Venous Stasis Dermatitis as a Risk Factor for Pasteurella Multocida Bacteremia: a Case Report and Literature Review

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Abstract

Pasteurella multocida is a gram-negative bacterium found in the oral flora of dogs and cats. Pasteurella infections are typically localized to skin and soft tissue, but at-risk patients may progress to systemic infections. This report details Pasteurella bacteremia in an elderly patient with chronic venous stasis, highlighting venous stasis dermatitis as a risk factor for systemic infection. Diagnosis was confirmed via blood cultures. Management included ceftriaxone per infectious disease recommendations and was later supported by sensitivities. This case underscores the importance of recognizing chronic skin conditions as risk factors for systemic Pasteurella infections, emphasizing the need for early identification to provide targeted treatment in at-risk patients.

Introduction

P. multocida is a non-motile, facultative anaerobic, gram-negative coccobacillus that is a normal part of the upper respiratory tract flora of many mammals. It is the most frequent isolate from dog and cat bites and scratches, which are the primary mode of infection and account for approximately 1% of all emergency room visits [1-3].

Most research on *P. multocida* infection focuses on skin and soft tissue infection, which is relatively common and affects otherwise healthy individuals; in contrast, invasive infections (meningitis, endocarditis, peritonitis) are much rarer and affect almost exclusively patients with significant underlying risk factors or disease [4-8]. Prior case reports have not yet identified reliable symptoms, imaging, or laboratory findings to distinguish invasive P. multocida infections from those caused by other pathogens [9,10]. This absence of distinguishing features is concerning is because patients with invasive infections face increased risk of developing *P. multocida* bacteremia, which often onsets in under 24 hours after exposure and has a mortality rate of approximately 30% [7-11].

Previously described predisposing conditions for *P. multocida* bacteremia include liver dysfunction, diabetes mellitus, solid organ transplantation, malignancy, and advanced age [8]. However, these only are present in 67% of diagnosed patients, meaning one-third of patients may not have clear indicators for risk at presentation. Skin exams are a quick and non-invasive means of assessing patients; however, little research has explored whether dermatologic conditions may be useful in identifying patients at increased risk of *P. multocida* infection.

Between 2 and 6 million Americans have advanced forms of chronic venous insufficiency, notable on physical exam with swelling and hyperpigmented skin changes of the extremities [12]. Chronic venous insufficiency causes vascular and skin barrier damage, ulcer formation, impaired and slowed healing, through the inflammatory changes mediated by leukocyte accumulation, oxidative stress, and matrix-metalloproteinase degradation of the vascular extracellular matrix [13-18]. However, an association between venous stasis, evidenced by skin changes, and *P. multocida* bacteremia has not been previously described.

Case Presentation

A female in her 70s presented to the emergency department (ED) with fever, nausea, and pain in left lower extremity one day after a dog scratch. The patient's medical history included obesity (BMI 68.3), asthma, obstructive sleep apnea, hypertension, hypothyroidism, prior stage 1 breast cancer, and recurrent bacterial and fungal skin infections affecting her lower extremities. At presentation, the patient was not on any immunosuppressive medications. The patient reported that, at baseline, she used a wheelchair for ambulation. She lived at home with her husband, her grandson, her grandson's family and two small dogs. One year prior to this presentation, she was diagnosed with culture-negative cellulitis in the same extremity and so she became concerned when her left leg became red and painful.

In the ED, vital signs showed temperature 37.8

°C, heart rate 124 beats per minute; respiratory rate 20 breaths per minute, blood pressure 139/80, and oxygen saturation of 94%. Physical examination revealed erythema and warmth of a tender left lower extremity extending from the dorsal left foot to the ipsilateral knee along with two <1 cm purpuric puncture wounds on the lateral ankle which drained clear-yellow fluid and blood. Examination of bilateral lower extremities revealed diffuse pink-to-brown darkening of the skin most pronounced inferiorly and anteriorly, with xerotic plaques and overlying white flaking scale (Image 1).

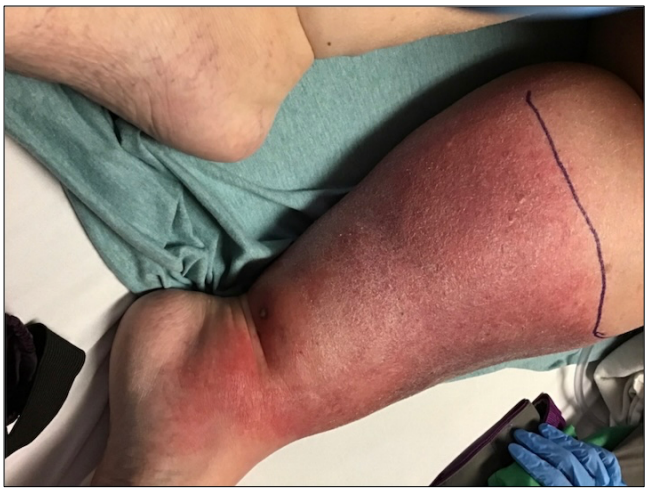

Image 1. Examination of bilateral lower extremities revealed diffuse pink-to-brown darkening of the skin most pronounced inferiorly and anteriorly, with xerotic plaques and overlying white flaking scale.

