University of Missouri - Columbia
[2]Department of Medicine

Introduction

Abdominal aortic aneurysm (AAA) is a permanent dilation of the abdominal aorta leading to substantial morbidity and mortality. Histone deacetylases (HDACs) play critical role in the regulation of genes involved in aortic vascular integrity. Our preliminary study demonstrated that HDAC6 is upregulated in experimental AAA tissues. The purpose of this study is to examine the effect of HDAC6 inhibition on Angiotensin II + β-aminopropionitrile (AngII+BAPN) -induced AAA formation in normolipidemic mice.

Methods

Male C57BL/6 mice (8-10 weeks old; n=10/group) were fed with chow diet. The HDAC6 inhibitor, Tubastatin-A (Tub-A; 25 mg/kg/day) or vehicle was administered daily by i.p. for 5 weeks. After 1 week of Tub-A or vehicle dosing, the mice were infused subcutaneously with Ang II (2,000ng/kg/min) by osmotic mini-pumps for 4 weeks. BAPN (0.15g/kg/day) was administered in drinking water.

Results

Ang II+BAPN administration significantly increased AAA luminal dilation as measured by ultrasonography compared to baseline (Vehicle: pre-infusion-0.80±0.02 versus post-infusion- 1.56±0.25; Tub-A: pre-infusion-0.78±0.01 versus post-infusion-1.21±0.12 mm; $P<0.05$). However, Tub-A administration had no influence on AngII+BAPN induced aortic luminal dilation (Vehicle: 1.56±0.25 versus Tub-A: 1.21±0.12 mm; P=NS). Ex vivo measurement of external aortic expansion showed no significant difference on AngII+BAPN-induced AAA between vehicle and Tub-A treated groups (Vehicle: 1.86±0.2 versus Tub-A: 1.56±0.1 mm; P=NS). Tub-A administration had no significant difference on AngII+BAPN-induced AAA incidence (Veh:9/10 vs Tub-A: 6/10) and rupture (Vehicle:3/10 vs Tub-A:1/10) compared to vehicle group.

Conclusion

These findings suggest that HDAC6 inhibition by Tub-A showed no effect on Ang II + BAPN-induced AAA formation in mice.

Transmission risk assessment of H4N6 influenza A viruses from avian species to mammals

Emily Giri,[1-3] Xiaojian Zhang[1,2,3], Xiu-Feng Wan[1,2,3,4]

[1]University of Missouri - Columbia
[2]Center for Influenza and Emerging Infectious Diseases
[3]Department of Molecular Microbiology and Immunology
[4]Department of Electrical Engineering & Computer Science

Wild aquatic birds are the natural reservoir for influenza A viruses (IAVs), some of which can transmit from these birds to various mammalian hosts and eventually humans. Swine are proposed to serve as a 'mixing vessel' in which avian and mammalian IAVs can reassort, adapt to mammalian hosts, and potentially spill-over into humans. At least one or more gene segments of all four known influenza pandemic strains are of avian origin while swine have been implicated in the emergence of at least three of these strains. Here we aim to elucidate the molecular mechanisms that differentiate replication capabilities of avian IAVs in mammalian hosts. We hypothesize that the genetic diversity of avian IAVs influences the virus's ability to interact with host proteins, allowing some viruses to replicate effectively in swine respiratory tracts, while others cannot. We utilized two subtype H4N6 viruses: A/blue-winged teal/Ohio/12OS2244/2012(OS2244) and A/blue-winged teal/Ohio/15OS5426/2015(OS5426). OS2244 replicated efficiently in swine respiratory tracts, whereas OS5426 did not; minigenome assays showed that the exchange of the PB2 gene between the two strains resulted in distinct polymerase activities. Sixteen reassortants were created by swapping genes between these strains. Currently, we are evaluating the growth kinetics of these reassortants in swine tracheal and nasal epithelial primary cells, and the ANP32 protein in these swine cells will be knocked down to assess the significance of the interaction between PB2 and the ANP32 protein in viral replication. Through this study, we expect to enhance our understanding of how avian IAVs transmit to mammals, particularly swine.

POSH function in murine T cells

Caitlyn Guldenpfennig,[1] Yue Guan,[2]
Emma Teixerio PhD,[2] Mark Daniels MD[2]

[1]University of Missouri-Columbia
[2]Deparment of Molecular Microbiology and Immunology

Abstract

Plenty of SH3 Domains (POSH) is a critical scaffold protein in neuronal and lymphocyte signaling involved in survival, development, and effector function. Our lab has shown a sharp decline in survival and activation in T cells upon inhibition of POSH function in vitro. However, the in vivo function of POSH has not been examined. We hypothesize that POSH deletion in vivo impacts T cell activation and differentiation. We used the Cre/Lox system to conditionally knockout POSH in T cells early during development (CD4-Cre) or upon stimulation (GzmB-Cre) in C57B6 mice. Loss of POSH in both CD4-Cre and GzmB-Cre CD8 T cells has no effect on development nor on naïve CD8 T cells in the periphery. Upon stimulation, there is a negative selection against POSH knockout CD4-Cre and GzmB-Cre CD8 T eff cells. POSH knockout CD4-Cre and GzmB-Cre CD8 T cells downregulate CD69 sooner than wild-type and do not upregulate FasL. These results demonstrate that upon loss of POSH, CD8 T cells do not become activated and cannot properly differentiate into T eff cells. When challenged by VSV infection in vivo, POSH knockout GzmB-Cre CD8 T cells expand significantly less than control T cells at the peak of infection and do not make it into the memory phase. This indicates that there may also be defect limiting the ability of CD8 T cells to properly differentiate into memory cells upon the loss of POSH after activation. Thus, the presence of POSH is essential for CD8 T cell activation and differentiation.

Human Bocavirus 1 muscle trandcution efficiency following local injections in a murine DMD model

Bryan Hu PhD,[1,2] Yongping Yue,[1,2] Xiufang Pan,[1,2]
Dongsheng Duan[1,2,3,4,5]

[1]University of Missouri-Columbia
[2]Department of Molecular Microbiology and Immunology
[3]Department of Biomedical Sciences
[4]Department of Neurology
[5]Department of Chemical and Biomedical Engineering

Introduction

Adeno-associated virus (AAV)-mediated gene therapy is the leading approach to treating various genetic diseases. However, the ~4.7kb packaging capacity of AAV limits certain therapeutic strategies. Human Bocavirus (HBoV)-mediated gene therapy presents an alternative with an advantageous ~5.5kb packaging capacity. Here, we evaluated the local muscle transduction efficiency of the HBoV1 vector in mdx mice, a murine Duchenne muscular dystrophy model.

Methods

The HBoV1 reporter vector expressed green fluorescent protein (GFP) under the transcriptional regulation of the cytomegalovirus promoter. The same vector genome (vg) was packaged in AAV8/9 for comparison. Local delivery was studied by intramuscular injection to the tibialis anterior (TA) muscle (n=4 mice). The HBoV1-GFP vector was injected into the left TA muscle at the dose of 3.80E10vg/muscle. The right TA muscle received the AAV8/9-GFP vector at the dose of 0.24E10vg/muscle, 0.95E10vg/muscle, 3.80E10vg/muscle, or 7.60E10vg/muscle. Tissues were harvested at four weeks post-injection.

Results

We detected robust GFP expression in muscles that received 0.95E10vg/muscle, 3.80E10vg/muscle, and 7.60E10vg/muscle of the AAV vector, but not in the muscle that received 0.24E10vg/muscle of the AAV vector. Weak GFP expression was observed in one HBoV1 vector-injected muscle. No GFP expression was detected in the remaining HBoV1 vector-injected muscles. Vg copies were quantified with qPCR. We found a correlation between GFP expression and vg copy number in both AAV and HBoV1-injected muscle.

Conclusion

Overall, the vg copy number was substantially lower in the muscles that received the equivalent dosage of the HBoV1 vector.

Understanding and analyzing the HL7 messages data of the Missouri immunization information systems 'ShowMeVax'

Muhammad Muinul Islam PhD, MPA, MSS,[1] Lemuel R Waitman PhD,[1] Eduardo J. Simoes MD, MSc, MPH,[1] Zachary J. Kempf MPH,[2] Md Kamruz Zaman Rana MS,[1] Md Saber Hossain MS,[1] Md Soliman Islam M.Sc,[1] Vasanthi Mandhadi,[1] Yaswitha Jampani BDS, MSHI,[1] Vyshnavi Paka MHSA, PMBA, MSITM,[1] David Walsh,[3] Tamara M. McMahon MA,[3] Abu Saleh Mohammad Mosa PhD, MS, FAMIA[1]

[1]University of Missouri-Columbia, Department of Health Manamgenet and Information
[2]Missouri Department of Health and Senior Services
[3]University of Missouri-Kansas City, Department of Biomedical and Health Informatics

Introduction
HL7 is a set of international standards for the exchange, integration, sharing, and retrieval of electronic health information. HL7 standards describe how healthcare data should be structured and formatted for consistent and efficient exchange between different healthcare systems. This is particularly important in IIS (Immunization Information Systems), where immunization data needs to be accurately recorded, stored, and shared among various healthcare providers, public health agencies, and other stakeholders. The study has analyzed Missouri's IIS data known as 'ShowMeVax' (SMV) data to analyze the HL7 messages in the light of data quality dimensions.

Methods
To analyze the HL7 data, the SMV data is extracted from WebIZ database using a data staging process with Python and PowerShell scripts. Once the data is loaded, data related to HL7 has been analyzed to investigate how they correspond the dimensions of data quality for the IIS in the state of Missouri. Given the HL7 content in the IIS is very large, the study has specifically looked into data related to (a) HL7 Log type status, (b) HL7 Submission and Response status, (c) status of HL7 Message Acknowledgement, and (d) HL7 error for the duration of January 11th, 2022 to April 9th, 2022. The analysis of HL7 data investigates, in specific, the consistency and validity of data quality.

Results
The specific HL7 content that the study analyzed covers if the HL7 interface or the messaging systems work in a way that effectively meet the IIS data standards in the state of Missouri. The analyzed HL7 content covers the issue of completeness, consistency, and validity of immunization data quality. For example, among four different log type codes, 49.08% of HL7 messages have log type code as 'Get', and 49.92% of HL7 messages have log type code as 'Send'. While there is no data available on 'Error' log type in the SMV data, the 'Rerun' log type code appears to be 0.08% of HL7 messages which amounts to a total of 59,755 rerun messages in the SMV data. Likewise, the study also produces statistics about the status of HL7 message submissions by provider organizations' HL7 interface to SMV and responses back from SMV to provider organizations' HL7 interface in terms of various HL7 message types, different types of error when an HL7 message is transmitted to the system by the SMV providers and the distribution of error severity in terms of informational (I), warning (W), and error (E) etc.

Conclusion
Overall, the study reveals the status of HL7 activity and HL7 data in the SMV system and how the data quality of HL7 may affect an effective Immunization Information Systems (IIS) in Missouri.

Lung tumor induction in a transgenic oncopig model

Kirtain Joshi,[1] Nagabhishek Sirpu,[1] Marudhu Shanmugam,[1] Ravikanth R. Poonooru,[1] Pradeep Subramanyam,[1] Colleen Garret,[1] Sarah Schlink DVM, DACLAM,[1] Samantha Gerb MS, DVM,[1] Jesse Porter BHS,[1] Manjunath Yariswamy,[1] Suvilesh Nagara,[1] Dae Kim MS, PhD, DVM, DACVP,[1] Jeffrey Kunin MD,[1] Timothy Hoffman PhD,[1] Bhanu Telugu PhD,[1] Satyanrayana Rachagani PhD, DVM,[2] Jussuf Kaifi MD[3]

[1]University of Missouri-Columbia
[2]Department of Veterinary Medicine and Srugery
[3]Department of Thoracic Surgery

Introduction

Lung cancer (LC) is the leading cause of cancer-associated death in the US. Small animal models vastly do not translate into human clinics. There exists an urgent need to develop relevant preclinical large animal models for LC. In this study, we developed a novel transgenic Oncopig ($Kras^{G12D}$-$TrP53^{R167H}$ mutation) model for LC.

Methods

The Oncopigs (n=9; 6F and 3M) at 9 weeks were anesthetized and injected/lavaged with adenovirus carrying Cre recombinase gene (Ad-Cre) + polybrene + IL-8 or polybrene and/or IL-8 (control) via flexible bronchoscopy. The initiation and progression of LC in Oncopigs were monitored with CT images at 2-,4-,7-,10-and 16 weeks post-intervention. Of which, five Oncopigs were euthanized at week 8.

Results

Lung masses were detected on CT scans at 2 weeks post-intervention at injection/lavage sites. However, decrease in masses were observed on CT at 7 weeks post-intervention but with increasing attenuation. One pig had a right-sided pleural effusion which was monitored and appeared unchanged 7 weeks post-intervention. One pig had distant metastases to skin. Lavage-based lesions appeared more heterogeneous with intense inflammation. Transbronchial-injection-based lesions appeared consolidated and coin-shaped without surrounding inflammatory changes. Control injection sites appeared normal on CT imaging.

Conclusion

LC was induced in Oncopigs. Autopsies on 5 Oncopigs revealed macroscopically varying sizes of tumors 8 weeks post-intervention. 2/5 oncopigs were positive for pan-cytokeratin-18, IDA, and CD3. Dysplastic and inflammatory cells were observed in the tumor. One oncopig had a carcinomatous skin growth. Another Oncopig cohort (n=4) is monitored longitudinally for tumor growth and development of metastasis.

Free driving lessons to reduce motor vehicle accidents - the tenth leading cause of death in Missouri

Ugonna Kanu MPH,[1] Jessica Osaze PhD,[2] Lynelle Phillips MPH, RN[2]

[1]University of Missouri-Columbia
[2]Department of Public Health

Introduction
Motor Vehicle Accidents (MVA) are Missouri's 10th leading cause of death. The unreliable public transportation system in Columbia and different modes of driving in other countries put international students at risk for MVAs. The purpose of this report is to evaluate a free driving lesson program for international students.

Methods
We sourced funds and partnered with other organizations/offices on campus so that these lessons will be free to students. We sent a needs assessment survey, and 102 participants completed the survey indicating interest as learners or volunteer instructors. We then organized an orientation where the participants signed a release of liability waiver and reviewed the Missouri driver's manual. Then upon producing their learner permit, they were scheduled for 8 driving lessons.

Results
Out of 102 registered participants, 31 learners and 7 volunteer instructors met all requirements and concluded their driving lessons. Of the 31 learners, 20 got their learner's permit because of this project, and 8 so far have obtained their actual driver's licenses. Feedback indicated that the number of lessons should increase from 8 to 12.

Conclusion
We received astonishing testimonies from the participants on how this project has made their lives better. However, ongoing MVA surveillance is needed to assess the impact of reduced MVAs in this population. While 8 lessons are enough for some participants, others need more, therefore we will need more funding to provide extra lessons for those participants.

Extended lifespan and atypical death of Helicobacter pylori-infected human neutrophils

Lisa Khuu,[1] Laura Whitmore,[2] Lee-ann Allen PhD[1]

[1]University of Missouri-Columbia, Department of Molecular Microbiology and Immunology
[2]University of Iowa

Introduction
Neutrophils are essential leukocytes that function to resolve infection and inflammation. Helicobacter pylori is a human-specific bacterium that infects the gastric mucosa of >50% of the world's population and causes gastritis, peptic ulcers, and gastric cancer. H. pylori infects neutrophils and induces a subtype differentiation notable for hyper-segmented nuclei and lifespans ~2-3 times longer than uninfected cells. We hypothesize H. pylori induces an atypical mechanism of cell death in neutrophils.

Methods
We used microscopy, flow cytometry, immunoblotting, and plate reader assays to interrogate the fate of H. pylori-infected neutrophils. Microscopy was used to examine the localizations and absence or presence of cellular components, and flow cytometry was utilized to measure mitochondrial and plasma membrane integrity. Plate reader and immunoblotting were used to assess the processing and activity of caspases and to measure the release of lactate dehydrogenase and cytokines.

Results
Membrane permeability assays suggested a lytic form of cell death was induced during infection. H. pylori-cells exhibited an abnormal, lobular extrusion of DNA without granule components, differing from NETosis. Immunoblotting revealed the selective disappearance of key necroptosis proteins RIPK-1 and RIPK-3 after ~24-48 hours of infection. Furthermore, pyroptosis components (caspase-4 and Gasdermin pore-forming proteins) were processed to active fragments despite the lack of IL-1b or IL-18 secretion in infected neutrophils.

Conclusion
H. pylori-infected neutrophils did not appear to die via apoptosis, necroptosis or NETosis as currently defined. We are presently interrogating the hypothesis that a hybrid mechanism of cell death is induced which includes elements of pyroptosis and NETosis.

Identification of medical countermeasures for mustard-induced corneal blindness using RNA-seq analysis

Rajnish Kumar PhD,[1,2,3] Rajiv R. Mohan PhD[1,2,3]

[1]University of Missouri-Columbia
[2]Department of Opthahlomology
[3]Harry S. Truman Memorial Veterans' Hospital

Introduction

Serious visual damage can arise from exposure to sulfur mustard (SM). Some eyes acquire permanent late ocular diseases that may cause corneal blindness, while some of the eyes demonstrate clinical resolution of the SM-injury. Improved treatment options may result from a better understanding of the pathogenic mechanisms that underlie the emergence of late pathology.

Methods

The purpose of this study was to investigate the mRNA expression profiles of SM-induced damaged, undamaged, and naïve corneas. RNA sequencing (RNA-seq) data (4 weeks post SM exposure) were used for differential expression (DE) analysis. The DE analysis of the damaged cornea group compared with the naïve cornea group yielded a total of 5930 differentially expressed genes (upregulated:3196, downregulated:2734). The undamaged corneal group compared to the naïve cornea group yielded 1884 differentially expressed genes (upregulated:1029, downregulated:855). When the damaged corneal group was compared with the undamaged corneal group, a total of 985 differentially expressed genes (upregulated: 308, downregulated: 677) were found. The log2(FC)±2 and adjusted $p<0.05$ were considered for screening of differentially expressed genes. The DE profiles were further subjected to pathway enrichment analysis.

Results

The cell proliferation and differentiation pathways were studied to extract the top five upregulated genes (BTBD16, HEPACAM2, SLC15A3, L1CAM, MED17) common to both pathways. Furthermore, pathway analysis of cell migration, cell death, apoptotic processes, cell adhesion, extracellular matrix, and tumor necrosis factor production for the identification of novel genes and therapeutic targets is underway.

Conclusion

This bioinformatic analysis shows promise for identifying novel therapeutic genes and pathways for keratopathy.

Sulfar mustard exposure disrupts transmembrane water channel proteins in rabbit corneas *in vivo*

Brenden Lankau,[1] Rajiv R. Mohan PhD[1,2,3]

[1]University of Missouri-Columbia
[2]Department of Opthahlomology
[3]Harry S. Truman Memorial Veterans' Hospital

Abstract

Transmembrane water channel proteins, Aquaporins (AQPs), play an important role in corneal homeostasis, hydration, and transparency maintenance influencing keratocyte function, inflammatory and wound healing processes in vivo. The mechanistic role of AQPs in mustard gas keratopathy (MGK) remain elusive. Recently, for the first time, we identified involvement of AQP1, AQP3, and AQP5 in MGK in vivo (Bhend et. al., Exp Eye Res 2023). This study investigated (a) the effects of sulfur mustard (SM) gas exposure on the expression of AQP1, AQP3, and AQP5 transcript and protein levels in the cornea in vivo and (b) tested if SM toxicity to corneal aquaporins could be rescued by topical eye drop (TED) treatment. New Zealand White Rabbits exposed to SM vapor (200 mg-min/m3 for 8 mins) were divided into 3 groups: Naïve (n =3), SM (n =3), and SM+TED (n =3) (2 drops/day for 4 weeks). At 2-month and 4-month post SM-exposure, corneas were collected and snap-frozen after humane euthanasia. Corneal tissues were used to prepare serial sections and isolate total RNA and cDNA preparation. Histopathological H&E, immunofluorescence, and qRT-PCR analyses were performed to measure changes in AQP1, AQP3, and AQP5 transcript and protein levels. The clinical eye tests and imaging in live rabbits were performed with the slit-lamp microscope, in vivo confocal microscope, Fante's grading system, fluorescein staining, Schirmer's tests, pachymetry, applanation tonometry, specular microscope, and optical coherence tomography prior to euthanasia. The SM-exposed, clinically impaired rabbit cornea showed a decrease in AQP1 (0.5 ± 0.04 fold; $p<0.001$), AQP3 (0.62 ± 0.01 fold; $p<0.001$) and AQP5 (0.75 ± 0.05 fold; $p<0.001$) of 2 month, likewise, AQP1 (0.59 ± 0.03 fold; $p<0.001$), AQP3 (0.35 ± 0.04 fold; $p<0.001$) and AQP5 (0.43 ± 0.05 fold; $p<0.001$) of 4 month. More importantly, the changed AQP levels were significantly enhanced by the administration of TED at 2 month, AQP1 (2.18 ± 0.03 fold; $p<0.001$), AQP3 (1.75 ± 0.05 fold; $p<0.001$) and AQP5 (1.45 ± 0.04 fold; $p<0.001$), likewise, AQP1 (1.84 ± 0.03 fold; $p<0.001$), AQP3 (3.11 ± 0.22 fold; $p=0.004$) and AQP5 (2.8 ± 0.22 fold; $p=0.03$) at 4 month. We concluded that transmembrane water channel proteins (Aquaporins) may be targeted to develop a new SM-antidote for MGK. More studies are warranted.

Vascular smooth muscle cell mechanical stress modulates tissue transglutaminase activity and cytoskeletal architecture

Olubodum M. Lateef,[1] Christopher A. Foote,[1] Francisco Ramirez-Perez,[1] Marc Augenreich,[1] Jaume Padilla PhD,[2] Luis Martinez-Lemus PhD, DVM[3]

[1]University of Missouri-Columbia
[2]Department of Nutrition and Exercise Physiology
[3]Department of Medical Pharmacology and Physiology

Introduction

Vascular smooth muscle cells (VSMCs) are exposed to a wide range of extracellular mechanical stimuli both in physiological and pathological conditions. These mechanical stimuli are converted into biochemical signals that regulate VSMC contractility and the cytoskeletal architecture in a process known as mechanotransduction. The ability of VSMCs to sense and respond to mechanical signals is essential for proper regulation of vascular tone. We hypothesize that tissue transglutaminase 2 (TG2) plays a key role in the process of mechanotransduction serving as mechanosensor in VSMC.

Methods

Immortalized human aortic vascular smooth muscle cells (HAoSMCs) were cultured in basal medium supplemented with 2% serum and seeded on Uniflex culture plates coated with collagen I. HAoSMCs were left unstretched or exposed to cyclic uniaxial stretch using a Flexcell tension system with 11% elongation and 1 Hz for 6hr. HAoSMCs were also treated with the nitric oxide (NO) donor s-nitrosoglutathione under stretched and unstretched conditions, as NO is a known inhibitor of TG2. HAoSMCs were fixed in 4% paraformaldehyde and the levels of specific proteins were measured using immunofluorescence.

Results

Our results showed that cyclic uniaxial strain increased VSMC F-actin and TG2 content after 6hr of mechanical stretch when compared with the unstretched group. Notably, the increase in F-actin content and TG2 activity occurring in response to stretch was inhibited by NO, resulting in similar levels of F-actin and TG2 activity to those of the unstretched group.

Conclusion

These results suggest that stretch-induced actin cytoskeletal remodeling is potentially mediated by TG2 activity in VSMC.

Digital light 4D-printing of bioresorbable shape memory elastomers for personalized biomedical implantation

Alireza Mahjoubnia,[1] Dunpeng Cai PhD,[1] Yuchao Wu,[1] Skylar D. King PhD,[1] Pooya Torkian,[1] Andy C. Chen,[1] Shi-you Chen DVM, PhD,[2] Jian Lin PhD[3]

[1]University of Missouri-Columbia
[2]Department of Surgery
[3]Department of Mechanical and Aerospace Engineering

Abstract

Personalized care and minimally invasive surgery hold paramount importance in clinical biomedical settings with patient-specific biomedical device implants. Despite significant advances in cost-effective fabrication of these personalized devices, the practical in vivo functionalities remain hindered. 4D-printing unlocks new potentials for personalized biomedical implantation but still lacks suitable materials. The shape memory elastomer (SME) was digital light 4D-printed by co-polymerizing glycerol dodecanoate acrylate prepolymer (pre-PGDA) with acrylic acid monomer to form a crosslinked Poly(glycerol dodecanoate acrylate)-Polyacrylic acid (PGDA-PAA) network. We then conducted in vitro biocompatibility tests and in vivo vascular grafting trials. Finally, a patient-specific left atrial appendage (LAA) occluder was printed. The 4D-printed SME, boasting high precision of ~150 microns, showcases shape programming at physiological temperatures and mimics the mechanical properties of soft tissues. In vitro experiments displayed biocompatibility with >90% cell proliferation and significantly improved cell attachment. In vivo vascular grafting trials underlined the geometrical and mechanical adaptability of the 4D printed constructs in regenerating the aorta tissue. Along with absorption of the implant, this shows possibility of full replacement of natural tissue over time. The 4D-printed LAA occluder was successfully implanted endovascularly in a printed in vitro heart model. Our innovation marks a great leap in the 4D-printing field. The PGDA-PAA elastomer exhibits biocompatibility, biodegradability, mechanical strength and elasticity for easy biomedical implantation using one single material. Successful demonstration in printing a patient-specific LAA occluder paves a possible way to personalized biomedical implantation that can be integrated and adapted to the target tissue to reduce complications post-implantation.

Trends in trusted sources for vaccine information

Kassandra Maturino MPH,[1] Yuhao Wang,[1] Kayla Spence,[1] Amy R. Brant,[1] Alexandra Marko,[1] Robin N. Vanderbeck,[1] Lynelle Phillips,[2] Kevin D. Everette PhD,[1,3] Jane A. McElro[1,3]

[1]University of Missouri-Columbia
[2]College of Health Sciences
[3]Department of Family and Community Medicine

Introduction

Understanding the wide range community perceptions and trusted sources related to COVID-19 vaccination can provide useful information to public health leaders (e.g., CDC) and healthcare providers who communicate new vaccination recommendations and health care guidelines.

Methods

A survey measuring demographics, trusted source for vaccination information, and COVID-19 vaccine perceptions was administered at community events in Missouri resulting in a sample of 5, 717 surveys from December 2021 to August 2023. We used quantitative descriptive analyses and logistic regression models to determine associations with trusted sources about COVID-19 information and vaccination status and identify changes related to trusted sources (2 time periods: Dec 2021-Oct 2022 and Nov 2022-Aug 2023).

Results

Doctor/healthcare provider (HCP,72%), family member(s) (11%), and CDC/government (8%) were the top three trusted sources for vaccine information in first time period. While the top trusted source for vaccine information remained as HCP (37%), trust in the CDC/government significantly increased to 30%, and trust in family members (3% in 2nd time period) was replaced by trust in nobody (only trust myself) (5% in 1st time period to 8%).

Conclusion

Community members strongly leaned on HCP for information in the first year of the COVID-19 pandemic but less so in subsequent years with CDC strengthening as a trusted source. Further elucidation of these patterns can help local clinicians and public health agencies work to reassure their communities that they are knowledgeable partners who can be relied on for future vaccine recommendations and health information.

Western diet promotes intratumor bacteria colonization and advances pancreatic cancer development

Olamide Olaoba,[1] Ming Yang PhD,[1] Eric Kimchi MD,[1,2] Kevin Staveley-O'Carroll MD PhD[1,2], Guangfu Li PhD[1,3]

[1]University of Missouri-Columbia
[2]Department of Surgery
[3]Department of Molecular Microbiology

Introduction

Pancreatic ductal adenocarcinoma (PDAC) is a lethal malignancy with extremely poor prognosis and resistance to therapy. The presence of intratumor microbes in PDAC were thought to promote tumor growth and contribute drug resistance through bacterial dysbiosis; bacteria-derived products exert function in advancing tumor growth and inducing immune suppression. Diet is an important factor that influences dysbiosis of the gut microbiota, which induces resident of specific bacteria in tumors. In this study, we propose to define tumor-resident microbiome in mice fed with choline-low high fat high sugar diet (CL-HFS) and relationship of tumor-resident bacteria with intrapancreatic immunity.

Methods

C57BL/6 mice received either normal or CL-HFS diet for 14 weeks, followed by intra-pancreas inoculation of pancreatic cancer cells. 2 weeks later, mice were euthanized, buccal swab, tumors, and spleen were harvested. Tumors were digested into single cells and cultured on blood agar. Mixed bacteria colonies were sequenced for identification.

Results

HFS promotes tumor growth, worsens OS independent of weight loss, and facilitates the migration of 8 unique bacteria genera from the oral microbiome into the PDAC tumor. Splenomegaly, splenic melanosis, and reduction of T cells and macrophages population in melanotic spleens were the observed splenic complications.

Conclusion

Taken together, our result showed that HFS can advance orthotopically induced pancreatic cancer and facilitate bacteria colonization of the tumor. The long-term goal of the current study is to provide a comprehensive overview of the role of diet on the structure and function of intratumor microbiota; and to improve treatment strategies for PDAC patients.

MRI neuroimaging of brain remodeling in western diet induced obese mice

Ishan Pathak[1], Dongqing Chen BS,[1] Guanghong Jia PhD,[1, 2] Ashley Berendzen BS,[1] Ping Yu PhD,[1,2] Lixin Ma PhD[1,3]

[1]University of Missouri-Columbia
[2]Department of Medicine
[3]Department of Physics and Astronomy
[4]Department of Radiology

Introduction

Non-invasive magnetic resonance imaging (MRI) neuroimaging provides insights in brain health and disease. In this project, we designed a set of innovative tools including ultrahigh-resolution MRI neuroimaging methods to study brain remodeling in a Western diet (WD) induced obese mouse model.

Methods

In vivo MRI was performed on 7T/20 MRI equipped with a CryoProbe (Bruker). Six-week-old C57BL/6 mice were fed either a high-fat WD or a control diet (CD) for 12 weeks. Mice were anesthetized under 1.5% isoflurane via nose cone, maintaining 80-100 breaths/minute and temperature. Whole-brain T2-weighted (T2W) MRI was carried out for tissue segmentation. Continuous arterial spin labeling (CASL) imaging, diffusion tensor imaging (DTI), MR angiography (MRA), and 1H spectroscopy (MRS) was conducted to measure cerebral blood flow (CBF) perfusion, white matter connectivity (WMC), vessel density, and metabolites' concentration, respectively. Data were analyzed using Paravision-7 (Bruker), DSI-Studio and LCModel.

Results

Females on WD showed hypoperfusion in hippocampus, cortex, and thalamus regions, and decreased Fractional Anisotropy (FA) in white matter regions. Both males and females had decreased vasculature density after 12-week WD feeding. Phantom was used to validate the metabolite concentrations. Concentrations of alanine (Ala), creatine (Cr), myo-inositol (mI), glutamate (Glu), glutamine (Gln), taurine (tau), choline (Cho), N-Acetyl Aspartate (NAA), and Gamma—5.15-Aminobutyric Acid (GABA) were obtained. Females showed increases in GABA and tau, and decreases in Ala, mI, and Cr, whereas males had decreases in Ala, Cr, and NAA after WD feeding.

Conclusion

Mice on 12-week WD showed CBF hypoperfusion, impaired vasculature and WMC.

Smooth muscle cell specific beclin-1 deficiency spontaneously accelerates abdominal aortic aneurysm and promotes angiotensin II-induced aortic rupture in mice

Nithya Ramesh,[1] Ana Clara Frony PhD,[1] Arun Kannan,[1] Edward Downey,[1] Venkateswaran Subramanian PhD[1-3]

[1]University of Missouri-Columbia
[2]Department of Medicine
[3]Division of Cardiovascular Medicine

Introduction

Abdominal aortic aneurysms (AAAs) are permanent dilations of the aorta with 80% mortality after rupture. Vascular smooth muscle cells (SMCs) maintain aortic structural integrity, and SMC-rich aortic media is disrupted in AAAs. Autophagy is a self-regulatory process by which cell digest and recycles their cytoplasmic materials for energy purposes under stress. Recent studies highlighted that Beclin-1, an autophagy induction gene, is highly upregulated in AAA tissues from patients. Using Angiotensin II (AngII) infusion model of AAAs, we examined the contribution of SMC- Beclin-1 during AAA development in mice.

Methods

Mice with inducible deletion of Beclin-1 in SMCs were produced by breeding male mice hemizygous for Acta2-CreERT2 (Cre+) to female Beclin-1 floxed mice. At 8 weeks of age, male Beclin-1 x Acta2-CreERT2 (Cre+) and non-Cre littermates (Cre-) mice were injected with tamoxifen (25mg/kg, i.p.) for 5 days. To study the role of SMC-Beclin-1 in AAAs, male Cre+ and Cre- (N=5-7/group) mice were infused subcutaneously with AngII (1,000ng/kg/min) by osmotic mini-pumps for 4 weeks.

Results

Western blot analyses showed depletion of Beclin-1 protein in the aortic media from Cre+ mice compared to Cre- littermates. Interestingly, ultrasound measurements post tamoxifen demonstrated that depletion of Beclin-1 in SMCs spontaneously but significantly accelerated abdominal aortic dilation in mice compared to littermates (Cre-:0.85±0.04mm vs Cre+:1.02±0.01mm; $P<0.05$). Furthermore, SMC-specific Beclin-1 deficiency significantly promoted AngII-induced aortic luminal dilation (Cre-:0.93±0.05mm vs Cre+:1.30±0.08mm; $P<0.05$) and AAA rupture (Cre-:0% vs Cre+:100%; $P<0.05$).

Conclusion

These findings demonstrate that SMC-Beclin-1 plays a critical role in suppressing AAA formation and rupture in mice.

Advanced molecular imaging in vivo of the probiotic L. lactis expressing fluorescent proteins to monitor transit through the gastrointestinal tract

Martin Ramos-Gonzalez,[1,2] James Amos-Landgraf[1,3] Satyanarayana Rachagani,[1,2] Lacey R. McNally,[4,5] Jorge Gomez-Gutierrez[1,6]

[1]University of Missouri-Columbia
[2]Roy Blunt NextGen Precision Health Institute
[3]Department of Veterinary Pathobiology
[4]University of Oklahoma
[5]Department of Surgery
[6]Department of Child Health

Introduction

The ability to image in real-time the biodistribution of probiotic bacteria expressing a reporter protein represents an important area of investigation for gastrointestinal (GI) pathologies. Fluorescent probiotic bacteria could be useful to evaluate the interaction of probiotics with the gut microbiome, either under normal conditions or dysbiosis. Also, they could be employed to determine whether probiotic bacteria preferentially target the harsh hypoxic, and/or acidic microenvironment of digestive diseases such as inflammatory bowel diseases (IBD) or adenomatous polyps of the colon.

Methods

In this study, we evaluated the ability of *Lactococcus lactis* expressing different fluorescent reporter proteins to track their transit through the GI tract after oral gavage inoculation using the in vivo fluorescent imaging system Ami HTX.

Results

We found that imaging live mice using the green channel to detect *L. lactis*-GFP results in a strong tissue autofluorescence. The signal from *L. lactis*-mCherry could not be detected in mice because the red wavelength lacks enough deep tissue penetrance to pass through the intestines and abdominal wall. Interestingly, *L. lactis*-iRFP can produce a strong well-localized signal, that can be detected in real-time in live animals for up to 48 h after oral gavage administration.

Conclusion

These results suggest that *L. lactis*-iRFP has the desired features to serve as a fluorescent protein reporter for in vivo imaging that can be used to monitoring the bacterial presence, permanence and interactions with the anatomical structures while transiting through the GI tract.

How men's modifiable diet affect prostate cancer incidence, progression, and mortality

India Reed,[1] Christa Torrisi MSN APRN PhD,[1,2] Leanne Sherwin PhD MS FNP-BC[1,2]

[1]University of Missouri-Columbia
[2] Sinclair School of Nursing

Introduction

For the year 2023, approximately 288,300 new cases of prostate cancer and 34,700 deaths from prostate cancer are estimated. It is critical to find effective strategies that combat this disease. While there is no prevention for prostate cancer, diet is a way to minimize disease risk. This literature review aimed to focus on the effect of various foods on prostate cancer incidence, progression, and mortality.

Methods

The PubMed database was searched between June and July of 2023. Eight articles were found that met this review's inclusion criteria of American-based study, written in English, published within the last six years, and demonstrating how males' diets affected prostate cancer incidence, progression, and mortality. Studies were excluded if their primary focus was nutritional supplements. A PRISMA flow chart was created to illustrate the articles that met the inclusion criteria for this study.

Results

There was an increased risk of prostate cancer with dairy intake in six of the included studies, and well-cooked and processed meat in three different studies. In contrast, leaner meats decreased prostate cancer risk in two studies and lycopene fruits and vegetables in three additional studies. The effect of low-fat dairy on prostate cancer was inconsistent between two studies. Eating a diet high in fruits and vegetables, with minimal dairy products and certain meats, appeared to reduce the risk of prostate cancer.

Conclusion

This literature review sheds light on the effects of dietary elements that influence prostate cancer development, progression, and mortality. Dietary education in men is crucial to decrease prostate cancer risk.

Development and validation of large animal models for acute fracture-related infections

Bryce W. Rigden,[1] Chantelle C. Bozynski DVM MS,[1,2] Aaron M. Stoker MS PhD, [1,2] Kyle M. Schweser MD, [1,2] James L. Cook DVM PhD OTSC [1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Fracture-related infections (FRIs) are a major challenge in orthopaedics. FRIs often require patients to undergo multiple operations that involve irrigation and debridement (I&D) as well as the removal of fracture fixation implants. The need for implant removal is largely due to microbial biofilms that form on fixation devices. This study characterizes two preclinical canine models for studying FRIs.

Methods

All procedures were performed with ACUC approval. Fracture-fixation bone plates and screws were incubated in a suspension of *Staphylococcus aureus* (OJ1) for 48 hours. Following, skeletally mature purpose-bred research hounds (ulna model: n=16, fibula model: n=8) underwent 1 cm ostectomies of distal ulnas and proximal fibulas. Defects were stabilized using the pre-inoculated hardware. At 3 weeks and 7 days, respectively, ulna and fibula fracture sites underwent I&D. Tissue samples from fracture sites were collected for quantitative microbial cultures. Radiographs were obtained and assessed for findings consistent with osteomyelitis, implant failure, and bone healing complications. Fracture-fixation implants were assessed histologically for biofilm severity.

Results

At the study endpoint, all ulna and fibula fracture sites had confirmed FRIs with culture-identified *S. aureus.* Radiographic findings depicted implant failure and bone healing complications. Histological evaluation confirmed bacteria-laden biofilms present on all implant devices

Conclusion

Two canine models of FRI were validated to result in clinical and radiographic signs of fracture site infection as well as biofilm formation on fracture fixation implants. As such, these models allow for clinically relevant development of therapeutic strategies for improving the management of this problem in orthopaedics.

A novel method for clinical corneal neovascularization severity in live animals employing automation algorithm

Prashant R Sinha,[1,2] Suneel Gupta PhD,[1,3] Rajiv R Moha PhD[1,4]

[1]University of Missouri-Columbia
[2]Department of Ophthalmology
[3]School of Medicine and College of Veterinary Medicine
[4]Harry S. Truman Memorial Veterans' Hospital

Introduction

Corneal neovascularization (CNV) is a vision-threatening condition. This study aimed to develop an automatic algorithm based method for grading clinical CNV severity levels *in vivo* using a mouse model.

Methods

Seventy C57BL/6 mice were used. CNV was produced by alkali trauma as approved by IACUC. The CNV formation, progression, density, and localization were monitored with stereomicroscope images to train the model and develop algorithm. Histology was used to validate automation method/grading.

Results

The density of vasculature (D), existence of vasculature (E), length of vasculature (L), thickness of vasculature (T), and area of vasculature (A) in corneal tissue was measured with automated algorithm (DELTA). Over 90% high level of sensitivity, precision, specificity, dice, and accuracy of was found in training and testing with an R-square value of 0.8234 in challenges. DELTA grades were assigned; 0: no CNV; Grade 1: mild CNV 1; Grade 2: moderate CNV 3; Grade 4: severe CNV. H&E and flat mount lectin staining supported automated DELTA grades.

Conclusion

The DELTA algorithm may offer a novel automated method for clinical CNV grading in patients in a fast and reliable manner. Additional studies are warrented.

Syncytiotrophoblast subtypes revealed by single nucleus RNA sequencing, immunocytochemistry and fluorescence activated nuclear sorting of trophoblast derived from primed-type human pluripotent stem cells

Teka Khan,[1-3] Arun S. Seetharam,[4,5,6] Laura C. Schulz,[1,3] Geetu Tuteja,[4,5,6] R. M. Roberts[1,2]

[1]University of Missouri-Columbia
[2]Division of Animal Sciences
[3]Department of Obstetrics and Gynecology
[4]Iowa State University
[5]Department of Ecology, Evolution, and Organismal Biology
[6]Department of Genetics, Development and Cell Biology

Syncytiotrophoblasts (STB) are multinucleated cells in the human placenta that are responsible for gas and nutrient exchange, hormones essential for pregnancy maintenance, and, during implantation, invasion into maternal endometrium. We study STB generated from human pluripotent stem cells treated with BMP4 in the presence of A83–01 and PD173074, inhibitors of ACTIVIN/TGFB and FGF2 signaling, respectively (BAP exposure). Within 48 h, the cells are almost entirely KRT7-positive, and by d 5-7 STB producing copious amounts of hCG. Here, we have employed single nucleus RNAseq (snRNAseq) analysis on BAP-exposed H1 human embryonic stem cells (hESC) to study the heterogeneity of STB that forms during the first 8 days of differentiation and its similarities to STB from human pregnancies. Single nucleus RNAseq rather than single cell RNAseq is essential for the analysis STB because of the fragility and size of the cells. Nuclei were isolated at d 8, and cDNA libraries constructed by the 10X Genomics protocol from a total of 5,355 nuclei, which, after subtracting sequences representing ribosomal genes and contaminating mitochondria, provided between 200 and 7,500 unique sequences per nucleus. Seurat analysis revealed at least eight distinct clusters of nuclei, of which four were likely different kinds of mononucleated cytotrophoblasts (CTB) (clusters 1,4,7,8), two (2, 3) weakly resembled extravillous trophoblast, while two well separated clusters (5, 6) were highly enriched for human STB markers. A comparative analysis with published scRNA-seq data sets, namely human first trimester placenta, human pre-gastrulation embryos and STB derived from human trophoblast stem cells, validated the STB gene expression profiles in both STB clusters. Gene ontology and pathway analysis revealed that transcripts upregulated in STB cluster 5 relative to 6 related to mitochondria and energy metabolism, translation, protein destruction via the proteosome, and selenium and iron metabolism, while cluster 6 was enriched for genes linked to the AKT/P13K/mTOR metabolic pathways, DNA damage responses, cell division, and lipid metabolism. We then used STB markers expressed in either both clusters (TEAD3 and TOP1) or differentially upregulated in cluster 5 (JUNB and NR2F6) and cluster 6 (SMAD7 and TBX3) in conjunction with immunocytochemistry and fluorescence activated nuclear sorting to confirm that distinct STB subtypes co-existed in the d 8 cell colonies. Finally, by following STB formation over time, we have demonstrated that cluster 5 nuclei emerge earlier in the developmental trajectory than cluster 6. Our results confirm that STB can be readily generated from primed-type pluripotent stem cells, that this STB resembles that formed in vivo, and that there may be more than a single lineage of STB in placental trophoblast.