Laboratory studies revealed white blood cells, inflammatory markers, and electrolytes within normal limits; lactate was elevated at 4.2 mmol/L. Chest x-ray demonstrated perihilar/infrahilar-predominant airspace consolidation compatible with pulmonary edema and/or pneumonia. X-ray of tibia and fibula showed posterior fibular cortical indistinction and diffuse regional subcutaneous soft tissue inflammation, suggestive of osteomyelitis (Image 2). Blood cultures were drawn, and the patient was admitted for evaluation of sepsis and cellulitis (Table 1).

The patient was treated empirically with intravenous clindamycin and vancomycin with differential diagnoses including sepsis and osteomyelitis. Two days after admission, blood cultures returned positive for gram-negative rods. MRI showed diffuse subcutaneous edema and overlying soft tissue nodularity of the medial leg without fluid collection or significant osseous hypointensity, and thus imaging was inconsistent with abscess or osteomyelitis. On the third day of admission, blood culture identified the infectious agent as P. multocida.

Table 1. Patient Results at Presentation

Vital Signs	Value	Normal	Units
*Temperature**	37.8	36-37.8	Celsius
*Heart Rate**	130	60-100	Beats Per Minute
*Respiratory Rate**	20	8-20	Breaths Per Minute
SBP NIBP	89	90-139	mmHg
DBP NIBP	64	60-90	mmHg
SpO2	95	88-100	%
BMI	68.3	18.5-24.9	kg/m2
Hematology Profile	**Value**	**Normal**	**Units**
RBC	4.27	3.9-5.03	x10(12)/L
HGB	14.3	12-15.5	g/dL
HCT	43.8	34.9-44.5	%
MCV	102.6	81.6-98.3	fL
*MCH**	33.5	26-33	pg
*MCHC**	32.6	32-36	g/dL
*RDW SD**	49.7	46.3-46.3	fL
RDW CV	13.2	11.9-15.5	%
PLT	204	150-450	x10(9)/L
WBC	4.13	3-5-10.5	x10(9)/L
Abs Granulocytes	3.76	1.7-7	x10(9)/L
mmature Granulocytes	0.01	0-0.03	x10(9)/L
*Abs Lymphocytes**	0.28	0.9-2.9	x10(9)/L
*Abs Monocytes**	0.05	0.3-0.9	x10(9)/L
*Abs Eosinophils**	0.02	0.05-0.5	x10(9)/L
Abs Basophils	0.01	0-0.3	x10(9)/L
General Chemistry	**Value**	**Normal**	**Units**
Sodium Level	136	136-145	mmol/L
Potassium Level	3.9	3.5-5.1	mmol/L
Chloride	105	98-107	mmol/L
CO2	21	20-31	mmol/L
Anion gap	14	0-20	mmol/L
Glucose Level	104	70-139	mg/dL
BUN	17	8-23	mg/dL
reatinine, standardized	0.8	0.5-1	mg/dL
*mated GFR for Adults**	77	>90	mL/min/1.7
Calcium Level	10	8.3-10.6	mg/dL
Total Protein	7.1	5.7-8.2	g/dL
Albumin Level	3.9	3.4-5	g/dL
Total Bilirubin	1.02	0.3-1.2	mg/dL
Alkaline Phosphatase	58	35-104	U/L
AST-SGOT	31	<=34	U/L
ALT-SGPT	18	10-40	U/L
Immunology/Virology	**Value**	**Normal**	**Units**
CRP	0.8	<=1.0	mg/dL
*Lactic Acid, Plasma**	4.2	0.5-2.2	mmol/L

After identification, clindamycin was discontinued and cefepime was started. A midline IV was placed on day 6 of admission to administer ceftriaxone 2g daily for 14 days, per infectious disease recommendations. Sensitivities returned after ceftriaxone was initiated but confirmed susceptibility to both penicillin and ceftriaxone.

The patient was discharged on day 15 and was seen two months later in clinic. At that time, her recovery was without complications attributable to the infection.

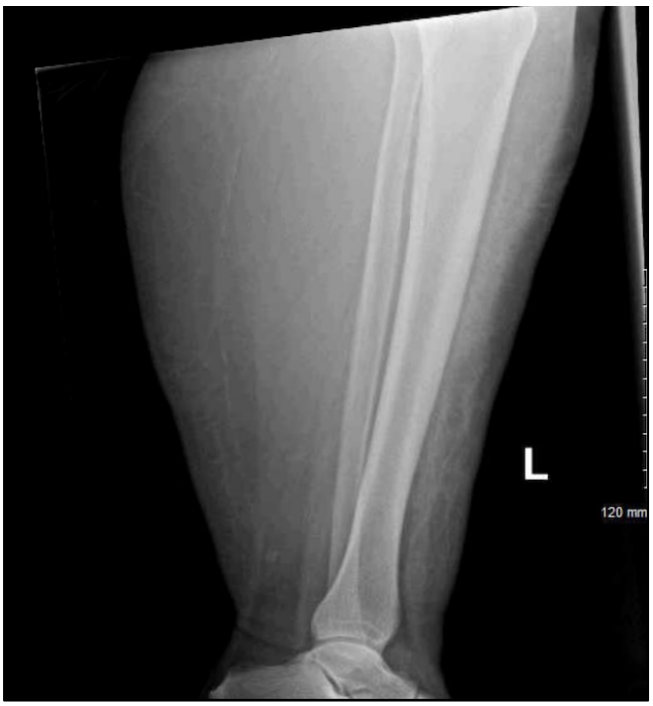

Image 2. X-ray of tibia and fibula showed posterior fibular cortical indistinction and diffuse regional subcutaneous soft tissue inflammation, suggestive of osteomyelitis

Discussion

This patient's presentation of tachycardia, hypertension, and suspected cellulitis aligns with existing literature on Pasteurella bacteremia, which is commonly linked to dog or cat exposure and usually arises in the context of skin and soft tissue infection or other invasive disease. Patient's recurrent history of lower extremity cellulitis and recall of recent dog scratch supported infectious etiology, even though patient was alert and oriented, afebrile, and labs showed normal leukocyte count at presentation.

P. multocida, likely transmitted via dog scratch, was determined to be the cause of her illness. While often an infection of skin and soft tissue in immunocompetent persons, invasive infections are almost entirely seen in immunocompromised patients, the elderly or neonatal patients, or those with chronic pulmonary disease. Venous-stasis-induced inflammation and oxidative stress damaged the patient's skin barrier and endothelium, predisposing her to this infection, in addition to previous lower extremity skin and soft tissue infections. Furthermore, the extent of her venous stasis is exacerbated by sedentarism and use of a wheelchair at baseline [19].

Atypical Pasteurella infections, including non-bite transmission, such as in this patient, are associated with increased morbidity and mortality [8]. To avoid rapid progression and severe symptoms, prompt recognition of risk is necessary to avoid severe symptoms, despite risk factors. This highlights the value of thorough patient interviews and the importance of obtaining blood cultures, even in ambiguous cases.

Patient Perspective

What were the first signs and symptoms you recognized?

"The first thing I noticed was redness and heat right on my left leg. It became painful. It went so fast that that I was kind of fully into the whole infection before I knew what happened. I was sick and running a fever and somewhat out of it – almost delusional. It was a very strong and fast reaction compared to any others I've had. I have problems with MRSA, so any time I get a scratch from my dogs, I watch it pretty close. After I got scratched, I watched it; it was feeling hot. My grandson happened to be visiting and was the one who called my husband. We had to tell him to turn right around and come back. I have a power wheelchair and our car is the only one that can transport me."

What were your thoughts or concerns while sick?

"I remember being in the hospital pretty well, but I remember when I was first there and talking to the doctors, what I said wasn't what I was actually thinking. It was a little scary and weird. I never had an experience like that before. My brain was really out of it."

"There were a lot of things going on that they were watching me pretty close. The emergency room doctor said I was close to – or I was – septic and that my leg might be need to be removed. I don't have a good recollection of some of this."

What was your experience with treatment?

"Once I started treatment, I started feeling like myself. My leg did hurt, I was in a lot of pain. Some of the pain was brought on by my handling in the hospital because of my hip."

Do you feel that you have fully recovered?

"I feel that I have mostly recovered. There are some things like some of the abilities I had before I went to the hospital [which have not recovered], but it's because of the pain more than what the injury was. My hip has deteriorated over this time."

Have you changed any aspects of your life since hospitalization?

"The biggest thing is maybe a change in attitude. When you go through your worst possible experience, it's something you don't want to go through again. That's part of what has motivated me to lose weight. I've been working really hard to get healthier, and I've been somewhat successful. I've lost 60 pounds."

Have you changed your relationship with animals since hospitalization?

"Not really. They're family. I just wear my long pants all the time and try to make it heavy enough that they can't scratch through it. I have worked on their behavior a bit so I can avoid repeating the hospitalization."

"The next time I got a scratch, the nurse practitioner I was seeing at the time, instead of waiting to see what would happen, we did mupirocin and fresh dressings every day for a week or two. It didn't get infected. I have some of that on hand, so if I get even a small scratch I just go ahead and use it until I feel it is starting to heal."

Have you changed any aspects of your skin care?

"I haven't made any specific changes to my skin care."

Learning Points

1. A compromised skin barrier may serve as an independent risk factor for systemic infection.
2. Skin exam is amongst the most rapid means of gaining important information about patients for whom infection is suspected.
3. A detailed history, including animal exposures, should be collected for all patients who present with signs of systemic infections, even if patients do not report a recent bite.
4. In patients with underlying venous stasis skin changes, education on skin hygiene, protection from injury, and inspection of affected limbs may help prevent invasive infections.

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