COVID-19 tracheostomy outcomes: A retrospective institutional review

Austin Baker DO,[1] Laura Dooley MD,[1,2]
David Chang MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology–Head & Neck Surgery

Introduction

Tracheostomy safety, timing, and overall outcomes was a highly controversial topic during the initial stages of the COVID 19 pandemic. Our objective was to compare comorbidities, ventilator data, and outcomes after tracheostomy in COVID positive and COVID negative patients with prolonged ventilator dependence secondary to acute respiratory failure

Methods

A retrospective chart review was performed of 121 (60 COVID negative, 61 COVID positive) tracheostomies performed for prolonged ventilator dependence secondary to cardiopulmonary related respiratory failure from 2012 to 2022. Tracheostomies performed for traumas or other pathologies were excluded. Comorbidities were analyzed using chi-square test, ventilator timing was analyzed using two sample t-test. A p-value of <0.05 was considered significant.

Results

Comorbidities were found to be more associated with COVID negative patients. COVID negative patients were more associated with CAD (33.7% vs 14.8%, p=0.017), CHF (31.6% vs 11.8%, p=0.007), COPD (40% vs 13.1%, p=0.001), and history of smoking (60% vs 35.6%, p=0.008). COVID positive patients had a longer time from intubation to tracheostomy procedure (18.15 vs 14.83 days, p=.006). There was no statistically significant difference in length of ICU stay or ability to wean off of the ventilator between the two groups.

Conclusion

Among 121 patients undergoing tracheostomy, comorbidities including CAD, CHF, COPD, and smoking history were significantly associated with COVID negative patients as compared to COVID positive patients. COVID positive patients had statistically significant increased intubation time prior to tracheostomy.

Rare case of B-cell acute lymphoblastic leukemia with t(14;14)(q11.2;q32)

Linnea Banker MD,[1] Christine Sholy,[1]
Lakshmi Chelapareddy MD,[1]
Richard D. Hammer MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Pathology and Anatomical Sciences

Introduction

A 53-year-old female with no significant medical history presented to University Hospital with fatigue and abnormalities on complete blood count at an outside institution. White blood cell count was 36,190/microL with a differential including 66% blasts, hemoglobin was 6.2g/dL, and platelet count was 124,000/microL. A peripheral blood smear and bone marrow aspirate (BMA) were obtained for analysis.

Methods

Flow cytometric analysis, chromosome analysis, fluorescent in-situ hybridization (FISH), next generation sequencing (NGS), and measurable residual disease (MRD) analysis were performed on the BMA.

Results

Flow cytometry confirmed B-cell acute lymphoblastic leukemia (B-ALL). Chromosome analysis was abnormal and demonstrated 46,XX,t(14;14)(q11.2;q32)[4]/46,XX[5]. B-ALL FISH indicated 84% of nuclei with IgH gene rearrangement. NGS revealed alterations in NRAS and IGH with variant allele frequencies of 43.99% and 36.40%, respectively. Following Hyper-CVAD part A, post-therapy BMA was negative for MRD by flow cytometry and ClonoSeq as zero residual clones were detected. The findings were consistent with complete remission (CR).

Conclusion

To date, there have been seven previously reported cases of B-ALL with t(14;14)(q11;q32). These described CR following initial chemotherapy cycles, proposing that this translocation may be associated with a more favorable prognosis. In the present case, the patient's BMA after CVAD completion was negative for leukemia by flow cytometry, and no residual clones were detected by molecular testing. This clinical picture aligns with previously reported cases of B-ALL with t(14;14)(q11;q32), supporting an association with a favorable prognosis. This cytogenetic abnormality is a rare finding, and further studies are necessary to confirm its prognostic significance.

Effect of circadian rhythm on labor induction

Kylie Cataldo,[1-3] Hanne Hoffman PhD,[4,5] Rene Cortese PhD,[1-3]

[1]University of Missouri-Columbia
[2]Department of Pediatrics
[3]Department of Obstetrics, Gynecology, and Women's Health
[4]Michigan State University
[5]Reproductive and Developmental Sciences Program

Introduction

This descriptive study aims to analyze labor induction, specifically the relationship between time of induction and the duration of labor. Research suggests a potential interaction between induction hormones and melatonin. Utilizing the body's circadian rhythm could support labor progression.

Methods

This data was obtained through a collaboration with Michigan State University, consisting of 7,957 patients. The data was subset for pregnant women who were induced and delivered naturally, reducing to n = 2,756. Labor duration was calculated by subtracting time of induction from time of delivery. Principle component analysis (PCA) was used to identify key variables related to labor induction and duration of labor.

Results

Inducing labor during early morning hours reduces the average duration of labor by up to 5 hours. Average labor duration is lowest at 5:00AM and increases throughout the day. The effect of induction time is more prominent in early term deliveries (between 37 weeks 0 days —38 weeks 6 days gestation). PCA and correlation plots revealed key variables to include gestational age (GA), para, BMI and pre-pregnancy weight, as well as induction variables such as Pitocin and Misoprostol doses.

Conclusion

Inducing labor during early morning hours to work with the body's circadian rhythm and natural hormones could prove an effective labor management strategy to reduce labor duration. Pregnant women induced at early term would potentially benefit the most. Further research is needed to determine the effect of confounding variables on duration of labor with respect to induction.

Effect of orphenadrine administration in the post anesthesia care unit on postoperative pain control and opioid utilization: A retrospective study

Jordan Cruz MD,[1,2] Adebayo Bello MD,[1] Noah Timko MPH,[3,4] Julie M. Marshall MD,[1,2] Sarah VonThaer MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Anesthesiology and Perioperative Medicine
[3]Duke University
[4]Department of Anesthesiology

Introduction

Orphenadrine, a centrally acting, non-opiate analgesic and muscle relaxant, has potential as an opioid sparing medication in the PACU. We compared opioid use and clinical complications between patients that received orphenadrine in the PACU and matched controls.

Methods

A retrospective chart review evaluated patients who received IV orphenadrine in the PACU in a two-month period compared to matched controls who did not receive orphenadrine. Eighty patients were included in each group.

Results

There were no significant mean differences in preoperative patient characteristics, duration of surgery and intraoperative morphine equivalents. No significant mean difference in morphine equivalents in PACU or NRS-11 pain score at PACU discharge. Patients who received IV orphenadrine did receive more mean ketamine (1.88 vs 0.75 mg, p= 0.03), ketorolac (2.63 vs 0.94 mg, p= 0.049), and acetaminophen (108.13 vs 25 mg, p=0.03). Patients who received IV orphenadrine had shorter mean time to PACU discharge (88.2 vs 103.2 min, p=0.02) and lower mean oxygen requirement at PACU discharge (1.69 vs 2.66 L/min, p=0.01), but had increased mean incidence of nausea (32 vs 14, p=0.002).

Conclusion

There was no significant difference in opioid utilization in the PACU regardless of orphenadrine use. The orphenadrine group also received more ketamine, ketorolac, and acetaminophen in the PACU. Patients receiving orphenadrine had a shorter time to PACU discharge, despite a higher incidence of nausea. Timing of the administration of orphenadrine relative to other medications given was not controlled and could be a point of emphasis for a future prospective study regarding orphenadrine.

The impact of an enhanced data visualization tool for hypertension in the electronic health record on physician judgments about hypertension control

Sean Duan MA,[1] Pete Wegier PhD,[2] KD Valentine PhD,[3] Shannon M. Canfield MPH,[1] Jeffery L. Belden MD,[1] Linsey M. Steege PhD,[4] Mihail Popescu PhD,[1] Victoria A. Shaffer PhD,[1] Richelle J. Koopman MD[1,2]

[1]University of Missouri-Columbia
[2]Humber River Hospital & University of Toronto
[3]Massachusetts General Hospital
[4]University of Wisconsin-Madison
[5]Department of Family and Community Medicine

Introduction
Uncontrolled hypertension is a significant US health problem, despite existing effective treatments. This study assessed the impact of variations in patterns of blood pressure data on physician perceptions of hypertension control using different forms of data visualization. Reducing clinical uncertainty around patient blood pressure should lead to improved shared decision making and ultimately better health outcomes.

Methods
Physicians (N=57) reviewed 8 brief vignettes describing a fictitious patient; each included a graph of the patient's blood pressure data. We examined how variations in mean systolic blood pressure (SBP), blood pressure standard deviation (SD), and form of visualization (e.g., line graph with raw values or smoothed values only) affected judgments about hypertension control and need for medication change.

Results
Judgments about hypertension control were influenced by mean SBP value, SD, and data visualization type ($P<.05$). For controlled hypertension, judgments about hypertension data presented as a smoothed graph were significantly more positive (i.e., hypertension deemed to be better controlled) than judgments about the same data presented as raw data. These main effects are qualified by significant interactions between SBP mean and data visualization type ($P<.05$). Differences in judgments between methods of data visualization are greatest when hypertension is controlled (i.e., SBP mean = 130). However, when hypertension is uncontrolled (i.e., SBP mean = 145), physician judgments are uniformly negative.

Conclusion
Data visualization can direct physicians to attend to more clinically meaningful information, thereby improving their judgments of hypertension control. As a result, well-designed data visualization has the potential to reduce clinical uncertainty around blood pressure measurements, which is one of the key drivers of clinical inertia and uncontrolled hypertension.

Prolonged neurologic impairment following high dose intrathecal methotrexate, inpatient rehabilitation outcome: a case report

Andrew Goldblum DO,[1,2] Claire Finkel MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine and Rehabilitation

Case Description

A previously healthy and functionally independent 20-year-old female diagnosed with T Cell Acute Lymphoblastic Leukemia (ALL) in remission, on interim maintenance therapy developed right hemiparesis and aphasia. Patient with NIHSS score of 11, and physical exam showed 0/5 and 1/5 strength of the right upper and lower extremity, respectively. MRI was concerning for toxic-metabolic multifocal leukoencephalopathy. Patient previously on intrathecal (IT) methotrexate (15 mg/m^2) had an increased dosage (150 mg/m^2) 13 days prior to presentation. On admission to IPR, patient had deficits of 3/5 right hip flexion and 4/5 right foot dorsiflexion, resolving but persistent aphasia, and abnormal cerebellar findings (i.e. proprioception, coordination). At time of discharge, she was rated as independent in all categories except for ambulation (CGA) and problem solving/memory.

Discussion

The patient's physical exam, laboratory values, and MRI findings led to the diagnosis of Methotrexate-Induced Leukoencephalopathy. The literature associates leukoencephalopathy as a delayed complication of IT methotrexate usually presenting after 6 months to years later with cumulative IT dosing exceeding 140 mg, which in this case was 13 days after starting an IT methotrexate regimen surpassing the associated toxicity threshold. Clinical presentation was of ataxia and hemiparesis. Methotrexate neurotoxicity treatment is dextromethorphan 24 hours after symptom onset and recovery expected by 13.9 hours. Patient received rescue treatment within 72 hours after presentation yet did not achieve recovery by the end of inpatient rehabilitation stay.

Conclusion

Early recognition/diagnosis of chemotherapy induced neurotoxicity is important for appropriate treatment. Deficits which impact patient functional status may persist despite appropriate rescue treatments.

Racial disparities among patients diagnosed with colorectal cancer in the united states

Hadie Islam DO,[1,2]
Eleanor Fontana,[1] Kushal Naha MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Medicine

Introduction

Over 1 million Americans currently live with colorectal cancer, and although the number of survivors in the United States continues to grow, many disparities in treatment outcomes remain among racial minorities. Previous studies have shown that the racial disparities between white and non-white Americans are due to two main factors: insurance coverage and tumor characteristics, including stage, grade, and comorbidities.

Methods

To attempt to examine the factors that influence colorectal cancer survival in rural and central Missouri, data was collected and analyzed for 88 white and 67 non-white patients. Data was obtained through patient chart review and the variables collected included past screening information, demographics, tumor characteristics, and treatment offered. Statistical analysis was performed using SPSS software.

Results

Upon analysis, it was found that non-white patients were less likely to have undergone prior screening tests before diagnosis, however white and non-white patients were equally likely to be diagnosed at stage IV. Response to first line therapy was similar among white and non-white patients regardless of stage. There was no significant difference between white and non-white patients with regards to rates of KRAS, BRAF, and MSI mutations in Stage IV colon cancer patients.

Conclusion

These findings suggest that non-white patients are equally likely to have response to first line therapy as white patients. The findings also suggest that minority populations are less likely to undergo screening colonoscopies than white patients. Ultimately, our research suggests that socioeconomic factors may play a larger role in colon cancer disparities among white and non-white patients versus biologic/genetic factors.

Is race associated with referral disparities for patients with diabetic foot complications?

Mubinah Khaleel DO,[1,2] Ashwin Garlapaty,[1] Kylee Rucinski PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Racial minorities, including African Americans, American Indians, Asian Americans, Hispanic/Latinos, and Pacific Islanders are more likely to develop Type II diabetes and experience associated microvascular complications. Amputation rates related to diabetes and/or peripheral arterial disease are three times higher for African Americans, suggesting that race, access, and/or mistrust of the medical community may contribute to adverse outcomes for certain minority groups. Determining where the breakdown along the care continuum occurs is fundamental for achieving equitable outcomes among minority groups. This retrospective study sought to examine specialist referral rates for patients diagnosed with diabetic foot complications.

Methods

Patients were extracted from the medical record based on a diagnosis related to diabetic foot complications made between January 01, 2018, and June 01, 2023, in the family medicine or endocrinology clinics at the University of Missouri (MU). Referral incidence to specialty orthopaedic foot clinic at the Missouri Orthopaedic Institute (MOI) and patient demographics were collected and analyzed.

Results

597 patients were eligible for inclusion. Patients referred to MOI (n=133, 22.3%) were significantly younger (56.5 ± 10.9 years vs. 61.1 ± 12.5, $p<0.001$), and significantly more likely to have Medicaid insurance ($p=0.01$). No significant differences in referrals were seen for race, sex, or marital status, suggesting minority patients with diabetic foot complications are referred to specialists equally at MU compared to non-minority patients. Future research should explore additional factors contributing to adverse outcomes in minority patients.

Conclusion

Patient race was not associated with decreased referral rate to specialty clinic for diabetic foot complications.

Comparison of outcomes after primary or salvage osteochondral allograft transplantation for treatment of femoral condyle osteochondritis dissecans lesions

Mubinah Khaleel DO,[1,2] Clayton Nuelle MD,[1,2] Kylee Rucinski PhD,[1,2] James Cook DVM PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Osteochondral allograft transplantation (OCAT) allows for restoration of femoral condyle osteochondritis dissecans (OCD) lesions using an osteochondral unit. When OCD lesions are irreparable or treatments have failed, OCAT is an appropriate approach for revision or salvage surgery. Based on its relative availability, cost-effectiveness, and lack of donor site morbidity and advances in preservation methods, OCAT is an attractive option for primary surgical treatment for femoral condyle OCD.

Methods

Patients were enrolled into a registry for assessing outcomes after OCAT. Patients who underwent OCAT for femoral condyle OCD and had a minimum of 2-year follow-up were included. Reoperations, treatment failures, and patient-reported outcomes were compared between primary and salvage OCAT cohorts.

Results

Twenty-two consecutive cases were included for analysis with no patients lost to 2-year follow-up (mean: 40.3 months, range: 24-82 months). OCD lesions of the medial femoral condyle (n=17), lateral femoral condyle (n=4), or both condyles (n=1) were analyzed. No statistically significant differences between primary (n=11) and salvage (n=11) OCAT cohorts for patient demographics and surgical characteristics were noted. 91% of patients had successful outcomes at a mean of >3 years after OCAT. For both primary and salvage OCATs, patient-reported measures of pain and function significantly improved at 1-year and final follow-up.

Conclusion

Based on the low treatment failure rates and statistically significant and clinically meaningful improvements in patient-reported outcomes, osteochondral allograft transplantation can be considered an appropriate option for primary and salvage surgical treatment for patients with irreparable femoral condyle OCD lesions.

Protein biomarkers can distinguish symptomatic from asymptomatic degenerative lumbar intervertebral discs

Jacob S. Kramer PhD,[1,2] Aaron M. Stoker PhD MS,[1,2] Emily V. Leary PhD,[1,2] Theodore J. Choma MD,[1,2] Abigail F. Baumann,[1] Don K. Moore MD,[1,2] James L. Cook DVM PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction

Intervertebral disc degeneration (IVDD) is asymptomatic in the majority of people but is unpredictably associated with debilitating pain in others. Therefore, this study was designed to characterize potentially different protein release profiles of similarly degenerated symptomatic versus asymptomatic IVDs. It was hypothesized that symptomatic IVDs would release significantly increased concentrations of inflammatory cytokines, degradative enzymes, and significantly decreased concentrations of degradation inhibitors compared to asymptomatic IVDs with similar morphologic IVDD.

Methods

With IRB approval (IRB#2010692) and informed patient consent, IVD tissues were recovered from symptomatic (SYM) clinical IVDD patients (n=184) and asymptomatic (ASYM) tissue donors (n=20). Explants from SYM and ASYM IVDs were created and cultured for 3 days. Radiographic and gross evaluation were used to classify SYM IVDD (Pfirrmann grade 1-5) or ASYM IVDD (Thompson grade 1-5) severity, respectively. Media were analyzed for inflammatory cytokines, degradative enzymes, degradation inhibitors, and growth factors. Ex vivo protein release was compared using multivariable linear models with adjustment for patient characteristics, with significance set at $p \leq 0.05$.

Results

SYM AF and SYM NP tissues released significantly ($p \leq 0.05$) increased concentrations of numerous inflammatory cytokines, specific degradative enzymes, and significantly decreased concentrations of degradation inhibitors compared to ASYM AF and ASYM NP tissues.

Conclusion

Inflammation, degradation, and a lack of degradative inhibition may represent fundamental differences between symptomatic and asymptomatic IVDD with similar morphologic IVDD. Ongoing studies in our lab are aimed at further characterization of symptomatic and asymptomatic IVDs to determine direct links to development of symptomatic IVDD that may serve as biomarkers for clinical application.

Impact of acute sedentary time on cerebral blood flow and neurovascular coupling in healthy young adults

Matt McDonald MS,[1] Brian Shariffi MS,[1] Jennifer L. Harper BS,[1] Jill Kanaley PhD,[1,2] Jacqueline K. Limberg PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Nutrition & Exercise Physiology

Introduction

A lifetime of physical inactivity increases the risk of dementia and Alzheimer's disease. Although mechanisms are unclear, physical inactivity may have detrimental effects on the cerebral vasculature. Herein we examined the effect of acute (60 min) physical inactivity on resting cerebral blood flow and neurovascular coupling. We hypothesized cerebral blood flow and neurovascular coupling would be reduced following 60-min of physical inactivity in healthy young adults.

Methods

Middle cerebral artery blood velocity (MCAv, transcranial Doppler ultrasound) were measured while sitting prior to and following 60 min of physical inactivity in 10 healthy young adults (5F/5M, 27±4 yrs). CBF and MCAv were measured at rest and in response to an acute visual stimulus (Where's Waldo). Neurovascular coupling was assessed as the relative (%) increase in MCAv and CBF from baseline during the first 30-sec of visual stimulation.

Results

MCAv (52±9 to 46±9 cm/s, $p=0.03$) was reduced from baseline levels following 60-min of physical inactivity. Visual stimulation led to an elevation in MCAv ($p<0.01$), however the relative increase in MCAv from baseline was unaffected by acute physical inactivity (16±10 vs 16±11%, $p=0.84$).

Conclusion

Resting cerebral blood flow was reduced following acute (60 min) of physical inactivity in healthy young adults. However, contrary to our hypothesis, physical inactivity had no effect on neurovascular coupling in healthy young adults. Future studies should examine the cerebrovascular effects of inactivity in disease states (e.g., obesity, insulin resistance, Alzheimer's disease).

Bridging the gaps: How K-12 outreach programs can help diversify orthopaedics

Abdoulie Njai MD MPH,[1,2] L. Nathan Gause MD,[1,2] Laura Henderson-Kelley MD MPH,[1,3] Yak Nak BS,[1] James L. Cook DVM PhD,[1,2] Stephanie Choo MD,[1,2] James P. Stannard MD,[1,2] Emily Leary PhD,[1,2] Gregory J. Della Rocca MD MBA PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery
[3]Department of Medicine

Introduction

The field of orthopedic surgery remains one of the least diverse in medicine. Our institution hosted its inaugural "Bridging the Gaps Outreach Day" earlier this year as an opportunity to provide a diverse group of middle and high school students with the chance to explore the field.

Methods

51 students from across the state attended the event. 75% of participants identified as female and 30% as underrepresented racial minorities. 79.2% of participants reported that they would be the first person in their immediate family to become a physician. The all-day event included tours, physician-led panels and lectures, and hands-on workshops.

Results

46 students completed the post-event evaluation survey. 84.4% were more likely to consider college, 95.6% were more likely to consider a career in medicine, 97.7% had a better understanding of how to become an orthopaedic surgeon, and 81.8% met mentors who could help them pursue a career in orthopaedic surgery. 100% reported that they recommend this event to a friend. Prior to the event, 28% were "not very confident" or "not confident at all" in their ability to become an orthopaedic surgeon prior to the program. After the program all students were "extremely confident," "somewhat confident," or neutral in their ability.

Conclusion

This event highlights the ability of outreach programs to inspire students to pursue higher education and possibly a career in medicine. The event was awarded the MU Outstanding Diversity/Multicultural Program of the Year Award and will be hosted again in February 2024 at MOI. It will also expand to Kansas City.

Prevalence of musculoskeletal pain in nurses at a stand-alone rehabilitation hospital

Kotomi Obayashi DO,[1,2] Paul Jones DO[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine and Rehabilitation

Introduction
Nurses play a key role in healthcare, and aspects such as physical handling of patients can increase risk for work-related injury. Registered nurses have a higher-than-average rate of injury and some of the highest rates of injury in the healthcare sector. Previous studies have examined the prevalence of work-related pain in nurses, often with focus on back pain. Few have assessed the prevalence of pain in rehabilitation nurses.

Methods
An electronic questionnaire was sent to all nursing staff at a rehabilitation hospital (n= 63). Self-reported data included demographics, symptoms, and ergonomic treatment received.

Results
47.6% of staff responded. In this sample, 96.7% reported current or previous pain while at work. The most common location of pain was the low back. 7.9% experienced a work-related injury. Responders who reported 30+ hours of direct patient care tasks were more likely to report current pain symptoms than those spending less than 30 hours (p= 0.015). Responders who reported standing at work over 50% of time were more likely to report current pain symptoms (p= 0.042) than those standing less than 50% of working time. All received formal ergonomic training.

Conclusion
This study demonstrates a high prevalence of pain in nurses with the most common location, the low back, being consistent with previous studies. Pain occurred despite ergonomic training indicating possible gaps in training which require further investigation. Understanding the factors that can decrease rates of work-related injury in rehabilitation nursing staff is critical for career longevity and work satisfaction.

Non-localizing 4D-CT for parathyroid adenoma: Patient characteristics and surgical outcomes

Edouard Oudin MD,[1,2] Varun Jeevan,[1]
Robert Zitsch MD,[1,2] Patrick Tassone MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology–Head & Neck Surgery

Introduction
Directed parathyroidectomy is the standard treatment for primary hyperparathyroidism with a localized parathyroid adenoma. Multiple imaging modalities are available to localize parathyroid adenomas, including neck ultrasonography and ^{99m}Tc-sestamibi scanning. More recently, four-dimensional CT scans (4D-CT) have been utilized to localize adenomas not seen on traditional imaging modalities. Despite improved specificity, some 4D-CT scans do not identify an adenoma. The intent of our study is to investigate patient characteristics and surgical outcomes in patients with non-localizing 4D-CT scans in our institution.

Methods
We performed a retrospective chart review of patients with primary hyperparathyroidism who underwent 4D-CT imaging and had no adenoma identified. We reviewed patient's characteristics, imaging findings, and surgical outcomes.

Results
14 patients were identified. 57% were female with average age of 63.2 and average BMI 30.8. 57% had a preoperative PTH < 100. 21.4% had a history of parathyroidectomy, and 7.1% had a history of thyroidectomy. 50% required bilateral neck exploration. 21% had greater than one parathyroid adenoma identified. Average adenoma size was 0.46 grams. A biochemical cure was achieved in 85.7%, as defined by normal PTH and calcium at 6 months post-operatively.

Conclusion
Our data leads us to suspect certain characteristics increase the chances for non-localizing adenomas including small adenoma size, low severity of biochemical disease, and re-operative cases. We maintain a good surgical cure rate in this patient population. Higher patient numbers will allow us to further identify risk factors for non-localizing 4D-CT scans and to further define expected surgical outcomes in this patient population.

Impact of resident and attending surgeon training level on free tissue transfer ischemia time and complications

Brooke E. Porter MD,[1-3] Sarah E. Langsdon MD,[1-3] Thalia C. Anderson MD,[1-3] Angela S. Ash,[1] Leanna M. Zelle,[1] Thomas D. Willson MD[1-3]

[1]University of Missouri-Columbia
[2]Department of Surgery
[3]Division of Plastic Surgery

Introduction

Microsurgical free tissue transfer has become an essential method for reconstruction of complex surgical defects, making the level of training an important factor to consider. There is little published regarding the impact of training level and microsurgical outcomes. This study investigates microsurgical free tissue transfer ischemia time and post-operative complications based on resident and attending surgeon experience level.

Methods

A retrospective review of all free flaps at a single institution from 1/1/2013 to 12/31/2021 was performed. A multivariate linear regression was performed analyzing ischemia time of 344 free flaps and attending surgeon experience defined by years in practice and resident level defined as PGY (post graduate year). A multivariate logistic regression model was used to analyze complications based on attending experience and resident level.

Results

The average resident PGY was 3.56 +/- 0.77; the average attending has been practicing 6.4 +/- 5.12 years. There was no statistically significant difference in ischemia time or complication based on resident PGY or attending surgeon experience level. As such, more junior residents were not found to slow down these surgeries or increase complication rates.

Conclusion

Microsurgical free tissue transfer is considered a safe procedure in residency training and should be encouraged to allow resident education and growth of technical skills.

Intensive outpatient rehab in an ASIA A spinal cord injury patient after comprehensive inpatient rehab

Rafid Rahman MD,[1,2] Benjamin Boyett MD,[1,2] Annie Sevy DO[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine and Rehabilitation

Introduction

Mr. B is a 20-year-old male with spinal cord injury (SCI) after a motor vehicle accident. Upon arrival at the hospital, the patient had no motor control or sensation to the lower extremities. He was unable to feel his legs or rectum. He also had a L1 burst, L2, right 12th rib, and manubrial fracture. Patient underwent L1 laminectomy with dural repair and arthrodesis T11-L3. Following stabilization, he was admitted to acute inpatient rehabilitation (IPR).

Methods

Upon IPR admission, the patient's ASIA (American Spinal Injury Association Impairment Scale) exam revealed a diagnosis of T12 AIS A SCI. Within 20 days of MVA, patient progressed to AIS C with newfound voluntary rectal tone, deep anal pressure. Patient had 45 days of inpatient rehabilitation. At discharge, he had not yet been able to walk. He was discharged to an intensive outpatient SCI rehab program. After completing the intensive outpatient rehab, the patient had advanced to T12 AIS D. He was able to ambulate with a walker.

Results

Spinal cord injuries are prevalent, roughly 12,500 cases in the US yearly. A diagnosis of AIS Grade A (complete spinal cord injury) has approximately 2.1% of patients improve to incomplete injury in 5 years. The recovery in this case is extraordinary compared to most AIS Grade A patients

Conclusion

The additional utility of intensive outpatient rehab should be considered in patients who are progressing rapidly in the inpatient rehab setting to maximize functional improvement in ASIA A SCI.

Improved adherence to swallowing rehabilitation program with use of motor imagery

Kaitlyn Reichl MD,[1,2] Stephanie Knollhoff PhD CCC-SLP,[1] Laura Dooley MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology–Head & Neck Surgery

Introduction

Radiation therapy (RT) is often used as a treatment for head and neck cancer (HNC) patients as it preserves anatomy. Although RT is effective, it commonly results in dysphagia. Swallowing exercises before and during RT have shown positive outcomes in radiation-induced dysphagia. However, adherence to swallowing exercises during RT is poor. Studies have reported less than half of participants even partially adhering to swallowing exercise programs. When assessing poor adherence, pain is routinely noted as the barrier. Thus, there remains a need to increase adherence to swallowing exercises. Motor imagery, a mental process during which a subject internally stimulates a movement without any corresponding motor output, has potential to be an effective intervention to increase adherence.

Methods

In this study, participants completed execution swallowing exercises for the first three weeks of RT followed by imagery swallowing exercises starting at week four and completing through the remainder of RT. Regardless of the modality, patients completed the exercises once a day, five days a week. All participants received training on the exercises during their initial visit and were provided a method for exercise tracking.

Results

Throughout RT, exercise completion was greater than 50%. There was a decrease in exercise completion during weeks 1-3 with an improvement upon week 4 when motor imagery was initiated. Approximately 65% of patients had strong adherence.

Conclusion

Motor imagery is promising to improve adherence to swallowing rehabilitation for HNC patients undergoing RT. The adherence rate to this rehabilitation program was much higher than reported national averages.

A unique case presentation of pediatric spinal ependymoma with chromothripsis of chromosome 6

Keela R. Scott MD,[1,2] Melissa A. Gener MD,[3,4] Elena A. Repnikova PhD[3,4]

[1]University of Missouri-Columbia
[2]Department of Pathology and Anatomical Sciences
[3]University of Missouri-Kansas City
[4]Department of Pathology

Introduction

Ependymomas are the third most common central nervous system tumor in the pediatric population; however, spinal ependymomas in children are rare. Ependymomas affecting the spinal cord most frequently occur in adults of 20 to 40 years of age. The current WHO Classification System for ependymomas is now comprised of ten different entities based on histopathology, location, and molecular studies, with evidence that the new classification system more accurately predicts clinical outcomes.

Methods

We present the case of a pediatric patient with a history of neurofibromatosis type 2 with multiple schwannomas, meningioma, and spinal ependymoma.

Results

Chromosome analysis of the harvested spinal ependymoma tumor sample revealed a 46,XX,+7,-22+mar[16]/46,XX[4] karyotype. Subsequent OncoScan microarray analysis of the formalin-fixed paraffin-embedded tumor sample confirmed +7, -22, and clarified that the marker chromosome represents chromothripsis of the entire chromosome 6 with more than 100 breakpoints. Fluorescent in situ hybridization and microarray analysis showed no evidence of *MYCN* amplification. The final integrated pathology diagnosis was spinal ependymoma (CNS WHO grade 2) with no *MYCN* amplification.

Conclusion

This case adds to the existing literature of pediatric patients with spinal ependymomas and expands the cytogenetic findings that may be seen in patients with this tumor type. This case also highlights the value of cytogenetics and microarray analysis in solid tumors to provide a more accurate molecular diagnosis.

Does gastric bypass surgery increase the risk of complications following fracture ORIF?

Conor A. Smith MD,[1,2] Samuel D. Hawkins,[1] Brett D Crist MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction
Existing research has clearly established a link between gastric bypass surgeries and an increased risk of frailty fractures; however, little data is available connecting these fractures and an increased rate of complication. We suspect patients status post gastric bypass who sustained a fracture will have increased bony complication rates with correlating changes in lab values.

Methods
We retrospectively identified 60 patients post gastric bypass who subsequently sustained a fracture treated with open reduction internal fixation (ORIF) and collected demographic data, types of fracture, mechanism of injury, and relevant laboratory work. Fracture type, mechanism, and complications were recorded for each cohort (complication vs no complications).

Results
Distal radius fractures 15/60 (25%) and femur fractures 13/60 (21.7%) were most common, with 40 low energy and 17 high energy fracture mechanisms. Bone healing complications requiring operative management occurred in 8/60 (13.3%) patients including 5 for non-union and 3 for malunion. No differences in vitamin D, PTH, and calcium levels were identified between groups at standardized follow-up visits and time of fracture.

Conclusion
The average age of our cohort was 51 years old, but the fracture type (distal radius) and mechanism (low energy) were more consistent with osteoporotic patients. We identified higher risk for non/malunions of status post gastric bypass patients. Lab values over the entire measured interval were similar in the groups (complication vs. no complication). Our findings of increased risk of frailty fractures with bony healing difficulties without signs of associated lab abnormalities are conflicting and warrant a better powered study.

Transient paraplegia after jiu jitsu sparring: a case report

Christian Van Doren DO,[1,2] Carl Giacchi DO,[1-3] Mark Drymalski MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine and Rehabilitation
[3]Harry S Truman Memorial Veterans' Hospital
[4]Missouri Orthopaedic Institute Spine Clinic

Introduction
Reports suggest Jiu-Jitsu training puts strain on athletes' backs. Disk herniations are a common pathology found, however, this study is the first to report transient paraplegia after acute lumbar spine hyperextension during Jiu-Jitsu.

Methods
A 38-year-old male with latent autoimmune diabetes of adults (LADA) sustained acute bilateral lower extremity paraplegia and paresthesia after lower back hyperextension during Jiu-Jitsu. The patient immediately developed bilateral lower extremity paraplegia. There was no voluntary movement below mid-thigh, and soft touch/painful/vibratory sensations were absent below the hamstrings. The patient experienced improvement; by the time EMS arrived, the patient exhibited toe flexion/ankle dorsiflexion/plantarflexion at 3/5 strength with altered sensation. Physical exam showed intact cranial nerves, all extremity strengths were 5/5, and light touch sensation was normal for lower extremities. The patient was discharged. Eleven days later, the patient was neurologically intact in all extremities, Hoffmann's sign was negative, Babinski was negative, and tandem gait was intact. The patient had full range of motion of the lumbar spine and was asymptomatic with full flexion and hyperextension.

Results
The MRI of the lumbar spine did not demonstrate osseous abnormalities or spinal cord signal changes. The patient regained full strength and sensation in the ED. The patient was discharged and slowly returned to Jiu-Jitsu.

Conclusion
This case emphasizes the value of ED, sports medicine, and primary care integrating their knowledge of possible causes of acute spinal cord injury in acute hyperextension moments of sports origin. Such cases are rare, and early investigation of the spinal vasculature is essential.

Cervical and thoracic spinal cord stimulator placement for the management of pain in diffuse schwannomatosis: a case report

Bryan Wacker DO,[1,2] Amer Mohiuddin MD MBA,[3,4] David Gordon MD, Claire Finkel MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Physical Medicine and Rehabilitation
[3]Indiana University
[4]Department of Anesthesiology

Introduction

Diffuse Schwannomatosis (DS), a rare variant of neurofibromatosis, poses a complex array of challenges in both the diagnosis and management of associated pain. DS involves the development of diffuse, benign nerve tumors called schwannomas, often affecting peripheral/spinal nerves. DS has an annual incidence of 0.58 cases per 1,000,000 persons, markedly less common than other forms of neurofibromatosis.

Case

A 68-year-old female presented to our clinic in October 2022 as a transfer of care from the West Coast with a diagnosis of DS made via biopsy. Other than her oral analgesics and therapy, the patient previously underwent trigger point injections, steroid joint injections, interlaminar epidural/transforaminal steroid injections, RFAs, and ketamine infusions.

Methods

After a successful cervical spinal cord stimulator trial, the patient underwent permanent implantation in December 2022. After the implantation, the patient reported an 80% improvement in her bilateral hand cramping at the initial follow up visit. In June of 2023, the patient underwent a subsequent placement of a thoracic spinal cord stimulator.

Results

After the procedures, the patient reported nearly 100% improvement in her pain. She was also able to move her left foot for the first time in 5 years, which was limited by cramping.

Conclusion

With diffuse schwannomatosis patients requiring increased amounts of drug therapies and surgery becoming a less reliable solution, there is a need for alternative therapies. This case report sheds light on the potential of spinal cord stimulator placement as a primary/adjunct treatment for patients with this disease.

Despite the rates: Many rural mothers want to breastfeed their infants

Karry Weston PhD(c) MSN-Ed RN, Linda Bullock PhD RN

[1]University of Missouri-Columbia
[2]Sinclair School of Nursing

Introduction

Across the U.S., rural mothers initiate breastfeeding at lower rates than their urban and suburban counterparts. Missouri, a predominantly rural state, is among the lowest states for breastfeeding initiation. The goal of this research is to describe what occurs during the decision-making process for rural pregnant individuals when deciding how to feed their infants.

Methods

An ongoing qualitative study is being conducted with a population of first-time mothers in rural Missouri whose infants are under 1 year of age. Semi-structured interviews are being conducted with mothers over Zoom or by telephone to investigate their decision-making processes around how they intend to feed their infant after delivery and community characteristics influencing their infant feeding decisions. Eighteen women were interviewed, and all interviews were transcribed, double-checked for accuracy, and analyzed using NVivo software.

Results

Three styles of decision-making trajectories for infant feeding were found: 1) Women who decided to breastfeed during pregnancy, 2) Women who were undecided on their feeding method at delivery and, 3) Women who decided to formula feed during pregnancy. Most women interviewed were in the group that decided to breastfeed during pregnancy. However, upon delivery many barriers prevented them from doing so confirming Weston's Breastfeeding Experience and Support Model for Low-Income Women. The processes of decision-making and barriers will be discussed.

Conclusion

Our findings highlight a need for additional interventions during the decision-making process for rural mothers to help them succeed in breastfeeding after delivery.

Effects of a behavioral health program on graft survival rates after osteochondral allograft transplantation in the knee

Jonathan Williams,[1] Kylee Rucinski PhD MHA,[1,2] Renee Stucky PhD,[1] James P. Stannard MD,[1,2] Aaron Stoker PhD,[1,2] James L. Cook DVM PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Introduction
Joint preservation surgeries accomplished through osteochondral allograft (OCA) transplantation require extensive pre-operative preparation as well as post-operative adherence to rehabilitation protocols. A behavioral health program (BHP) including pre-operative assessment and education and post-operative counseling and support, led by a health behavior psychologist, was implemented for patients considering OCA transplantation. This study was designed to test the hypothesis that patients enrolled in this program would realize a significantly higher functional graft survival rate when compared to patients not enrolled.

Methods
With IRB approval and informed consent, patients seeking OCA transplantation in the knee were presented with the opportunity to participate in the BHP. The Kaplan-Meier method was used to compare 2-year cumulative survival rates between BHP and no-BHP cohorts. Multivariable Cox regression analyses adjusted for age, BMI, non-adherence, and tobacco use were used to evaluate the influences of BHP on graft survival.

Results
303 patients were included: 81 were enrolled in the BHP. At 2-year follow-up, a significantly lower cumulative graft survival rate was observed for patients not enrolled in the BHP (68.5% vs 91.3%; p = .0038). Age, BMI, tobacco use, and non-adherence to post-operative protocols were not significantly different between groups. Adjusting for age, BMI, tobacco use, and non-adherence, patients not enrolled in the BHP demonstrated a 3-times greater likelihood to fail by 2 years (95% CI, 1.38-6.57; p = 0.01).

Conclusion
Our findings indicate that enrollment in a comprehensive behavioral health program had positive effects on functional graft survival for patients undergoing OCA transplantation in the knee.

The crista ovale a constant middle cranial fossa landmark: a computer tomographic imaging anatomical evaluation

Juan C. Yanez-Siller MD MPH,[1,2] Sami Abdulnabi,[1] Edmund Howe MD,[1] Raywat Noiphithak MD,[3] Jeffrey Liaw MD,[1,2] Arnaldo Rivera MD[1,2]

[1]University of Missouri-Columbia
[2]Department of Otolaryngology–Head & Neck Surgery
[3]Thammasat University

Introduction
The crista ovale (COv) is a consistent anatomical structure in the middle skull base. It was recently described as a reliable landmark in transorbital endoscopic approaches (TOEA) to the middle cranial fossa (MCF) in cadaveric specimens. The COv has not been evaluated on imaging of live subjects.

Objective
Study the COv in computer tomographic (CT) imaging of live human subjects and evaluate anatomy on imaging and illustrate its potential relevant surgical implications

Methods
100 CT temporal bone (200 sides) of live subjects free of intracranial or middle ear tumors were analyzed to evaluate anatomy of the COv. Findings were stratified to age, sex, side. Anatomic relationships were described.

Results
The COv was readily identified in 89% temporal bone CT in 41 males and 49 females (Median age: 43.4 y; range 1-90) Close relationship to the foramen ovale and foramen spinosum was consistent with prior studies with mean distance to the COv of 8.4 mm ±SD 2.5 and 13.0 mm ±SD 2.7, respectively. The mean height, width and length of the COv were 2.7 mm ± SD 1.1, 7.9 mm ±SD 2.7, and 8.7 mm ±SD 3.2, respectively. Four different morphologic configurations were identified.

Conclusion
The COv is readily identified in CT temporal bones and facial bone CT in live human subjects. Multiple morphologic variations exist and can be identified on imaging. The COv is a consistent and reliable anatomical landmark that serves for identification of the foramen ovale and foramen spinosum.

Transcriptomic changes in eutopic endometrium and ectopic lesions in mouse model during endometriosis progression

Rong Li PhD,[1] Dinh Nam Tran PhD,[1] Bruce A. Lessey MD PhD,[2] Steve L. Young MD,[3] Tae Hoon Kim PhD,[1] Jae-Wook Jeong PhD[1]

[1]University of Missouri-Columbia, Department of Obstetrics, Gynecology and Women's Health
[2]Wake Forest University, Department of Obstetrics and Gynecology
[3]Duke University, Department of Obstetrics and Gynecology

Introduction

Endometriosis affects 10% of women with 30-50% of those affected were infertile. However, due to great individual variation and ethical issues, transcriptomic analysis of human endometrium has not identified conserved biomarkers for endometriosis and cannot be performed during early pregnancy to study endometrial defects. Therefore, we established a novel mouse endometriosis model that develops human relevant endometriosis after 1 month (1M) and 3 months (3M) surgery induction and its fertility drops from normal at 1M to severely subfertile at 3M, similar to human.

Methods

Fertile, subfertile *Pgr*$^{cre/+}$*Rosa26*$^{mTmG/+}$ mice with endometriosis, and sham mice as control (n=4/group of endometriosis). These mice underwent either surgery to induce endometriosis or sham surgery. Fertile sham and mice with endometriosis were used 1M after surgery, while subfertile ones were used three months after surgery.

Results

Similar to human, estradiol, inflammation, angiogenesis, and fibrosis pathways were consistently elevated in all the ectopic lesions compared to eutopic endometrium. Cholesterol/glucose synthesis and stem cell pluripotency pathways were enhanced in ectopic lesions from subfertile mice. Dysregulation of infiltration of macrophage, dendritic, T and B cells were validated by immunohistochemistry in ectopic lesions. Multiple ligand-receptor pairs were predicted between the ectopic and eutopic endometrium. Suppressed Wnt and EGF pathways were found in the eutopic endometrium from subfertile mice not fertile mice.

Conclusion

Our mouse endometriosis model recapitulates the transcriptomic changes of ectopic progression in human and implies the critical signaling in eutopic endometrium for endometriosis associated infertility.

Olfm2 promotes development of atherosclerosis through inducing smc foam cell formation

Ning Shi PhD,[1,2] Shiyou Chen DVM PhD[1,2]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery

Atherosclerosis is a complex and progressive disease characterized by the buildup of plaques composed of lipid-rich foam cells, inflammatory cells and fibrous elements in arterial intima, which is associated with high risk of coronary heart disease and stroke. It is well established that vascular smooth muscle cell (SMC) dysfunction and nuclear factor (NF)-κB signaling contribute to development and progression of atherosclerosis. However, the factors and mechanisms that govern atherosclerosis, especially SMC function in atherosclerosis, remain largely unknown. We found that Olfactomedin 2 (Olfm2) is induced in SMCs by lipid loading in vitro and in vivo and plays a critical role in the development and progression of atherosclerosis. Olfm2 deficiency (Olfm2-/-) inhibits high fat diet-induced atherosclerotic plaque formation and inflammatory responses, and also improves plaque stability in advanced atherosclerosis, with the elevated serum high density lipoprotein-cholesterol levels and the downregulated expression of inflammatory markers in aortas of the ApoE-/- mice. Knockdown of Olfm2 inhibits while overexpression of Olfm2 promotes lipid accumulation and inflammatory marker expression in oxidized low density lipoprotein-treated SMCs, suggesting that Olfm2 plays a role in SMC-derived foam cell formation during atherosclerosis development. Importantly, Olfm2 appears to promote SMC foam cell formation through activating (NF)-κB signaling pathway. Taken together, these data demonstrate that Olfm2 is a novel protein factor promoting atherosclerosis by mediating SMC foam cell formation.

The Inaugural 2024 NextGen Pathways Symposium: Accelerating Discoveries and Fostering Discoverers

Editorial by W. David Arnold, MD

Executive Director, NextGen Precision Health Initiative

Professor of Physical Medicine and Rehabilitation, Neurology and Medical Pharmacology and Physiology

I am excited to publish the abstracts from the 2024 NextGen Pathways Symposium, which highlighted work from across the University of Missouri System, including the University of Missouri-Columbia, the University of Missouri-Kansas City, the Missouri University of Science and Technology, and the University of Missouri-St. Louis. Held on March 22, 2024, in Columbia, Missouri, this inaugural symposium marked a significant milestone for the NextGen Precision Health Initiative. The motivation behind the symposium is to connect researchers across the University of Missouri System, accelerating discoveries that impact human health in Missouri and beyond. The NextGen Pathways Symposium serves not only as a platform for presenting research but also as a catalyst for building a vibrant scientific community. We are bringing together students, early-career researchers, and established experts, creating an environment primed for mentorship, collaboration, and innovation. This symposium is a crucial part of that vision, offering a platform for our participants to share their work, receive feedback, and form lasting connections that will support their careers. This event demonstrates our commitment to fostering the next generation of scientists, clinicians, and academics by providing them with the tools, networks, and experiences essential for their professional growth.

The NextGen Precision Health Initiative leverages research from the molecular to population level. This comprehensive view of research progress, from early-stage discovery to population health

impact, underscores the importance of each step in the research continuum and the collaborative effort required to advance human health. The abstracts presented at Pathways highlighted work at all stages of development and approaches, from groundbreaking basic science to innovative clinical applications. These abstracts showcase talent from across the University of Missouri System community.

We were honored to host Dr. Thomas Pedersen as our first keynote speaker. Dr. Pedersen's journey from basic science research to founding a company and developing a treatment now in clinical trials is a powerful example of the impact that dedicated research can have. His talk highlighted the pathway from laboratory discoveries to real-world applications, emphasizing the importance of perseverance, innovation, and collaboration. Dr. Pedersen's recent publication in *Science Translational Medicine* further underscores the significance of his work and its potential to transform patient care.

A significant goal of Pathways is to highlight and support the varied career trajectories that our participants can pursue (e.g. different career "pathways"). We aim to provide a clear view of the many professional avenues available and encourage our participants to explore and pursue their unique career aspirations. At a reception for the symposium held on Thursday March 21, 2024, participants were able to candidly discuss professional development challenges and considerations with a panel of scientists at various career stages. The intent is that future symposiums will continue to provide opportunities to explore the increasingly complex career landscape of biomedical research.

The abstracts presented here are just the beginning. We envision the NextGen Pathways Symposium as a launching pad for ongoing collaboration and career development. By fostering an environment where ideas can be freely exchanged and new partnerships can be formed, we are building a foundation for future scientific breakthroughs and career success. I want to extend my heartfelt thanks to all the participants, the mentors, and the NextGen Precision Health Initiative team who have made this symposium possible.

As you read through these abstracts, I hope you will be as inspired as I am by the incredible work being done by our NextGen Pathways participants. Together, we are forging a future where collaboration and innovation pave the way for new discoveries and career opportunities.

DHA supplementation moderates absolute and relative brain volumes and corresponding behavior change in a prenatal stress-associated ASD murine model

Nick L. Ahmed,[1] Taeseon Woo,[1]
Candice King,[1] Maddison Cordes,[1]
Elizabeth Clarkson,[1]Celiane T. Suarez,[1]
Jacob Ellegood,[1] Jason P. Lerch,[1]
Matthew J. Will,[1,2] David Q. Beversdorf[1,2]

[1]University of Missouri - Columbia
[2]Department of Psychological Sciences

Objective
Our previous work showed in a maternal SERT+/- prenatal stress-associated ASD mouse model, DHA supplementation mitigates dopaminergic excess found in the striatum of this model, as well as behavioral effects. The present study aimed to quantify the absolute and relative brain volume variability across offspring of SERT+/- dams exposed to prenatal stress vs C57BL/6J controls with and without DHA supplementation.

Methods
After weaning, offspring of those given supplementation also received DHA until behavioral testing began on post-natal day 60. Brains were collected from offspring around post-natal day 70 after behavioral testing was completed. Using deformation-based morphometry 7T MRI, we assessed neuroanatomical differences across our four conditions (SERT+/- prenatally stressed with DHA supplementation (HS/D), SERT+/- prenatally stressed no supplementation (HS/ND), C57BL/6J not stressed with DHA supplementation (WT/D) , and C57BL/6J not stressed no supplementation (WT/ND).

Results
Without DHA supplementation, SERT+/- prenatally stressed offspring were seen to have significantly larger absolute and relative brain volumes in the striatum, nucleus accumbens, olfactory peduncle, flocculus, claustrum and cingulate cortex areas 24a and 24b compared to wildtype controls. DHA appeared to reverse many of these findings, as several areas related to the striatum and dopaminergic pathways were significantly decreased in the HS/D compared to HS/ND offspring including the amygdala, thalamus, olfactory peduncle, flocculus, claustrum, and a variety of cingulate cortex areas. In contrast, only the olfactory peduncle and the cingulate cortex areas 24a and 24b showed a relative area decrease between SERT+/- stressed offspring controls and those given DHA. While deficits in social interaction were not rescued by DHA supplementation, grooming behaviors were significantly decreased with supplementation.

Conclusion
In conclusion, DHA supplementation in the prenatal stress-associated ASD mouse model seems to influence a wide variety of brain regions including those associated with the striatum and its related dopaminergic pathways.

Impact Statement
This study demonstrates that DHA supplementation in a prenatal stress-associated ASD mouse model can significantly impact brain structure and behavior. Specifically, DHA supplementation mitigated the enlargement of brain regions associated with the striatum and dopaminergic pathways in SERT+/- prenatally stressed offspring. While it did not improve social interaction deficits, DHA supplementation did reduce excessive grooming behaviors, indicating a potential therapeutic role for DHA in neurodevelopmental disorders.

Manipulation of the gut microbiome to alter animal models of human disease phenotypes

James Amos-Landgraf,[1,2] Aaron Ericsson,[1,2] Elizabeth Bryda,[1,2] Craig Franklin[1,2]

[1]University of Missouri - Columbia
[2]Department of Veterinary Pathobiology

Objective
Recent work by our group and others has highlighted that not only the host genome but also the host microbiome can significantly contribute to the phenotypes of animal models of human disease. The objective was to determine the impact of different specific pathogen free (SPF) gut microbiomes (GM) on disease phenotypes to improve reproducibility and to identify and manipulate specific microbes to reveal mechanisms of disease progression.

Methods
To evaluate the reproducibility and translatability of mouse and rat models the Mutant Mouse and Rat Resource and Research Centers rederived models of familial cancer, IBD, diabetes, and COVID with various specific pathogen-free microbiomes. To facilitate reproducibility the MMRRC has created CD-1 colonies that harbor the GMs of four major commercial vendors' SPF microbiomes that we use as surrogate dams for rederivation or transgenic mouse model production. We examined phenotypes in the C57BL/6-ApcMin, IL10-/-, DSS-induced colitis, NOD/ShiLtJ, and ApcPirc rats. and the K18-hACE2 mouse model of COVID-19. We used 16s rRNA sequencing to characterize the GM and untargeted mass spectroscopy-based metabolomics we identified differences in the metabolic capacity.

Results
While the resulting animals are SPF, the diversity and richness of the GMs in the animals vary significantly with unique taxa in each of the GMs and significant differences in relative abundances of various shared taxa. In one case, the influence of the microbiome masked genetic drift in the population and compromised the comparison of datasets. The phenotypes in nearly all cases resulted in significant differences in disease phenotypes between the GM groups.

Conclusion
The gut microbiome contributes to the irreproducibility of animal models of human disease and can mask genetic drift in animal colonies. We believe that simple characterization and documentation of the microbiome present during an experiment can provide valuable data to enhance the rigor and reproducibility of animal models.

Impact Statement
The gut microbiome has a significant impact on phenotypes in animal models of human disease. This has a significant impact on reproducibility and translatability of mouse and rat disease models. We have found that utilizing various complex microbiomes can reveal differences in disease processes that may translate into a better understanding of human disease processes.

A multi-omics approach to investigate the mechanistic basis of cancer immunoprevention mediated by a novel CD137 agonist

Feyza Nur Arguc,[1] Mohit Verma,[1] Yen On Chan,[1] Pallav Singh,[1] Vahap Ulker,[1] Mohammad Tarique,[1] Esma S. Yolcu,[1-3] Trupti Joshi,[1,4] Haval Shirwan[1-3]

[1]University of Missouri - Columbia
[2]Department of Molecular Microbiology and Immunology
[3]Department of Pediatrics
[4]Department of Biomedical Informatics, Biostatistics, and Medical Epidemiology

Objective
Clinical application of agonistic antibodies (Ab) targeting 4-1BB (CD137) immune checkpoint pathway for cancer immunotherapy showed moderate efficacy and significant toxicity. We hypothesized that these observations may arise from the use of Abs and generated an oligomeric form of the ligand, SA-4-1BBL, that showed robust cancer immunotherapy efficacy in the absence of detectable toxicity in preclinical tumor models. Surprisingly, treatment with SA-4-1BBL as a single agent invokes an immune surveillance mechanism that prevents the growth of various cancer types in preclinical models and agonist Abs lack such protection. We herein applied a multi-omics approach to decipher the mechanistic underlying of cancer immunoprevention efficacy of SA-4-1BBL.

Methods
C57BL/6 mice were pretreated subcutaneously with SA-4-1BBL or an agonistic Ab or saline twice two weeks apart followed by challenge with the syngeneic TC-1 cancer cells two weeks later. Deep immunophenotyping and bulk RNA-seq were performed on treatment site-draining lymph nodes 3 days after the second SA-4-1BBL treatment.

Results
Pretreatment with SA-4-1BBL prevented tumor growth in 60% of mice, while the remaining animals exhibited slow progression of the tumor. In marked contrast, all mice treated with the saline or Ab expired from tumor burden within 30 days. Deep immunophenotyping revealed significantly increased numbers of NK, NKT, CD4+ T, and various myeloid cells in mice treated with SA-4-1BBL as compared to Ab and saline groups. Bulk RNA-seq analysis identified 250 differentially expressed genes unique to the SA-4-1BBL that belonged to innate immune, complement, cytokine/chemokine, and PPAR pathways.

Conclusion
These results demonstrate that SA-4-1BBL as a single agent invokes an immune surveillance mechanism by altering various immune pathways. Further elucidation and confirmation of the pathways that exert protection against cancer hold significant potential for cancer immunoprevention.

Impact Statement
Although immunotherapy has transformed cancer treatment, its efficacy varies among patients with the same tumor type and is not effective against all types of tumors. Our data demonstrating the prophylactic efficacy of SA-4-1BBL against diverse tumors lends support to the concept of cancer immunoprevention. Deciphering the mechanisms underlying SA-4-1BBL efficacy may lead to the discovery of new druggable targets with significant implications for the development of preventive treatments for individuals at high risk of developing cancer.

Investigating variability in response of MinE07 (anti-EGFR aptamer) anti-cancer mechanism of action on NSCLC cell lines

Sania Z. Awan,[1,2] Brian J. Thomas,[1,3] Mark Daniels,[1,3] David Porciani,[1,3] Donald H. Burke,[1,3,5] Trupti Joshi[1,2,4]

[1]University of Missouri - Columbia
[2]Institute for Data Science and Informatics
[3]Department of Molecular Microbiology and Immunology
[4]Department of Biomedical Informatics, Biostatistics, and Medical Epidemiology
[5]Department of Biochemistry

Objective
The anti-EGFR aptamer discovered has demonstrated promising results in reducing cell viability and tumor burden in certain Non-Small Cell Lung Cancer (NSCLC) cells. However, variability in response among different NSCLC cell lines and potential divergent mechanisms of action have been observed. The aim of this study is to refine our understanding of the anti-EGFR aptamer's effects through a comprehensive computational analysis.

Methods
Total RNA was collected and processed from 4 NSCLC cell lines, H3255, H1975, H549, H820, treated with 3um of anti-EGFR aptamer MinE07, non-targeting control aptamer C36, or Vehicle for 24 hours. Differentially Expressed Genes (DEGs) were calculated using Cufflinks suite. The selection of significantly dysregulated genes is based on Padj value < 0.05 & $|\log2FC| > 1$.

Results
Principal Component Analysis revealed cell line-based clustering with no unexpected variability. FPKM normalization and Euclidean distance calculated similarity for all conditions, informing a PPI network construction using StringDB. In A549, C36 vs Vehicle revealed 156 significant genes (55% up, 45% down), minE07 vs C36 had 117 genes (53% up, 47% down), and E07 vs Vehicle showed 122 genes (52% up, 48% down). In H1975, C36 vs Vehicle had 124 genes (52% up, 48% down), minE07 vs C36 had 192 genes (61% up, 39% down), and E07 vs Vehicle had 174 genes (54% up, 46% down). H3255 had 130 genes (56% up, 44% down) in C36 vs Vehicle, 282 genes (56% up, 44% down) in minE07 vs C36, and 290 genes (50% up, 50% down) in E07 vs Vehicle.

Conclusion
This work merges experimental insights with advanced computational analysis, delving into the details of the anti-EGFR aptamer's effects. Our goal is to not only confirm our first findings but also reveal hidden aspects in the data. Finding unique mechanisms in different cell lines adds depth to our understanding, opening avenues for more precise therapeutic interventions tailored to specific NSCLC subtypes.

Impact Statement:
Our research on the anti-EGFR aptamer's impact has far-reaching implications for NSCLC integrating experimental insights with computational analysis, our work validates and expands initial findings. Together with another poster on antitumor efficacy and mechanism of action of these and other aptamers, by Brian Thomas, this nuanced understanding enables tailored therapeutic interventions for specific NSCLC subtypes, potentially revolutionizing clinical strategies. Our findings promise to enhance patient outcomes by informing innovative approaches in the treatment of NSCLC.

Investigating heterogeneity of neuromuscular resiliency in aging wildtype C57BL/6 mice

Fereshteh B. Darvishi,[1,2]
Azam Roshani Dashtmian,[1,2] Sindhuja Ayyagari,[1,2]
Peter Moore,[1,2] Nathan Kerr,[1,2] Ahmiel Ford,[1]
Prameela J. Bobbili,[4,5] Deepti Chugh,[7]
Chitra Iyer,[4,5] Kelly Rich,[8] Hallie Harris,[4,6]
W. David Arnold[1,3]

[1]University of Missouri - Columbia
[2]NextGen Precision Health
[3]Department of Physical Medicine and Rehabilitation
[4]Ohio State University
[5]Department of Neurology
[6]Department of Plastic and Reconstructive Surgery
[7]Indian Institute of Technology
[8]Walden University

Introduction
By 2050, the global population aged ≥ 60 is anticipated to double. While chronological aging poses a significant risk for adverse health conditions, the accumulation of biological aging, varies widely within and across individuals. Majority of preclinical research often focus on chronological age as compared to biological age; our study investigates the heterogeneous effects of chronological aging on neuromuscular function in aging wild-type mice.

Methods
Data from 303 C57BL/6 mice aged 4 to 30 months underwent retrospective analyses of prior cross-sectional studies at six age groups: 4-6, 11-13, 19-21, 22-24, 25-27, and 28-30 months. Electrophysiological assessments on the gastrocnemius muscle including muscle excitation (assessed via compound muscle action potential, CMAP), motor unit number estimation (MUNE), average single motor unit potential size (SMUP) and in vivo plantarflexion contractility were performed. Using K-cluster analysis, we stratified mice into resilient and frail groups. Subsequently, we have initiated a longitudinal study from 12-24 months of age in 43 C57BL/6 mice (21 female/ 22 male).

Results
Cross-sectional data indicate impact of age on neuromuscular function. MUNE was significantly decreased from 19 to 27 months compared to younger mice (4-6 months) ($p < 0.0001$). Distinct heterogeneity in MUNE was evident among mice aged 25-27 months, with values ranging from 48 to 395 (MUNE=300-400 in young healthy mice). CMAP exhibited a notable decline at 25-27 months ($p < 0.0001$). There was a significant effect of age on plantar flexion muscle contractile torque with decline starting at 11-13 months ($p = 0.03$).

Conclusion
Neuromuscular function showed significant but strikingly heterogeneous decline across the lifespan of mice. A follow up longitudinal study is ongoing to allow determination of the temporal relationships between physiological features of neuromuscular dysfunction. Additionally, plans are ongoing to investigate motoneuronal transcriptome profiles from resilient and frail mice to understand heterogeneity of neuromuscular biological aging.

Impact Statement
This research aims to elucidate the timing of motor unit dysfunction in aging mice and its role in age-related decline in physical function. Our comprehensive and innovative approach will focus on heterogeneity in aging along with the neuromuscular deficits in old mice. The combination of phenotypic profiling and the analysis of motoneuronal transcriptomes, represents a novel and innovative methodology.

The syndemic solutions summit: A collaborative approach to advancing health services

Mattea Brooks,[1,2] Adam Viera PhD MPH,[1,2]
Lisa Carter MS LPC LCAC,[1,2]
Maxine Henry MSW MBA,[1,2] Holly Hagle PhD,[1,2]
Laurie Krom MS, [1,2]
Kristin Metcalf-Wilson DNP WHNP-BC,[1,2]
Jacki Witt JD MSN WHNP-BC FAANP,[1,2]
Kelly Reinhardt PWP,[1,2]

[1]University of Missouri - Kansas City
[2]Collaborative Center to Advance Health Services

Objective
Syndemic solutions are vital in current public health initiatives due to their comprehensive approach to addressing interconnected disease states and health disparities within notable demographics. The term "syndemic" refers to the presence of multiple diseases that interact symbiotically. This approach acknowledges that health issues and social conditions rarely exist in silos, but rather they intertwine and contribute to negative impacts.

Methods
Utilizing an integrative approach, this initiative continues to engage with diverse groups and methods focusing on building provider comprehension of the interrelationships of health disparities within communities and strategizing around how to meaningfully address these complex health issues. To accomplish this, a two-day Syndemic Solutions Summit was held where different stakeholders, such as government representatives, leadership from national and local organizations, researchers, and advocates, came together to discuss how they are using syndemic solutions within their programs. Three main points that came from the Summit are that policy change and structural intervention are vital, health and social service providers need to adopt a holistic approach in their work, and a 'one-door' approach to patient access to services is critical.

Results
By embracing syndemic solutions, public health initiatives can delve into root causes, alleviate health disparities, and devise more potent strategies for prevention, treatment, and ongoing support. During the two-day Syndemic Solutions Summit, there were 33 featured speakers and presenters and 165 attendees from across the country. Ultimately, the feedback was positive. Attendees shared that they wanted to see more speakers with lived experience.

Conclusion
The integration of syndemic solutions into contemporary public health strategies stands as a vital paradigm shift. Steering away from isolated disease-centric approaches, these solutions offer a more comprehensive understanding and response to the complexities faced by communities. Syndemic solutions pave the way for targeted interventions, aiming not just to treat ailments but to address their root causes. Embracing this approach holds promise for mitigating health disparities, foster

Impact Statement
Continuously conveing collaborators and disseminating resources to address health disparities through syndemic solutions, fostering lasting impact and community empowerment by situating this work within a larger, ongoing initiative.

A novel interaction between CD4-CD8 double positive thymocytes and MHC: New perspectives on the paradigm of thymic selection

Jenna M. Canfield,[1] Diana Gil,[1-4]
Adam G. Schrum[1-5]

[1]University of Missouri - Columbia
[2]Department of Molecular Microbiology and Immunology
[3]Department of Surgery
[4]Department of Bioengineering
[5]Department of Dermatology

Objective

Thymocyte maturation to the double positive CD4-CD8 coreceptor stage, or DP, prompts positive and negative selection, rigorous steps that ensure T cells are both functional and safe. It is at this DP stage that ninety percent of developing thymocytes, expressing T cell receptors that do not recognize self-peptide-MHC complexes, undergo programmed cell death, known as death by neglect. Although many studies focus on T cell development, questions remain regarding what disqualifies most DP thymocytes from undergoing positive and negative selection.

Methods

To address this, we utilized several murine genotypes with targeted mutations that alter TCR-CD3 signaling or eliminate antigen presentation, arresting thymocyte development at the pre-positive selection DP stage. We applied the techniques of immunization, transplantation, and classical flow cytometry to isolate differences and determine responsiveness of the DP thymocyte population.

Results

We found that DP thymocytes exhibit a range of surface co-receptor expression and these differences, in conjunction with other surface markers, defined subtle, yet distinct, stages within DP. Higher surface co-receptor expression correlated with an early DP stage and interaction of the TCR-pMHC triggered co-receptor downregulation. Although pMHC is required for co-receptor downregulation, this is not a selection event, but a calibration process. Additionally, unlike positive/negative selection, MHC-required maturation through early DP stages is not restricted to specific peptides, as the DP population responds to a single pMHC. This early TCR-pMHC interaction, also revealed a new role in alpha-beta and gamma-delta T cell lineage divergence. How does this early TCR-pMHC interaction affect the peripheral T cell repertoire? Peripheral T cells, developed in the absence of MHC, retain high co-receptor expression and exhibit polyspecificity, binding to multiple, unrelated pMHC complexes.

Conclusion

These results reveal new roles for MHC complexes, functioning to calibrate TCR-MHC restriction, modulate antigen specificity, and surprisingly, mediate an alternative pathway to gamma-delta T cell development.

Impact Statement

The discovery of this early MHC calibration step and its importance in regulating the dynamics of DP thymocyte maturation and selection not only challenges the concept of thymocyte death by neglect but will allow us to measure the impact of dysregulation in immunocompromised states that could affect repertoire diversity potential. Furthermore, revelation that MHC contributes to T cell lineage commitment prompts a reevaluation of our understanding of the mechanisms that govern T cell development.

Effect of circadian rhythm on labor induction

Kylie Cataldo BSc,[1-3] Dr. Hanne Hoffman PhD,[4,5] Dr. Rene Cortese PhD[1-3]

[1]University of Missouri - Columbia
[2]Department of Pediatrics
[3]Institute of Data Science and Informatics
[4]Michigan State University
[5]Reproductive and Developmental Sciences Program

Objective
Spontaneous labor occurs frequently at night, suggesting a potential interaction between induction hormones and melatonin. In this study, we aim to analyze the relationship between labor induction and circadian rhythm by observing the effect of induction time of day on labor across maternal phenotypes.

Methods
Data was obtained through a collaboration with Michigan State University and subset for pregnant women who were induced (n = 3,704). Labor duration was calculated by subtracting the time of initial induction from time of delivery. The rhythmic component of labor induction was identified using the Lomb-Scargle method with 1-hour periods over 24-hours. Principle component analysis (PCA) was used to identify features contributing to labor induction and duration of labor.

Results
Inducing labor during early morning hours reduced the average labor duration by up to 5 hours, with the shortest duration at 5:00AM and gradually increasing throughout the day. Lomb-Scargle analysis revealed a significant rhythm, spiking at 7:00AM ($p = 0.00695$). PCA identified gestational age, parity, BMI, pre-pregnancy weight, and induction variables as features impacting labor duration. We detected a shift in the circadian rhythm for labor duration in overweight and obese women. In addition, we identified a significant interaction between induction time and gestational diabetes mellitus (GDM). GDM women have significantly lower odds of laboring beyond 24 hours with induction between 15:00-18:00 compared to induction at any other time of day (OR = 0.3 [0.10, 0.79]).

Conclusion
Inducing labor during early morning hours could prove an effective labor management strategy to reduce labor duration by utilizing the body's circadian rhythm. Maternal variables condition the effect of induction time on labor duration, specifically for women with gestational diabetes or obesity. Consideration of maternal phenotype to induce labor at the optimal time may prove beneficial to support labor progression in induced women.

Impact Statement
Induction during the early morning reduced average labor duration by up to 5 hours. Maternal variables condition the effect of induction time on labor duration and should be considered to determine optimal induction time across phenotypes. Working with the circadian rhythm to induce labor at the optimal time could prove an effective labor management strategy to support labor progression.

Transient focal ischemia in middle-aged mouse caused circadian desynchrony in the affected brain region

Abigail Chischolm BS,[1] Rishi Sharma PhD,[1,2] Meet Parikh MS,[1,2] Pradeep Sahota MD,[1,2] Mahesh M. Thakkar PhD[1,2]

[1]University of Missouri - Columbia
[2]Department of Neurology

Objective
This study investigates the impact of ischemic stroke (IS) on circadian gene expression in affected brain regions. The central hypothesis is that IS affects clock gene cycling in these regions, leading to sensorimotor deficits while not impacting the suprachiasmatic nucleus (SCN), the master circadian pacemaker.

Methods
The study utilized middle-aged C57BL/6J mice, approximating the young adult human population. Under sterile conditions and isoflurane anesthesia, focal cerebral ischemia was induced by middle cerebral artery occlusion (MCAO) for one hour. Sham controls underwent the same procedure without occlusion. Animals were then left undisturbed for 48 hours before euthanasia. Brain regions supplied by the middle cerebral artery (motor cortex, striatum, and hippocampus) and the SCN were isolated for RT-PCR analysis to examine gene expression.

Results
Preliminary results indicated that mice subjected to IS displayed cerebral infarction in the motor cortex and striatum and sensorimotor deficits 48 hours post-MCAO compared to sham animals. While the circadian rhythms of Bmal1 expression in the SCN remained entrained to the light-dark (LD) cycle (showing no significant difference in Bmal1 expression between stroke and sham animals), the rhythms in the cortex and striatum of stroke animals failed to entrain. This was evidenced by a significant reduction in Bmal1 expression in the cortex of stroke animals, suggesting circadian desynchrony.

Conclusion
This study is the first to demonstrate the effects of IS on circadian gene expression in affected brain regions. Understanding the role of circadian genes in post-stroke recovery is crucial for developing new and effective therapeutic strategies for stroke rehabilitation. The findings suggest that targeting circadian desynchrony could be a novel approach in stroke therapy.

Impact Statement
This groundbreaking study shows how ischemic stroke has a big effect on circadian gene expression in the affected brain areas. It gives us a new way of looking at things that could change the way we treat stroke recovery by focusing on circadian desynchrony.

Targeting acid-sensing ion channels as novel therapeutic strategy for cocaine addiction

Rahul Jilakara,[1] Jake Zahn,[1] Will Obert,[1] Wesley Stark,[1] Abbas Bader,[1] Abdul Yousaf,[1] Mohamed Refaat,[1] Dylan Glaser,[1] Daniel Song,[1] Sarah Ding,[1] Eric Chai,[1] Michael Wacker,[1,2] Xiang-Ping Chu[1,2]

[1]University of Missouri - Kansas City
[2]Department of Biological Sciences

Objective
Acid-sensing ion channels (ASICs) are highly expressed in the brain and contribute to synaptic plasticity, learning/memory, neurological and psychological diseases. Although, the involvement of ASICs in cocaine addiction has previously been reported by using ASIC1 and ASIC2 knock-out (KO) mice, the precise mechanisms of ASIC1a and ASIC2a in cocaine addiction remain uncertain.

Methods
Both ASIC1 and ASIC2 have two variants (a and b). Here, ASIC1a and ASIC2a KO mice were generated. Whole-cell patch-clamp recording in brain cortical neurons and behavioral activities (total distance) to cocaine were recorded.

Results
Disruption of ASIC1a genes results in no detectable ASIC currents when the pH drops from 7.4 to 6.0, while deletion of ASIC2a genes results in large ASIC currents in more than half of the neurons at the same pH drops. We further examined the behavioral consequences of loss of ASIC1a and ASIC2a in response to acute and chronic cocaine administration. Acute cocaine administration (20 mg/kg i.p.) induced an increase in locomotor activities in WT, ASIC1a KO and ASIC2a KO mice, however, ASIC2a KO male mice displayed a significant increase in activities compared to WT and ASIC1a KO mice. In females, ASIC1a KO and ASIC2a KO mice both displayed significant increase in activities compared to WT mice. In a chronic cocaine administration model (20 mg/kg, once daily for 5 days, i.p. injection), daily cocaine injection triggered an increase in locomotor activities in all genotypes. After a two-week withdrawal period, a challenge injection of cocaine (10 mg/kg) caused an evident behavioral sensitization in the cocaine-pretreated, but not saline-pretreated ASIC1a KO, ASIC2a KO and WT mice. Compared to WT mice, both male and female ASIC2a KO, and male ASIC1a KO mice exhibited a significant increase in behavior sensitization to cocaine.

Conclusion
Our results demonstrate the important role of ASIC1a and ASIC2a in the modulation of behavioral sensitivity to cocaine. Thus, targeting ASICs might be a potential therapeutic strategy for treatment of cocaine addiction.

Impact Statement
Drug addiction remains remarkably difficult to treat. This is partially due to the lack of a precise understanding of mechanisms of drug addiction. Our study demonstrates that targeting ASICs might be a potential therapeutic strategy for treatment of cocaine addiction.

We're using the wrong statistics for precision medicine research

Sharlee Climer[1,2]

[1]University of Missouri - St. Louis
[2]Department of Computer Science

Objective
Advances in Precision Medicine (PM) for cancer patients are extending the healthspan of countless lives by tailoring treatments to heterogeneous cancer subtypes, yet progress has been slow for other complex diseases. A key obstacle in PM research of biomarker associations is the use of statistical methods, such as AUC, fold change, and LASSO, that are inherently unable to properly handle heterogeneity. We present evidence of these failures and introduce a machine-learning (ML) technique that resiliently adapts to heterogeneous subtypes.

Methods
Our ML method utilizes 2-median clustering to identify optimal partitioning of the data points. Each group, diseased cases and normal controls, are clustered and the difference between the distinctiveness of the clusters provides a score. Validation is performed using permutation trials and subsequent testing on unseen held-out data. We analyze several omics datasets using all methods. To demonstrate consistency of performance, 1000 large-scale trials on synthetic data with nearly perfect subtypes are conducted.

Results
As shown by the synthetic trials, existing statistical methods are unable to capture associations when the subtype group is less than roughly half of the entire group, while ML trials capture 100% of the associations down to subtypes representing only 10% of the group, and captured many at the 5% level. For the omics trials, histograms reveal the distribution of values for ML discovered biomarkers with clear subtype associations while these signals are completely overlooked by AUC, fold change, and LASSO.

Conclusion
Current statistical methods are valuable for identifying biomarkers associated with most of a diseased group but are unable to capture elusive biomarkers representing a small proportion within a heterogeneous group. Our ML method examines the distribution of values using optimal 2-median clustering, rather than summary statistics or regression methods, and leverages extensive computational validation trials to reveal robust subtype associations.

Impact Statement
Subtype identification is key for generating hypotheses for drug targets, selecting individuals for drug trials, and enabling precision medicine in which individuals can be screened, treated, and monitored effectively. Current statistical methods are valuable for identifying biomarkers associated with most of a diseased group but are unable to capture elusive biomarkers representing a small proportion of a heterogeneous group. We introduce a machine-learning method which examines the distribution of values to reveal robust subtype associations.

Understanding inner working aggression by examining indictors found within patients who have untreated ADHD for years

Kiel Corkran[1]

[1]University of Missouri-Kansas City

Objective

Gain a better quantitative understanding of individual factors behind aggression in patients as they age given they suffer from untreated ADHD by identifying statistically significant predictors that are nested within communities where these patients live. This includes such things as race, ethnicity, socio-economic variables of income or surrounding status, and medical symptoms common among patients of untreated ADHD.

Methods

A linear mixed regression model will be created with predictors to represent suspected factors and then factors that affect patients at a group level. Once created the linear will refined until it consisted of predictors at the individual and group level that have to be statistically significant and also checked if that significant correlation between final variables left in model

Results

Preliminary findings, pending further analyses, show statistical significance correlation between untreated ADHD and aggressive behaviors. Further investigation will reveal that certain aspects that relate to a person's make up and aspects of the disorder have a greater effect in increasing the likelihood of indirect or direct violence. Inclusion of additional covariates found not to be statistically significant is expected to worsen, overall accuracy of the model's prediction about being involved.

Conclusion

We believe that by creating this regression model that physicians will have a better tool in understanding the dynamics associated with a patient being involved in direct or indirect violence given they suffer from a long case of untreated AHAD. Better understanding will also allow treatments administered by physicians to be more effective as the model gives a precise way to quantitatively predict if violence will occur with a patient before any actual violence does.

Impact Statement

Our team believes that this research will have two precise and profound impacts in physician offices found throughout the country. First, it will add a accessible tool for physicians to help better treat their patients by better understanding the dynamics of where their aggression is coming from. Secondly, this will also give physicians more clear information about what is effective for reducing direct or indirect violence by patients through the targeting of specific variables rather than a more broad approach.

Circulating DNA profiling for early detection of fetal growth disorders

Rene Cortese PhD,[1-4] Kylie Cataldo BSc,[1-3]
Justin Hummel MSc,[1,4] Gracie Smith BSc,[1,2]
Madison Ortega BSc,[1,2] Madison Richey MSc,[1,2]
Hung Winn MD JD,[1,2,5]
David Gozal MD MBA PhD,[3,6]
Jean Ricci Goodman MD MBA[1,2]

[1]University of Missouri - Columbia
[2]Department of Gynecology, Obstetrics and Women's Health
[3]Department of Pediatrics
[4]Institute for Data Science and Informatics
[5]Saint Luke's Hospital of Kansas City
[6]Marshall University

Objective

Early diagnosis, close follow-up and timely delivery constitute the main elements for appropriate detection and management of fetal growth disorders (FGD). We hypothesized that markers in circulating DNA (cirDNA) in maternal blood may facilitate early detection of FGDs. Our objective was to build marker panels that can predict FGD occurrence, as early as in first trimester of gestation.

Methods

Plasma cirDNA was isolated from samples prospectively collected during first trimester gestation (n=56). Small, Large and Adequate for Gestational Age (SGA n=11, LGA n=18, and AGA n=29, respectively) status was determined at birth according to weight and gestational age. cirDNA amount, fragmentation, mitocondrial/nuclear ratio and cirDNA methylation profiles were quantified using qPCR-based assays. Generalized Logistic Models (GLM) were applied to build a molecular signature for the prediction of LGA and SGA. Prediction accuracy was assessed by Receiving-Operating Curve (ROC) analysis, and Positive and Negative Predictive values (PPV and NPV, respectively) were calculated.

Results

We observed a non-significant increase in the total concentration of plasma cirDNA in SGA and LGA compared to AGA pregnancies (p=0.283; Kruskal Wallis test). The fraction of fragmented DNA was significantly increased (p=0.002) in SGA and LGA compared with AGA pregnancies Likewise, the ratio of mitochondrial/nuclear DNA was significantly increased (p=0.005) in LGA and LGA compared with AGA pregnancies. In addition, DNA methylation in 5 genes showed significant differences ($p<0.05$) across the SGA, LGA and SGA samples. We combined these molecular and epigenetic cirDNA markers in a signature that reliably discriminates between FGD and AGA pregnancies with high accuracy (AUC>0.95), achieving 89% PPV and 86% NPV.

Conclusion

Our findings demonstrate that maternal blood cirDNA profiles accurately detects early gestation FGD. The proposed novel marker panel should enable the implementation of low invasive approaches for reliable prediction of FGDs as early as the first trimester of pregnancy.

Impact Statement

cirDNA profiles in maternal blood can serve as marker for fetal and maternal health during pregnacy. Our novel marker panels will enable accurate prediction of fetal growth disorders using a low invasive approach that can be implemented as early as the first gestational trimester. The application of these panels in a clinical setting holds the potential to enable a disruptive path toward precision medicine in FGD.

Metabolomic analysis and biomarker discovery for clinical methamphetamine use

Leslie B. Essel,[1,2] Nitish R. Mishra,[1,2] William G. Gutheil,[1,2] Gerald J. Wyckoff[1,2]

[1]University of Missouri - Kansas City
[2]Division of Pharmacology and Pharmaceutical Sciences

Objective:
Methamphetamine (METH) stands as a widely abused synthetic amphetamine-type drug, classified under Schedule II of the Controlled Substances Act due to its highly addictive psychostimulant properties. Prolonged, uncontrolled METH use leads to the development of a use disorder, progressing from recreational to a compulsive, relapsing drug-seeking and use behavior. METH induces functional and structural changes in cortical brain regions and activates the dopamine reward system, resulting in states of euphoria or "high" and negative withdrawal emotions or hyperkatifeia. Despite the adverse effects, METH has beneficial medical applications, particularly in the clinical therapy of attention deficit hyperactivity disorder (ADHD) and narcolepsy. Unfortunately, existing METH studies predominantly focus on its abusive neurotoxicity, overlooking the potential effects of controlled use. This study addresses this gap by assessing the metabolomic changes associated with sub-toxic exposure to METH.

Methods
In vitro experiments involved daily METH treatment for 5 days on primary human brain neurons and SH-SY5Y neuroblastoma cells. Two protocols were employed: the treatment protocol, where the experiment was terminated after 5 days, and the withdrawal protocol where METH cessation occurred after the treatment period, with an additional 3 days of observation prior to termination. Cells and culture media were collected and processed for metabolomic analysis on a high-resolution mass spectrometer (HRMS). In vivo experiments involved C57BL6/J mice (4 months old, n = 5) treated with intraperitoneal injections of METH for 2 months. Brain tissue and plasma samples were collected and processed for HRMS analysis.

Results
Utilizing machine learning and statistical analytical tools, and curated metabolite databases, we identified METH-induced differentially expressed mall molecule biomarkers in brain tissue, plasma, and neuronal cell cultures during the two distinct clinical stages of use.

Conclusion
METH exposure induces metabolite biomarkers unique to both continual use and withdrawal episodes, providing insights into the complex metabolic alterations associated with controlled METH use.

Impact Statement
Beyond traditional pharmacological observations, there is currently no established measure of the different states (use vs. withdrawal) of clinical METH use. This study identifies biomarkers associated with these states, offering valuable insights into the proper medical uses of METH. With further validation, these biomarkers may be useful as diagnostic tools.

A novel role for the phosphorylated glucocorticoid receptor in neural stem cell differentiation and white matter formation in the adult brain

Emma Famous,[1] Jake Lally,[1] Neeru Silswal,[1,2] Joey Ferrari, Robert A. Oakley,[3,4] John A. Cidlowski,[3,4] Donald B. DeFranco,[5-7] A. Paula Monaghan-Nichols[1,2]

[1]University of Missouri - Kansas City
[2]Department of Biomedical Sciences
[3]National Institute of Environmental Health Sciences
[4]Molecular Endocrinology Group
[5]University of Pittsburg
[6]Department of Pharmacology and Chemical Biology
[7]Department of Neuroscience

Objective
Exposure to synthetic glucocorticoids (sCGs) in both pre and postnatal periods have been noted to cause long term neurologic alterations. Additionally, white matter deficits have been associated with sCG repetitive exposure in the neonatal period. Rodents exposed to sGCs prenatally exhibit changes in cerebral architecture and behavior as adults. The glucocorticoid receptor is phosphorylated on multiple sites, and two of sites in hime (S220, S232) has been implicated in psychiatric disorders. To determine whether phosphorylation on S220 is required for the normal development of the brain and adult behavior in the presence or absence of sGC, we examined stem cell properties and the neuroanatomical organization of the brain in control (WT) and knockin mice (KI) where serine on 220 was replaced by alanine (S220A).

Methods
S220A KI mice were obtained from NIH. Primary neural stem cells (NSCs) were isolated from the developing brain and passaged in vitro. Affymatrix gene array was performed to compare transcriptome of KI and WT after a 4 hour vehicle or sGC stimulation. The proliferative and differentiative properties of NSc were examined in the presence or absence of sGCs. Adult WT and KI brains were examined by immunohistological staining with markers of neurons, oligodendrocytes or glia.

Results
Whole transcriptome analyses identified unique sets of genes altered in both basal and sGC stimulated conditions in KI versus WT. S220A altered the proliferative and differentiative properties of MNSC's in response to sGC. Distinct morphological changes were observed in the brain in white matter tracks in both basal and induced conditions.

Conclusion
Phosphorylation on S220 is required in both basal and sGC stimulated conditions in neural stem cell biology and loss of phosphorylation on S220 alters the developmental trajectory of the brain.

Impact Statement
sGC are extensively used in the neonatal period to reduce the risk of respiratory distress syndrome and bronchopulmonary dysplasia. While they provide significant pulmonary benefit, their use is associated with neurological complications. This study aims to identify the beneficial and minimize the detrimental effects of sGC on the developing brain so that a targeted therapy can be developed to reduce the risks associated with pre-term birth and its associated postnatal complications.

Heart rate variability as a predictor of the effects of propranolol on gastrointestinal problems in children and adolescents with Autism Spectrum Disorder

Brad Ferguson

[1]University of Missouri - Columbia
[2]Department of Neurology
[3]Thompson Center for Autism and Neurodevelopment

Objective
Many individuals with autism spectrum disorder (ASD) experience gastrointestinal (GI) problems, which have been shown to be associated with the response to stress. Propranolol, a beta-adrenergic antagonist that decreases sympathetic tone, has been shown to provide GI relief for some individuals with ASD, but not others. The vagus nerve modulates the stress response as well as digestion and GI motility. This study examined whether heart rate variability (HRV), a measure that is sensitive to cardiac vagal tone, predicted the response to propranolol in decreasing GI problems in children and young adults with ASD.

Methods
A sample of 37 individuals with ASD aged 7-24 participated in a 12-week open label trial of propranolol. The Gastrointestinal Severity Index (GSI) and 5-minute electrocardiogram (ECG) recordings were collected at baseline and at the end of the trial period. Baseline HRV was used as a predictor of GI change score in a linear regression and conducted Pearson bivariate correlations between HRV change score and GI change score.

Results
Baseline standard deviation of heart rate (STD HR; $r = .603$, $p = .029$) and triangular interpretation of NN interval (TiNN; $r = .578$, $p = .038$) were positively correlated with response to propranolol, but only for adolescents and young adults (15-24 year olds). The correlations between baseline HRV and GI change score were not significant for 7-14 year olds (p's $> .05$). HRV change score was not correlated to GI change score (p's $> .05$).

Conclusion
The results from this open-label trial suggest that adolescents and young adults with higher HRV may have a better response to propranolol and show the greatest reduction GI symptoms. Future translational research is needed in this area to examine the effects of other variables, such as the microbiome, on the treatment response to propranolol in those with ASD and co-occurring GI problems.

Impact Statement
The results indicate that examining biomarkers such as autonomic nervous system functioning may provide valuable information for precision medicine efforts in treating GI symptoms in ASD. Further, the results suggest that although a large portion of the treatment response to propranolol may be related to autonomic functioning, other variables may also be important such as the composition of the microbiota. More biomarker-driven translational research is needed in this area so that new treatments can be developed to improve the quality of life in people with ASD.

Are publication metrics valued in determining open access publication impact?

Steve C. Friedman MLIS[1,2]

[1]University of Missouri - Columbia
[2]Bond Life Sciences Center

Objective
The age-old metric associated with traditional print academic journals, the journal impact factor (JIF), is used by some electronic open access journals (OA) to validate relevance. OA has its share of newer metrics, alternative journal impact factors (A-JIFs). Both metric methods receive a fair share of criticism, ranging from the ability for JIFs to be manipulated by publishers, to A-JIF methodologies being statistically unreproducible. Can either method best represent publication value to an ever-increasing OA world? The objective of this review examines the suitability of JIFs and A-JIFs for electronic OA journals and explores whether they serve the same purpose and value they have for traditional print journals.

Methods
A search in scholarly databases maintained by MU Libraries (e.g., PubMed, Scopus), as well as Google Scholar and the web blog The Scholarly Kitchen, produced 21 relevant academic products. Terms were "open access AND impact factor," "alternative metrics," "traditional publishing AND open access publishing." Articles were qualitatively assessed for merit and depth.

Results
Different themes emerge from this examination, central to this is that OA journals approach comparable scientific impact quality to subscription journals, especially in biomedicine. A-JIFs and alternative metrics (e.g., PlumX; Altmetric.com) should be refined to complement, not entirely replace, traditional impact methods like the JIF. Quantitative evaluation and qualitative expert evaluations need to work in tandem to improve publishing metrics. Academic researchers also should develop lists in their fields using qualitative evaluation techniques to measure OA impact.

Conclusion
Research should not be solely published based on highest JIF tabulations or social media posts tabulated through alternative metrics. There is global need for OA since less developed countries in science and technology choose it for publishing. Tenured and untenured faculty need to discuss the current realities of publishing to encourage more fair tenure evaluation plans regarding OA publishing.

Impact Statement
The growth of legitimate open access (OA) publishing means reliable measures for global users are needed to assess both journal and article scholarly value. Current methods like the journal impact factor (JIF) and alternative journal impact factors (A-JIF) are not entirely dependable. Qualitative and quantitative measures will need to be employed and refined to ensure impact factor methods in OA can achieve better validation.

Advancing pain equity in environmental justice community

Mei Rosemary Fu[1,2]

[1]University of Missouri-Kansas City
[2]Department of Nursing and Health Studies

Objective
Environmental justice addresses situations where minority or low-income communities bear disproportionately poor human health outcomes and environmental risks. Research is lacking in identifying poor health outcomes faced by adult residents in environmental justice community where exisiting place-based structural and racial determinants may exacerbate health inequities. This study aimed to examine incidence of pain in an environmental justice community where diverse and marginalized populations reside.

Methods
A cross-sectional design was used to enroll 594 adult residents who resided an environmental justice community. The Brief Pain Inventory-Short Form was used to measure the incidence and impact of pain. Data on demographic and health characteristics, socioeconomic determinants, substance use, and physical activity were collected.

Results
Among the 594 participants, 59.8% were Black and 19.1% Hispanic; 59.2% were women and 38.4% men. The majority (87.5%) had family income below $35,000. Of the participants, 34.8% had pain occasionally, 42.4% had pain frequently or always. High-impact pain that limits life and work activities was reported by 29.2% of the participants who reported pain. Older age, substance use, and less physical activity were predictors of pain.

Conclusion
Comparing the national pain rate of 21% and 8% of high-impact pain, higher incidences of pain and high-impact pain were reported among adults in environmental justice communities where the majority were Black or Hispanic and had financial disadvantages.

Impact Statement
Policies are needed to advance pain equity in environmental justice communities and older adults through community-focused assessments and easy-to-access behavioral interventions for physical activity and substance use.

Advancing reproductive health, the substance use continuum of care, and infectious disease prevention through technology transfer for 30 years

Susan Garrett MPH,[1,2]
Maxine Henry MSW MBA,[1,2] Holly Hagle PhD,[1,2]
Laurie Krom MS,[1,2] Lisa Carter MS LPC LCAC,[1,2]
Kristin Metcalf-Wilson DNP WHNP-BC,[1,2]
Kelly Reinhardt PWP,[1,2] Adam Viera PhD MPH,[1,2]
Jacki Witt JD MSN WHNP-BC FAANP[1,2]

[1]University of Missouri - Kansas City
[2]Collaborative Center to Advance Health Services

Objective
The Collaborative Center to Advance Health Services (CCAHS) has been a leading expert in providing research and best practices for reproductive health; the substance use continuum of care; and infectious disease prevention for three decades. It is headquarters to eight federally-funded national and one international center that provide training and technical assistance (T/TA) to build capacity in systems, organizations, and people - promoting adoption and implementation of evidence-based, culturally responsive practices.

Methods
The CCAHS's technology transfer (TT) model accelerates the diffusion of EBP's into the workforce. TT begins with developing a new technology, then dissemination, and extends into implementation. It requires stakeholders, resources, and activites for translation and adoption. TT is realized through numerous T/TA modalities and is avaliable to healthcare professionals, researchers, community organizations, systems of care, decision-makers, people with lived experience, and others.

Results
The CCAHS's high-quality T/TA has developed and disseminated thousands of tools. The CCAHS creates spaces for collaboration and sharing resources across the U.S. and worldwide. One example is the first known national syndemic solutions summit (2023) - 200 practitioners and five federal agencies. Our poster will demonstrate our model's impact, and we will provide evaluation data.

Conclusion
The CCAHS adds value to systems change in reproductive health; the substance use continuum of care; and infectious disease prevention. However, the need for applied research and education outweighs the resources available. Given the complexity of TT and its numerous networks, it is difficult to conduct empirical studies at this broad level of conceptualization. Rather, we hope to spur research within the processes outlined. Our work in applied science and health services has demonstrated direct value to the scientific, academic, and professional communities. We continue to improve health service delivery through application of scientific advancements to improve our communities' health in culturally responsive and inclusive ways.

Impact Statement
Over 30 years and across the Collaborative Center to Advance Health Services' eight national and international centers, we have trained 300,000+ public health professionals. We have provided up-to-date, evidence-based tools and resources to individuals, organizations, and systems. Through our efforts, an entire network of public and behavioral health stakeholders is able to better serve their communities. The technology transfer model is designed to accelerate the diffusion of an innovation through training and technical assistance.

Influence of sociodemographic factors on parental reporting of ADHD symptoms

Tabish Gul[1]

[1]University of Missouri-St. Louis
[2]Department of Psychology

Objective
Historically, Attention Deficit Hyperactivity Disorder (ADHD) has been observed at a higher rate in boys compared to girls and some traits being more typical for certain ages than others. Furthermore, studies show that parental reporting of psychopathological symptoms plays a significant role in the diagnostic process (Kim et al., 2016) and that its accuracy may be affected by a range of sociodemographic factors (Stokes et al., 2011; Smith, 2007). The current research investigates whether parental endorsement of their children's ADHD symptoms based on the DSM-5 criteria is uniquely influenced by socio-demographic factors while controlling for more objective measures of cognitive self-regulation, such as effortful control.

Methods
The study included a non-clinical sample of parents (N = 132) of children (66 girls and 66 boys; aged 3 to 6 years). It was hypothesized that, after controlling for effortful control (as measured by the Children's Behavior Questionnaire; Putnam & Rothbart, 2006), parent endorsement of ADHD symptoms would be higher for boys compared to girls and higher for younger compared to older children. The data were analyzed using hierarchical multiple regression model, with Effortful Control, Gender, Age, and Age-Gender Interaction as predictors and DSM-5 ADHD symptom endorsement as the outcome.

Results
The model was statistically significant ($F(5, 122) = 7.60$; $p < .001$) showing that controlling for effortful control, parents' endorsement of ADHD symptoms was higher for boys than girls ($\beta = .19$, $p = .02$) and a lower for older than younger children ($\beta = -.24$, $p = .003$).

Conclusion
Sociodemographic variables, such as gender and age may influence parental reporting of ADHD using the DSM-V criteria compared to more objective measures of self-regulation such as effortful control. The study findings emphasize the importance of considering a variety of self-regulation measures to produce a more objective diagnoses of ADHD.

Impact Statement
This research challenges traditional perceptions of ADHD prevalence by revealing that parental reporting of ADHD symptoms, based on the DSM-5 criteria, is significantly influenced by child's gender and age. After controlling for objective measures of cognitive self-regulation, boys and younger children are reported to exhibit higher ADHD symptoms than girls and older children. These findings underscore the necessity of incorporating diverse self-regulation measures to enhance the objectivity and accuracy of ADHD diagnoses.

Mobile assessment of perceived cognition: Development of the mobile everyday cognition scale (mECog)

Greta Hermann,[1,2] Sawyer Harmon,[1,2] Courtney Gann,[1] Rylea Ranum,[1] Sara Farias,[3,4] Andrew Kiselica[1,2]

[1]University of Missouri - Columbia
[2]Clinical Evaluation and Research in Alzheimer's Disease and Related Dementias Lab
[3]University of California - Davis
[4]Department of Neurology

Objective
Over 6 million individuals have Alzheimer's disease (AD), and this number is expected to more than double by 2050. One early indicator of AD is the presence of subjective cognitive concerns (SCC) or self-perceived thinking problems. Precision assessment of SCC is important for early detection, clinical trial recruitment, and symptom monitoring. However, current SCC measurement tools are limited to single-point data collection and may fail to capture perceived fluctuations in cognition due to intrapersonal and environmental factors. Advances in mobile technology and ecological momentary assessment could overcome these limitations; yet there are no currently compatible measures of SCC. Thus, we developed and piloted a mobile version of the Everyday Cognition Scale (mECog).

Methods
31 community-dwelling older adults completed a baseline assessment, including a demographic survey, measures of mental health symptoms, and measures of SCC, followed by once daily mobile device reporting on the mECog for 28 days. We evaluated feasibility, acceptability, and psychometric properties of the mECog.

Results
The average number of assessments completed was 22, and respondents rated the mECog mobile assessment platform as easy to use (M=4.5, Mdn=5, SD=1.02) and non-interfering with daily life (M=1.42, Mdn=1, SD=.58). The test-retest reliability of the mECog was high (ICC =.85 across study, ICC= .83-.87 across all 2-week combinations). We found non-significant correlations with demographics or mental health symptoms, but the mECog demonstrated strong associations with existing versions of the ECog, including the ECog-39 and ECog-12 (r=.59-73, p<.01). Results provide evidence of construct validity.

Conclusion
The mECog is a feasible, acceptable, and highly reliable measure that adequately captures SCC in a mobile assessment environment. The mECog holds promise for improving precision medicine in AD by enhancing early detection, facilitating clinical trial recruitment, and monitoring change in symptoms of over time.

Impact Statement
We utilized accessible mobile assessment technology to develop a measure of subjective cognitive concerns (SCC) in naturalistic environments among older adults with and at risk for Alzheimer's disease (AD). The resulting mobile Everyday Cognition Scale (mECog) had excellent psychometric properties. This tool holds promise for improving precision medicine in AD by enhancing early detection, facilitating clinical trial recruitment, and monitoring change in symptoms of over time.

Role of estrogen receptor alpha and Endothelin-1 in pathogenesis of abdominal aortic aneurysm in male mice

Yijin Huang,[1,2,4] Neekun Sharma,[1-3] Camila Manrique Acevedo[1-5]

[1]University of Missouri - Columbia,
[2]NextGen Precision Health
[3]Department of Medicine
[4]School of Medicine
[5]Harry S. Truman Memorial Veterans' Hospital

Objective
Abdominal aortic aneurysm (AAA) is a potentially lethal vascular disease lacking non-surgical treatments. AAA is associated with decreased estrogen receptor alpha (ERα) expression in the aorta. The significance of this finding and the mechanisms by which lack of ERα signaling contributes to AAA pathogenesis have not been examined. In this investigation, we test the hypothesis that ERα signaling protects against AAA by decreasing endothelin-1 (ET-1) production and regulating inflammation.

Methods
AAA was induced in endothelial cell-specific ERα knockout (eERαKO) male mice and their littermates (ERαFL2) (n=6-11) by administering β-Aminopropionitrile (BAPN) via drinking water (1 mg/ml, 0.15 g/kg/d) 3 days before angiotensin II (Ang II; 1 μg/kg/day) infusion for 2 weeks. Development of AAA was assessed by in vivo ultrasound measurement of aortic luminal dilation. Relevant molecular mechanisms were examined in abdominal aortic tissues, human aortic endothelial cells (HAECs) and mouse bone marrow-derived macrophages (BMDMs).

Results
BAPN/Ang II increased abdominal aortic diameter in ERαFL2 and eERαKO mice compared to control. Lack of ERα further augmented the BAPN/Ang II-induced increase in aortic diameter and AAA incidence compared to ERαFL2 mice. Immunohistochemical staining revealed that BAPN/Ang II co-infusion significantly upregulates ET-1 expression and macrophage infiltration of the abdominal aorta in eERαKO mice compared to ERαFL2 mice. In vitro studies in HAECs demonstrated that treatment with ERα agonist, β-estradiol (100 nM, 24 h), decreases TNFα (15 ng/ml)-induced ET-1 production, while treatment with ERα-specific antagonist, methylpiperidinopyrazole (1 μM, 24 h), increases ET-1 production. BMDMs obtained from the eERαKO mice exhibited increased production of the pro-inflammatory cytokine monocyte chemoattractant protein-1 compared to macrophages from ERαFL2 mice.

Conclusion
Our findings demonstrate a protective effect of endothelial ERα signaling against AAA in male mice likely through decreased ET-1 production and reduced pro-inflammatory macrophage activation of the aorta. Further studies are needed to delineate the crosstalk between endothelial ET-1 with macrophage phenotype and their impact in AAA pathogenesis.

Impact Statement
Our study is innovative as it uncovers a novel molecular mechanism underlying the pathogenesis of AAA. Our data indicate that ET-1 antagonism may represent the readily available clinical approach to ameliorate AAA growth, as estrogen therapy is not a perfect choice of treatment for this male-predominant disease. These findings offer a potential novel treatment strategy for medical intervention to treat individuals afflicted with AAA.

Identification of multi-gene prognostic signatures using a novel exploratory data mining algorithm for stages 2 and 3 colorectal cancer disease-free survival

Justin Hummel,[1,2] Danlu Liu,[1,3] Erin Tallon,[1,2] John Snyder,[1,3] Wesley Warren,[1,5,6,7] Chi-Ren Shyu[1-3] Johathan Mitchem,[1,6,8,10,11] Rene Cortese[1,2,8,9]

[1]University of Missouri - Columbia
[2]Institute for Data Science and Informatics
[3]Department of Electrical Engineering and Computer Science
[4]Department of Statistics
[5]Department of Animal Sciences
[6]Harry S. Truman Memorial Veterans' Hospital
[7]Department of Surgery
[8]Department of Child Health
[9]Department of Gynecology, Obstetrics, and Women's Health
[10]Washington University in St. Louis
[11]Siteman Cancer Center

Objective
Clinicopathological presentations are critical for establishing a postoperative treatment regimen in Colorectal Cancer (CRC), although the prognostic value is low in stage 2 CRC. Implement a novel exploratory algorithm based on artificial intelligence (XAI) to identify multi-gene prognostic signatures by repurposing the FoundationOne Companion Diagnostic (F1CDx) assay.

Methods
Our Artificial Intelligence algorithm uncovers contrast patterns consistent with mutation profiles that benefit CRC patients through stratification into subgroups accounting for genomic and clinicopathological indications relevant to disease-free survival. Our CRC training cohorts for stages 2 and 3 (n=378 patients) were acquired from the cancer genome atlas (TCGA).

Results
Two unique prognostic signatures per subgroup were generated and denoted as either 'mutation-positive' (class01) or mutation-negative (class02). Our approach identified a 32-gene molecular signature for CRC stage 2 and validated it in an independent dataset (GENIE BPC CRC v2.0-public; n=149), resulting in a high precision prognosis (AUC: 0.9524; PPV=0.9737; NPV=0.9231).

Conclusion
Our multi-gene prognostic signatures and NCCN guidelines will improve recurrence predictions in CRC molecular stratification.

Impact Statement
By repurposing the F1CDx assay using an artificial intelligence approach, we identified a 32-gene signature that predicts recurrence in CRC Stage 2 patients with high accuracy (>95%). We have demonstrated the translatability of the FDA-approved F1CDx companion diagnostic to better assess the risk of recurrence in CRC stage 2 patients, with high precision, according to both phenotype and this multi-gene prognostic signature.

Discovery of anti-transforming growth factor beta receptor II (TGFβRII) cyclic peptides

Nurudeen Mohammed Ibrahim[1,2]

[1]University Of Missouri-Kansas City
[2]Division of Pharmaceutical Sciences

Objective

Transforming Growth Factor Beta (TGF-Beta) is overexpressed in various cancers, driving cancer pathogenesis through immunosuppression, angiogenesis, metastasis, extracellular matric remodeling. The study explores the utilization of low molecular weight cyclic peptides, offering advantages like high selectivity, low immunogenicity, and improved tumor penetration to inhibit the TGF-Beta signaling pathway and potentially reverse its cancer-related functions

Methods

An innovative phage display biopanning procedure was used to discover and optimize small cyclic peptides targeting TGF-Beta-RII using an in-house cyclic peptide phage library. Peptides were synthesized via Fmoc solid-phase peptide synthesis. Inhibitory concentrations (IC50) were determined through competitive ELISA and Surface Plasmon Resonance (SPR), followed by in vitro assays assessing binding specificity, serum stability, plasma protein binding, and effects on cancer-associated fibroblast proliferation and migration. The best peptide's antitumor activity was examined in an MC38 subcutaneous colon cancer model in C57BL/6 mice.

Results

Peptides blocking TGF-Beta-1/TGF-Beta-RII interaction were successfully identified. CMCP5R3 peptide, with an IC50 of 300nM in ELISA and 630nM in competitive SPR assays, exhibited the highest blocking efficiency after optimization through alanine scanning. The peptide showed notable serum stability (2.35 hours half-life), binding specificity in TGF-Beta-RII overexpressing cells, and neutralized TGF-Beta-1 induced proliferation and migration of cancer-associated fibroblasts in vitro. In an MC38 mouse model, CMCP5 R3 displayed significant antitumor activity, surpassing a previously developed anti-PDL1 peptide, and was associated with increased CD8+ T-cell infiltration into tumors.

Conclusion

This study identified and optimized a cyclic peptide inhibitor targeting TGF-Beta-1/TGF-Beta-RII interaction. The peptide demonstrated metabolic stability, neutralized TGF-Beta-1 induced effects on cancer-associated fibroblasts and exhibited significant antitumor activity in the MC38 mouse model. These results further support anti-TGF-Beta-RII peptides as therapeutic agents for modulating the tumor microenvironment and treating TGF-Beta dependent cancers.

Impact Statement

Peptide drug therapeutics offer a viable strategy compared to other drugs dominating the market due to their safety, high specificity, and ease of production. Identifying and optimizing CMCP5 R3, a low molecular weight cyclic peptide inhibitor selectively targeting TGFβ1-TGFβRII interaction using phage display, highlights the potential advantages of leveraging therapeutic peptides. This research addresses a critical imperative in cancer therapeutics by targeting the transformative growth factor β (TGFβ) pathway, a pivotal player in cancer progression.

Targeting systemic and central nervous system inflammaging with senolytic agents Dasitinib and Quercetin

Arsh Ketabforoush,[1,2] Meifang Wang,[1,2]
Fereshteh B. Darvishi,[1,2]
Azam Roshani Dashtmian[1,2]
William David Arnold[1-5]

[1]University of Missouri - Columbia
[2]NextGen Precision Health
[3]Department of Physical Medicine and Rehabilitation
[4]Department of Neurology
[5]Department of Medical Pharmacology and Physiology

Objective
Aging is a major risk factor for chronic disease. A major hallmark of aging is the accumulation of senescent cells of which a subset develops a maladaptive phenotype known as the senescence-associated secretory phenotype (SASP). SASP is associated with the secretion of various signaling molecules such as inflammatory cytokines that result in age-related systemic inflammation (inflammaging) and tissue dysfunction. There is recent evidence that senolytics can effectively reduce SASP-cells and mitigate inflammaging. The objective of this project was to investigate the therapeutic impact of D+Q on features of central nervous system (CNS) and systemic inflammation.

Methods
Aged mice (~2 years) were randomized to oral Dasatinib (D, 5 mg/kg) and Quercetin (Q, 50 mg/kg) (n=11) or vehicle (n=8) delivered three consecutive days every two weeks for 12 weeks. Leukocyte Rolling (LR) and Adhesion (LA), indicators of CNS inflammation, were quantified by intravital microscopy (via cranial window). Multiplex assay was used to quantify systemic cytokines and chemokines and investigate correlations with LR and LA.

Results
D+Q treated mice showed nearly 70% LR reduction versus controls (390.4 ± 127.2 vs. 1291 ± 458.4 leukocytes/mm2/min, respectively; $p < 0.001$). LA was not observed in either group. Plasma Multiplex assay demonstrated a significant decrease in the levels of monocyte chemoattractant protein-1 (MIP-1α), and cytokines IL-12p70, and IL-17 in the D+Q versus control ($P<0.05$). Notably, significant correlations ($P<0.05$) were identified between LR and the cytokines IFNγ, MIP-1β, M-CSF, IL-12p40, and IL-13 (r=0.69, 0.68, 0.71, 0.70, and 0.68, respectively) in the D+Q treated mice.

Conclusion
Senolytics significantly reduced age-related systemic and CNS inflammation. The systemic reduction of SASP-related cytokines appears to primarily impact innate rather than adaptive immunity. Future steps will include investigation of the impact of senolytics on neurological function and the relationship between intravital measurements and functional outcomes.

Impact Statement
Dasatinib and Quercetin (D+Q) emerge as promising senolytic agents, demonstrating a remarkable reduction in CNS leukocyte rolling and several systemic cytokines. This study highlights the significant impact of senolytics on innate immunity, with implications for addressing age-related inflammation and tissue dysfunction. The findings pave the way for future investigations into the neurological benefits of senolytic interventions and the correlation between intravital measurements and functional outcomes.

Improving evidence-based practice skills in medical students with novel open-access web-based resource library adjunct to medical school curriculum

Samuel Kim[1,2]

[1]University of Missouri-Kansas City
[2]School of Medicine

Objective

The COVID-19 pandemic has exposed a current lack of evidence-based practice (EBP) across medical specialties. However, reviews on curriculum for EBP in medical training have shown to have poor uptake and response. Even so, EBP was effectively taught if made adjunct to core curriculum during early education. The Dr.eam Journal team has designed digital content that empowers medical students to self-educate through categorized literary libraries formed by peers who filter through and paraphase credible publications on MEDLINE. The purpose of the Dr.eam Journal Company, an educational 501(c)(3) non-for-profit organization, is to provide free online content to medical students, aiming to guide aspiring clinicians in career-long research literacy to promote evidence-based practices. Our methodology translates the current medical literature into concise articles, making the language accessible to non-experts to build habits in engaging research through developmental confidence.

Methods

Our study aims to assess the confidence of medical students in their research literacy and critical appraisal skills after engaging our articles. Current evaluation includes collection of student body opinions at University of Missouri-Kansas City concerning content impact on research literacy confidence. Future evaluation includes nationwide survey statistics from pre-medical and medical programs.

Results

We currently serve 3 pre-medical programs, have over 80 written articles, and have reached over 400 unique visitors on our website. Our writers have consistently reported improved research confidence. Preliminary results demonstrate a 1.4 increase on a 10-point scale in medical knowledge confidence. Current survey-based projects are underway for improved outcome assessment.

Conclusion

Our study demonstrates the utility of a digital library of development-appropriate articles exposing current medical research early in the education of pre-doctoral students for the improved confidence in engaging with research in a meaningful and clinically significant way. This innovative design has preliminary results that demonstrate effective methodology that is transferrable to all major medical schools.

Impact Statement

Medical practice has become decreasingly attentive to implementing research findings in clinical care. As a result, Dr.eam Journal has created a free, online library for medical schools that improves evidence-based practice and research literacy through engaging articles written at an appropriate reading level. The innovative design has already reached several students and programs as an acclaimed service adjunct to medical education that has shown to improve medical knowledge confidence.

Familial adenomatous polyposis gene MUTYH shows high mutation rates in anaplastic thyroid carcinoma

Mikhail Kovalenko,[1,2] Laura M Dooley,[1,3] Nai-Wei Chen,[1,4] Richard D Hammer[1,5]

[1]University of Missouri-Columbia
[2]Institute for Data Science and Informatics
[3]Department of Otolaryngology
[4]Department of Biomedical Informatics, Biostatistics and Medical Epidemiology
[5]Department of Pathology and Anatomical Sciences

Objective
Anaplastic thyroid carcinoma (ATC) is a rare aggressive disease and is unresponsive to typical chemotherapy. Next-Generation Sequencing allows identification of potentially novel targets for precision cancer therapies. MUTYH is associated with some carcinomas, especially in MUTYH-associated polyposis (MAP), but its association with thyroid carcinoma is not defined.

Methods
Exploratory analysis of pathogenic mutations in 727 ATC cases using a 254-gene panel and RStudio and 'arulesViz' R package was conducted for informative maximal frequent patterns among mutated gene combinations to identify gene clusters that include genes not commonly associated with ATC. TCGA database was reviewed for frequency of MUTYH mutations in thyroid carcinoma.

Results
Analysis showed MUTYH short-variant mutations in 17 ATC patients (2.34%). The reported incidence of germline MUTYH variants is 1.43% in normal samples. Six patients (35%) had BRAF co-mutations, which correlates with expected frequency of BRAF mutations in ATC thought to transform from papillary carcinoma. One case had MUTYH mutation as the sole mutation while a second had MUTYH along with TERT and TP53. TCGA database contained 6(0.2%) cases of thyroid papillary carcinoma with MUTYH mutations (total 2871 MUTYH-mutated carcinomas), but no cases of ATC or other thyroid tumors.

Conclusion
MUTYH is a DNA repair enzyme linked to colorectal cancers (CRC) and other cancers. MUTYH mutations occur in 6.7% of MAP patients and 1¬–2.2% of sporadic CRC cases that are mutually exclusive of BRAF mutations. While MAP increases the lifetime risk of CRC by over 60%, the link of MUTYH mutations to thyroid cancer (mostly papillary type) has only been observed in the context of MAP and has not been described outside of it. To our knowledge this is the first description of MUTYH mutations in ATC, especially without concurrent BRAF mutation (11 cases), suggesting MUTYH independently contributes to pathogenesis of ATC in some cases.

Impact Statement
ATC is a rare tumor with an aggressive course and short survival with limited treatment options. We have analyzed the largest genomic data set of ATC ever reported (727 cases) and identified distinct molecular clusters that suggest biological pathways of origin. In addition, this group is being analyzed for novel mutations that may predict pathogenesis and/or be targets for precision drug therapy and drug repurposing.

GPU-accelerated Nextflow pipeline for variant calling applied to human genomics data

Skyler Kramer,[1,2] Mary York,[1,2]
Hong An,[1,2] Lyndon Coghill[1,2]

[1]University of Missouri - Columbia
[2]Bioinformatics and Analytics Core

Objective
As the scale and resolution of biological data rapidly increases each year, it becomes important to repurpose community-validated bioinformatics tools in response to this data volume. Specifically, this can be accomplished by leveraging workflow languages and GPU acceleration. Nextflow is a domain-specific language that supports the development of scalable, reproducible bioinformatics pipelines that process genomics, transcriptomics, and other data types. The objective of this project is to showcase the benefits of leveraging NVIDIA Parabricks – a GPU-accelerated genomics analytics suite – in a Nextflow pipeline for variant calling from short-read sequencing data.

Methods
Two variant calling pipelines were developed with Nextflow DSL2. The first pipeline utilizes the GPU-accelerated version of the Genome Analysis Toolkit (GATK) that is built into the NVIDIA Parabricks software suite, whereas the second pipeline utilizes GATK with CPUs. These pipelines are run in the University of Missouri – Columbia's Hellbender HPC environment, which includes NVIDIA A100 tensor core GPUs. We benchmark these workflows against each other with the NIST-hosted Genome in a Bottle dataset, which includes five human samples. Variant calling is performed with respect to the GRCh38 reference genome.

Results
We show that GPU-accelerated variant calling have a significantly faster runtime than the CPU-based analyses.

Conclusion
These results highlight the benefits of leveraging GPUs for bioinformatics analyses like variant calling. Further, the use of a workflow language like Nextflow has many practical benefits, such as scalability, reproducibility, and efficient resource management. We expect that these benefits will generalize to other bioinformatics analyses that are commonly used in translational biosciences.

Impact Statement
To contend with the rapidly increasing scale and resolution of biological data, it is critical to develop reproducible bioinformatics methods that efficiently and quickly process these data at scale. We perform variant calling with human genomics data to show the relative runtimes between Nextflow pipelines run with and without GPU-acceleration. These results show that the GPU pipeline runs dramatically faster than its counterpart.

RECK and EGFR signaling in metabolic dysfunction-associated steatotic liver disease

Alexa A. Krause,[1,2] Ryan J. Dashek,[1,2] Jack D. Flink,[1] Grace Shryack,[1,2] Christopher L. Taylor,[1] Grace M. Meers,[1,2] B. Chandrasekar,[1,3] R. Scott Rector[1,2,4]

[1]University of Missouri-Columbia
[2]Department of Nutrition and Exercise Physiology
[3]Department of Medical Pharmacology and Physiology
[4]NextGen Precision Health

Objective

Metabolic dysfunction-associated steatotic liver disease (MASLD) was previously called the nonalcoholic fatty liver disease (NAFLD nomenclature). MASLD is characterized by increased fat deposition and inflammation in the liver and is associated with dysregulation of crucial cellular processes affecting the extracellular matrix (ECM). We have previously observed that the expression of Reversion Inducing Cysteine Rich Protein with Kazal motifs (RECK), a key ECM regulatory protein, is negatively correlated with MASLD-associated fibrosis and inflammation (metabolic dysfunction-associated steatohepatitis, MASH). Epidermal Growth Factor Receptor (EGFR) signaling is elevated in MASLD; however, it is unclear whether RECK interacts with EGFR, and modulates its activity in MASLD and MASH development.

Results

Our results in cultured primary murine hepatocytes demonstrated that siRNA-mediated RECK silencing significantly increased amphiregulin (AREG, an EGFR ligand) and EGFR mRNA expression, while adenoviral driven RECK overexpression downregulated AREG and EGFR mRNA expression. In addition, exogenous AREG-induced EGFR activation in hepatocytes, an effect counteracted by EGFR inhibition (EGFRi) and adenoviral RECK overexpression. Western diet (high-fat, -carbohydrate, and cholesterol) feeding in adult male C57BL/6 mice significantly upregulated hepatic AREG and EGFR protein expression; whereas pharmaceutical EGFRi significantly attenuated histological steatosis and hepatocellular ballooning, decreased markers of hepatic stellate cell and Kupffer cell activation (aSMA and PDGFb RNA expression, ($p \leq 05$), and modestly increased hepatic RECK mRNA expression.

Conclusion

Collectively, these data reveal a novel interaction between hepatic RECK and EGFR activation in MASLD and MASH, pathways which warrant further investigation.

Impact Statement

In the present study, we utilize in vitro and in vivo approaches to investigate the interaction of RECK and EGFR in hepatocytes, and how such interactions may further MASH development. In conjunction with previous data from our group highlighting the depletion of RECK with worsening MASLD-phenotype, these data indicate the potential relationship of RECK and EGFR in the progression of MASLD.

Improving long-term cancer survival prognosis with multiomics informed deep convolutional neural architecture and biomarker identification for enhanced health outcomes

Ajay Kumar,[1-3] Shuai Zeng,[1,2] Trupti Joshi[1-7]

[1]University of Missouri - Columbia
[2]MU Institute for Data Science and Informatics
[3]Christopher S. Bond Life Sciences Center
[4]Division of Plant Science and Technology
[5]Department of Electrical Engineering and Computer Science
[6]Department of Biomedical Informatics, Biostatistics, and Medical Epidemiology
[7]NextGen Translational Bioinformatics

Objective
The primary aim is to enhance long-term cancer prognosis accuracy by developing a multiomics-informed deep neural network model, leading to improved health outcomes and biological understanding.

Dataset
The study uses multiomics data from 23 Cancer Genome Atlas cancer studies, including SNPs, gene expression, CNVs, protein levels, DNA methylation, and RNA sequencing. Binary classification predicts long term survival (over 3 years).

Methods
A deep convolutional neural network (CNN) with dense layers performs binary classification to predict survival. Optuna's hyperparameter optimization uses techniques like grid search and quasi-Monte Carlo sampling. An in-house model called G2PDeep multicnn is introduced and compared to other machine learning models.

Results
The multicnn model outperforms other models, especially for skin cutaneous melanoma predictions. Mapping highly predictive multicnn biomarkers to the KEGG pathway database strengthens understanding of biomarkers' prognostic role.

Conclusion
Integrating multiomics data improves model performance metrics like AUC-ROC and F1-scores. The G2PDeep multicnn surpasses traditional machine learning methods in accuracy and exhibits state-of-the-art performance for long-term cancer prognosis. Findings reinforce links between molecular biomarkers and cancer survival. The approach enhances prognosis reliability, supporting improved patient outcomes and biological understanding. Link https://g2pdeep.org/ (Earlier version, we worked to extend this project for multi-omics cancer data).

Impact Statement
Discovering Biomarkers Responsible for Underlying Causal Factors in across cancer studies with Implications for Human Health.

Cardiac Function in an Aging Osteogenesis Imperfecta Murine Model

Brittany Lafaver,[1] Maike Krenz,[1,2] Li Lee,[1,3] Lixin Ma,[1,4] Timothy Domeier,[1,2] Charlotte L Phillips[1,5]

[1]University of Missouri - Columbia
[2]Department of Medical Pharmacology and Physiology
[3]Department of Physics and Astronomy
[4]Department of Radiology
[5]Department of Biochemistry

Objective

Osteogenesis imperfecta (OI) is a heritable connective tissue disease that affects 1:10,000 births. OI patients often present with brittle bones and scoliosis. Recent investigations have begun to elucidate the presence of inherent muscle weakness and cardiopulmonary complications. Echocardiographic clinical studies suggest that diastolic dysfunction in the OI patient population is common, often presenting as valvular regurgitation with dysfunction increasing with age. Of the extracellular matrix (ECM) in the heart myocardium, approximately 85% is type I collagen, which has been shown to be important in maintaining the structural integrity of the myocardium. Whether the presence of reduced or abnormal collagen levels alters cardiovascular health in OI patients has not been largely studied, but cardiovascular complications are thought to be the second leading cause of death in OI. The OI patient population has an increased risk for heart failure compared to healthy individuals.

Methods

The osteogenesis imperfecta murine (oim) model represents severe OI in its homozygous form. In the present study wild-type (Wt) and oim littermates were aged to 18-months-old and assessed for survivability as well as in vivo cardiac function using echocardiography.

Results

Male oim mice had a survival of roughly 50% by 18 months compared to 85% of Wt littermates, while female mice experienced the same rate of death events regardless of genotype (90% for wt and 85% for oim). Echocardiography studies revealed cardiac dysfunction in male oim mice, with decreased left-ventricular fractional shortening and presence of aortic regurgitation. Female oim and Wt mice had normal left-ventricular fractional shortening and minimal aortic regurgitation.

Conclusion

Overall, our data indicate that 18-month-old male oim mice have cardiac dysfunction, while female oim mice exhibit no differences compared to their Wt littermates. Further studies are required to identify mechanisms behind this sex-specific cardiac dysfunction in oim.

Impact Statement

As the OI patient population ages, the potential for developing cardiac abnormalities is an important risk factor for premature death. Elucidating in vivo cardiac function using a mouse model of OI will aid in our understanding of the pathophysiology of a type I collagen defect and the role sex has in the development of heart failure. We hope to help guide clinicians in understanding and approaching potential cardiac dysfunction in the OI population.

Self-reported quality of life in developmental language disorder

Caroline Larson[1]

[1]University of Missouri - Columbia
[2]Department of Speech, Language and Hearing Sciences

Objective
Developmental language disorder (DLD) is a highly prevalent neurodevelopmental condition characterized by primary deficits in language (Bishop et al., 2017; Norbury et al., 2016), as well as lifelong challenges in academic, vocational, and social-emotional outcomes (Durkin & Conti-Ramsden, 2012; Le et al., 2021; Whitehouse et al., 2009). Recently, there have been calls for research characterizing self-reported quality of life in adults with DLD (e.g., neurodiversity advocates), yet current state of the literature is in a nascent stage. Our objective was to begin to characterize self-reported quality of life in DLD and factors contributing to wellbeing.

Methods
We administered a standardized language assessment to determine DLD group eligibility (n = 5), and Qualtrics surveys that included an experimental measure of morphosyntax (an area of disproportionate weakness in DLD), self-report measures of quality of life, and self- and parent- report measures of risk factors, such as sociodemographics and health, to DLD individuals and a control group of neurotypical peers (n = 20).

Results
The DLD group did not report poorer quality of life than neurotypical peers. Performance on the morphosyntax task, however, suggested that individual differences in language were associated with self-reported happiness, ability to be oneself, and the degree of sensory barriers and support in their environment. Nonverbal abilities appeared to be a stronger risk factor than sociodemographics or health, yet participants with remarkable health histories (e.g., neonatal intensive care, jaundice as infants) reported quality of life concerns, including barriers to general happiness and educational experiences.

Conclusion
Findings suggest an important role for individual differences in language skills in self-reported quality of life to a greater degree than DLD status, particularly for happiness, social function, and barriers versus support in their everyday functioning. In addition to language, nonverbal skills and health factors should be considered in overall wellbeing in DLD.

Impact Statement
Adopting a neurodiversity perspective, this study begins to characterize quality of life in developmental language disorder (DLD), a highly prevalent, yet underserved neurodevelopmental condition. This preliminary study suggests that individual differences in a key area of language weakness in DLD, as well as risk factors related to nonverbal abilities and health history, may contribute to poorer self-reported quality of life. These preliminary findings provide direction for future research and guidance for clinical practice.

E7-conjugated multifunctional nanofibrous microspheres for guided alveolar bone regeneration

Qian Li,[1] Xiaohua Liu[1]

[1]University of Missouri Chemical Biomedical Engineering

Objectives

The goal of this review is to investigate maternal mortality rates (MMR) in African countries. Because the MMR of Black women in the United States is 3-5x higher than in White women, this study aims to identify if a similar racial disparity is present in Africa. It also explores factors contributing to high MMR including socioeconomic status, age, comorbidities, ethnicity, and access to healthcare.

Methods

Nanofibrous hollow gelatin microspheres (NFHMS) were fabricated via combining double emulsification technique and thermally induced phase separation process. E7 peptide, a short peptide that selectively promotes BMSC adhesion, was conjugated onto the surfaces of NFHMS. Bone forming peptide (BFP)-loaded calcium phosphate (CaP) nanoparticles were encapsulated into NFHMS-E7 to form NFHMS-E7-CaP/BFP. The NFHMS-E7-CaP/BFP were implanted in a rat mandibular periodontal intrabony defect and harvested to examine alveolar bone regeneration.

Results

NFHMS-E7-CaP/BFP selectively promoted adhesion of BMSCs and expelled adhesion of fibroblasts and epithelial cells. The BFP was sustainedly released from NFHMS-E7-CaP/BFP. The expression levels of osteogenic markers in NFHMS-E7-CaP/BFP were significantly higher. More calcium was deposited in the NFHMS-E7-CaP/BFP. After implanted into a rat periodontal bone defect for 8 weeks, the distance from cemento-enamel junction to alveolar bone crest in the NFHMS-E7-CaP/BFP was the shortest. In addition, the NFHMS-E7-CaP/BFP group had the highest ratio of bone volume fraction and bone mineral density.

Conclusion

Multifunctional injectable microspheres NFHMS-E7-CaP/BFP, which conjugated E7 on the surfaces and encapsulated CaP/BFP in the hollow core of the microspheres, were synthesized and characterized in this work. The E7-modified multifunctional microspheres served as an excellent biological barrier for guided alveolar bone regeneration.

Impact Statement

We report the design and fabrication of multifunctional nanofibrous hollow microspheres (NFHMS) for enhanced alveolar bone regeneration. Conjugate E7 peptide onto the surfaces of NFHMS and encapsulate CaP/BFP nanoparticles in the hollow space of NFHMS-E7. Selectively promote the adhesion of BMSCs and expelled the adhesion of fibroblasts and epithelial cells, and spatially and temporally controlled delivery of the BFP from NFHMS to effectively enhanced the osteogenesis of BMSCs in vivo for alveolar bone tissue regeneration.

Assembling nanofibrous microspheres into 3D matrices for alveolar bone regeneration

Yingzi Li,[1] Xiaohua Liu[1]

[1]University of Missouri-Columbia

Objectives

Alveolar bone regeneration generally needs the guidance of biomaterials. Injectable biomaterials are attractive for the regeneration of irregular shapes of alveolar bone defects. As a new type of injectable biomaterials, functional microspheres possess advantageous features compared to other injectable biomaterials (e.g., hydrogels). However, one limitation is the migration of microspheres outside the defective area, leading to the risk of potential adverse events. In this work, we prepared nanofibrous and photo-crosslinkable functional gelatin-based microspheres as a new type of injectable biomaterials and used them for alveolar bone regeneration. Photo-crosslinkable double bonds on the nanofibrous microsphere surfaces assembled the microspheres into well-defined 3D matrices, thus preventing microsphere migration. In addition, a bone forming peptide (BFP) was loaded to enhance its osteoinductivity.

Methods

BFP was encapsulated into calcium phosphate (CaP) nanoparticles, which were subsequently added to gelatin methacryloyl (GelMA) solution. Then adding solution mixture was added in mineral oil to form a microemulsion. A thermally induced phase separation (TIPS) process was induced by pouring the mixture into isopropanol/hexane/ethanol mixture. The obtained microspheres were crosslinked at 4°C for 24 h to stabilize the nanofibrous microspheres. To form well-defined 3D matrices, the microspheres were stacked and photo-crosslinked with UV light irradiation. The mechanical properties, encapsulation efficiency, BFP release, biocompatibility, and mechanical stability were measured.

Results

GelMA microspheres composed of gelatin nanofibers (diameter of approximately 63-90μm) were fabricated. Photo-crosslinking of the microspheres under a mild condition (e.g., under the condition of 100 mW/cm2 UV intensity and a time of 30 seconds) formed a stable microsphere-based 3D matrix. The biomimetic matrix promoted bone marrow stem cell adhesion, migration, and proliferation. Furthermore, photo-crosslinking effectively prevented microsphere migration.

Conclusion

The biomimetic 3D matrix assembled from nanofibrous GelMA microspheres serves as a promising cell carriers and drug-delivery vehicles for alveolar bone regeneration.

Impact Statement

This research provides an innovative method for improving alveolar bone regeneration from a mechanical perspective. We developed nanofibrous microspheres with photo-crosslinkable double bonds on the surfaces, through which the microspheres can be assembled into well-defined three-dimensional matrices to effectively prevent microsphere migration. Loaded with bone-forming peptide, the matrices can enhance alveolar bone regeneration.

The effect of risk behaviors on lymphedema among breast cancer survivors

Bowen Liu[1]

[1]University of Missouri-Kansas City

Objectives

Among the 3.8 breast cancer patients in the United States, 1 in 4 of them are affected by lymphedema. Lymphedema has no cure and is caused by irreversible damage from cancer treatment (e.g., surgery, radiation) to the lymphatic system. In clinical practice, patients are usually instructed to prevent lymphedema by avoiding risk behaviors (e.g., lifting objects, carrying shoulder bags, infection, sunburn, cutting cuticles, oil splash burn). This study aimed to examine the effect of risk behaviors on lymphedema.

Methods

A cross-sectional design was used to enroll 567 patients from a metropolitan cancer center. The Lymphedema-Related Behaviors was used to assess risk behaviors. Data on demographic and clinical information were also collected. A factor analysis was conducted to elucidate the structure of risk behaviors. Bivariate and regression analyses were performed.

Results

Patients who practiced more than five risk behaviors are significantly associated with a higher odd of lymphedema (OR = 1.81, 95% CI = 1.32-2.50, $p<0.001$). Bivariate analysis suggested that the patients with the experience of infection (OR = 2.58, 95% CI = 1.95-3.42, $p<0.001$), cuts or scratches (OR = 2.65, 95% CI = 1.97-3.56, $p<0.001$), sunburn (OR = 1.89, 95% CI = 1.39-2.56, $p<0.001$), oil splash burns or steam burns (OR = 2.08, 95% CI = 1.53-2.83, $p<0.001$), and insect bites (OR = 1.59, 95% CI = 1.18-2.13, $p<0.001$) were associated with higher odds of having lymphedema. The factor analysis revealed a two-factor risk behavior structure: risk behaviors leading to skin injury and risk behaviors requiring heavy lifting or carrying objects. The subsequent logistic regression suggested that risk behaviors leading to skin injury was associated with a higher odd for lymphedema (OR = 1.90, 95% CI = 1.47-2.47, $p<0.001$).

Conclusion

Infection and risk behaviors leading to skin injury are significant risks of lymphedema for patients treated for breast cancer.

Impact Statement

Research has demonstrated a psychological burden and anxiety placed upon breast cancer patients induced by the avoidance of risk behaviors and the associated unscientifically founded fear of resultant lymphedema. Our study provided much needed evidence that risk behaviors leading to skin injury are risks of lymphedema. Such findings will lessen patients' burden and anxiety by providing a evidence-based foundation for targeted behavioral intervention that emphasizes the importance of preventing risk behaviors leading to skin injury.

Mechanical and biological characteristics of materials for a sinus implant

Stefan Lohfeld,[1] Roland Klar,[1] Naren Raja[1]

[1]University of Missouri-Columbia

Objectives

The loss of premolar and molar teeth in the maxilla regularly leads to bone loss and subsequent sinus pneumatization. A bone height of less than 5mm in the maxilla indicates the need for bone regeneration prior to implant placement and/or loading via the lateral window sinus lift technique. During this procedure the sinus membrane is detached from the bone to create a space for new bone formation. The manual elevation of the membrane often leads to its perforation, which occurs in up to 60% of membrane elevations. Perforations create a 3x higher risk of implant failure, a 6x higher risk of sinus infection for the patient, and in some cases require to abort the surgery immediately and to wait until the membrane has healed, causing substantial delay for the dental treatment. To reduce manual membrane handling and risk of perforation, we are developing an implant that carefully detaches and lifts the membrane without significant manual interaction with the tissue. The objective of the current research is to determine mechanical properties and biocompatibility of the chosen implant material.

Methods

Samples were created from PCL/TCP composites with ratios between 3:2 and 3:1. Mechanical testing was performed using samples in shape of envisaged designs for the implant on an Instron universal testing machine with a 30kN load cell in air. Biocompatibility testing was performed using disks in direct contact with osteogenic cell line OmGFP66 for up to 28 days.

Results

Mechanical test showed the elasticity of the samples being reduced with decreasing PCL/TCP ratios. Short-term biocompatibility assays did not reveal any cytotoxic effects from the chosen materials. Long term cultures in presence of the materials revealed a clear exponential increase in cellular formation.

Conclusion

Increasing TCP amounts may benefit new bone formation but impact the implant's end height after unloading in situ.

Impact Statement

The development of the proposed implant can help to simplify lateral window sinus lift procedures and reduce the prevalence of membrane perforations. This can reduce the failure rate of dental implants that replace premolar and molar teeth were a sinus lift had to be performed prior to implant placement.

Variable cardiac filling time accompanied by poor heart function in some with atrial fibrillation in real-time magnetic resonance imaging

Zhijian Luan 1, Ummul Afia Shammi,[2] Joanne Cassani,[2] Talissa A. Altes,[3] Robert P. Thomen,[2,3] Steven R. Van Doren[2]

[1]University of Missouri-Columbia
[2]Department of Biological, Biomedical and Chemical Engineering
[3]Department of Radiology

Objectives

Atrial fibrillation (AFib) is common and increases the risk of stroke and myocardial infarction. Electrocardiograms are used to diagnose AFib, but do not visualize it. Real-time cardiac MRI (rtCMR) was recently shown effective in visualizing the irregular cardiac cycles of AFib. We developed software to measure the durations of the cardiac cycle and its filling time in dynamic rtCMR images without requiring sinus rhythm. Study subjects with a history of AFib vary from sinus rhythm to severe arrhythmia and apparent heart failure.

Methods

Real-time cardiac MRI scanning of 40 subjects was sponsored by AHA and the MU Coulter Partnership. Analysis software was developed in Python. It produced cardiac-time courses, measured and assessed the lengths of heartbeats and their filling times from short-axis slices. Heart function was assessed using an estimate of ejection fraction (using ImageJ) at a single short-axis slice position. Our custom software identified abnormal long or short beats and collected them for visualization.

Results

The variability of filling time (FT) and ejection fraction (EF) shows a moderate correlation (Pearson's r = -0.4). The case study shows the worst case of heart irregularity is accompanied by poor heart contraction (highly variable filling time= andEF <30%), suggesting heart failure. Nine subjects have multiple pairs of abnormally long and short beats which could be evidence of another common arrhythmia called premature ventricular contractions (PVCs), e.g, a subject with 5 pairs of short and long beats. Our software's reporting on subjects such as these will be shown.

Conclusion

By taking advantage of our new software to analyze rtCMR, we identified subjects with a history of AFib ranging from healthy sinus rhythm to severe arrhythmia and heart failure. We also found evidence of PVCs, another common arrhythmia.

Impact Statement

Common cardiac arrhythmias of AFib and PVC have been semi-automatically identified and visualized. This included heart failure accompanying severe AFib. New software interpretation of real-time cardiac MRI offers potential to enhance diagnostic insight into arrhythmias.

Empowering Covid (SARS-CoV-2) virus genomics surveillance for Missouri using data analytics and integration portals

Zhen Lyu,[1] Christopher Bottoms,[3] Matthew Sinn[4], Joshua Featherston,[4] Kate Cleavinger,[4] George Turabelidze,[4] John Bos[4], Melissa Markham,[2] Nathan Koffarnus,[2] Trupti Joshi[3]

[1]University of Missouri-Columbia
[2]Missouri Department of Health and Senior Services
[3]MU Institute of Data Science and Informatics
[4]Dicision of Community and Public Health

Objectives
To enhance understanding of SARS-CoV-2 prevalence in Missouri, we collaborated with the MO Department of Health and Senior Services and MO State Public Health Laboratory. Our objective was to design a bioinformatics data analytics pipeline and a Covid-19 Genomics Surveillance Portal to provide local authorities with real-time, detailed information.

Methods
The analytics pipeline incorporates sequence and variant effect annotations, phylogenetic and cluster analyses, and geospatial mapping. Using SARS-CoV-2 genome sequencing data from patient specimens, the pipeline aims to identify genetic variations, assess demographic trends, and determine similarities to other variants.

Results
The Covid-19 Genomics Surveillance Portal (https://dataportals.missouri.edu/SARSCoV2) integrates information of all sequenced samples from MSPHL with analyzed results for other samples from commercial labs. It provides details about variant proportions, trends of variants of concern (VOC) over period, variants by county, and frequency of top 10 mutations in S gene. The portal is updated weekly, and data is submitted to GISAID. Additional data analytics are underway for studying mutation patterns and hotspots observed in the different variants for understanding future trends.

Conclusion
By leveraging data analytics and integration portals, Missouri can proactively monitor and respond to the evolving dynamics of the COVID-19 virus. The project's outcomes enhance public health management and preparedness for future infectious disease challenges.

Impact Statement
In collaboration with the MO Department of Health and Senior Services and MO State Public Health Laboratory, our project aimed to deepen understanding of SARS-CoV-2 prevalence in Missouri. Through a sophisticated bioinformatics analytics pipeline and the Covid-19 Genomics Surveillance Portal, we provided real-time, detailed information to local authorities. The portal integrates sequenced samples, offering insights into variant trends, county-specific data, and top mutations. Our outcomes empower proactive monitoring and fortifying public health management.

Relationship between amygdalar functional connectivity and camouflaging in young adults with autism spectrum disorder

Jane Manson[1,2], Nanan Nuraini,[3] Carrina Appling,[3] Bradley Ferguson,[3,5] David Beversdorf[3,4]

[1]University of Missouri-Columbia
[2]Thompson Center for Autism and Neurodevelopment
[3]Cognitive Neuroscience Labaratory
[4]Department of Psychological Sciences
[5]Department of Radiology

Objectives
The social deficits which characterize autism spectrum disorder (ASD) are correlated with abnormal functional connectivity (FC) and structure of the amygdala. Several studies to date have shown links between abnormal amygdalar FC and the presence and clinical severity of ASD. To minimize the impact of social deficits, many autistic people camouflage, or attempt to hide autistic traits. This study aims to conduct a novel analysis of how autistic camouflaging and resting-state FC in the amygdala are related. We hypothesize that the two will be correlated, though the nature of this relationship is unclear.

Methods
The sample contained 14 participants, primarily white males, aged 18-27 (M=21.8) diagnosed with ASD. Functional connectivity was assessed in the resting-state with a twelve-minute fMRI scan. During the scan, participants were asked to lay still with their eyes closed and were not presented with a stimulus. Camouflaging was assessed using the Camouflaging Autistic Traits Questionnaire (CAT-Q), which contains 25 questions with responses on a seven-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). It is comprised of three subscales: compensation, masking, and assimilation.

Results
Preliminary analyses found that higher scores on the CAT-Q were associated with weaker connectivity between the right amygdala and the middle temporal gyrus as well as between the left amygdala and both the Central Opercular Cortex left and Insular Cortex right. Higher scores on the CAT-Q were also associated with stronger connectivity between the left amygdala and superior lateral occipital cortex.

Conclusion
The relationships found between fc in areas of the brain important for social communication and camouflaging were heterogeneous. Future studies should aim to recruit more females and people of color to examine if these effects hold for a more diverse sample.

Impact Statement
While camouflaging can be adaptive to secure employment and education, it is also linked to negative mental health outcomes, including higher stress, exhaustion, anxiety, and depression. Camouflaging is more common in females, and often impedes them from acquiring diagnoses and consequently accessing appropriate resources. Expanding the understanding of the neural networks underlying ASD is important for diagnostic purposes and as predictors for outcomes related to camouflaging.

G-quadruplex formation in RNA aptamers selected for binding to HIV-1 capsid

Miles D. Mayer,[1] Paige R. Gruenke,[4] Rachna Aneja,[2] Zhenwei Song,[3] Donald H. Burke,[3] Xiao Heng,[2] & Margaret J. Lange[3]

[1]University of Missouri-Columbia
[2]Department of Biochemistry
[3]Department of Molecular Microbiology and Immunology
[4]Christopher S. Bond Life Sciences Center

Objectives
The HIV-1 capsid (CA) is an important target for both better understanding virus-host dynamics and development of CA-targeting therapeutics. To accomplish its various roles in HIV replication, CA assumes distinct assembly forms presenting unique, solvent-accessible surfaces. However, the roles of these forms in replication and virus-host interactions are not well understood, as there are limited tools for their study. We have identified RNA aptamers capable of binding CA assembly forms. Notably, the aptamers have been demonstrated to bind biologically relevant forms of CA and a subset of those evaluated have been shown to inhibit viral replication. To further develop these aptamers as tools to study CA, it is important to understand aptamer structural elements. Here, we apply instrumental, biochemical, and thermodynamic approaches to clarify representative aptamer architectures, their stability, and the potential moieties that may be necessary for CA binding affinity.

Methods
To investigate aptamer structure, we applied an innovative combination of technologies including circular dichroism spectrophotometry, UV melting, thermal difference spectra, nuclear magnetic resonance spectroscopy, rG4-specific fluorescence assays, filter binding assays, nuclease digestion, Van 't Hoff analysis, and Lagrange interpolation.

Results
We provide data to support the stable formation of RNA G-Quadruplex (rG4) structures within multiple CA-binding aptamers using a progressive combination of the methodologies outlined above.

Conclusion
rG4 motifs are especially promising for downstream applications of these aptamers due to their high thermostability, their amenability to biosensor and microscopy applications, and the availability of rG4 structure-specific dyes. The rG4 motifs present within these aptamers may be utilized to examine CA assemblies in cells, identify accessible and potentially therapeutically targetable binding sites on different CA assemblies, and identify novel CA assembly form binding host factors.

Impact Statement
HIV-1 capsid (CA) plays several key roles in viral replication but is an elusive target for study. Here we present RNA aptamers shown to bind and, in some cases, inhibit HIV-1. By having identified certain binding moieties within these aptamers, it is possible to develop improved methods for the investigation of CA binding sites and CA-host interactions, as well as assist in the development of much-needed therapeutic tools.

Profiling the peptide composition of a biological fluid by MALDI-ToF MS

Stephen Mensah[1]

[1]University of Missouri-Columbia

Objectives
Saliva is a potential biomarker source. Biomarkers have been identified in saliva for Alzheimer's disease, multiple sclerosis etc. This study, therefore, focused on the identification of proteins in human saliva using MALDI-ToF mass spectrometry using nine different matrices: dihydroxybenzoic acid, 2-cyano-3-(2-thienyl) acrylic acid, 1,5-diamminonaphthalene, 5-amino-1-naphthol, 2,5-dihydroxyacetophenone, 2,6-dihydroxyacetophenone and hydralazine

Methods
The study employed quick acid digest to produce peptides which were then subsequently analyzed to produce a mass spectrum. The spectra were then processed, and a peak list was generated and submitted to MASCOT database for protein identifications.

Results
Of the nine matrices five of them were able to yield useful peptides for protein identification. Amongst them, 1,5-diamminonaphthalene shows promise as a useful matrix that may be able to successfully identify proteins in human saliva.

Conclusion
MALDI-ToF MS with 1,5-diamminonaphthalene as matrix can be a potential technology that may serve as a noninvasive approach for identifying biomarkers in human saliva.

Impact Statement
This research if advanced can revolutionize the detection of biomarkers in the clinical diagnosis and treatment of diseases

The stress and coping framework for the development of type 2 diabetes mellitus

Joshua Minks PhD, NP-C[1]

[1]University of Missouri-St. Louis

Objectives
To develop a framework that incorporates the influence of psychological stress and coping measures on established risk factors for the onset of type 2 diabetes mellitus.

Methods
The framework resulted from literature review and a research study. The literature review focused on the impact cortisol and established risk factors have on insulin resistance. The study examined the influence of stressful life events on the development of type 2 diabetes; three theories guided the study: Selye's General Adaptation Syndrome, Lazarus and Folkman's theory of Stress, Appraisal, and Coping, as well as McEwen's Allostatic Load Theory.

Results
The influence of stress and coping measures can have consequential effects that amplify or mitigate the risk posed by established risk factors such as advancing age and weight management. Distress from events associated with advancing age and weight management can directly and chronically influence HbA1c levels secondary to insulin resistance as a result of unresolved stressors.

Conclusion
A clinical approach to type 2 diabetes management and prevention should include an assessment of stress appraisal and coping measures to complement traditional approaches for glucose management.

Impact Statement
The most recent census data reveals that the number of diagnosed cases for all diabetes increased by 12.4 million between 2007 and 2021; if considering 90% of all cases of diabetes are type 2 diabetes, an average greater than three-quarters of a million people were diagnosed each year. Contemporary glucose management strategies focus on "glucose displacement" or weight management with physical, dietary, and medicinal approaches. What impact could stress management have?

Virtual combinatorial DNA-encoded library generation, docking and distance constraint-based screenings for predicting potential SIRT6 activators

Akhila Mettu,[1] Dmitri Kireev[2]

[1]University of Missouri-Columbia
[2]Department of Chemistry

Objectives

SIRT6, an NAD+-dependent enzyme within the Sirtuin family, possesses crucial chromatin regulatory functions and has been implicated in aging, cancer, and metabolic diseases. The project aims to identify potent and selective SIRT6 activators, with the potential to serve as novel therapeutics for promising therapies. The design approach is targeted to prioritize ligands from the meticulously curated virtual library demonstrating no unfavorable contacts with the substrate at its binding site, thereby enhancing the identification and selection of promising SIRT6 activators.

Methods

A comprehensive three-step chemical enumeration was performed on 297 amino and 922 carboxylic acid groups-based building blocks, along with amino uridine molecule, employing RDKit and Python, resulting in the generation of a virtual chemical library, representing the possible products from these reagents. Subsequently, this library was docking at the active site of SIRT6 using the Maestro application of Schrodinger drug discovery suite. Post-docking, the distance constraints-based Python script was applied to process the docking poses, prioritizing ligands based on their adherence to predefined distance constraints.

Results

The chemical enumeration process applied to amino and carboxylic acid building block reagents produced an extensive virtual library, totaling 269,217 unique compounds. These libraries were then docked to identify the energy-minimized best pose for each molecule and then the 3D coordinates of these poses were utilized to run a distance-based python script, which identified ligands exhibiting close contacts (<1.5 Ao) with substrate atoms, deemed to be undesirable (bad ligands) and excluded from further consideration, while ligands with no unfavorable interactions were selected for in-depth analysis.

Conclusion

This study successfully generated a DNA-encoded virtual library utilizing the proposed building blocks and systematically processed the compounds for their potential to minimize unfavorable interactions with SIRT6 substrate, and thereby proposing these novel compounds for SIRT6 activation.

Impact Statement

In the endeavor to construct a DNA-encoded virtual library, employing proposed building blocks a library with a size of 269,217 was generated. Comprehensive docking studies and post-docking processing employing Python-based distance constraint script were applied to meticulously identify ligands with minimal substrate interference. The culmination of these steps forms a robust methodology for the generation, screening, and post-docking analysis of a DNA-encoded virtual library, to identify ligands that could act as potent Sirt6 activators.

Reversal of clinical death by intra-arterial infusion of phospholipid nanoparticles (VBI-1)

Stephen Mishriky,[1] Philemon Shallie,[1] Prashanth Anamthathmakula,[1] Cuthbert Simpkins[1]

[1]University of Missouri-Kansas City

Objectives

To restore breathing and maintain survivable blood pressures (BP) in rats through the use of nanoparticle solutions (VBI-1, VBI-S) after clinical death (CD) induced by hemorrhagic shock.

Methods

Male and female Sprague Dawley rats were divided into four groups (n=6). The rats were anesthetized with isoflurane, followed by cannulation of femoral arteries. Blood was withdrawn over two minutes until respiration ceased. Equal volumes of either Ringer's Lactate (LR), shed blood, VBI-1, or VBI-S were infused over one minute, with continuous monitoring of BP.

Results

Loss of respiration occurred with blood withdrawal ranging from 39.8% to 43.2% of the predicted total blood volume. After intra-arterial infusion, the survival rates of the four groups for 240 minutes were as follows: 100% with VBI-1 (n=6), 83.3% with blood (n=7), 66.7% with VBI-S (n=6), and 0% with LR (n=6). Two-way ANOVA analysis revealed a significant difference in mean arterial pressure (MAP) among the four fluids (p=0.0004). Post-hoc analysis indicated the fluid responsiveness in elevating MAP as follows: VBI-1 > VBI-S = shed blood > LR. Regarding the VBI-1 infusion routes, intra-arterial infusion demonstrated 100% survival (n=6) compared to intra-venous infusion with 40% (n=6) survival.

Conclusion

VBI-1 outperformed all other fluids, including blood, in achieving reanimation and elevating MAP. Intra-arterial infusion of VBI-1 demonstrated a higher reanimation rate compared to intra-venous infusion. Based on these findings, VBI-1 is a promising new treatment for CD due to severe hemorrhagic shock, potentially saving numerous lives.

Impact Statement

Ninety percent of deaths from potentially survivable injuries on the battlefield are attributed to hemorrhagic shock, leading to clinical death with the loss of pulse and respiratory drive before reaching a surgeon. However, currently available fluids are inadequate for rescuing exsanguinated warfighters and are capable of reperfusion injury in vital organs. Thus, we evaluated the effectiveness of two phospholipid nanoparticle formulations (VBI- 1, VBI-S) and compared intra-arterial versus intra-venous infusion on reanimation.

Exploring arm kinematics contribution to the arm stiffness modulation during an overground physical human-robot interaction task

Mohsen Mohammadi Beirami[1]

[1]Missouri University of Science and Technology

Objectives

The aim of this study is to investigate to which extent human arm kinematics influence arm stiffness modulation during an overground physical human-robot interaction (pHRI) experiment. In our earlier study, we conducted experiments in which human participants, while blindfolded, were directed by our robot designed for the Overground Physical Human-Robot Interaction Experiment (OPHRIE), along various trajectories and force interactions. Previous findings revealed that, in uncertain interactions, humans tend to reduce the stiffness of their arms to enhance their sensitivity to the partner robot's movement. However, a question remained unanswered, how much of the arm stiffness modulation was due to arm kinematics or muscle activation?

Methods

To investigate arm kinematics, elbow, and shoulder angles over entire trials of four subjects were obtained from the motion capture data of the pHRI experiment. For each joint angle time series, we focused on investigating the modulation of the joint angles at the onset of the perturbation as well as the average of the angles over approximately one stride period just before the onset. Then, we used a linear mixed-effect model to examine the effect of subjects, blocks, and conditions.

Results

It was found that arm kinematics modulation contributed minimally to arm stiffness modulation. We found that no significant differences exist across the conditions as different metrics demonstrated different levels of significance. Furthermore, elbow angles (Onset and Average) increased as the block number increased, while shoulder angles did not show this trend. Subject variability had a significant impact on both elbow and shoulder angles, with subject variability being the primary reason for the variability in shoulder angles.

Conclusion

These results imply that arm kinematics in overground physical Human-Robot Interaction tasks do not highly contribute to arm stiffness modulation and suggest that arm stiffness modulation may be primarily achieved through muscle activation.

Impact Statement

Physically interactive robots are developed to aid rehabilitation in centers for injured individuals, support the mobility of the elderly, and assist those with limited capabilities. Their application extends to workplaces where direct or indirect physical interactions occur between humans and robots, showcasing their versatility in various settings.

General proprioceptive pathway pathology in a canine disease model of amyotrophic lateral sclerosis

Brandie Morgan-Jack,[1] Grace Kick,[2] Martin Katz,[2] Joan Coates[2,3]

[1]University of Missouri-Columbia
[2]Neurodegenerative Diseases Research Laboratory
[3]Department of Neurology and Neurosurgery

Objectives
Canine degenerative myelopathy (DM) is a model for amyotrophic lateral sclerosis (ALS) associated with mutations in the superoxide dismutase 1 gene (SOD1). Sensory involvement is increasingly recognized in some forms of ALS and the earliest clinical sign of DM is asymmetric general proprioceptive ataxia in the pelvic limbs. Previous studies showed significant loss of sensory root axons and degeneration in dorsal root ganglion (DRG) in DM thoracic spinal cord. A better understanding of the earliest pathology in sensory pathways will help identify therapeutic targets. Pathways for general proprioception from the pelvic limbs were analyzed to identify early biochemical and structural changes.

Methods
Histopathologic evaluations were performed on components of the somatosensory and cerebellar projection pathways involving general proprioception of the lumbar spinal cord from Pembroke Welsh Corgis with early- and late-stage DM and age- and breed-matched controls.

Results
DM was accompanied by SOD1 protein aggregation, a hallmark of SOD1-ALS, in DRG sensory neurons. In early-stage disease, this accumulation was only present in some DRG neurons, but involved almost all DRG neurons by late-stage. SOD1 accumulation was not accompanied by DRG neuron cell loss. Substantial SOD1 accumulation was detected in sensory root axons. Additionally, axonal loss and myelin abnormalities indicative of distal axonopathy were observed in a pelvic limb mixed nerve. Substantial axonal pathology was present in the spinal sensory tracts, and SOD1 accumulation in the nucleus thoracicus of the lumbar spine was apparent early in disease progression.

Conclusion
These findings indicate that pathology in the sensory components of the general proprioceptive pathway occurs early in DM and is at least partially responsible for early pelvic limb general proprioceptive ataxia. Because disease pathology and neurologic dysfunction spread from the pelvic limbs and ascend, early proprioceptive pathway pathology could be a target for therapeutic intervention in some forms of ALS.

Impact Statement
Amyotrophic lateral sclerosis (ALS) is a devastating and fatal neurodegenerative disease with no cure. Results from this histopathological study of general proprioceptive pathways in canine degenerative myelopathy (DM), an established animal model for some forms of ALS, highlight changes in components of sensory pathways in early disease stages. Sensory dysfunction is reported in some forms of ALS, and these results could be used to identify targets for therapeutic intervention.

Tissue-specific DNA-methylation markers of biological aging and colorectal cancer

Drew R. Nannini,[1] Austin Reed,[1] Gerhard C. Hildebrandt,[2] Rene Cortese[3,4]

[1]University of Missouri-Columbia
[2]Division of Hematology and Oncology
[3]Department of Department of Child Health
[4]Department of Obstetrics, Gynecology, and Women's Health

Abstract

Colorectal cancer (CRC) is the third most common cancer worldwide. While prior investigations observed associations between biological aging and CRC, these studies primarily estimated biological aging using peripheral blood and whether such associations are consistent with colorectal tissue remains elusive. The purpose of this study was to investigate the association between colorectal tissue-specific markers of biological aging and CRC in a publicly available dataset. Tumor and normal adjacent colorectal tissue underwent DNA methylation profiling using the Illumina MethylationEPIC BeadChip. Six markers of biological age acceleration were estimated: intrinsic epigenetic age acceleration (IEAA), extrinsic epigenetic age acceleration (EEAA), PhenoAge acceleration (PhenoAA), GrimAge acceleration (GrimAA), skin and blood age acceleration (SkinBloodAA), and telomere length attrition (TLA). Multiple linear regression analyses were conducted to examine the association between CRC and each marker of biological age. Interaction and stratified analyses by microsatellite stability (MSS) were performed to evaluate whether MSS modified the association between biological aging and CRC. After adjusting for chronological age, sex, and ethnicity, colorectal cancer tissue was associated with a 9.15 [95% CI: -17.46, -0.85; P=0.032] year decrease and a 19.07 [95% CI: 10.13, 28.01; P<0.001] year increase in EEAA and PhenoAA, respectively. Colorectal cancer tissue was also associated with a 0.61 [95% CI: -0.82, -0.39; P<0.001] decrease in TLA. Additionally, MSS significantly modified the association between EEAA and CRC with MSS status (P=0.001). Specifically, participants with MSS exhibited a 16.07 [95% CI: -23.57, -8.57; P=0.001] year decrease in EEAA compared to a 7.47 [95% CI: -20.28, 35.22; P=0.545] year increase in participants with high microsatellite instability. The results presented here provide novel insights into the effect of CRC on tissue-specific age-related changes to the epigenome, as well as the interplay between genetic and epigenetic factors.

Impact Statement

We observed DNA methylation markers of biological aging to be associated with colorectal cancer. We additionally identified genetic factors that modified the association between these markers of biological aging and colorectal cancer. The findings presented here may serve as biomarkers to identify individuals who are at greater risk of more aggressive disease, and potentially, lead to early therapeutic intervention.

Randomized controlled trial of propranolol on gastrointestinal symptoms and relationship with amygdalar functional connectivity in autism spectrum disorder

Nanan Nuraini,[1,2] Carrina Appling,[2] David Beversdorf,[2] Bradley Ferguson[2]

[1]University of Missouri-Columbia
[2]Thompson Center for Autism and Neurodevelopment

Objectives
Recent research found a positive correlation between the stress response and GI symptoms, suggesting central nervous system involvement in GI symptoms in ASD. However, the role of the amygdala, a brain region that responds to environmental stress, is not well understood as it is relates to GI symptoms in those with ASD. We examined the effects of the beta adrenergic antagonist propranolol on GI symptom severity in those with co-occurring ASD and GI symptoms.

Methods
Nineteen individuals with ASD (age 7-24), who had at least one GI symptom were enrolled and randomized to a 12-week course of propranolol or placebo in a double blinded manner. Blinded GI assessments were completed by caregiver report via the Gastrointestinal Impact Scale (GIS) at baseline, and after 12 weeks of receiving either propranolol or placebo. We investigated FC between the amygdalae, temporal poles, and DLPFC using resting state 3T fMRI BOLD.

Results
Baseline FC between the left amygdala and superior frontal gyrus, which is located in the DLPFC, was significantly negatively correlated with GIS severity scores at the 12-week time point in the propranolol group. Overall, propranolol reduced GIS scores in half of the participants, but this reduction was not statistically significant.

Conclusion
Baseline FC between the left amygdala and left superior frontal gyrus was associated with reduced GI symptoms after participants took propranolol for 12-weeks. This functionally-connected network is also associated with those with anxiety disorders, suggesting that anxiety may be involved with GI symptoms in ASD. Furthermore, a clinical benefit of propranolol on GI symptoms was found, but this benefit was not statistically significant. These findings are preliminary in nature and need to be reproduced in future studies before finite conclusions can be made.

Impact Statement
The study underscores the significant impact of gastrointestinal (GI) symptoms on individuals with autism spectrum disorder (ASD). The research highlighted potential neural pathways altered in those individuals by exploring the functional connectivity (FC) between the amygdala, temporal lobes, and dorsolateral prefrontal cortex (DLPFC). The examination of the beta-adrenergic antagonist propranolol reveals promising clinical benefits in reducing GI symptom severity, emphasizing the need for further validation in the future.

Impact of covid-19 on healthcare workforce staffing in Missouri: Perspectives of community-oriented healthcare providers

Kelechi Onyeaka MPH,[1] Nicole Williams MPH,[1] Wilson Majee PhD, MPH[1]

[1]University of Missouri-Columbia

Objectives

In this study, we aimed to assess the impact of the COVID-19 pandemic on healthcare workforce staffing in Missouri, focusing on generating insights and recommendations to address challenges faced by healthcare professionals in the state.

Methods

Employing an exploratory contextual qualitative study design, we conducted two focus group discussions (FGD) involving 8 participants who were actively engaged in the COVID-19 pandemic response. Participants, recruited from a previous survey, represented various healthcare settings, including Local Public Health Agencies/Departments (LPHA), Federally Qualified Health Center (FQHC), and Small Rural Hospitals (SRH). These discussions, facilitated via Zoom, provided a convenient platform for participants to share their perspectives.

Results

The results revealed that community-oriented healthcare providers, such as LPHA, FQHC, and SRH, bore the brunt of the pandemic's impact. LPHAs faced challenges in hiring new staff, while all three entities encountered difficulties in maintaining adequate staffing levels during the crisis. Staff roles underwent significant changes to adapt to the evolving situation, yet essential services like immunization remained unaffected. Despite healthcare workers' resilience, fatigue and burnout were prevalent. Furthermore, amidst staffing shortages, LPHA, FQHC, and SRH showcased innovative solutions to deliver care and disseminate accurate information about COVID-19 through social media platforms like Facebook and TikTok. Additionally, challenges in accessing training, professional development, and support systems emerged as significant factors influencing these organizations' capacity to address pandemic-related challenges.

Conclusion

In conclusion, the study highlights the disruptive impact of the COVID-19 pandemic on healthcare workforce staffing in Missouri. The need for adaptable staffing approaches is underscored, especially considering the increased workload, and shifted responsibilities among healthcare professionals. Collaboration between organizations is crucial in addressing public health emergencies, contributing to the rebuilding and fortification of trust in both government and the public health system.

Impact Statement

This study explores the profound impact of the COVID-19 pandemic on healthcare workforce staffing in Missouri. Through qualitative research perspective, it reveals challenges faced by community-oriented healthcare providers, emphasizing the critical need for adaptable staffing approaches. The findings, derived from focus group discussions and thematic analysis, offer valuable insights and recommendations to enhance the resilience and effectiveness of healthcare professionals in navigating future public health crises.

Effects of antisense-induced downregulation of circadian gene Period 1 in the basolateral amygdala on spontaneous sleep-wakefulness and consolidation of traumatic memory regeneration

Meet Parikh 1, Rishi Sharma PhD,[2] Abigail Chilchosm,[2] Rouaa Alhakim,[1] Deepak Kempuraj,[1] Mahesh Thakkar PhD,[2] Pradeep Sahota MD[2]

[1]University of Missouri-Columbia
[2]Department of Neurology

Background

The basolateral amygdala (BLA) is implicated in the regulation of emotional processes. Recently it has been shown that the BLA has a role in sleep-wakefulness. Considering the significance of the BLA in sleep-wakefulness and traumatic memories, we asked! Does the circadian gene Period 1 (Per1) within the BLA contributes to sleep-wakefulness and in the consolidation of traumatic memories? Thus, we hypothesize that downregulation of Per1 in the BLA will result in changes in sleep wakefulness and impaired traumatic memory consolidation.

Methods

Adult male C57BL/6J mice were stereotaxically implanted with three screw electrodes on the skull for recording EEG and three wire electrodes in nuchal muscle to record muscle activities (EMG). In addition, three Teflon-coated tungsten wire electrodes (76 µm dia) along with bilateral stainless-steel guide cannulas were also implanted (2.0) mm above the BLA region. The animals were connected to the recording setup and allow to habituate for 7-day period. Experiment 1: The mice were divided into two groups: Antisense and Saline. Antisense (experimental group) and saline solutions (control group) were respectively infused through the guide cannulas into the BLA on light-onset. Spontaneous sleep-wakefulness was recorded for following 48 hours. Experiment 2: One hour after light-onset, contextual training was performed with contextual cage as conditioned stimulus (CS;5 min) and soiled cat litter as unconditioned stimulus (US;10 min) on Day-1 followed by memory recall testing on day-2. LFP were recorded from the BLA.

Results

Experiment 1: Knockdown of Per1 in the BLA reversed sleep-wake cycle with increased wake and reduced sleep during the light period, increased sleep, reduced wake during dark period.
Experiment 2: The effect of Per1 downregulation in BLA on contextual training, is ongoing.

Conclusion

Initial studies suggest that antisense-induced downregulation of Per1 in the BLA, reverses sleep-wake cycle, has effect on traumatic memory.

Impact Statement

1. Unraveling the Role of Period 1 in Amygdala-Mediated Sleep-Wakefulness Dynamics
2. Downregulating Period 1 in this specific brain region sheds light on potential connections between circadian dysregulation after PTSD acquisition
3. While the sleep-wake cycle itself doesn't reverse, the disruptions in sleep architecture can lead to a variety of symptoms that contribute to the overall sleep disturbance experienced by individuals with PTSD.

Improving turnover time in gynecology robotics pperating rooms at St. Luke's Hospital

Evelyn Peng MSV,[1] Tammy Neblock MD,[1] Chelsea Krause RN,[1] Petrena Barrett RN, BSN[1]

[1]University of Missouri-Kansas City

Objectives

This project aims to reduce the average turnover time (TOT) in gynecology robotics operating rooms at St. Luke's Hospital (SLH) from 52 to 42 minutes by March 1, 2024.

Methods

Three interventions were devised to address identified barriers to efficient turnover, which include understaffing, challenges in replacing contaminated instruments, and missing equipment from the case cart during setup. OR side staff were previously responsible for covering turnovers in addition to setting up case carts, so the first intervention involved dedicating side staff to exclusively assist in turnovers for gynecology robotics cases, which will eliminate unnecessary motion, increase the efficiency of side staff, and reduce case cart instrument errors. The second intervention aims to increase the availability of Xi Peel packs for prompt replacement of contaminated instruments during OR setup. The third intervention introduced a trained robotics coordinator to prepare robotic instruments a day before to reduce the incidence of instrument errors during OR setup. TOT data for gynecology robotics cases will be extracted from the SLH EMR. Correlation analysis between staffing changes, Xi Peel pack availability, and TOT variations will be conducted to assess improvements and identify barriers. Average TOT across the SLH main OR will be monitored for detection of potential negative impacts on other case services due to increased staffing for gynecology robotics surgeries.

Results

The first PDSA cycle, focusing on side staff changes, began in September 2023. Preliminary results show a promising reduction in the average TOT for gynecology robotics cases, decreasing from 47 minutes in September 2023 to 42 minutes in November 2023. We anticipate continued improvement with the implementation of additional PDSA cycles throughout the project timeline. These initial findings suggest the efficacy of the interventions in achieving the set TOT reduction goal.

Impact Statement

Operating room efficiency and turnover time delays are critical challenges for hospital administrators and OR managers. Extended turnover times not only diminish resource utilization and compromise staff well-being but also negatively impact patient outcomes and overall quality of care. This project aims to address a critical need for standardization and efficiency in robotics surgery turnovers, offering insights for ongoing improvements in OR management practices across all surgical services.

Improving detection of eating disorders in a pediatric weight management clinic

Rachel Perera MS,[1] Cristina Fernandez MD,[1] Amy Beck PhD,[1] Nicholas A. Clark MD,[1] Sara Gould PhD,[1] Andrea Nos MD,[1] Helena Laroche MD,[1] Brooke Sweeney MD,[1] Lora Edwards RD,[1] Amy Moran RN,[1] Kelsey Dean RD,[1] Kimberly Hughes MS,[1] Sarah Hampl MD,[1] Jared Tucker PhD,[2] Eileen Chaves PhD[3]

[1]Children's Mercy Kansas City
[2]Helen DeVos Children's Hospital
[3]Nationwide Children's Hospital

Objectives

To consistently apply a validated eating disorder (ED) screening survey, increasing screening from 55% (non validated tool) to 90% of new weight management clinic (WMC) patients 12y+ of age from November 1, 2021, to May 31, 2022.

Methods

The WMC is in a tertiary-care, free standing, children's hospital serving as the primary regional referral center. The A3 improvement framework was utilized by a multidisciplinary team of physicians, nurses, dietitians, psychologists, and exercise physiologists. The outcome measured monthly mean provider documentation of screening. Our first Plan-Do-Study-Act (PDSA) cycle included educating providers on the literature and implementing a non-validated set of 9-questions to consistently screen. Our second PDSA cycle replaced the screener with the validated 10-question Adolescent Binge Eating Scale (ADO BED)

Results

Special cause improvement from 55% to 90% of total screen done (sample of one quarter results) Positive screen were 6% of all our screening results

Conclusion

•Implementation successful using dot phrases in electronic health record and reeducation to reach >90% of new 12y+ WMC patients screened for ED.
•Next steps include:
1. Analysis of survey data from 90 other WMC nationwide on ED diagnosis to support implementation
2. Dissemination of ED screening to a national group of WM providers and work on a plan of action for positive screen results.

Impact Statement

Adolescents with obesity are at higher risk of disordered eating than the general population. Detection of eating disorders (ED) is difficult yet necessary, particularly in weight management clinics (WMC). Literature suggests screening questionnaires may aid in early detection of ED and that WMC are beneficial in managing ED, specifically bulimia and binge eating disorders (BED). In our Institution, over the previous year 55% of patients in WMC were screened using a 4-question non-validated survey, yet clinicians in WMC saw enhanced prevalence of BED patients at our institution.

Characterization of the NeflE396K mouse model for Charcot-Marie-Tooth type 2E (CMT2E) therapeutic development

Dennis Perez-Lopez[1]

[1]University of Missouri-Columbia

Objectives

To advance the development of therapeutics for Charcot-Marie-Tooth (CMT) type 2E (CMT2E) and to better understand the underlying biology of disease progression, we generated Nefl+/E396K and NeflE396K/E396K mice. CMT is the most common hereditary peripheral neuropathy with an incidence of 1:2,500. CMT2 is a type of CMT that presents as a slow, progressive disorder associated with axonal dysfunction. CMT2 clinical symptoms include distal muscle weakness and atrophy, sensory loss, toe and foot deformities, and reduced nerve conduction velocity. CMT2E is a type of CMT2 associated with mutations in the gene neurofilament light chain (NEFL). The protein, NF-L, is one of five subunits that makes up neurofilaments and contributes to the axonal cytoskeleton. CMT2E is typically inherited in an autosomal dominant manner with variable onset and severity.

Methods

Motor function, balance, and strength assessments were performed on the Nefl mice to evaluate disease progression. Additionally, muscle pathology, innervation status, nerve morphology, and in vivo measurements of neuronal function have been performed.

Results

Our new mouse models, Nefl+/E396K and NeflE396K/E396K, present axonal defects at P21 and showed a reduced compound muscle action potential (CMAP), reduced negative area, and increased distal latency. At 6 months and 12 moths months disease progression is more evident in terms of distal latency and showed a more significant functional deficit. Muscle atrophy and denervation is present at 3 weeks of age. Cross-sectional images of the sciatic nerve showed axonal degeneration and myelination defects in Nefl+/E396K and NeflE396K/E396K mice starting at 3 weeks.

Conclusion

Collectively, our thorough phenotyping of these novel mouse models of disease conclusively demonstrates that there is an early and quantifiable neurological phenotype in our novel CMT2E mice, making it ideal for the evaluation of therapeutic approaches.

Impact Statement

Charcot-Marie-Tooth 2E (CMT2E) disease is a slowly developing yet unrelentingly progressive axonopathy (no therapeutics currently exist). To better understand disease progression and to evaluate gene therapies for CMT2E, we have generated two mouse models with the E396K mutation in the neurofilament light gene that present a severe and consistent phenotype. This project further quantitatively investigates the pathology associated with the patient-based to provide insight into the biological implications of this mutation.

Unraveling the impact of the RNAi Pathway gene, r2d2, on Arbovirus transmission and fitness of the Yellow Fever mosquito, Aedes aegypti

Vivek Pokhrel,[1] Kyah M. Featherston,[2] David G. Rehard,[3] William R. Reid,[2] Alexander W.E. Franz[2]

[1]University of Missouri-Columbia
[2]Department of Veterinary Pathology
[3]Division of Biological Sciences

Objectives
Previously, the functions of genes such as dicer-2 and argonaute-2 belonging to the small interfering RNA pathway in Aedes aegypti have been described. The main objective of this study was to investigate the influence of another critical RNAi pathway gene, r2d2, on arthropod-borne virus (arboviruses) transmission and fitness of Ae. aegypti.

Methods
CRISPR-Cas9 with a guide RNA targeting r2d2 was used to develop a loss of r2d2 function mosquito line (AF-59). The r2d2 impaired and wild-type (control strain: HWE) mosquitoes were orally challenged with artificial bloodmeals containing Mayro virus (MAYV; Togaviridae) or Zika virus (ZIKV; Flaviviridae). At defined timepoints, viral loads along with expression levels of r2d2 as well as other RNAi pathway genes (dicer-2, ago-2, loquacious) were analyzed through q-RT PCR. Additionally, a limited fitness study was carried out to compare fecundity, fertility, and sex ratios between r2d2 loss-of-function and wild type mosquitoes (strain: HWE).

Results
Female heterozygous r2d2 (+/-) individuals exhibited a 50% reduction in the relative expression of r2d2 and generated a significantly higher MAYV RNA copy number than the HWE control strain. However, there was no significant difference in ZIKV RNA copy numbers between r2d2 (+/-) and HWE females. Additionally, fertility was significantly lower in r2d2 (+/-) females compared to HWE females. Interestingly, it was found that male and female r2d2 (+/-) individuals passed on the transgene exclusively to male and female progeny, respectively, suggesting that r2d2 is linked to the sex determination locus of Ae. aegypti.

Conclusion
Partial (although stable) knockout of r2d2 in Ae. aegypti enhanced MAYV replication in the mosquito and had a negative fertility effect. Our study also indicates that the inheritance of the r2d2 gene is sex linked.

Impact Statement
This study shows the impact of the siRNA pathway gene, r2d2, on transmission of Mayro virus along with its influence on mosquito fertility. Any potential crosstalk between r2d2 and other innate immune pathways in the mosquito still needs to be elucidated. A detailed understanding of RNAi pathway gene functions in Ae. aegypti will have greater implications for the development of novel arboviruses control strategies targeting the mosquito vector.

LiveCare: Advancing patient monitoring with LiDAR-based real-time health surveillance

Omar Rinchi,[1] Nawfal Guefrachi,[1] Ahmad Alsharoa[1]

[1]Missouri University of Science and Technology

Objectives

We propose LiveCare (LiDAR Intelligent Vital Eye Care), a LiDAR-based solution for real-time, continuous patient monitoring, emphasizing privacy. LiveCare excels in three areas: advanced respiratory tracking, dynamic activity monitoring, and sophisticated body part segmentation for gesture recognition. Its respiratory tracking captures subtle breathing patterns remotely, ensuring patient comfort. The system's activity monitoring accurately detects and differentiates a wide spectrum of patient activities, facilitating timely interventions in various care settings. The gesture recognition capability is crucial for detailed movement analysis in rehabilitative therapy and enhancing non-verbal patient communication.

Methods

Utilizing a LiDAR sensor, LiveCare starts with object detection to locate patients, which informs two key functions: activity recognition and body part segmentation. Activity recognition uses deep learning to differentiate between normal and abnormal behaviors, such as falls or unstable walking. Concurrently, body part segmentation isolates specific areas for gesture identification and precise breathing monitoring. By segmenting the chest area, LiveCare tracks respiratory patterns and metrics, offering a comprehensive health status overview in real-time.

Results

In testing, LiveCare's LiDAR system achieved 100% accuracy in respiratory event detection and up to 94% precision in breath-holding scenarios. The PV-RCNN model delivered 83.32% precision in patient detection, and the PointNet model showed 83.92% accuracy in activity recognition, surpassing the Voxel MLP benchmark. These results, supported by low RMSE values in breath depth, confirm LiveCare's effectiveness and real-time capabilities in remote healthcare technology.

Conclusion

In conclusion, LiveCare stands out as a LiDAR-based monitoring system that provides comprehensive, remote patient surveillance. It demonstrates exceptional skill in respiratory tracking and activity detection, offering improved communication in healthcare. LiveCare's successful application of LiDAR technology marks a significant step forward in patient monitoring, enhancing healthcare outcomes.

Impact Statement

LiveCare revolutionizes patient monitoring by leveraging LiDAR technology for remote, real-time health surveillance. It enhances patient safety and care by accurately detecting respiratory patterns and physical activities, ensuring timely interventions. This innovative approach promises significant advancements in healthcare, offering a privacy-conscious solution that improves patient outcomes and communication in clinical settings.

Investigating the link between motoneuronal dysfunction and cognitive impairment in Alzheimer's Disease

Azam Roshani Dashtmian,[1] Fereshteh Babaei Darvishi,[2] Angia Chen,[1] Peter Moore,[1] Sindhuja Ayyagari,[1] Charles Brennan,[2] Zachary Williard,[1] Jaylen Hickman,[1] Nathan Kerr,[1] and W. David Arnold[1]

[1]NextGen Precision Health
[2]University of Missouri-Columbia

Background
Alzheimer's disease (AD) primarily causes progressive loss of cognitive function. Loss of mobility is a major contributor to AD morbidity. Growing evidence suggests that motor function loss might precede the onset of overt cognitive impairment. Yet, the relationships between motor and cognitive dysfunction in AD remain unclear. Here, we aim to investigate motor and neuromuscular function in 5XFAD mouse model of AD compared to age-matched wildtype controls and exploring the effect of 12 weeks of progressive resistance exercise.

Methods
5XFAD (n=12) and wildtype (WT) (n=12) C57BL/6J mice (2-3 months of age) were included with 50% randomized to (weighted cart) or control (unweighted cart) groups. Progressive resistance exercise was performed 3 times a week over 12 weeks. At baseline, 4, and 12 weeks, mice underwent assessments of muscle strength (Max weight pulling test), motor unit physiology including compound muscle action potential, motor unit number estimation, H-reflex, motor evoked potentials (MEP), and plantarflexion torque. Y maze spontaneous alternation test measured cognitive function following 12 weeks of exercise.

Results
Baseline observations revealed significant neuromuscular deficits in 5XFAD mice. Compared to controls, 5XFAD mice exhibited lower muscle excitability (p=0.0447) and H-reflex (p=0.0001), with significantly higher MEP amplitude (p=0.0014). After 12 weeks of exercise, improvements in muscle strength (p=0.0289) and cognitive function (p=0.0414) were observed in WT mice. However, exercise did not significantly impact neuromuscular or cognitive functions in 5XFAD mice.

Conclusion
Our preliminary findings suggest early neuromuscular impairment preceding cognitive decline in the 5XFAD model. Resistance exercise increased muscle strength and cognitive performance in WT mice but did not ameliorate observed neuromuscular or cognitive deficits in 5XFAD mice. We will expand the sample size and investigate the correlation between cognitive and neuromuscular functions in AD through a longitudinal study, repeating measurements every 2 months in both 5XFAD and WT mice (2-12 months old).

Impact Statement
Emerging evidence supports a strong connection between muscle weakness and cognitive decline in aging and Alzheimer's disease. However, the mechanisms that underlie the crosstalk motor and cognitive functions remain insufficiently explored. Our study demonstrates novel neuromuscular deficits, offering new mechanistic insights to help accelerate discoveries to alleviate the impact of Alzheimer's disease.

A robust A-mode ultrasound technology for continuous monitoring of blood viscosity in vivo

Nilesh Salvi,[1] Jinglu Tan[2]

[1]University of Missouri-Columbia
[2]Department of Chemical and Biomedical Engineering

Objectives

This project aims to develop and rigorously validate a novel, non-invasive technology for continuous, in vivo blood viscosity (BV) measurement, overcoming limitations of existing methods and significantly improving human health monitoring.

Methods

We will design and prototype a device utilizing A-mode ultrasound sensing and advanced algorithms for real-time, continuous in vivo BV measurement. A multi-phased approach will ensure accuracy and real-world applicability:

1. Controlled lab testing: Validate basic principles with simulator systems and blood analogues.
2. Refinement with whole blood: Integrate whole blood into testing for accurate translation to the human body.
3. Preclinical human study: Evaluate device functionality and initial clinical viability in subjects undergoing BV-affecting treatments. Technical challenges to overcome include eliminating interferences, differentiating vessel geometry changes from BV variations and leveraging pulsatile blood flow dynamics for enhanced BV assessment accuracy.

Results (Anticipated)

• A functional prototype device demonstrating accurate and continuous in vivo BV measurement.
• Robust algorithms for reliable BV estimation from captured data.
• Real-time BV monitoring data validating the technology's potential in disease prevention and health care.

Conclusion

This project seeks to establish continuous BV monitoring as a valuable clinical tool. Real-time data empowers evidence-based decision-making, enabling personalized interventions and early disease detection. This advancement paves the way for improved patient outcomes and personalized medicine across diverse healthcare fields.

Impact Statement

By pioneering continuous, non-invasive blood viscosity monitoring, our project empowers clinicians with real-time data to detect diseases early, personalize interventions for blood disorders, and optimize treatment. This transformative technology holds the key to personalized medicine, saving lives and revolutionizing healthcare.

Neuroimaging Markers for Cerebral Small Vessel Disease

Ria Shahapeti,[1] Lixin Ma[1]

[1]University of Missouri-Columbia

Objectives

The purpose of this systematic review is to investigate cerebral small vessel disease (CSVD) pathogenesis, and a multitude of its diagnostic markers. This discussion will specifically include neuroimaging modalities and biomarkers of CSVD, the advantages and limitations of the clinical use of studied diagnostic markers, and the future considerations for research within this field.

Methods

The investigation of CSVD was done by researching credible primary and secondary papers on PubMed. The search included cerebral small vessel disease, pathogenesis mechanisms, genetic etiologies, structural and emerging imaging techniques in the context of CSVD, biomarkers of CSVD, and the clinical application of neuroimaging biomarkers.

Results

This systematic review illustrated important, applicable pathogenic mechanisms of CSVD. This includes endothelial dysfunction, white matter damage and activation of a variety of inflammatory pathways. It will also discuss the genetic and pathological classifications of CSVD, and detailed mechanisms of the most common causes seen clinically. The most prominent include subcortical infarcts, lacunar infarcts, white matter hyperintensities, microbleeds, enlarged perivascular spaces, and brain atrophy. This study further discusses the specific MRI findings associated with these markers, its diagnostic value, and future directions of the study on neuroimaging biomarkers of CSVD.

Conclusion

CSVD is a complex pathology with a multitude of etiologies, inducing genetic and lifestyle -acquired, as well as a variety of mechanisms including endothelial dysfunction, impaired vasodilation, white matter damage, atrophy and pre-existing co-morbidities. This study on neuroimaging markers will outline the best modalities to visualize and diagnose CSVD, including those visualized on diffusion weighted imaging, perfusion imaging, and functional MRI.

Impact Statement

We hope that this project provides more insight into the current understanding of CSVD for clinicians and researchers. This will allow us to further understand disease progression, significance of certain diagnostic markers, and thus better diagnose and treat CSVD. CSVD can be impact an individual's health in many ways, from dementia to stoke like symptoms, thus sharing the recent studies on this pathology and diagnostic markers will aid in providing patient-centered care as well.

Gene drive performance in the yellow fever mosquito, Aedes aegypti, for the delivery of antiviral effectors

Zachary J. Speth,[1,2] David G. Rehard,[1,2] Patricia J. Norton,[1,2] Alexander W.E. Franz[1,2]

[1]University of Missouri-Columbia
[2]Department of Veterinary Pathobiology

Objectives

The objective of this study is to assess the potential for deployment of two CRISPR/Cas9 gene drives for antiviral effector delivery into populations of Ae. aegypti. We tested and compared gene drives which express Cas9 in the germline at an ideal locus for antiviral effector delivery using either native nanos- or zpg- promoter sequences. We measured gene drive performance characteristics in small populations of Ae. aegypti mosquitoes in order to bridge the gap between modeling studies and a field release scenario.

Methods

Starting with an initial release of 1:9 male gene drive carriers : wild-type males for two CRISPR/Cas9 gene drives into populations of 300 total mosquitoes (1:1 sex ratio), we tracked the gene drive carrier and allele frequencies over subsequent generations. Gene drive carrier and allele frequencies were tracked using a fluorescent marker and a PCR test, respectively. The formation and retention of gene drive blocking mutations were measured using deep sequencing.

Results

Over 11 succeeding generations, we measured a substantial increase in gene drive carrier frequency from 5% in the initial release up to over 60% of the population for both gene drives. The nanos- gene drive spread more quickly, reaching 50% of the mosquito populations on average by generation 5. Our modeling predicts that the zpg- gene drive may perform better over long periods of time.

Conclusion

Gene drives provide a promising tool for the delivery of antiviral effectors to disease vector populations, with the potential to prevent millions of human infections with arboviruses annually. Our data shows that both, choice of the target locus and promoter, are essential for the development of effective gene drives. The nanos- and zpg- gene drives tested in this study performed better in small populations than any other gene drives developed to date for Aedes aegypti.

Impact Statement

Aedes aegypti is a potent vector for arboviruses infecting over 100 million people annually, including dengue, Zika and chikungunya viruses. The species is endemic globally throughout the tropics and is present in all of the Southern United States. Antiviral effectors are genetic elements which can prevent virus infection and replication in arthropod vectors. The spread of antiviral effectors could be achieved in targeted mosquito populations through the use of gene drives to prevent human infections.

pRospective And REtrospective assessment of diagnostic, clinical, and GENEtic determinants of health in patients with rare and orphan disease (R.A.R.E.G.E.N.E)

Joshua Staley[1]

[1]University of Missouri-Kansas City

Objectives

The primary objective of our study is to assemble a comprehensive database that includes Patient Reported Outcomes (PROs), genetic risk factors, and medical records to inform future research. Additionally, we aim to establish a registry for individuals with rare and orphan diseases (RORD). Our goals are to examine the nexus between Social Determinants of Health (SDOH) and RORD, optimize PRO analytical methodologies, gauge RORD prevalence in Kansas City, explore the interplay between health outcomes and social determinants, and unravel genetic variations tied to RORD frequency.

Methods

Our methodological approach involves the collection and integration of various data types. This includes PROs, genetic risk factors, and medical records. We will analyze linguistic disparities between intricate disease diagnoses and routine visits, detect patterns indicative of underlying genetic diseases, and probe the impact of SDOH on PROs. Furthermore, we will delve into the genetic realm to discern potential genetic correlations with long-term outcomes. We also plan to examine systemic healthcare gaps by focusing on aspects such as wait-times, referral efficacy, and discipline cohesion.

Results

The expected outcomes include a better understanding of the journey of RORD patients, an optimized methodology for analyzing PROs, data on RORD prevalence, insights into the relationship between health outcomes and SDOH, and the identification of genetic variations related to RORD frequency.

Conclusion

We anticipate that through this multi-pronged approach, our study will bridge existing knowledge gaps related to rare and orphan diseases. The establishment of a comprehensive database and registry is expected to pave the way for enhanced patient care, targeted research initiatives, and a deeper understanding of the systemic healthcare gaps that affect RORD patients, ultimately contributing to improved healthcare outcomes for this underserved population.

Impact Statement

This study aims to improve the management of rare and orphan diseases (RORD) through an innovative database integrating Patient Reported Outcomes (PROs), genetics, and medical records. It will illuminate the nexus between genetic factors, Social Determinants of Health (SDOH), and RORD, setting the stage for tailored treatments and informed policy-making.

Post-acute concussion-related neuromotor control deficits measured using a low-cost movement assessment system

Jacob M. Thomas,[1] Rebecca Bliss,[3] Jamie B. Hall,[3] Trent M. Guess[2,3]

[1]University of Missouri-Columbia
[2]Department of Orthopaedic Surgery
[3]Department of Physical Therapy

Objectives
Neuromotor control deficits may linger past symptom resolution in athletes who have sustained a concussion, contributing to high rates of musculoskeletal injury following return-to-play. As concussion involves multiple sensory systems, clinicians have called for multi-faceted tools to monitor neuromotor control recovery following concussion. Our objective was to build a linear discriminant analysis model using outcome measures from a low-cost movement assessment system and assess classification accuracy between healthy individuals and those with recent concussion.

Methods
Twenty-two recreationally active adults participated in this study. Ten (20.5±0.97 yrs., 9 females) had been diagnosed with concussion (3.9±1.66 months post-concussion), and twelve (23.27±0.90, 8 females) had no history of concussion. All participants completed the same tasks: walking (normal, dual-tasking, and head shaking), Romberg balance (eyes open and eyes closed firm surface) and reaction time while being recorded by the Mizzou Point-of-Care Assessment System (MPASS). MPASS combines a Kinect camera, a custom-built force plate, and an Arduino-based interface board to form a multi-modal tool. For walking, spatiotemporal parameters and discrete kinematics were collected via Kinect. For balance tasks, a force plate recorded center of pressure and Kinect recorded center of mass. Reaction time was recorded using the interface board. Ensemble averages of trials for each participant and each discrete measurement were calculated, resulting in 35 unique variables. Principal component analysis (PCA) was used to reduce the dimensionality of the dataset. Retained PCs (Horn's parallel analysis) were used to create a linear discriminant analysis (LDA) model. Leave-one-out cross validation was used to validate the LDA model.

Results
Using four retained PCs, the LDA model achieved a statistically significant ($p = 0.007$) accuracy of 82% with 80% sensitivity and 83% specificity for classifying participants into groups.

Conclusion
Results indicate persisting neuromotor control deficits following concussion, which are currently undetected by clinical measures, can be measured using MPASS.

Impact Statement
This study found outcome measures from MPASS can be used to discriminate between healthy individuals and individuals who have sustained a concussion injury with 82% accuracy. Our approach also presents a model for reducing multi-sensor movement-based measurements into one composite variable for classification, which is useful for a variety of clinical populations. This approach may allow for similar movement-based monitoring of neuromotor control in other clinical populations, such as those with Parkinson's or cerebral palsy.

Fielding feedback: Getting feedback to intended recipients

Anne Sales,[1] Jennifer Kononowech,[2] Christa Torrisi[1]

[1]Sinclar School of Nursing
[2]VA Ann Arbor Healthcare System

Objectives
Feedback interventions are demonstrated to be moderately effective. There is very little in the literature about how feedback gets to the intended recipient(s). Method of distributing, or fielding, a feedback intervention is important but rarely discussed. We provide a brief overview of methods and success rates in fielding feedback reports.

Methods
We report two case examples of fielding methods for feedback. In one study, conducted in Canada, we distributed written feedback reports by hand directly to intended recipients every month, observing what recipients did when they received the report. In the second study conducted in 19 U.S. Veterans Health Administration nursing homes, we delivered monthly feedback reports by email to champions who took responsibility for report distribution. We conducted a follow-up survey by email to all intended recipients, asking five questions: did they receive the feedback report, did they read it, did they understand it, did they find it useful, did they discuss it with another staff member?

Results
The observations in the first study were reported in a published process evaluation; briefly, over the 13 months of the intervention, distribution shifted from reports being handed to an individual 68% of the time in the first month to 12% at study end. Leaving the report somewhere instead of handing it to an individual increased from 15% to 87% of the time. Through the second study survey, we found that very few champions delivered the feedback reports to intended recipients, and a very small proportion of intended recipients were aware of the feedback intervention.

Conclusion
Theory underlying effective feedback interventions assumes that intended recipients receive feedback, but there is little to support that assumption. We recommend developing reporting guidelines specific to feedback interventions which would encompass best practices in many domains of feedback intervention, including information about fielding methods and success in reaching recipients.

Impact Statement
The method of distributing feedback interventions, also called fielding, describes how feedback reaches recipients. However, this is rarely discussed in the literature. To ensure that intended recipients are receiving feedback, a process should be developed that guides feedback interventions, including information about fielding methods and success in reaching recipients.

A unique role for phosphorylation on serine 234 of the glucocorticoid receptor in brain development

McCarthy, N.,[1] Tuschhoff, J.,[1] Silswal, N.,[1] Lei, T.,[1] Chen, C.,[1] DeFranco, D.,[3] Monaghan Nichols, AP.[2]

[1]University of Missouri-Kansas City
[2]Department of Biomedical Sciences, University of Missouri-Kansas City
[3]Department of Neuroscience, University of Pittsburgh

Objectives
Synthetic glucocorticoids are administered in the neonatal period to promote lung maturation, induce changes in neural stem cell fate, and lead to anatomical and behavioral changes in the developing brain. We aim to assess the role of glucocorticoid receptor phosphorylation on neural stem cell transcriptomics, fate, and neurogenesis in the developing brain.

Methods
Knock-in mice were genetically engineered to replace the mouse equivalents of human serine 226 (S234A) with alanine. Cerebral cortices were used to establish neural stem cell cultures from knock-in and control mice and exposed to sGCs. Biological and genomic consequences were examined using whole genome expression studies, cell proliferation, and cell fate assays in vitro. Experimental and control embryos were treated with sGC or vehicle on embryonic day 14 in vivo, and anatomical consequences were examined using immunohistochemical staining for the proportion of cells in the M phase of the cell cycle and the proportion of intermediate progenitor cells in the cortex.

Results
Genomic studies indicate that a loss of phosphorylation on S234 activates a distinct transcriptome basally and a unique transcriptome in response to sGC stimulation. Loss of phosphorylation leads to basal and sGC-induced changes in gene expression profiles, with altered genes implicated in neurodevelopmental disorders and neurological disease. In-vitro studies suggest loss of phosphorylation leads to a change in differentiation of distinct progenitor subtypes. In-vivo studies further indicate that phosphorylation is required for cell fate specification and anatomical organization of the developing cortex.

Conclusion
These studies indicate a unique role for phosphorylation on S226 in regulating neural stem cell function and cell fate specification in the cerebral cortex both in basal conditions and in the absence of sGCs.

Impact Statement
As we explore the impact of synthetic glucocorticoids on the brain, we hope to gain more insight into the roles of GR Phosphorylation unligated roles of the GR in neurogenesis. We hope these studies will provide insights into potential therapeutic approaches that will maintain the beneficial effects of sGCs on lung development while minimizing abnormal effects during brain development in the neonatal period.

Cognition and subjective-objective sleep discrepancy and insomnia in younger adults: A preliminary investigation

Madison Musich,[1,2] Mukund Viswanadha, [1,3,4] Jackson Weller,[3] Vanessa Lampley,[5] David Beversdorf,[1,2,6] Ashley F. Curtis[7]

[1]University of Missouri-Columbia
[2]Department of Psychological Sciences
[3]Department of Biological Sciences
[4]Department of Statistics
[5]Department of Mathematics
[6]Departments of Radiology and Neurology
[7]College of Nursing, University of South Florida

Objectives
Differences between subjective and objective sleep (subjective-objective sleep discrepancy, SOSD) are prevalent in insomnia. Despite associations between cognition and sleep, the impact of cognitive functioning on SOSD is unclear. We examined whether insomnia status moderated associations between various cognitive domains and SOSD in younger adults.

Methods
Younger adults with (N=21) and without (N=14,) insomnia [met DSM-5 criteria plus reported >30 mins sleep onset latency (SOL) and/or wake time after sleep onset (WASO) on 3+ /7 nights] completed measures of subjective sleep (14-days of sleep diaries), objective sleep (one-night polysomnography, PSG), and objective cognition (National Institute of Health – Cognition Battery). Moderated regressions determined associations between cognitive and insomnia status (non-insomnia/insomnia) on SOSD (computed as: same-night sleep diary – PSG) for SOL, WASO, total sleep time (TST) and sleep efficiency, controlling for sex, apnea-hypopnea index, and sleep medication usage.

Results
For those with insomnia, worse episodic memory was associated with better (longer) self-reported than PSG measured TST (b=-10.31, SE=4.61, p=.03). Conversely, for non-insomnia, worse (shorter) self-reported than PSG measured TST was associated with worse episodic memory (b=16.92, SE=5.38, p=.004) and processing speed (b=5.93 SE=1.95, p=.005), and worse (lower) self-reported than PSG measured sleep efficiency was associated with worse processing speed (b=1.17, SE=0.40, p=.007).

Conclusion
As expected, worse cognitive functioning is associated with worse perceived sleep, in non-insomnia younger adults. However, worse cognitive functioning and insomnia-specific pathophysiology may disrupt perceptions of poor sleep-in younger adults with insomnia. It is also possible hyperarousal (prevalent in insomnia) further contributes to insomnia-specific neurophysiology, providing potential cognitive compensatory benefits and better perceived sleep-in younger adults with insomnia. Prospective studies should examine the interactive relationship between cognition, arousal, and insomnia on SOSD, as well as across the lifespan. This research project was made possible by a grant from the Sleep Research Society Foundation (PI: Musich)

Impact Statement
The difference in self-reported and objectively measured sleep is more prevalent in insomnia populations, yet the role of cognition contributing to this sleep misperception is unclear. Present findings suggest that worse cognitive functioning relating to episodic memory and processing speed may be an underlying mechanism contributing to paradoxical ratings in sleep but are insomnia dependent. During clinical assessments, taking cognitive functioning into consideration may better inform insomnia clinical profiles.

Aged motor neurons in the primary motor cortex are hyperexcitable

Jose A Viteri,[1] W David Arnold,[1] Joseph M Santin,[1] Nikolaus D Bueschke[1]

[1]University of Missouri-Columbia

Objectives

Muscle weakness is a major contributor to loss of physical function in older adults. The major drivers of age-related muscle failure are incompletely understood but have been attributed to both neural and muscle related deficits. Voluntary muscle activation originates in cortical motor neurons (cMNs) in the primary motor cortex, but impact of aging on cMN function hasn't been investigated. Therefore, our objective was to investigate intrinsic properties in cMN from mice at young (2 months), middle (12 months), and old (23+ months) ages.

Methods

Intrinsic properties were measured using the whole-cell current clamp configuration. To measure the persistent inward current (PIC), we ran triangular voltage ramps in the whole-cell voltage-clamp configuration (10mV/s).

Results

At 50pA stimulation, old cMNs had a higher mean firing frequency compared with middle-aged (17.32Hz vs 11.35Hz, p=0.0234) and young cMNs (17.32Hz vs 9.941Hz, p=0.0012). At 300pA, old cMNs had a higher mean firing frequency than middle-aged (40.71Hz vs 30.35Hz, p=0.0004) and young cMNs (40.71Hz vs 30.61Hz, p=0.0002). Second, we found that the mean peak PIC amplitude was larger in old cMNs than in young cMNs (-1722pA vs -1402pA, p=0.0161). The mean voltage at which the PIC peak occurred was also more negative in old cMNs than in young cMNs (-27.77mV vs -23.01mV, p=0.0049). Additionally, both the mean onset (-69.67mV vs -65.38mV, p=0.0162) and mean offset voltages (-73.91mV vs -66.52mV, p=0.0008) were significantly more negative in old cMNs than in young cMNs.

Conclusion

Aged mice show increased cMN excitability, and an increase in the amplitude and duration of the PIC. Similar to our findings, age-related neuronal hyperexcitability has also been demonstrated in the hippocampus and somatosensory cortex. Work is ongoing to understand the potential mechanisms of cMN hyperexcitability and how cMN hyperexcitability contributes to loss of physical function during aging

Impact Statement

Loss of muscle strength is an important contributor to loss of physical function in older adults, but mechanisms of age-related muscle failure remain incompletely understood. Our findings identify cortical motor neuron excitability dysfunction, in the form of hyperexcitability and increased persistent inward current, as a striking phenotype in aged mice. Future work will investigate how cortical motor neuron excitability dysfunction contributes to age-related loss of physical function.

Microglia-mediated synaptic dysfunction contributes to chemotherapy-related cognitive impairment

Jingxiong Wang,[1,2] Hua Zhang,[2] Marc Augenreich,[3] Zhaofu Sheng,[2] Peiru Zheng,[2] Hui-Ming Chang,[4] Edward H. Yeh,[4] Zhenguo Liu,[2] Luis Martinez-Lemus,[2,3] Heike Wulff,[5] De-Pei Li[2]

[1]University of Missouri-Columbia
[2]Center for Precision Medicine
[3]Department of Medical Pharmacology and Physiology
[4]Departments of Pharmacology and Toxicology and Internal Medicine, The University of Arkansas for Medical Sciences
[5]Department of Pharmacology, University of California Davis

Objectives
To test our hypothesis that microglia-mediated synaptic plasticity drives CRCI.

Methods
Adult C57BL/6J wild-type male mice were treated with chemotherapeutic drugs 5-Fluorouracil and leucovorin (5-Fu/LV) and co-administrated microglia inhibitor minocycline (MC) plus 5-Fu/LV (MC+5-Fu/LV) to decipher the mechanisms underlying CRCI. We assessed in vivo cognition by novel object recognition (NOR) and open field exploration (OFE) tests, and assessed the levels of the hippocampal LTP, evoked excitatory postsynaptic currents (EPSCs) and N-Methyl-D-aspartic acid receptor (NMDAR)-EPSCs. We characterized morphology and function of hippocampal microglia by immunohistochemical (IHC) staining and phagocytotic assay.

Results
5-Fu/LV-treatment deteriorated cognition in the mice; distorted microglial morphology and function in hippocampus illustrated by an increase in the total and activated microglial numbers, and a decrease in phagocytotic microglia with shortened processes and diminished endpoints vs vehicle. 5-Fu/LV treatment also reduced hippocampal LTP and attenuated evoked glutamate-NMDAR-EPSCs. In addition, 5-Fu/LV treatment enhanced hippocampal Homer1 and PSD95 protein expression levels. Notably, co-administration of MC+5-Fu/LV rescued the deteriorated cognitive, elevated the decrease in LTP and NMDAR-EPSCs, restored the increased expression levels of post-synaptic Homer1 and PSD95, and educed microglial ramification.

Conclusion
Our data suggest that microglial malfunction and related synaptic dysfunction contribute to 5-Fu/LV-induced cognitive impairment. Targeting microglia during chemotherapy may mitigate cognitive impairment clinically.

Impact Statement
Microglia actively and constantly survey and acts with the alterations of the milieu of CNS due to chemotherapy. Malfunction of microglia and related synaptic dysfunction contribute to 5-Fu/LV-induced cognitive impairment. Targeting microglia during chemotherapy may mitigate cognitive impairment clinically.

IP-electroCL: Assessing physiologic multiprotein complexes with immunoprecipitation detected by electrochemiluminescence

Melissa T. Zaidi,[1] Adam G. Schrum[2]

[1]University of Missouri-Columbia
[2]Department of Molecular Microbiology and Immunology

Objectives

Proteins join together to instruct the cell to perform functions, thus, the hypothesis that protein-protein interactions (PPIs) activity is distinct in healthy vs. diseased states. The field needs technologies that expand our capability to observe and measure PPI networks, ideally from small samples. This will be a major step toward understanding diseases, and toward designing drugs to combat malignant signals or enhance the body's immune defenses. This work is dedicated to the technical development, validation, and preparation of an ultrasensitive ELISA plate-based procedure that can be used for such analyses using a Mesoscale QuickPlex SQ 120 instrument. For this purpose, the T cell antigen receptor (TCR) PPI network was chosen due to its importance in immunological tolerance and immunity.

Methods

Affinity measurements of capture reagents specific for the TCR/CD3 complex were performed using the platform. The Mesoscale system's sensitivity, specificity and dynamic range were assessed & determined. Parameter optimization was carried out to determine conditions for best signal-to-noise (S/N) ratio. We also investigated whether the system follows the rule of analyte-independence and ambient analyte conditions. Finally, the platform was applied to hypothesis testing on the composition of the TCR/CD3 complex in the CD3 epsilon delta KO mice.

Results

The assay is specific, sensitive (with experimentation possible with as low as 49 cells) and has a broad dynamic range. Capture reagents display a range of affinities which we found, impacts their capture capacity. We identified experimental conditions for best S/N and where poor affinity reagents can still be reliably used. The Mesoscale system respected the analyte independence and the AAC rules and was successfully used to observe a second CD3 epsilon gamma heterodimer in the CD3 delta KO mice.

Conclusion

These assay properties make this platform suitable to measure multiprotein complexes from physiological sources.

Impact Statement

IP-electroCL provides a platform to measure multiprotein complexes from physiological sources, upon which we will expand and apply our network analysis. Our goal is to apply it to T cell signaling in the context of cancer immunotherapy and autoimmunity. We propose that IP-electroCL will allow network analysis to identify qualitative, quantitative, and kinetic differences in networks of multiprotein signaling complexes between different conditions. Such knowledge could substantially impact strategies for pharmacological targeting.

Ellis Fischel Cancer Center Research Day Editorial

Editorial by Gerhard Hildebrandt, MD

Director of Ellis Fischel Cancer Center
Chief of the Division of Hematology and Medical Oncology
Nellie B. Smith Endowed Chair of Oncology
NextGen Precision Health Investigator

The Ellis Fischel Cancer Center (EFCC) at the University of Missouri held its 2nd Annual Research Day on April 30, 2024. The Research Day was initiated by the EFCC leadership last year to promote and showcase the impact of the ongoing research at the University of Missouri on the residents of central Missouri and beyond nationally and internationally. The Cancer Center Research Day provides the unique opportunity to trainees and scientists throughout all stages in their career to showcase their work and to interact with colleagues and peers. This all-day meeting was attended by over 150 guests representing the major regions of Missouri including Kansas City, Springfield, St. Louis, Lake Ozark, and Cape Girardeau.

The meeting featured prominent keynote speakers from the University of Michigan and the National Cancer Institute. The "Oppenheimer-Franklin Cancer Lecture" was delivered by Daniel F. Hayes, MD, FASCO, FACP from the University of Michigan on "Late Recurrence and Extended Endocrine Therapy for Estrogen Receptor Breast Cancer." The "Cancer Prevention and Control Lecture" was given by Phillip E. Castle, PhD, MPH, Director of the Division of Cancer Prevention from the National Cancer Institute. In addition, Parvesh Kumar, MD, Associate Dean for Clinical and Translational Research and the Associate Director of Clinical Research for the EFCC, presented an overview of the significant progress that has been made regarding the clinical trial enterprise that includes establishment of the "Protocol Review and Monitoring System" and the virtual doubling of enrollments to therapeutic interventional clinical trials during the last 3 years.

In addition, a "Top Enroller" acknowledgement and recognition ceremony was held for the clinical investigators and the Disease Working Group Chairs / Co-Chairs including the Clinical Trials Office research staff for their significant contributions to the success of the clinical trial enterprise. The meeting was capped off by the annual "State of the Cancer Center" address that was delivered by the Cancer Center Director which also included the Director's awards. This address reviewed the significant progress that has been made at the EFCC during the last 2 years including recruitment of new medical oncology clinical faculty, tremendous growth in the volume of cancer patients and the establishment of the first and only central Missouri CAR-T Cell Therapy Center.

An impressive 54 abstracts were presented at the meeting that highlighted the collaborations among our basic scientists and clinical research investigators involving many schools and departments at the University of Missouri. The event was marked by the recognition of Peggy Birikorang, PhD(c), and Nagabhishek Sirpu Natesh, PhD, who each received the Director's Research Award for their outstanding abstracts. Birikorang was honored for her work titled "Preclinical Evaluation of an Anti-EphA2 Minibody-based ImmunoPET Agent for Glioma," which represents a significant advancement in imaging technologies for brain cancer. Natesh's research, "Unraveling the Mechanism: MiR-345-5p Suppresses Pancreatic Cancer Metastasis via Regulation of the KLK7/E-Cadherin/β-Catenin/Rap1 Axis," provided new insights into the molecular pathways that could potentially halt pancreatic cancer metastasis.

In addition to the director's awards, selected abstracts were presented orally, demonstrating a range of innovative approaches to cancer research. Topics covered included advancements in Bruton Tyrosine Kinase inhibitors, the relationship between acute myeloid leukemia (AML) and cardiovascular disease (CVD), and novel therapeutic approaches in cancer immunotherapy.

The best poster awards recognized exceptional visual presentations, including Feyza Nur Arguc's exploration of CD137 agonist-mediated cancer immunoprevention and Valerie Carroll's study on Boron Neutron Capture Therapy in tumor-bearing mice, showcasing the Center's commitment to pioneering innovative cancer treatments.

We also highlight the diversity of our abstracts by showcasing a sampling of 6 abstracts that were presented at the EFCC 2nd Research Day as noted below. These abstracts covered diverse research areas such as incidence / prevention, social media and AI, treatment and outcomes, stem cells and comparison of health care hospital standards:

1. Vishwa Bhayani: "Cervical Cancer- A snapshot from Incidence to Prevention in Missouri region"
2. Deborah Carey: "Treatments and Outcomes of Hematopoietic and Lymphoid Cancer"
3. Lucinda Ham: "Childhood Cancers Incidence in Missouri: Analysis from 2004-2020"
4. Nishant Jain: "Utilizing Social Media and Generative AI for Rare Cancer Information: Complementing Existing Resources"
5. Evadne Rodriguez: "Comparing HealthCare Standards: Hospital Teaching Status and Lung Cancer Patient Hospitalizations"
6. Kerem Yucebas: "Identification of Endometrial Cancer Stem Cells"

Trends, treatments, and outcomes of hematopoietic and lymphoid cancer diagnosed 2011 - 2020

Deborah Carey ODS-C,[1,2] Lucinda Ham,[1,2] Chester Schmaltz,[1,4] Iris Zachary PhD, MS, FAMIA, ODS-C,[1,2] Joseline Hernández, MPH[1,2]

[1]University of Missouri-Columbia
[2]Missouri Cancer Registry and Research Center
[3]Missouri Department of Health and Senior Services
[4]Center for Medical Epidemiology and Population Health

Introduction

Hematopoietic and lymphoid cancers consist of distinct subtypes of leukemia, lymphoma, and multiple myeloma. In 2024, the American Cancer Society (ACS) estimates that 62,770 individuals will be diagnosed with leukemia and 89,190 individuals will be diagnosed with lymphoma in the U.S. Chemotherapy and immunotherapy are the standard first course of treatment. According to the ACS, cancers not amenable to standard first course treatments may be treated with high-dose chemotherapy followed by stem cell or bone marrow transplantation. Recent years have seen a decline in mortality rates for these cancers attributed to advancements in targeted therapies.

Objectives

This study aims to analyze incidence trends, prevalent cancer subtypes, patient survival rates, and treatment modalities for hematopoietic and lymphoid cancers in Missouri. This study highlights potential incidence trends, prevalent cancer subtypes, and treatments.

Methods

The study analyzed data from the Missouri Cancer Registry on malignant cancer incidence by gender, county at diagnosis, and treatment modalities for 2011 through 2020 (excluding 2020 in trend analyses since COVID-19 may have made that year anomalous). Rates were age-adjusted to the 2000 US Census population. Cancer types were categorized according to the SEER Site Recode ICD-O-3/WHO 2008 Definition.

Results

The study identified consistent treatment approaches and incidence rates between Missouri and the United States. The rates in Missouri were 21.3 per 100,000 people for Lymphoma, 6.6 for myeloma, and 14.0 for Leukemia. The most frequent Leukemia subtype was Chronic Lymphocytic Leukemia (rate 4.7), and the most frequent lymphoma subtype was Nodal Non-Hodgkin Lymphoma (rate 12.8). Rates were statistically significantly higher for males than females for lymphoma (43% higher), myeloma (58% higher), and leukemia (64% higher). The majority received chemotherapy as part of first-course treatment (64% for lymphoma, 63% for myeloma, and 53% for leukemia). We detected differences in incidence rates by geographical region for each of these cancer types. The five-year relative survival was 74.5% for lymphoma, 54.6% for myeloma, and 62.2% for leukemia. Gender disparities were evident, with males showing significantly higher incidence rates across all cancer types. Although overall trends remained stable, specific leukemia subtypes exhibited significant decreases in incidence. First-course treatment in Missouri mirrored national patterns for chemotherapy over immunotherapy. The five-year relative survival rates were 74.5% for lymphoma, 54.6% for myeloma, and 62.2% for leukemia.

Conclusion

The period from 2011 to 2020 saw stable rates of hematopoietic and lymphoid cancer cases in Missouri, alongside improvements in survival rates, highlighting the crucial role of continuous advancements in treatment strategies. This comprehensive analysis underscores the importance of ongoing research and healthcare efforts to further enhance outcomes for patients with these challenging diseases.

Comparing healthcare standards: hospital teaching status and lung cancer patient hospitalizations

Evadne Rodriguez,[1] Saad Javaid MD,[2] Kelly Frasier DO, MS,[3] Olivia Carll,[4] Vivian Li,[4] Alexandra Loperfito[5]

[1]University of Missouri-Columbia
[2]Wyckoff Heights Medical Center
[3]Nuvance Health/Vassar Brothers Medical Center
[4]Lake Erie College of Osteopathic Medicine
[5]Edward Via College of Osteopathic Medicine

Introduction

We conducted a comprehensive cross-sectional analysis to investigate the potential impact of both hospital volume and teaching status on patient outcomes among those hospitalized with lung cancer.

Methods

Employing the National Inpatient Sample (NIS) data from the years 2019 to 2020, we identified individuals who were hospitalized with a primary diagnosis of lung cancer. Subsequently, we divided the cohort into two groups: those who were hospitalized in teaching hospitals, and those who were hospitalized in non-teaching hospitals. Subsequently, a multivariate regression analysis was conducted to adjust for confounding variables, and both primary and secondary outcomes were examined in each group.

Results

A total of 221,320 patients were hospitalized with lung cancer in the United States across all hospitals in 2019 and 2020. Of these, 42,050 (19.01%) were hospitalized in non-teaching hospitals, while 177,056 (80.98%) were hospitalized in teaching hospitals. There was no significant difference in mortality (OR 0.88, 95% CI 0.77-1.00, P=0.06) or length of stay (+0.15 days, 95% CI -0.04-0.34, P=0.141) in the hospital between teaching and non-teaching hospitals. However, the total cost of hospitalization was higher for patients admitted to teaching hospitals (+USD 8255, 95% CI 3746-12765, P<0.001). Additionally, patients in teaching hospitals had a higher incidence of sepsis (OR 1.32, 95% CI 1.07-1.63, P=0.010), acute respiratory failure (OR 1.79, 95% CI 1.73-1.86, p<0.001), ICU admissions (OR 1.12, 95% CI 1.18-1.26, P=0.035), and surgical interventions of the lungs (OR 1.60, 95% CI 1.42-1.80, p<0.001). On the other hand, there was a lower incidence of acute coronary syndrome (OR 0.60, 95% CI 0.43-0.84, P=0.003), pneumonia (OR 0.72, 95% CI 0.66-0.78, P<0.001), blood transfusion (OR 0.83, 95% CI 0.70-0.98, P=0.028), and anemia (OR 0.87, 95% CI 0.81-0.94, P<0.001) in patients admitted to teaching hospitals.

Conclusion

Patients admitted to teaching hospitals with lung cancer tend to incur higher costs of hospitalization and increased resource utilization. This is often attributed to the provision of high levels of care and frequent admissions to the intensive care unit. Moreover, teaching hospitals are known for their higher rates of accepting transfers of sicker patients necessitating advanced levels of care.

Identification of endometrial cancer stem cells

Kerem Yucebas,[1] Sooah Ko,[1] Jinyu Zhou,[2] Mark Hunter,[2] Shiying Jin[2]

[1]University of Missouri-Columbia
[2]Department of Obstetrics, Gynecology and Women's Health

Introduction

Endometrial cancer (EC) is the most common gynecologic malignancy in the United States. It typically presents with abnormal vaginal bleeding and pelvic pain, dramatically compromising quality of life for women. Thus, prevention or treatment of endometrial cancer is of importance to women's health. Cancer Stem Cells (CSCs) with self-renewal capacity have been identified in diverse cancers as the origin of carcinogenesis. Here, we hypothesize that Endometrial Cancer Stem Cells (ECSCs) initiate and support tumorigenesis and tumor expansion in the human uterine endometrium. ECSC identification will provide a novel understanding of EC and promote developing targeted therapies against ESCSs, reducing endometrial cancer-associated tumor burden and mortality.

Methods

Cryosections of endometrial cancer tissue, collected from hysterectomies at the University of Missouri, were stained with hematoxylin and eosin (H&E) revealing EC histology. Next, sections were immunofluorescent stained with epithelial cell marker CD326, cancer cell marker COX2 and cell proliferation marker MKI67 to determine the growth pattern of endometrial cancer. Staining was visualized and imaged with fluorescent microscopy and quantified to characterize expression levels and distribution.

Results

H&E staining showed expansion into the lumen, high cellular density, and a significantly thicker endometrium in EC, compared to non-cancerous control samples. The epithelial identity of cancer cells was confirmed by expression of CD326 and COX2. Expression of MKI67 constructed a dynamic growth map of EC across the basal and the functional zones.

Conclusion

The unique morphology and growth pattern of EC in humans, supported our hypothesis that ECSCs may initiate and support tumorigenesis and tumor expansion in human uterine endometrium.

Childhood cancers incidence in Missouri: Analysis from 2004-2020

Lucinda Ham RHIA, ODS-C,[1,2] Schmaltz Chester PhD,[1,2] Iris Zachary PhD, MS, FAMIA, ODS-C,[1,2] Joseline Hernandez MPH[1,2]

[1]University of Missouri-Columbia
[1]Department of Biomedical Informatics, Biostatistics and Medical Epidemiology

Introduction

Cancer remains the leading disease-related cause of death in children in the United States. In 2024, an estimated 9,620 children ages <20 years are projected by the American Cancer Society to be diagnosed with cancer. Nationally, the most commonly diagnosed cancers in children are leukemia, brain (including benign and borderline malignant tumors [henceforth, "benign brain"]), and lymphoma. The cancer death rate has declined dramatically nationwide due to improvements in treatment and high participation in clinical trials for the most common childhood cancers to less than 3%.

Objectives

This study examines the most prevalent cancer types among children in Missouri while assessing potential trends in cancer incidence across the state.

Methods

This study used data from the Missouri Cancer Registry (MCR) on childhood primary malignant cancers and benign brain tumors, and data from the US Cancer Statistics to evaluate age-adjusted incidence rates, and trends among children under 20 years of age diagnosed between 2004 and 2020. Tumor types were classified according to the International Classification of Childhood Cancer (ICCC) Third edition (IARC 2017), and were analyzed by gender, race/ethnicity (Non-Hispanic White, NH Black, NH Other, & Hispanic), SEER Summary Stage of disease, county at diagnosis (grouped into seven regions), Histology, and year of diagnosis (excluding 2020 in trend analyses since COVID-19 may have made that year anomalous).

Results

The overall incidence rate for malignant childhood cancers was 16.7 per 100,000, with notable differences based on gender, race/ethnicity, and cancer stage. The three most common malignant ICCC categories are *I Leukemias, myeloproliferative & myelodysplastic diseases (rate 3.9), III CNS and misc. intracranial and intraspinal neoplasms (rate 3.3)*, and *II Lymphomas and reticuloendothelial neoplasms* (rate 2.3). Missouri cancer profile aligns with national trends, with B-Cell Lymphoblastic Leukemia and Pilocytic-Astrocytoma being the most common histologies. Overall, 40% of children were diagnosed with a localized malignant cancer and 18% were regional, 39% distant, & 3% unknown/unstaged. Almost half (47%) were diagnosed at distant stage for ICCC category II (Lymphomas) and nearly all ICCC category I (Leukemias) were distant. For ICCC category III (CNS), 79% were localized; and for *XI Other malignant epithelial neoplasms and melanomas*, 60% were localized. The rate for all reportable benign brain tumors was 2.2. The overall malignant rate was lower in the Southwest but higher in the KC Metro area compared to the rest of the state; the benign brain tumor rate was statistically significantly lower for Southeast Missouri than the rest of the state.

Conclusion

This analysis highlights the importance of monitoring for early symptoms in the pediatric population. Many early signs and symptoms of childhood cancer are nonspecific, making awareness and early detection crucial for improved outcomes. The findings support the need for ongoing monitoring and targeted interventions to address disparities in childhood cancer incidence in Missouri.

Utilizing social media and generative AI for rare cancer information: complementing existing resources

Nishant Jain MS, MHA,[1,2,3,4] Suzanne Boren MHA, PhD, FACMI, FAMIA,[2,3,4] Iris Zachary PhD, MS, FAMIA, ODS-C,[2,3,4] Mohammad Beheshti MSHI,[2,3] Vishwa Bhayani MSHI,[2,3] Lucinda Ham RHIA, ODS-C,[2] Chester Schmaltz PhD[2]

[1]University of Missouri-Columbia
[2]Missouri Cancer and Registry Center
[3]Department of Health Management and Informatics
[4]MU Institute for Data Science and Informatics

Introduction

Rare cancers represent 20-24% of all cancer diagnoses and 25-30 % of all cancer deaths (1). They present unique challenges because information is still evolving and developing in clinical domains and information is not easily accessible/available. Very few studies have investigated social media platforms and research indicates that these platforms offer potential sources of rich, real-time data to supplement traditional information repositories (2–4). This study investigates the usefulness of Reddit, X (formerly Twitter), and Threads in providing insights into rare cancers, with a focus on content related to diagnosis, treatment, prognosis, and community engagement.

Methods

We used two different methods to gather and examine data from social media. First, we used various search terms such “rare cancer” using NodeXL, yielding 2361 posts from 1700 users, and additional posts using specific scientific names of rare cancers on Reddit (5). Second, we used the scientific names of specific cancers from the National Cancer Institute (NCI) About Rare Cancers website (6) to search on X and Threads, focusing on rare endocrine, soft tissue, and bone cancers. Additionally, utilizing openly available generative AI tools such as ChatGPT for prompt engineering, the text of the ten most recent messages for each type of cancer was compared to data from the NCI website.

Results

Our initial research suggests that social media sites include a variety of information relevant to uncommon tumors.

Based on content analysis, we identified four useful categories:

1) Medical Discussion/Information: Posts containing details on the features and locations of unusual tumors, as well as posts on their immunohistochemistry, pathology, and characteristics.
2) Research and Publications: Posts that include quotes from trade journals, news releases, or research updates about uncommon malignancies.
3) Professional Communication: Posts that feature doctors or other medical professionals talking about cases, sharing expertise, or advertising events.
4) Event Promotion: Posts promoting events related to rare cancer research or fundraising.

These categories offer a structure for classifying and interpreting social media posts about uncommon malignancies, which help with information sharing, research updates, health professionals, and community initiatives. Specifically, trustworthy resources like the NCI’s official webpage provided a more thorough picture, especially about diagnosis, treatment, prognosis, and related resources. But social media information can enhance current NCI resources by providing fresh viewpoints, conversations, and real-time updates.

Conclusion

Based on preliminary results, social media integration can improve the accessibility and comprehensiveness of information that is essential for managing and supporting rare cancers. In the future, we aim to design an automated information retrieval tool to extract social media data and harness the power of generative AI to interpret, summarize, and classify cancer information. Finally, we will use cancer domain experts to check/validate our findings, as needed.

Cervical cancer - A snapshot from incidence to prevention in Missouri region

Vishwa Bhayani MSHI,[1,2] Iris Zachary PhD, MS, FAMIA, ODS-C,[1,2] Chester Schmaltz PhD,[1,2,3] Lucinda Ham RHIA, ODS-C,[1,2] Joseline Hernandez MPH,[4] Xarria Lewis MPH,[4] Kathy Sluyter,[4] Anthony Belenchia PhD,[5] Katie Long MBA[4]

[1]University of Missouri-Columbia
[2]Missouri Cancer Registry and Research Center
[3]Department of Biomedical Informatics, Biostatistics and Medical Epidemiology
[4]Missouri Department of Health and Senior Services
[5]Dalton Cardiovascular Research Center

Introduction

Cancer remains the second leading cause of death in the United States after heart disease. Gynecologic cancers are the cancers that start in women's reproductive organs. Among gynecologic cancers, only cervical cancer has screening tests and immunizations available. Cervical cancer is one of five main types of gynecologic cancer. Missouri ranks 14th in the cervical cancer mortality rates in the United States. Human papilloma virus (HPV) is a risk associated with cervical cancer. Screening tests can confirm the presence of the virus or neoplasms in the cervix. The focus of this study is on prevalence, survival rates, cervical cancer and HPV related screening and immunization, and stage at diagnosis in Missouri from 2016-2020.

Methods

We used the most current Behavioral Risk Factor Surveillance System (BRFSS) data to obtain information on cervical cancer screening rates for 2016-2020, while the United States Cancer Statistics (USCS) data provided information on incidence and mortality rates (age-adjusted and per 100,000 women) of cervical cancer and survival/distribution by stage for 2016-2020, 5-year survival rates, prevalence rate of women diagnosed from January 1, 2015, to December 31, 2019 (5-year limited duration as of January 1, 2020), and cervical cancer screening rates in Missouri for 2020.

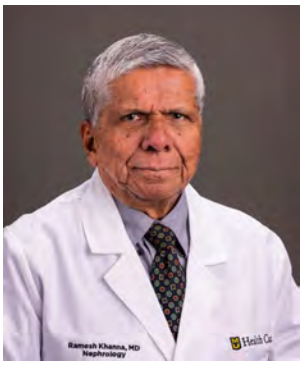
Results

Our analysis revealed that the incidence rate of cervical cancer in Missouri is 8.2 per 100,000 with rates of 9.3 for Non-Hispanic Black and 8.3 for Non-Hispanic White women. The mortality rate is 2.4, with rates of 4.0 for Non-Hispanic Black and 2.3 for Non-Hispanic White women. The prevalence of cervical cancer survivors diagnosed in the previous 5 years in Missouri on January 1, 2020, is 0.032% with a 5-year relative survival rate of 65.8%. The cervical cancer screening rate (within 3 years for ages 21-65) in Missouri in 2020 is 78.8% with the highest screening in three of the BRFSS regions (St. Louis Metro region, Central region, and Kansas City Metro region). The rate of HPV immunizations among teens ages 13-17 in MO is 63.8% in 2022. Most of the cervical cancers were diagnosed at the localized stage (43%) followed by regional stage (38.5%). The survival rate is highest at localized stage (88.8%) and drops to 17.6% when diagnosed at distant stage.

Conclusion

Our study highlights the importance of examining regional differences in cancer patterns and screening rates in Missouri. Increasing screening rates and timely HPV vaccinations can help prevent the incidence of cervical cancers in females. Detailed regional analyses can identify challenges and opportunities for cervical cancer prevention and control.

History of the Annual Dialysis Conference (ADC)



Editorial by Ramesh Khanna, MD

Professor of Medicine
Director and Chair - Karl D. Nolph, MD Division of Nephrology
Department of Medicine
MU School of Medicine

In the mid-1970s, Jack Moncrief and Robert Popovich introduced the concept of equilibrium peritoneal dialysis, later known as CAPD (continuous ambulatory peritoneal dialysis). Despite initial rejection of their abstract on this technique by the American Society for Artificial Internal Organs (ASAIO) Journal in 1976, the concept gained traction. At a January 1977 NIH Contractors' Meeting, Moncrief, Popovich, Karl Nolph, and others discussed implementing CAPD at the University of Missouri and proposed its broader adoption. They agreed that "continuous ambulatory peritoneal dialysis" was a more fitting name for their method of dialysis, which was subsequently used in their abstract submitted to the American Society of Nephrology (ASN) later that year and accepted for presentation. By January 1978, CAPD was prominently featured in the NIH Artificial Kidney Program Contractors' Conference Proceedings, solidifying its recognition. Early outcomes of their collaborative study were published in the Annals of Internal Medicine in 1978, marking a significant milestone that cemented CAPD's place in medical literature and practice. This paper is regarded as foundational in establishing CAPD as a standard dialysis technique. The National CAPD Conference originated from an initiative spearheaded by Karl Nolph during his coordination of the Registry. Initially proposed by the NIH, the conference aimed to boost enrollment in the Registry and disseminate advanced CAPD information to centers interested in establishing programs. Although initial hopes for NIH funding were dashed, the University of Missouri agreed to host the event, which required participants to cover expenses through a registration fee. Thus began the meticulous planning for the inaugural conference, held in Kansas City from February 16-19, 1981. The event drew 350 attendees from 40 U.S. states and 11 countries, evenly split between nurses and physicians. Little did organizers anticipate the conference's future growth, expanding to nearly 3,000 attendees from over 50 countries by 2002 and evolving into the Annual Dialysis Conference (ADC). By late 1989, the conference had

outgrown Kansas City's facilities, requiring a move to Dallas, Texas for its 9th consecutive year of successful conference, marking a significant progression from its humble beginnings.

Annual Dialysis Conference objectives were and remain to:

- Review appropriate dialysis therapies to meet the medical and psychosocial needs of CKD patients and their families.
- Describe current trends and established strategies in the management of the full range of services required by adult and pediatric dialysis patients.
- Compare and contrast research findings related to improving the quality of care for dialysis patients.
- Evaluate the latest evidence concerning the prevention and management of complications of CKD and dialysis.
- Discuss major controversies and new developments in PD, HD, and pediatric dialysis.
- Review fundamental knowledge of dialysis.

The Annual Dialysis Conference brings input from numerous professional societies and industries together for sharing of experiences and advances in both peritoneal dialysis and hemodialysis in adult and pediatric patients.

In the span of four decades since the small beginning, our initiative has achieved significant milestones, reflecting a commitment to advancing the field of dialysis on a global scale. The following are our accomplishments and highlight ADC's impact:

We have organized 44 consecutive yearly conferences in different cities spanning over east & west coast and mid-western cities in the US.

- Over 88,000 healthcare professionals have participated in our conferences, comprising approximately 40% physicians, 55% nurses, and 15% other healthcare professionals.
- A total of 9,600 experts have been invited to share their insights, pearls of wisdom, and research findings at the ADC.
- Our platform has hosted over 3,250 slide and 6,400 poster presentations, facilitating the dissemination of diverse research topics. Most of these presentations were later published as abstracts in the supplements of Peritoneal Dialysis International.
- Over 1,790 manuscripts have been published in Advances in Peritoneal Dialysis and Hemodialysis International Journals, consolidating our contributions to scholarly literature.
- Delegates from over 62 countries have participated, fostering international collaboration and knowledge exchange.

The “Advances in Peritoneal Dialysis” proceedings, edited annually by Dr. Ramesh Khanna, inadvertently shared its title with an earlier Berlin conference, highlighting the growing impact and evolution of the field.

In the 1980s, during the days of Kansas City conferences, our CAPD program in Columbia, Missouri, saw a notable increase in visitors, mostly driven by the desire to learn the new technique of CAPD, especially from overseas. Despite the bustling activity as hosts and organizers, it provided valuable opportunities to form new connections and offer support, experiences that we deeply appreciate.

A multidisciplinary approach to a multi-visceral intestinal transplant patient with ESKD: One center's experience

Diane Kraynak CPNP-PC CNN,[1,2]
Celina Brunson MD MSCE [1,2]

[1]Children's National Health System
[2]Department of Nephrology

Background

Intestinal transplantation is a growing area offering lifesaving modalities to both adult and pediatric patients. It is well-reported that calcineurin inhibitors used post-transplant can lead to renal insufficiency which may require dialysis. Thus, any transplant patient is at risk for renal failure in their post-operative period. Our Center is caring for a pediatric multi-visceral intestinal transplant (MVIT) patient due to gastroschisis as an infant, now in renal failure requiring chronic hemodialysis. He is anuric and receiving enteral nutrition via J-tube. He eats no food by mouth – solid or liquid. His MVIT was done in another institution in our city, and his medical management is split between two teams: us and his GI Transplant team. In addition to the expected dialysis issues such as hypertension, fluid management, and electrolyte disturbances, his course is further complicated with nutrition optimization because of the dependence on formula and its effect on managing his fluid. Compounding these challenges are two complete medical teams in different institutions, health medical records, plus home health nursing and Child Protective Services. Consistency of care has been difficult with attrition. Over our eighteen months with him, the staff turnover has been two physicians, two social workers, two nurse practitioners, and one case worker. This patient has frequent and prolonged inpatient admissions due to GI complications which further exacerbates the struggles of his management. The dual medical systems translate into double work with documentation, medication management, lab work and leads to errors across the board.

Aim

To facilitate consistency of care, our Center sought to develop a workable collaborative relationship between three entities: our hospital providing dialysis services, the hospital managing the MVIT, and social services (Child Protective Services).

Methods

Establishing a standing weekly Zoom meeting with all three entities regardless of if the patient was inpatient or outpatient. Developed a phone tree for family and home nursing to help ensure the family was calling the appropriate provider for the issue at hand.

Results

For the past eighteen months, utilizing our standing weekly Zoom meetings between the two hospitals, we've been able to maintain clear, consistent communication between our two teams. The standardization of this approach has led to better discharge coordination, medication reconciliation, and laboratory management.

Conclusion

MVIT patients with renal failure are complex and challenging. Given the growing success of MVIT, it's reasonable to assume nephrologists will begin to see more and more of these patients in CKD and Dialysis. Adopting a standardized multidisciplinary approach can help ease the strain of working with the various teams.

A real-time remote monitoring device of peritoneal dialysis treatment to support healthcare professionals and patients

Florence Naillat PhD,[1] Jana Tölli PhD,[1]
Juha Remahl MSc,[1] Monika Bürki RN,[1]
Markku Asola MD PhD,[1]
Markku Känsäkoski MSc,[1] Pirgit Silvast-Äikäs[1]

[1]Smart PD Solutions Ltd/Kiwecare

Background

As the world population grows older, the probability of developing conditions such as type 2 diabetes, obesity, and cardiovascular diseases increases, and such factors impact the development of chronic kidney disease (CKD). As a result, it often leads to end-stage kidney disease (ESKD) when the patient's kidneys cannot properly filtrate blood to remove waste products and water to produce urine. Dialysis treatments can be carried out either in dialysis centers or at home. Dialysis centers are still the most common option; however, the choice for home dialysis is steadily rising. E.g., peritoneal dialysis (PD) provides patients with greater lifestyle flexibility and independence than being treated in dialysis centers. Until now, no continuous monitoring device exists to check the efficacy of real-time PD treatment. The patient waits 6 to 12 weeks (ISPD guidelines) for a check-up when the blood and PD fluid samples are analyzed in a clinical lab to investigate the PD parameters.

Aim

To develop a monitoring device to measure the glucose, urea, and creatinine in the PD drain line in real-time.

Methods

Our proposed method is a novel monitoring device continuously measuring glucose, creatinine, and urea levels during PD treatment. A microfluidic flow sensor clamps on the drain line from the PD cycler, samples the drain line every cycle, and sends the real-time values to the cloud-based system.

Results

The monitoring device includes a microfluidic cassette with selected sensors and a reader device for data acquisition. The information is transmitted to a secure cloud for real-time data processing and visualized by our developed digital app. Patients and clinicians can connect to the cloud at any time and check how the PD treatment is progressing in effectiveness, efficacy, and efficiency.

Conclusion

ISPD Guidelines highlight that listening to the patient's view is necessary and managing volume overload is critical for the patient's health outcomes. Towards this goal, the key opinion leaders emphasize the incremental PD treatment, and our developed sensor will support this process as one option. To conclude, our solution is unique in the market. Our goals are to provide a better treatment outcome for PD patients and to support clinicians in improving PD treatments for each patient toward personalized treatment.

Carnitine deficiency in a pediatric dialysis population: Development of an administration protocol

Laura Quenneville RD,[1]
Abigail Brodovitch DtP[2]

[1]Children's Hospital of Eastern Ontario
[2]Montreal's Childrens Hospital

Background

Carnitine is an amino acid derivative involved in the transport of fatty acids to cells for energy production. There are two forms of carnitine; Free (active form or levocarnitine) and Acyl. The most common definition for carnitine deficiency is a total serum carnitine level less than 40 µmol/L, free carnitine level less than 20 µmol/L, or an acyl-carnitine (total carnitine - free carnitine) to free carnitine ratio greater than 0.4. Based on these biochemical parameters, multiple studies have documented carnitine deficiency amongst dialysis patients. This low molecular weight and non-protein bound molecule passes easily through the dialysis filter or peritoneal membrane, contributing to losses leading to the theory that patients on dialysis will require more carnitine than the rest of the population. Clinical symptoms of deficiency include muscle weakness, intra-dialytic hypotension, cardiac arrhythmia, EPO agent resistant anemia and cramping. The National Kidney Foundation has recommendations for carnitine supplementation in adults requiring dialysis treatments but none for children. They do not discourage therapeutic trials of the supplement when clinical symptoms are present, but clear guidelines are lacking to address and treat those patients whose laboratory findings are compatible with carnitine deficiency in the absence of clinical symptoms. Therefore, we endeavored to evaluate the need for and benefits of carnitine supplementation in pediatric dialysis population.

Methods

This was a registered dietitian led project that includes 7 PD, and 10 HD patients from two pediatric hospitals in Canada. We obtained initial serum carnitine levels, and then followed with periodic testing: 1 month post and every 2-3 months thereafter. Initial doses of levocarnitine were set at 1g/week IV (HD) and 1 g/month IP (PD) with follow up and monitoring every 1-3 months. The target acyl/free ratio is 0.4. Following initial management, the dose and timing of administration of levocarnitine were used to create a levocarnitine supplementation administration protocol.

Results

With the initial dosage schedule of 1 g/week (HD) and 1 g/month (PD), there was no increase to free carnitine levels 1 month post, and the acyl/free ratio remained unchanged, suggesting a suboptimal starting dose. When frequency and dosage were increased, acyl/free ratio improved without notable side effects. Specifically, carnitine dose was increased to 20 mg/kg and was administered multiple times a week post-HD and once a week (PD).

Conclusion

Children on dialysis consistently have low serum carnitine levels, suggesting widespread deficiency in this population. There is a lack of practical guidance with respect to appropriate supplementation. Some centers provide regular supplementation, but practices differ. The aim of this project was to better define current practice across certain Canadian hospitals with the goal of establishing a standardized tool to optimize the management of carnitine supplementation. This tool could include optimal dosages and suggest frequency for bloodwork monitoring (pre/post treatment). Considering the fact that there are no pediatric recommendations, our data could be used to generate a standardized protocol for levocarnitine administration and serve as a practical tool for pediatric dialysis centers.

Development of a novel second generation NxStage hemodialysis filter rotator for anticoagulation-free hemodialysis - Developers, investors and sponsors are welcome!

Macaulay Onuigbo MD MBA,[1,2]
Adam Locke CCHT[1]

[1]University of Vermont Medical Center
[2]Department of Nephrology

Background

In 2021, in the Mayo Clinic Proceedings Innovations Quality Outcomes journal, we had described the 'Locke-Onuigbo maneuver', a new original and groundbreaking hemodialysis filter rotational approach to achieve anticoagulation-free hemodialysis using the NxStage hemodialysis machine. We subsequently designed and developed the first prototype hemodialysis filter rotator (HDFR) in early 2022, and subsequently, we successfully completed the design and development of an advanced second-generation HDFR in 2023.

A November 2023 article in the Clinical Journal of the American Society of Nephrology reported a RCT that compared regional citrate anticoagulation with no-anticoagulation in 89 adult liver failure patients requiring CRRT. Severe hypocalcemia (13% vs. 77%, p < 0.001) was demonstrated with citrate anticoagulation, and higher filter failure occurred with no-anticoagulation. Clearly, there remains a global and critical unmet need for a sustainable approach to anticoagulation-free hemodialysis.

Methods

The aim of this project is to translate the 'Locke-Onuigbo maneuver' and to design and develop a functional HDFR that would work with the NxStage hemodialysis machine to achieve a sustainable and robust anticoagulation-free hemodialysis for the ICU, the in-center outpatient hemodialysis unit, and for patients on home hemodialysis.

Results

In the Spring of 2023, we successfully completed the design and development of an advanced second-generation HDFR that is now ready for testing, first in animals, and then finally in human subjects. We completed several "dry live runs" of this second-generation HDFR with saline prime on the NxStage machine while testing out all the different features and functionalities of the HDFR during the design and development process.

Conclusion

There is a long overdue imperative to develop a robust, safe, and sustainable modality for anticoagulation-free hemodialysis. Citrate anticoagulation and no-anticoagulation while available, have several drawbacks and limitations to their utilization. Our second-generation HDFR with its enhanced new features of increased resilience, longer running times, enhanced angle and speed consistency, improved ergonomics, solid state sensors for temperature and angle fidelity verifications, and an accompanying user-friendly versatile smartphone App with Bluetooth Connectivity to facilitate ease and convenience of monitoring and control of the HDFR, is the solution for this long overdue imperative for anticoagulation-free hemodialysis.

Development of a nutrition assessment tool for pediatric chronic dialysis patients

Dani Jackson MSN RN CPNP-PC,[1-3]
Yitong Liu MD,[1-3] Kristin Kueper, RD[1-3]

[1]Washington University in Saint Louis
[2]Department of Pediatrics
[3]Division of Nephrology

Background

Protein–energy wasting (PEW) in end stage kidney disease is due to a combination of insufficient nutrient intake, uremic toxins, inflammation, and catabolic state. Malnutrition is diagnosed by dietary history with biochemical and anthropometric measures; PEW is a state of malnutrition refractory to nutritional supplementation. In pediatric dialysis patients, growth is a sensitive marker of nutritional adequacy. We previously evaluated various nutrition classifications and found that the Gomez classification was most sensitive in detecting signs of malnutrition even when standard measures noted normal findings. There is currently no comprehensive assessment tool that utilizes both malnutrition classification and standard measures of growth and nutrition.

Aim

To create a nutrition assessment scoring tool incorporating malnutrition classification and standard measures and assess its applicability and utility in pediatric chronic dialysis patients.

Methods

In addition to standard measures of albumin, nPCR, and BMI, Gomez classification and age-based expected weight trends were noted as important information incorporated in our dietician's monthly assessment. Point values for each criterion were assigned based on the degree of abnormality and dialysis modality. For hemodialysis (HD), the maximum point value is nine, with a scale of zero to two points for all categories except for serum albumin, which ranges from zero to one. For peritoneal dialysis (PD), the maximum point value is eight, with a scale of zero to two points for all categories except for serum albumin and nPCR, which range from zero to one. A higher score corresponds to increased concern for malnutrition for which intervention and more frequent screening would be indicated. This tool was used month between March and June 2023 to evaluate its consistency and usability.

Results

For HD, we had 21 assessments across nine patients. In general, patients had stable scores with two who improved over the four-month period after nutritional supplementation. For PD, we had 37 assessments across 16 patients. Patients had stable scores with one patient consistently above four due to severe malnutrition on Gomez and low BMI.

Conclusion

Our scoring tool was consistent through the four-month test period and corroborated clinicians' perspective of nutrition status. It demonstrated improvement after nutritional supplementation was initiated so can objectively follow changes through intervention in the short-term. For future directions, we started using the scoring system as a formal screening tool in July 2023 with standardized intervention and rescreening timeframes based on scores. For scores less than four, no intervention is indicated, with rescreening in six months. For scores of four or five, nutritional supplementation is offered, with rescreening in three months. For scores seven and greater for HD or six and greater for PD, or for a point change of four or greater, further investigation of the etiology is warranted, with rescreening in one month. Our initial experience is promising with the scoring tool corresponding with some improvement after intervention. Further assessment is indicated to establish appropriate interventions and rescreening timeframes. Additionally, evaluation of this screening tool's longitudinal accuracy, as well as correlation with improvement in growth parameters, would help strengthen its use.

Establishing a comprehensive admission and onboarding process for pediatric patients dialyzing in adult units provides quality outcomes

Alicia Zerkle RN BS CCM,[1]
Patricia McCarley MSN RN ACNP-BC CNN,[1]
Dinesh Chatoth MD,[1] Jeffrey Hymes MD[1]

[1]Fresenius Medical Care

Background

In 2018 USRDS reported 742 pediatric patients on peritoneal dialysis and 654 on hemodialysis. Approximately one-third of this population were dialyzed within adult facilities. The goal of our study was to create a comprehensive interdisciplinary training and support program that fosters safe, quality, age-appropriate pediatric care in adult facilities.

Methods

A comprehensive admission anrd onboarding process was established to ensure the specialized needs of each patient. The process considered appropriate placement, training, and equipment preparedness. Pediatric-specific staff education, policies, and procedures standardized clinical care, emphasized growth and development needs, and ensured staff within each adult outpatient facility identified the unique considerations for this population.

A defined pediatric formulary created easy access to low-volume equipment and size-appropriate emergency supplies. Pediatric-specific orders and care plans allowed for the customization of specialized assessments, planning, and care delivery needs. Quick reference guides addressed subjects such as medication administration, peritonitis treatment and and anaphylaxis treatment. An interdisciplinary approach focusing on transplantation and adult transitions equipped each patient and family with the education needed to successfully navigate the next steps with timeliness, knowledge, and support. Pediatric-specific quality reports were developed to include age-appropriate adequacy, growth, bone and mineral metrics, vaccination, transplant, hospitalizations, infection, and mortality data. Pediatric-specific quality data was then used for care, interdisciplinary team oversight, and quality review.

Results

From February 2020 to October 2023, 397 pediatric patients were admitted to over 100 adult outpatient facilities. 18 dedicated pediatric policies and procedures, 10 pediatric-specific learning modules, 7 quick reference guides, and 3 skills checklists were developed to support clinical teams with specialized care delivery. Interdisciplinary pediatric subject matter experts provided additional support and individualized guidance. Company-wide pediatric-specific quality data was analyzed for potential root causes to develop, implement, evaluate, and revise action plans. Through quality trending, additional opportunities for protocols, algorithms, and care pathways were identified and prioritized.

Conclusion

A comprehensive interdisciplinary training and support program has empowered adult clinics to provide safe, quality, age-appropriate pediatric care and has created a dynamic foundation for future learning, resource development, and quality improvement.

Is it the pump or the drain?

Sandrica Young Peart, MBBS,[1]
Toni-Anne Fulford-Ramdial, MBBS, [1]
Charmaine Crooks-Edwards, MBBS,[1]
Peta-gay Scott-Brown, MBBS[1]

[1]Bustamante Hospital for Children

Background
Systemic Lupus Erythematosus (SLE) usually presents during adolescence, rarely prior to age ten years and has a notable female preponderance. It presents with renal manifestations in up to 60% of cases and usually within the first two years of diagnosis. Lupus nephritis is classified from 1-6 with 3/4 being associated with adverse outcomes.

Results
We describe two paediatric cases with lupus nephritis of varying presentation. The first is a seven-year-old female presenting with prolonged fever, night sweats and weight loss who subsequently developed nephrotic syndrome. Her spot protein: creatinine was 7.5 and her albumin was 19g/dl. She had a positive ANA, negative ds DNA and hypo-complementemia (C3-20, C4-42. Her renal biopsy revealed class 3 nephritis. The second patient is a 10-year-old female referred with a two-month history of weight loss, three day history of fever and decreased appetite. Her clinical examination was significant for a malar rash, mild proximal muscle weakness and elevated blood pressure of 131/93 mmHg. Her laboratory investigations revealed a hemoglobin of 8.5g/dL, CRP-100.5, positive ANA and moderate proteinuria. She was later diagnosed with SLE and juvenile dermatomyositis. Her renal biopsy revealed class 2 nephritis. Both patients developed Acute Kidney Injury (AKI) associated with COVID, one required chronic peritoneal dialysis while the other recovered spontaneously. Both developed myocardial dysfunction with poor function with the first patient dying from a myocardial infarction. The second patient had recurrent AKI requiring peritoneal dialysis. She succumbed to a pulmonary hemorrhage.

Discussion
A lot is unknown about the sequelae from Sars-Cov-2 virus infection. Paediatric multi-system inflammatory syndrome has been described and this may be associated with AKI. Cardiac sequalae has been described in patients with Covid-19 infection. Both patients developed myocardial dysfunction post Covid-19 infection. Their cardiac involvement led to worsening renal function requiring renal replacement therapy. It is uncertain whether their cardiac dysfunction was due to their primary disease, covid-19 or both. Both patients had an adverse outcome despite having class 2 and 3 lupus nephritis.

Conclusion
Patients with lupus nephritis have significant morbidities. The risk of progression to ESRD is increased in the Afro-Caribbean population. Planning for renal replacement therapy needs to be done in a timely manner especially in resource limited countries.

Microarray testing for common respiratory viruses: Novel technology to guide future vaccination protocols in the dialysis population

Marrey Quizon MD,[1] Philip Felgner PhD,[2,3] Joseph Lee MD,[2,4] Antoney Ferrey, MD[2,4] Ramy Hanna MD,[2,4] Wei Ling Lau MD[2,4]

[1]Eisenhower Medical Center
[2]University of California - Irvine
[3]Department of Physiology and Biophysics
[4]Department of Nephrology

Background

Vaccination in dialysis patients confers a lower immune response than in the general population. Notably, the risk of COVID-19-related hospitalization and mortality for ESKD patients is 4-8 fold higher compared with the general population. Determining immunity via a novel microarray antibody test for COVID-19 and other common respiratory illnesses is a highly promising tool to guide vaccination protocols for these diseases to determine booster dose timing outside of general vaccination guidelines.

Aim

We review recent published work on the viral microarray panel developed at UC Irvine Department of Physiology. The microarray was tested in Orange County, CA community dwellers and in healthcare workers who were vaccinated or had developed natural immunity for COVID-19 and other common respiratory illnesses. This technology is highly relevant to the ESKD population where individual immunity profiling can guide personalized management of COVID-19, influenza and respiratory syncytial virus (RSV) viruses where vaccines are available.

Approach

The microarray was created to include 61 antigens associated with viral respiratory infections including antigens from epidemic coronaviruses (SARS-CoV-2, SARS-CoV and MERS-CoV), RSV, and multiple subtypes of adenovirus, coronavirus, metapneumovirus, influenza and parainfluenza. This assay requires only a capillary fingerstick blood collection and does not involve handling live virus. To determine the antibody profile of COVID-19 infection, the differential reactivity to these antigens was evaluated with COVID-19 convalescent blood specimens from PCR-positive individuals (positive group) vs sera collected prior to the COVID19 pandemic from naive individuals (negative control group). All possible combinations of antigens were also evaluated for performance in discriminating the positive and negative groups. The serologic survey was done in Orange County, CA with 8000+ specimens collected and analyzed.

Results

The optimal antigen combinations were identified for both IgG and IgM. For detection of prior COVID-19 infection at least 7 days post symptom onset, the combination of IgG and IgM achieved overall sensitivity 87.8% and specificity 98.9% for a high-specificity threshold and sensitivity 92.9% and specificity 97.7% for a high-sensitivity threshold. Within the Orange County population in 2020-2021, 26% of specimens from unvaccinated residents were COVID-19 seropositive. During a vaccination campaign at UC Irvine Medical Center, seroprevalence increased from 13% pre-vaccination to 79% post-vaccination after one month, 93% after the second month, and 99% after the third month. Higher antibody levels were obtained with mRNA vaccination when compared to natural exposure. These results indicate that mRNA vaccination rapidly induces a broader and more robust antibody response than COVID-19 infection.

Conclusion

This microarray was shown to have high sensitivity and specificity in large-scale testing, with noted ease and practicality of use, making it an ideal tool to evaluate antibody responses after vaccination. Considering the severe clinical course of patients with kidney failure and infections, particularly COVID-19 infection, determining and then improving seroconversion by additional primary vaccination or booster vaccinations is critical. This technology is also relevant to influenza and RSV viruses where vaccines are available. Our research group is obtaining IRB approval to evaluate this microarray in dialysis patients as a valuable tool to guide future vaccination protocols.

Safety and feasibility of utilizing a mobility pathway for pediatric patients on CKRT: A pilot study

Deana Rosaia DPT,[1] Allison Freccero OTD,[1] Chelsea Noone RN,[1] Mayna Woo RN,[1] Cynthia Wong MD,[1-3] Eunice Koh MD[1,2]

[1]Stanford Medicine Children's Health
[2]Department of Pediatrics
[3]Division of Nephrology

Background
Current research supports that early mobility for pediatric patients is both safe and feasible in the pediatric intensive care unit (ICU). Though there is significant literature supporting the benefits of early mobility in critically ill children, data on feasibility and safety in pediatric patients receiving continuous kidney replacement therapy (CKRT) is limited.

Aim
To evaluate the safety and feasibility of utilizing a novel pediatric CKRT Mobility Pathway for our pediatric patients on CKRT.

Methods
The CKRT Mobility Pathway was developed and adopted for use at our institution by an interdisciplinary team of authors, including intensive care and nephrology medical providers, physical and occupational therapy clinicians, and nursing champions. The tool outlines inclusion and exclusion criteria, assesses patient participation, daily clinical status, and maximizes medical line safety to promote the highest level of mobility. Mobility events are defined as mobility occurring during physical therapy and occupational therapy rehabilitation sessions. All pediatric patients on CKRT who met inclusion criteria on the CKRT Mobility Pathway, between May and December 2023, were included in this pilot study. Participant's demographic and mobility data stored within the electronic medical record were retrospectively analyzed. Descriptive statistics were applied.

Results
Five patients were included with an average age being 12 years. Two patients mobilized out of bed as their highest documented mobility event while on circuit, including participating in standing and pre-gait activities. One patient mobilized to the edge of the bed, as their highest documented mobility event, and participated in seated exercises and age-appropriate play. Two patients were actively mobilized in bed while on circuit, including bed in chair positioning and engaging in bed level therapeutic exercises. A total of 27 mobility events occurred on circuit across the 5 included study patients. Forty-six mobility events were performed while patients were off circuit, for a total of 73 mobility events occurring during rehabilitation sessions throughout CKRT course. There were no adverse events.

Conclusion
Prior to this pilot study, the standard of care for patients on CKRT at our institution was to delay mobility due to fears around patient safety. This pilot study supports feasibility and safety of mobilizing pediatric patients on CKRT. To assess risk and guide mobility practices in pediatric patients on CKRT, we utilized the CKRT Mobility Pathway and have standardized our CKRT orders to automatically include physical and occupational therapy. Future studies will include a larger patient population and evaluate outcomes.

Safety and practical use of 4% tetrasodium EDTA (Kitelock™) for pediatric hemodialysis line locking

Rosaleen Nemec RN MAEd,[1]
Cal Robinson MD,[1,2] Ashlene McKay, MD[1,2]
Elizabeth Harvey MD,[1,2] Lor Tecson RN MN[1]

[1]The Hospital for Sick Children
[2]Division of Nephrology

Background
Central venous line (CVL)-associated bloodstream infections (CLABSI) are common in pediatric hemodialysis (HD) patients and are associated with significant morbidity and healthcare costs. Unlike standard locking solutions (e.g., heparin and alteplase), 4% tetrasodium EDTA (Kitelock™) has antimicrobial and antibiofilm properties. We aimed to study the safety and efficacy of Kitelock™ in pediatric HD patients.

Methods
Single-center, before-and-after, quality improvement study. We included all chronic HD patients (6mo-18yr old) and excluded those with EDTA allergy or <5kg. Our standard locking solution was heparin (1000 units/mL) pre-intervention and Kitelock™ post-intervention. For both study periods, alteplase (1mg/mL) was used as required. We compared unit-level pre- and post-intervention data for CLABSI, CVL procedures (exchange or removal and reinsertion following antibiotic therapy), laboratory results, and access complications (e.g., alarms, exit site pain).

Results
We present preliminary data for 18 patients (median age 14yr, 53% female, median 1-month since CVL insertion). The unit-level incidence rate of CLABSI pre-Kitelock™ was 0.9 events per 1000 catheter-days (25,769 total catheter-days). There have been no CLABSI events since Kitelock™ was introduced (4319 total catheter-days). The incidence rate of CVL procedures decreased from 1.99 per 1000 catheter days pre-Kitelock™ (4027 total catheter-days) to 0.93 per 1000 catheter-days post-Kitelock™ (4319 total catheter-days) (incidence rate ratio 0.47, 95%CI 0.14-1.55, p=0.2). Significant calcium, magnesium, and iron chelation was observed with labs drawn from the CVL with small discard volumes (<5mL), but not after a larger discard (≥6mL), or a small discard plus flushing protocol. We noted increased viscosity of the CVL discard using Kitelock™, which resolved with continued use.

Conclusion
In pediatric HD patients, CVL locking with Kitelock™ has resulted in a sustained unit-level reduction in CLABSI incidence, without an increase in the incidence of CVL procedures or access complications. Significant heavy metal chelation was observed with small discard volumes and was addressing using a new CVL bloodwork withdrawal and flushing protocol.

Standardizing the process for infection review in pediatric chronic dialysis patients

Dani Jackson MSN RN CPNP-PC[1-3]

[1]Washington University in Saint Louis
[2]Department of Pediatrics
[3]Division of Nephrology

Background

Despite rigorous protocols and training for both patients and families, infections happen in the chronic dialysis population. It is essential to review both the apparent cause of the infection and any contributing factors, to better understand the problem and work to improve practices to hopefully prevent future infections. Our practice with a dialysis-related infection is to fill out an Apparent Cause Analysis (ACA) form which includes details about the infection along with an interview with the family to identify any deviations from standard practice. We then aim to discuss the ACA as a team, ideally including our hospital's infection prevention (IP) team. This discussion should produce action items that we are able to implement in hopes to reduce risk of future infection. However, this process has not been routinely followed, and parts of follow-up would often be forgotten or delayed due to lack of ownership, such as starting the ACA weeks after the infection, forgetting to include IP in the discussion, or missing retraining altogether.

Aim

To create a standardized process for reviewing infections and disseminating findings among staff and families, allowing for more rigorous and timely follow-up.

Methods

We met as a dialysis team to determine where the breakdown in the process was occurring and delegate steps to appropriate team members. We also identified opportunities for revising the process to include new steps. These included a standard invitation to the IP team for discussion, adding a note in the patient's chart summarizing the ACA discussion, a nursing communication order for any needed retraining, and reviewing ISPD guidelines.

Results

Since the creation of this new process in May 2023, we have had six total infections (one PD exit site infection, one HD catheter tunnel infection, two BSIs, and two episodes of peritonitis). For those infections, the ACA was started within 24-48 hours of the infection, the patient's case was discussed as a team within one week, and IP was a part of every discussion. Additionally, staff reported that they felt more knowledgeable of the findings from the discussion and were better able to perform focused retraining.

Conclusion

Although concrete data was not collected prior to the implementation of this new process to evaluate for objective improvement, the dialysis team overall felt that this was a significant improvement in timeliness and thoroughness of review. We will continue to utilize this process for future infections as it has provided consistent follow-up and better team awareness.

Transition from home to home dialysis: Dialysis access is not a barrier

Sijie Zheng MD PhD,[1]
Rachel Gonzales-Clark RN[2]

[1]The Permanente Medical Group
[2]Satellite Healthcare

Background

Home dialysis (PD and HHD) is a preferred dialysis modality for patients and health care professions [1-3]. It is associated with greater patient satisfaction and autonomy, yet utilization is low [1]. In US, only 11% of ESRD patients on PD and 1-2% on HHD. For patients on PD, staying at home is extremely important to many of them. Transition from PD to HHD is extremely rare, with only 3% reported in one study [4]. Many nephrologists prefer or require patients to have a functional AVF/AVG before transition to HHD. For patients who do not have a matured AVF/AVG, they transition to in center hemodialysis units with a dialysis catheter. Here we reported a patient who successfully transitioned from PD to HHD with a dialysis catheter.

Case

76 y.o. male with ESRD due to DM, who started PD since April 2018. After four years of PD, he started to shown signs of burn out and persistent low BP. An AVG was placed in Dec 2022. One month later, he reported tingling sensation in his fingertips. Four months later, he started HHD training. However, the AVG was not matured to be cannulated. Therefore, a dialysis catheter was placed, he continued HHD training with the catheter. Patient completed HHD training in 10 weeks using the dialysis catheter without difficulty. He remained on the catheter as his permanent dialysis access. He has no complications from the dialysis catheter. His hypotension has resolved, and he is functioning well without any uremic symptoms.

Conclusion

A matured AVF/AVG should not be the pre-requirement for HHD, for patients not able to have matured AVF/AVG, a permanent catheter can be used safely as their dialysis access. In this situation, a dialysis catheter is “the right access, for the right patient, for the right reason, at the right time”.

Showcasing Student Research from Springfield, MO

Editorial by David Haustein, MD, MBA

Associate Dean, Springfield Clinical Campus
Professor of Physical Medicine and Rehabilitation
MU School of Medicine

Welcome to the latest issue of Missouri Health, the University of Missouri School of Medicine's academic journal. As the "Show Me State," this issue will showcase some of the research highlights from southern Missouri.

Springfield is the third largest city in Missouri, following St. Louis and Kansas City. With a location near the junction of Missouri, Arkansas, Oklahoma and Kansas, a tremendous amount of clinical care is happening in Springfield, with more than 3 million outpatient visits, 75,000 surgeries, and 6,000 deliveries yearly.

Given this immense volume and the associated learning opportunities, the MU School of Medicine opened the Springfield Clinical Campus in 2016 and is the home of 400 MU volunteer faculty physicians, as well as 28 third-year and 28 fourth-year medical students. The MU SOM Springfield students and faculty contributed to more than 30 posters, platform presentations and publications this past academic year. Springfield has two large private health systems, CoxHealth and Mercy, each with its own research infrastructure.

Annual medical research conferences featuring southwest Missouri:

Mercy's David Miller Trauma Symposium

- **What:** A two-day conference focused on trauma-related content such as epidemiology, injury prevention, pre-hospital care, acute or critical care, surgical management, wound care, rehabilitation, survivorship, program management, trauma workforce, health disparities, ethics, etc.

- **Who:** Healthcare professionals, students, and trainees from academic or official training programs are invited to participate.
- **When:** October 24 and 25, 2024 (annually in October)
- **Where:** Springfield, Missouri
- **Notes:** For more information, contact mercyresearchIIT@mercy.org

CoxHealth Research Conference

- **What:** A one-day conference aimed at increasing awareness of healthcare research occurring within Springfield and the surrounding communities
- **Who:** Open to the public but geared towards healthcare professionals and students
- **When:** April 25, 2025 (annually in April)
- **Where:** Cox South, Springfield, Missouri
- **Notes:** The poster hall is peer-reviewed and accepts a range of presentations, from quality improvement projects to IRB-approved research studies. For more information: https://www.coxhealth.com/research/ or email CoxHealthResearchConference@CoxHealth.com

Mercy's Robert W. Taylor, M.D. Research Colloquium

- **What:** A two-day conference highlighting in-house quality improvement and research
- **Who:** Mercy employees and MU School of Medicine Springfield students
- **When:** late April or May (annually in late spring)
- **Where:** St. Louis, Missouri
- **Notes:** The 2024 Research Colloquium featured plenary speakers, 42 posters, and 20 oral presentations. For more information, contact mercyresearchIIT@mercy.org

In addition, Springfield is the headquarters of both Jordan Valley Federally Qualified Health Center (FQHC), the largest FQHC in Missouri, and the U.S. Medical Centers for Federal Prisoners, a 1,000+ bed prison hospital, which each offer unique clinical care and learning environments.

Missouri is fortunate to have both the variety and depth needed to create incredible environments for advancing the science and art of medicine. Between the medical and allied health educational programs, residency and fellowship training opportunities, clinical care, and research happening in our larger cities and our rural communities, the University of Missouri School of Medicine and our partners throughout the Show Me State are creating the foundation and infrastructure to care for our friends, neighbors and family for years to come. Thank you for your contributions to a healthy Missouri.

Anti-MDA5 antibody-positive dermatomyositis (MDA5-FM): A case report

Priya Patel,[1] Sarah El Chami MD[1]

[1]Department of Rheumatology

Background

Patient is a 25-year-old male who presented to the rheumatology clinic for persistent fevers along with bilateral upper extremity paresthesia, diffuse rash, arthritis, dyspnea on exertion, dry cough, loose stools, muscle weakness, periorbital edema, and unintentional 40-pound weight loss. He did not improve on antibiotics. Prednisone improved some symptoms. CT showed multiple nodular ground glass opacities in the lung bases. Further workup showed elevated ACE, ESR, LDH, AST/ALT, and positive EBV IgG/Ig. Positive for MDA-5 and SSA. PFTs showed low DLCO at 52%. Given positive MDA-5 and worsening dyspnea on exertion, there was concern for rapidly progressive ILD. He was started on mycophenolate mofetil, IVIG, hydroxychloroquine, and eventually rituximab. Medications were stopped due to nausea and suicidal ideation. Overall, he has seen improvement in his skin ulcers and rash. He still has mild periorbital edema. He continues to have joint swelling. Medications need to be resumed and changed to alleviate GI symptoms.

Conclusion

MDA5-DM is a rare but rapidly progressive disease whose diagnosis and treatment poses a huge challenge to clinicians. This case highlights the importance of recognizing the combination of dermatomyositis rash and rapidly progressive ILD as concerning for MDA5-DM. Awareness of the complexity of this autoimmune condition and early recognition of presenting symptoms and associated conditions could help in tackling this challenge. There are no current guidelines for the management of anti-MDA5-DM, which poses another challenge in the treatment of this condition. However, a combination of immunosuppressives with mycophenolate mofetil (MMF), cyclophosphamide, tacrolimus, along with high dose steroids have been widely used with success. Additional therapies, such as rituximab, tofacitinib, basiliximab, may be added but novel therapies are needed for better prognosis of these patients.

Spontaneous resolution of tractional retinal detachment in a patient with proliferative diabetic retinopathy

Priya Patel,[1] Erica Ballard MD[1]

[1]Department of Ophthalmology

Background

The patient is a 71-year-old insulin-dependent Type II diabetic male who was referred to the retina service for a tractional retinal detachment. His presenting symptoms were blurred vision and floaters. Fundus exam of the right eye revealed inactive diabetic proliferative retinopathy without diabetic macular edema and peripheral pan photocoagulation scars. Fundus exam of the left eye revealed a tractional retinal detachment posteriorly from 3-9:00. There was a tractional fold nasally. There was no posterior vitreous detachment. Previous pan retinal photocoagulation scars were present. There were no definite breaks noted on scleral depressed exam despite suspicion of possible rhegmatogenous component. The macula at the fovea and inferiorly were detached. The ocular findings were consistent with tractional detachment of the left eye secondary to diabetic proliferative retinopathy. Patient planned to undergo Pars Plana Vitrectomy but was lost to follow-up due to multiple hospitalizations. He returned a year after due to persistent floaters. Exam at the that time revealed mild vitreous hemorrhage of the left eye and posterior vitreous detachment and resolved detachment and attached macula. Fundus photos and OCT imaging were consistent with the exam findings.

Conclusion

Tractional retinal detachment is a serious frequently blinding complication of proliferative diabetic retinopathy. The majority of cases are only improved with surgical correction, and the absence of interventions leads to poor visual outcomes. There have been few reported cases of spontaneous resolution retinal detachments such as this patient, and the mechanism remains largely unclear. Presumably, a posterior vitreous detachment could induce spontaneous peeling of pre-retinal membranes releasing traction if there is no rhegmatogenous component.

A qualitative study to investigate culturally competent care in the Amish community: One provider's 30+ years' experience

Clayton Brinkley,[1] Amy Harrison PhD,[1,2] Evan Reeves,[1] David Haustein MD MBA[1,2]

[1]University of Missouri - Columbia
[2]Cox South-Springfield

Introduction

In the U.S., the Amish population has grown from 178,000 in 2000 to 384,000 across 31 states as of 2023, an increase of 116%. At its core, the Amish community values disconnection and controlled interactions with the outside world, which include healthcare and modern health practices. Therefore, it can be difficult for healthcare providers to gain knowledge of the Amish perspective of the community and its core values, healthcare perceptions, and the use of alternative medicine. Lack of experience or understanding in these areas by providers can lead to alienation and healthcare disparities for members of this community. Extensive literature reviews aimed at healthcare providers have been published discussing these topics; however, there has been little research into the personal account of a healthcare provider's experiences within the Amish community. This qualitative study case study will present themes of data that illuminate the lived experiences of a rural healthcare provider who served an Amish community during their 35-year career tenure as a family medicine physician.

Methods

This study employed a single case study design and used the following data sources to achieve triangulation: interviews, archival records, document analysis, and a review of current scholarship related to Amish healthcare practice and access.

Results

Researchers were able to identify four emergent themes. The first theme, Developing Relationships Across Cultural Differences, encompasses the importance of having a background in serving diverse communities like the Amish. The second theme, Navigating Cultural Differences and Maintaining Professional Boundaries, investigates the nuances and complexities of cultural dynamics within professional healthcare relationships. The third theme, Challenges and Opportunities in Rural Practice, captures the strategies and opportunities used by the healthcare provider to incentivize Amish patients to engage in their healthcare options and to consider approaches regarded as non-normative in their community. The fourth theme, Amish Healthcare Disparities, encapsulates the healthcare disparities faced by the Amish community, including issues such as lack of standard vaccinations, high mortality rates during childbirth, and misrepresented statistical records.

Conclusion

Though the case involves a single practitioner's experience, results are useful to broaden the scope of knowledge around cross-cultural medical experiences and practices in general and then within the Amish community specifically. The themes presented illustrate the dispositional qualities practitioners should possess to be successful in another cultural setting, as well as shed light on the need for more research and clinical work among the Amish, who are a marginalized and underserved population within the nation's healthcare framework.

Expanding the differential: A consideration of hemoperitoneum, retrograde menstruation, and cervical stenosis

Emma Elbert,[1] Courtney Wiese MD,[2] David Tillman DO[2]

[1]University of Missouri - Columbia
[2]CoxHealth Physicians For Women OB/GYN

Introduction

Cervical stenosis can cause significant complications such as amenorrhea, hematometra, infertility, endometritis, and pelvic pain. It can also create challenges with future diagnostic evaluations including preventative screenings. The overall frequency of cervical stenosis is low, but a higher prevalence has been noted in patients who have undergone cervical excisional procedures such as those used in the treatment of cervical cancer precursors. Long term use of Depo-Provera may create physiological changes in the cervical healing process that could lead to an increased incidence of stenosis in those patients recovering from such procedures. Thus, pelvic pain in these patients may pose a diagnostic challenge. A comprehensive gynecologic history and physical is necessary in the work up for pelvic pain in women, and cervical stenosis should be included in the differential diagnosis in those with appropriate risk factors.

Case description

A 33 year old G0P0 female presented to the emergency department for evaluation of periodic diffuse, crampy abdominal and pelvic pain that was predominantly noted on the left. During a three month period, she presented three times due to worsening of this pain. Her past medical history included psoriasis and a cervical conization procedure for precancerous lesions. The conization process had occurred approximately ten years prior. Additional gynecologic history revealed that the patient had long term use of the Depo-Provera injection and had been amenorrheic since age 16. She had stopped this medication about 9 months prior to first presentation and she had not yet resumed menstruation. Over the three month period of evaluation, her transvaginal ultrasounds and abdominal and pelvic CT revealed a progressive thickening of the endometrium. It was accompanied by complex fluid accumulation within the uterus. Additional complex fluid was noted in the posterior cul-de-sac. At the second visit to the emergency department, an ultrasound revealed a new, large tubular left adnexal mass that was not present on the ultrasound two months prior. Concerns for tubo-ovarian abscess and endometritis were raised; however, labs revealed no evidence of infection and the patient reported no fevers. Gynecology was then consulted. On pelvic exam, cervical stenosis was noted. Given the patient's recent cessation of Depo-Provera, it was theorized that she had resumed her menstrual cycle and was experiencing retrograde menstruation that had resulted in hematometra and hemoperitoneum from tubal backflow. A diagnostic hysteroscopy and laparotomy were promptly scheduled and performed. During the procedure, no obvious cervix or cervical os were identified. Transabdominal ultrasound was used to guide a needle into the endometrial cavity for hematometra evacuation. On laparoscopy, hemoperitoneum was noted with a large left hydrosalpinx surrounded by old blood and a peritoneal inclusion cyst. Left salpingectomy and adhesiolysis were performed. The patient did well after surgery and opted for future definitive treatment with hysterectomy.

Discussion

Studies have suggested a connection between cervical excisional procedures (e.g. LEEP), Depo-Provera, and cervical stenosis. This patient likely developed cervical stenosis shortly after her initial conization procedure that was augmented by her long-term use of Depo-Provera. Because she continued with the Depo-Provera following the conization, her amenorrhea was sustained. It was only when the patient paused this birth control that her menstrual cycles resumed and the cervical stenosis became symptomatic. This case illustrates the value of a thorough history and a broad differential in a reproductive-age woman with pelvic pain and complex fluid in the abdomen.

Oral hairy leukoplakia in an immunocompetent patient

Evan Reeves,[1] Austin Hotop,[1] Chris Gilbert MD FCAP,[2] Minh-Thu Ngoc Le MD FAAAAI FACAAI[2]

[1]University of Missouri - Columbia
[2]Cox South-Springfield

Introduction

Oral hairy leukoplakia (OHL) is a diagnosis that providers commonly associate with immunosuppression. OHL was first reported in the 1980s as unique oral lesions found in AIDS patients. OHL presents as an asymptomatic, soft white corrugated lesion affecting the oral mucosa that cannot be scraped from the surface to which it adheres, which is commonly the lateral border of the tongue. Histologically, OHL demonstrates epithelial hyperkeratosis, acanthosis, hyperplasia, koilocytes, and sparse inflammatory cells within the lamina propria due to reactivation of latent Epstein Barr virus. OHL has also been documented as sequelae of other systemic processes such as hematological malignancies, systemic lupus erythematosus, Behcet syndrome, ulcerative colitis, and rheumatoid arthritis. The development of OHL has also been linked to local immunosuppression of the oral cavity through the use of inhaled corticosteroids, topical anti-inflammatories, tobacco products, and alcohol. It is an uncommon finding alone in a patient without underlying systemic immunosuppression and even more rare in those without either an identifiable source of systemic or local immunosuppression of the oral mucosa.

Case Presentation

Here we present a 66-year-old female with no identifiable source of immunosuppression that was diagnosed with OHL. She had a medical history significant for allergic rhinitis, chronic idiopathic urticaria, and hyperlipidemia. She presented with a lesion on the right lateral tongue during a dental examination. Subsequent tissue biopsy was read as oral hairy leukoplakia by pathology. She underwent further workup to evaluate for underlying systemic immunodeficiency. Her primary care physician ordered a CBC with differential, CMP, and HIV antigen-antibody by EIA, all of which were unremarkable. She was referred to an allergy and immunology specialist for further testing: SPEP, ESR, CRP, liver function test, B & T cell flow cytometry, Mannan Binding Lectin Pathway function, and serum immunoglobulin levels were all normal. The patient was not using any immunosuppressants, inhaled oral corticosteroids, or topical oral anti-inflammatory medications. She denied tobacco use and endorsed only rare alcohol use. The histopathologic slides from the patient's original biopsy were read by a second pathology department, which confirmed the diagnosis of OHL. No underlying cause of immunosuppression, local or systemic, was elucidated. No further workup or treatment pertaining to the lesion was pursued, and the patient is doing well in this regard.

Discussion

OHL is a diagnosis that is widely associated with systemic immunosuppression and was once considered pathognomonic for HIV infection. Our survey of the literature demonstrates that there are rare documented cases of OHL in patients with no apparent cause of immunosuppression. One theory for these cases is age-induced local immune-senescence, leading to reactivation of EBV and the development of OHL. With her negative history and immune work up, this mechanism could be responsible for the development of our patient's lesion.

Conclusion

This case is a valuable addition to the literature providing more evidence that OHL can be found in immunocompetent patients and should be considered in the differential diagnosis for all oral lesions, regardless of the patient's immune status. Additionally, this report adds to the small number of recorded cases in which OHL developed without either an identifiable source of systemic or local immunosuppression. This knowledge serves to increase clinical diagnostic accuracy and potentially decrease undue anxiety to patients.

Case report and review of the literature of dichorionic twin pregnancy with complete hydatidiform mole and viable fetus

Rebecka M. Ernst,[1] Molly Greenwade MD[1,2]

[1]University of Missouri - Columbia
[2]Cox South-Springfield Department of Gynecologic Oncology

Introduction

Complete hydatidiform mole with a coexisting live fetus (CHMCF) is an exceedingly rare and intriguing phenomenon in obstetrics, presenting unique challenges in diagnosis, management, and counseling. This case report and literature review aims to summarize the existing knowledge surrounding CHMCF, including its incidence, clinical presentation, diagnostic modalities, management strategies, and outcomes.

Case presentation

This case reports a 25-year-old female who was found to have Complete hydatidiform mole with a coexisting live fetus (CHMCF) at her initial presentation at 10w6d gestation. She was referred to MFM where she was provided recommendations for prenatal care. At 33w4d gestation she presented to the ED with concern for decreased fetal movements and was diagnosed with an intrauterine fetal demise. She was treated with a c-section and subsequent chest x-ray and CT confirmed metastatic disease to her lungs. She was referred to gynecology oncology where she is currently being treated with methotrexate for gestational trophoblastic neoplasia.

Conclusion

Complete hydatidiform mole with a coexisting live fetus is a rare and complex gestational condition that poses diagnostic and management challenges for clinicians. Further research is warranted to enhance our understanding of the pathophysiology, optimal diagnostic approaches, and effective management strategies to improve outcomes for patients affected by this rare entity.

Rural Scholars Community Integration Program

Editorial by Kathleen Quinn, PhD

Associate Dean, Rural Health
Adjunct Associate Professor
MU School of Medicine

Many medical schools have developed admission policies and clinical training programs designed to address the rural physician workforce shortages in their state. At the University of Missouri School of Medicine (MUSOM), the Rural Scholars Program, established in 1995, offers third-year medical students the choice of completing 3-4 of their seven required core clinical clerkships, or a 1-year longitudinal clerkship meeting all clerkship requirements, in community-based, rural training sites across Missouri. In these busy rural settings, students participate in the care of many patients and develop continuity relationships with community-based faculty and patients. The Rural Scholars Program is successful in producing rural physicians with over 57% of participating students choosing a rural location for their first practice. However, clinical training in rural areas alone is not always enough to prepare, attract, and eventually retain students in rural practice locations. In addition to clinical training in rural areas, programming that integrates students into rural communities can further encourage students to consider rural practice and assist in preparing them for living and working in rural communities.

As part of the Rural Scholars Program, the University of Missouri School of Medicine developed the Community Integration Program (CIP). Students, individually or in groups, identify a health need and implement a community-based project to meet that need.

Rural Scholars are required to participate in this self-directed, service-learning program. A service-learning program can be implemented and integrated into a curriculum without altering the current

curriculum structure. Service learning is ideal for strengthening campus community partnerships to support community-based training.

Rural Scholars identify and assess community health need(s), and work with local community organizations to develop, implement, and evaluate the impact of their project in meeting the identified needs of the community. These projects are longitudinal in nature and are expected to span the full program length.

Project Goals

• To promote medical student understanding of the social and public purpose of the profession
• To promote the ethic of service as an integral part of professional practice
• To foster autonomous, self-directed learning in the student
• To impact local issues and local needs
• To assist the communities in the development of programs that meet community identified needs
• To discover the health and quality of life concerns within the community
• To establish a stronger community-campus partnership

Project Learning Objectives

Upon completion of the CIP, students should be able to:

- Identify risk factors and healthcare disparity issues within the community through first-hand experience.
- Develop and fulfill a commitment to community needs. Identify strategies for improving healthcare standards/delivery systems.
- Develop effective communication, cultural competency, and research and evaluation skills.
- Write reflectively about the service and learning aspects of their experience.

All students (block and LINC) are required to create an academic poster and present during an annual poster session. Each poster and presentation are judged by faculty based on the quality and creativity of the project and research. Students are encouraged to present at local, statewide, and national conferences.

The CIP exposes students to rural culture and helps them understand community health needs. Replication of this program can increase student interest in rural medicine and better prepare students for rural practice.

Efficacy of opioid overdose recognition and Narcan administration training among high school students

Madison Billingsley[1,2]

[1]University of Missouri-Columbia
[2]Farmington Clinical Training Site

Background

The opioid epidemic is an ever growing and expanding problem with the number of opioid overdose deaths increasing annually. Looking locally to St. Francois County located in eastern Missouri south of St. Louis, data shows alarming rates of opioid overdose deaths. St. Francois County is ranked 3rd in the state of Missouri for all drug overdose mortality rates with 61.22 overdose deaths per 100K residents.

Most overdose deaths in St. Francois County are witnessed and could thus be prevented with only 2% of fatal overdoses in St. Francois County occurring without the presence of at least one bystander. A study completed in 2016 demonstrated that bystanders were less likely to provide aid in rural communities, as well as in public areas such as on streets or highways and public buildings. Studies have demonstrated that one of the leading reasons for bystanders to not intervene and call for emergency services during witnessed overdose is the fear of police response. Barriers to prevention of death from opioid overdose include lack of knowledge surrounding the use of naloxone, better known as Narcan, and fear of harming the victim through Narcan administration. One study found that approximately 30% of adolescents and young adults were able to correctly identify naloxone use, 14% reported knowing how to use naloxone, and only 67% identified being comfortable with calling emergency services in the case of suspected overdose.

Purpose

This study aimed to assess if a short educational session could increase comfort in both identifying and treating opioid overdose amongst students in health class at Farmington High School. Many barriers to care for overdose victims exist, and this study aimed to address those barriers, including fear of law enforcement involvement and lack of knowledge on how to recognize overdose and what actions should be taken should an individual witness an overdose.

Methods

The University of Missouri IRB office determined the project as quality improvement and deemed exempt status. Students in health class at Farmington High School were recruited to complete a short pre-education survey, attend a 15-minute education session, and then complete an identical post-education survey. Results were then analyzed using non-paired t-test.

The survey consisted of five knowledge questions with each of the knowledge questions followed by a Likert scale to assess confidence in the respondent's previous answer. The final question of the survey individually assessed the respondent's comfort in their ability to identify opioid overdose and comfort in their ability to administer Narcan.

The educational session was comprised of an approximately 15-minute PowerPoint presentation followed by a short video demonstration and time for questions. After the conclusion of the educational session and all questions were answered, the students were asked to complete an identical survey in order to assess the effectiveness of the training.

Results

The primary endpoints of the study assessed whether participants' confidence in recognition and treatment of opioid overdose increased. Post-education survey scores on comfort of identifying an opioid overdose and comfort of administering Narcan were both significantly higher with results of $t(30) = 5.00$, $SE = 0.27$, $p<0.001$, Cohen's $d = 0.91$. and $t(26) = 5.75$, $SE = 0.30$, $p<0.001$, Cohen's $d = 1.11$, respectively.

Secondary measures included the ability to correctly identify the Good Samaritan Law with pre- and post- results of 53% and 90%, respectively, with $t = 3.61$, $SE = 0.1$, $p=0.0006$ demonstrating a statistically significant increase in correct answers. The response to the session was overwhelmingly positive with 80% of participants stating they believed the session was effective and 84% of participants stating they learned something new during the session.

Conclusion

This study addressed the need for opioid education among high school students. Students who partook in the education session reported feeling more confident in their ability to identify opioid overdose and reported increased confidence in their ability to administer Narcan if needed. There were limitations to this study including a small sample size as well as the target population comprised of only high school students. As such, it cannot be stated that this educational format would be effective in the general population. Further studies should include education sessions for broader members of the community including a wide range of ages, employment, and socioeconomic statuses.

Identifying and comparing provider and patient perceived barriers to diabetic retinopathy exam compliance rates in rural southwest Missouri

Jeffrey Bodeen[1]

[1]University of Missouri-Columbia
[2]Branson Clinical Training Site

Purpose
This study aims to identify specific perceived barriers to diabetic retinopathy (DR) screening among patients living in rural areas, as viewed by both patients and physicians. The research seeks to provide data on these barriers to guide healthcare teams and systems in improving DR care and explore how patients versus providers perceive and experience these barriers.

Background
DR is a leading cause of preventable blindness in the United States, affecting approximately one-third of Americans with diabetes mellitus. DR often develops without noticeable vision changes, making annual screening essential. Despite this, only 62.3% of diabetic patients in the U.S. receive annual screenings, with rural patients exhibiting even lower rates. Understanding barriers to screening in these populations is crucial for improving care.

Methods
Patients completed a survey with 16 demographic prompts about race, ethnicity, livelyhood, and distance to eye-care, as well as 18 questions to assess their understanding of diabetic eye disease, likelihood of annual exams, attitudes towards eye care, access to care, and perceptions of DR. Physicians completed a separate survey with 11 prompts to evaluate their perceptions of patients' knowledge, attitudes, access, and logistical barriers, as well as demographic data about livelihood and years in practice. Data were analyzed using unpaired t-tests to compare means between patient and provider responses.

Results
Fourteen patients and eight providers completed surveys. Patients rated their knowledge of diabetic retinopathy ($M = 4.04$, $SD = 0.91$) significantly higher than providers expected ($M = 2.63$, $SD = 1.88$) ($p = .002$). Patients rated their access to eye care ($M = 4.57$, $SD = 0.36$) and attitudes towards care ($M = 4.51$, $SD = 0.71$) more positively than providers (access: $M = 3.63$, $SD = 0.92$, $p = .002$; attitudes: $M = 3.13$, $SD = 0.83$, $p = .0005$). Patients' perceptions of care and eye health ($M = 4.70$, $SD = 0.37$) were also rated higher than providers' expectations ($M = 3.25$, $SD = 1.04$) ($p < .0001$).

Conclusion
The study reveals a significant disconnect between patients' and providers' perceptions of barriers to diabetic retinopathy screening. Patients consistently rated barriers as less impactful compared to providers' assessments. Future research should expand geographically and socioeconomically to address these gaps. Future research should also consider alternative questionnaire designs to better understand specific health literacy barriers and their effect on screening compliance.

Effects of cannabis use on post-operative pain control in a rural community

Austin Hotop,[1,2] Evan Reeves,[1,2]
Ronin Rice,[1,2] W. Ray Silliman MD[3]

[1]University of Missouri-Columbia
[2]Cape Girardeau Clinical Training Site
[3]St. Francis Medical Center, General Surgery

Introduction

The legalization of recreational cannabis in Missouri has led to increased cannabis use. There has been a reported increase in pain perception following traumatic musculoskeletal injuries, leading to higher postoperative opioid requirements. Effective postoperative pain control is crucial for rehabilitation and recovery. St. Francis Healthcare System in Cape Girardeau, MO has noted an increase in patients reporting cannabis use across all specialties. This study aims to determine if there is a correlation between cannabis use and post-operative pain control in a rural setting.

Methods

A chart review was conducted of surgical patients' social history at St. Francis Medical Center who had surgery after January 2023 and used cannabis. Similar surgical patients who had not used cannabis were then identified. For each patient, the type, amount, administration route, and dosage of narcotics given throughout the entire postoperative hospital stay were recorded. The types of surgeries and ages of the patients were compared, followed by a two-tailed t-test to determine any statistical significance

Results

In the study, each group had 13 patients. Cannabis users were on average 53 years old, while non-cannabis users were on average 68 years old. The male-to-female ratio was 7:6 for cannabis users and 6:7 for non-cannabis users. The average number of narcotics administered was 4.77 for cannabis users and 4.54 for non-cannabis users. The p-value from a two-tailed t-test was 0.93.

Conclusion

This initial study revealed no statistical difference in the number of postoperative narcotics administered to cannabis users compared to non-cannabis users. It is recommended to conduct further investigation into the potential relationship between cannabis consumption and post-operative pain. Physicians may advise against cannabis use for overall well-being, but the data does not imply that recommendations should be made against cannabis use specifically in regard to postoperative pain.

A cross-sectional study investigating higher melanoma mortality rate in Missouri: Barriers to care and skin health education

Kenlee Jonas,[1,2] Brooke Kronk,[1,3] Emily Winfrey[1,4]

[1]University of Missouri-Columbia
[2]Branson Clinical Training Site
[3]Osage Beach Clinical Training Site
[4]West Plains Clinical Training Site

Despite a lower incidence rate of melanoma in rural Missouri, certain regions face a higher rate of melanoma-related mortality, indicating a prevalence of late-stage disease. This research project aims to assess the current landscape of dermatological care in rural regions of Missouri, identifying barriers to access. A cross-sectional study was administered in primary care facilities in southern and southwestern Missouri. The results of the study concluded that the primary challenges in accessing dermatologic care are long wait times and difficulty locating a provider within the resident's area. Additionally, our study highlights inadequate patient awareness and self-assessment of skin cancer manifestations, which could be attributing to the dissonance between a lower incidence rate and higher mortality rate seen in these regions. This study underscores the critical need for dermatologic care in rural areas of Missouri. Primary care physicians may be able to aid in education on early detection and preventive strategies. However, enhanced accessibility to specialized care, including telemedicine dermatology services, is essential for improving the overall well-being of rural patients and their communities.

An educational intervention to address obesity in three counties in western central Missouri

Jay Devineni,[1,2] Marcus Mallen,[1,2] Alexander Freeburger[1,3]

[1]University of Missouri-Columbia
[2]Sedalia Clinical Training Site
[3]MU Extension, Benton, Cooper, Moniteau, Morgan, and Pettis Counties

Introduction
In the Community Health Needs Assessment (CHNA) performed by Bothwell Regional Health Center (BRHC) in Sedalia, MO in 2022, the hospital identified heart disease / obesity as one of the three priority health issues for the rural communities it serves in Western Central Missouri. Three of the counties in this area (Pettis, Cooper, and Benton) have obesity rates of 42%, 40%, and 43%, respectively – all of which exceed the Missouri state average of 38%.

Objectives
The objectives of this intervention included: 1) Delivery of an educational intervention across the Missouri counties of Pettis, Cooper, and Benton to educate residents on the risk factors for obesity; 2) Empowering residents of these counties with the tools to eat healthfully and be physically active, while respecting cultural values and structural barriers that may affect dietary and exercise patterns; 3) Reducing and preventing obesity among these program participants.

Methods
A one-hour discussion-based presentation on obesity was provided to 53 residents of the Missouri counties of Pettis, Cooper, and Benton. The presentation was delivered at five different locations: three in Pettis County, one in Cooper County, and one in Benton County. The presentation addressed the benefits of physical activity and a balanced diet, as well as actions that participants can take to realize these benefits within the context of their personal beliefs and limitations. Pre-surveys and post-surveys were administered to identify demographic variables, baseline BMI, baseline exercise and eating habits, and improvements in knowledge and self-efficacy. Follow-up surveys were sent to participants two months after the presentation to assess changes in BMI and dietary and exercise behavior. SPSS Statistics 27 was used to assess the statistical significance in changes from baseline via paired samples T-test. The threshold for statistical significance was set at $p<0.05$.

Results
Knowledge and self-efficacy for healthful eating and exercise significantly increased immediately after the intervention ($p<0.001$), and three of these four measures remained elevated at 2-month follow-up ($p=0.011$ for knowledge regarding healthful eating, $p=0.020$ for knowledge regarding exercise, and $p=0.017$ for self-efficacy for healthful eating). Fruit intake significantly increased between baseline and 2-month follow-up ($p=0.008$). No significant changes were seen in the consumption of other food groups, although dietary patterns generally appeared more balanced after the intervention. Level of physical activity did not significantly change among overweight and obese participants following the intervention ($p=0.670$ for moderate-intensity physical activity, $p=0.591$ for vigorous-intensity physical activity), which may be because of small sample size or because baseline physical activity was already high. BMI also did not significantly change among overweight and obese participants following the intervention ($p=0.153$ for obese participants, $p=0.265$ for overweight and obese participants), which may be due to small sample size, a follow-up period that was too short, uncontrolled variables, or overall ineffectiveness of the intervention on this measure.

Conclusion
This intervention provides an evidence-based framework for empowering rural Missourians with the knowledge and confidence to eat healthfully and be physically active. However, effectiveness of this intervention on dietary, physical activity, and obesity outcomes remains a question, highlighting the need for more research, preferably with a larger sample size of individuals living with obesity who have lower baseline physical activity.

Creation of a free oral health clinic for uninsured and low-income adults in rural Missouri

Janie Leathers Bruce[1,2]

[1]University of Missouri-Columbia
[2]Hannibal Clinical Training Site

Oral health is an important factor in overall well-being. Many factors impact an individual's oral health including chronic conditions such as diabetes, and lifestyle choices such as smoking. Financial barriers and a lack of insurance limit access to oral health care services. A community health needs assessment conducted by Hannibal Regional Healthcare System in July 2022 revealed a lack of dental services for uninsured and low-income individuals. Hannibal Free Clinic partnered with a medical student from the University of Missouri School of Medicine to create a Free Oral Health Clinic program. Local oral health providers and students from A.T. Still University Missouri School of Dentistry & Oral Health were recruited to serve as volunteer providers. A Free Oral Health Clinic program was successfully created. The first clinic was held February 10, 2023. Since this date ATSU-MSDO faculty and students have continued to travel to Hannibal Free Clinic to provide oral health care and are working to incorporate this site as a permanent rotation in their curriculum. Coordination between several organizations was required to create a lasting program that will provide oral health care for patients that previously had no options. This program will serve individuals without dental insurance or who have low incomes in the surrounding area.

Medical education for high school coaches and athletes

Meaghan McConkey,[1,2] Devin Breckenridge[1,2]

[1]University of Missouri-Columbia
[2]St. Joseph Clinical Training Site

Introduction

While athletic training is a growing field, only around 51% of Missouri high schools employ an athletic trainer. Small schools in rural communities are the least likely to have access and face other challenges such as lack of access to advanced equipment and to other medical services. Coaches at these schools often assume additional responsibility including assessing injuries, taping and bracing, and providing health-related advice to students. This project aimed to ease some of the burden on high school coaches in northwest Missouri by providing basic medical education and skills demonstrations.

Methods

Athletic directors at 11 small schools in northwest Missouri indicated interest in participating. Coaches at these schools were surveyed to identify major health concerns and to indicate their comfort level with various medical topics. In-person demonstrations and virtual presentations were provided on assessment of common sports injuries, taping and bracing, exercise, injury prevention, nutrition, hydration, mental health, and vaping. Post-intervention surveys were conducted to measure the utility of the information provided.

Results

Pre-project surveys revealed that all coaches were responsible for injury assessments during practices, with 60% also handling assessments during games. Initially, 75% of coaches were uncomfortable assessing head or knee injuries. Post-seminar, all coaches reported comfort with ankle injury assessments, and most felt comfortable with head and knee injury assessments. For the online presentations, 85% of attendees reported increased knowledge, awareness, and comfort in addressing the covered topics.

Conclusion

Our project demonstrated a significant need for sports medicine education in rural high schools and successfully improved coaches' confidence in injury assessment and knowledge of various health topics relevant to student-athletes. Future iterations could expand topic coverage and increase school involvement through on-site sessions.

AED access in southwestern Missouri: Opportunities, limitations, and solutions

Rachel L. Schuler,[1,2] Derek Sopok[3]

[1]University of Missouri-Columbia
[2]Branson Clinical Training Site
[3]CoxHealth

Introduction
Bystander use of automated external defibrillators (AEDs) during out-of-hospital cardiac arrests (OHCA) is proven to increase neurologically intact survival rates due to reduced cardiac downtime. Despite the known benefits, the rate of public AED utilization remains consistently low, primarily due to a lack of knowledge, limited access, misconceptions about usage, and funding barriers. This study aimed to assess barriers to AED use and promote community engagement through a consolidated AED funding resource.

Methods
This study targeted attendees of CoxHealth EMS Education-directed community CPR events in Dade, Stone, Douglas, Webster, Christian, and Greene counties, Missouri. A pre-release survey was conducted in September 2023 among EMS educators to identify perceived barriers to AED utilization. In October 2023, a webpage listing local, state, and national AED grant opportunities was published. Data on website traffic were collected from October 2023 to March 2024. A post-release survey was conducted in March 2024 to evaluate the resource's impact and utility.

Results
The pre-release survey indicated that lack of awareness/education was the most commonly cited barrier to AED use (100%), followed by cost (75%), availability (50%), and fear of liability (50%). None of the instructors were aware of the number of AEDs in their service areas, highlighting the potential need for a state-wide AED registry. Following the publication of the funding resources page, a gradual increase in site traffic was observed, indicating rising community engagement. In the post-release survey, three out of four respondents could name at least two AED funding resources, suggesting increased awareness, although none reported using the resource during CPR training sessions.

Conclusion
Lack of knowledge and funding continue to be significant barriers to AED utilization in southwestern Missouri. The creation of a unified AED funding resource has shown initial success in raising awareness but requires further promotion and integration into community education initiatives. Continued efforts in public education and the establishment of a state-wide AED registry could further enhance AED accessibility and utilization, ultimately improving OHCA outcomes.

Effectiveness of supplemental teaching methods for tracking hypertension and diabetes

Jay Patel,[1,2] Jared Yates[1,2]

[1]University of Missouri-Columbia
[2]West Plains Clinical Training Site

Introduction

Ozark Healthcare in West Plains, Missouri serves the 9 counties in the local region. The National Community Health Needs Assessment (NCHNA) for this population shows 51.5% of people with Type 2 Diabetes Mellitus and 42.73% of people with Uncontrolled Hypertension are without adequate intervention to effectively treat these conditions (NCQA, 2021). Ozark Healthcare had chosen these as metrics to improve upon in the coming year. Improving patient understanding of their diagnosis and compliance with clinic recommendations from the American Heart Association (AHA) and American Diabetes Association (ADA) on diet, exercise and regularly recording blood sugars and blood pressures would improve these metrics and overall long-term health in this region.

Methods

This study compared the effectiveness of three different methods of patient education on patient compliance with clinic recommendations measured by follow-up weekly over the phone for 4 weeks: 1) Regular patient visit with the physician and consent to participate in a study with follow up in 4 weeks only (control, n=7). 2) A brochure on either high blood pressure or diabetes for the patient to take home and read on their own (brochure, n=22). 3) An in-person explanation of the brochure explaining the risks, pathology, and preventative recommendations of diet and exercise by the AHA and ADA (explanation, n=10).

Results

Results showed that compared to control, patients who received education in the brochure group and explanation group reported a significantly increased understanding of their diagnosis rated on a scale of 1-10, with a $t = 0.90$, $p < 0.05$ and $t = 1.61$, $p < 0.05$, respectively. Patient understanding between the explanation and brochure group was not significantly different. However, patients in the explanation group had a near perfect rate of follow-up and even took the initiative to call on their own with the results of their blood pressure, blood sugar, diet and exercise. Follow-up in this group was significantly higher with a $t = 2.32$, $p = 0.03$ and $t = 2.62$, $p=0.01$ when compared to control and the brochure group, respectively. An ANOVA comparing the follow-up between the three groups detected a significant difference with a $p = 0.04$.

Conclusion

In conclusion, these results suggest that educational items may increase patient knowledge, regardless of method, but spending time with patients and explaining their diagnosis and recommended plan helps increase patient follow-up and compliance with recommendations. It could be useful to create handouts on Type 2 Diabetes or Hypertension to explain to patients in the office to help meet NCHNA metrics in this region.