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# Rare Case of *Pasteurella canis* Bacteremia from Cellulitis

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**Abstract** *Pasteurella (P.) canis* bacteremia is rare with only five reported cases in the literature, which was likely correlated with a state of immunosuppression. A 59-year-old male with a history of right lower extremity (RLE) squamous cell carcinoma (SCC) and non-alcoholic cirrhosis presented for a two week duration of RLE pain, swelling, erythema, and open wounds. The patient admitted that his dog has regularly licked his wounds in the past week. Laboratory investigations and imaging confirmed cellulitis and *P. canis* bacteremia. Additionally, punch skin biopsies showed his SCC is well differentiated and invasive. The patient was started on empirical intravenous antibiotics. Once deemed medically stable and asymptomatic, the patient was discharged from the hospital on culture directed oral antibiotics. He was also educated on wound care and wound hygiene with his dog. It is important for the general practitioner to know that *P. canis* bacteremia is possible, although rare. Additionally, it is useful to know that patients without animal bites and immunosuppression are at risk of bacteremia. Finally, with the appropriate antibiotics, *P. canis* bacteremia can have a favorable prognosis.

***Keywords:*** *Pasteurella canis, Bacteremia, cellulitis, immunosuppression, Squamous cell carcinoma, cirrhosis*

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## 1. Introduction

In small mammals, such as cats and dogs, *Pasteurella (P.) canis* is considered normal flora, especially in the oropharynx and gastrointestinal tract. [1] It is widely known that being bitten by these mammals can cause an infection in humans including cellulitis, pulmonary infections, osteomyelitis, and infectious keratitis. [2,3,4] A thorough literature review revealed that *P. canis* bacteremia is rare, with only five reported cases thus far. [5,6,7,8,9] This patient not only describes the sixth overall case of *P. canis* bacteremia, but also the second of *P. canis* bacteremia from cellulitis. This case report was prepared following the CARE guidelines. [10]

## 2. Case Narrative

A 59-year-old male with a history of squamous cell carcinoma (SCC) of the right lower extremity (RLE), stasis dermatitis, non-alcoholic cirrhosis, portal hypertension, and remote methicillin-sensitive *Staphylococcus aureus* bacteremia presented to the emergency department with sudden onset of anterior RLE pain, swelling, and erythema. Of note, for the patient's RLE SCC it was most recently found to be in situ and treated with radiation. As for the non-alcoholic cirrhosis and portal hypertension, the patient has a transjugular intrahepatic portosystemic shunt (TIPS). Two weeks prior to presentation the patient noticed three blisters on his RLE that had recently ruptured. One day earlier, he stated he developed pain, swelling, and erythema that started near his right ankle and gradually progressed to involve the anterior and posterior surfaces of his right distal leg (Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6). The symptoms were associated with fever, chills, and nausea. Further history revealed that his dog has licked his open wounds, but denied any dog bites. The patient also denied any injuries or abrasions. The initial vital signs in the emergency department revealed the patient was febrile, but was otherwise stable. On a physical exam, the RLE showed 2+ pitting edema, erythema, petechiae, tenderness, and diminished sensation. In addition, three superficial wounds, each 1-2 centimeters (cm) in size were found that were bleeding, but without purulent drainage. Laboratory investigations revealed a normal white count with a left shift, elevated inflammatory markers, and metabolic acidosis with an elevated anion gap and lactic acid (Table 1). A right ankle x-ray was negative for acute fracture or dislocation, mild to moderate osteoarthritis changes, and soft tissue swelling (Figure 7). Subsequently, a RLE CT revealed soft tissue edema, lymphedema, and venous stasis, which confirmed the cellulitis (Figure 8). After 48 hours, two out of two blood cultures and one wound culture were positive for *P. canis*, which was performed by a matrix assisted laser desorption ionization-time of flight mass spectrometer. A punch skin biopsy of his chronic posterior SCC and anterior wounds indicated well differentiated and

invasive SCC (Figure 9, Figure 10) and chronic wounds with superimposed stasis dermatitis (Figure 11), respectively. He was initially started on broad spectrum intravenous antibiotics that were deescalated as per sensitivities. During the hospital course, the patient's RLE symptoms resolved. He was then discharged on oral levaquin and metronidazole for a total antibiotic duration of 10 days. Moreover, the patient was scheduled with dermatology and surgery for further management of his invasive RLE SCC and educated on proper wound care and wound hygiene with regards to his dog. However, the patient was non-compliant with these recommendations despite our outpatient clinic attempting to contact him.

**Figure 1.** Stage 1 of patient's right lower extremity cellulitis (The anterior surface of the right lower extremity developed swelling and erythema)

**Figure 2.** Stage 2 of patient's right lower extremity cellulitis (Blisters formed on the anterior right lower extremity.)

**Figure 3.** Stage 3 of patient's right lower extremity cellulitis (The right lower extremity wounds evolved into scabs.)

**Figure 4.** Stage 4 of patient's right lower extremity cellulitis (The right lower extremity wounds progressed to involve the anterior and posterior surfaces.)

**Figure 5.** Stage 5 of patient's right lower extremity cellulitis (Three wounds on the right lower extremity ruptured, which had a diameter of 1-2cm.)

**Figure 6.** Stage 6 of patient's right lower extremity cellulitis (Close up view showing two out of three wounds on the right lower extremity that had ruptured and was acutely bleeding. Picture was taken in the emergency room)

**Table 1. Laboratory and microbiology investigations on admission**

| | Laboratory Value | Institution Ranges |
|---|---|---|
| **White count (10^3 uL)** | 6.9 | 4.5-11 |
| **Neutrophils (%)** | 88.8 | 40-60 |
| **Procalcitonin (ng/mL)** | 4.28 | 0.1-0.49 |
| **ESR (mm/h)** | 63 | 0-20 |
| **C-reactive protein (mg/dL)** | <1 | 0-1 |
| **Total CO2 (mmol/L)** | 16 | 20-32 |
| **Anion Gap** | 12 | 2-16 |
| **Lactic acid (mmol/L)** | 3.0 | <1 |
| **Wound Culture** | No growth | N/A |
| **Blood Culture** | Pasteurella canis x2/2 (Susceptible to cefepime and levaquin) | N/A |
| **Punch Biopsy of right posterior calf** | Well differentiated and invasive squamous cell carcinoma | N/A |
| **Venous doppler of right lower extremity** | No deep vein thrombosis | N/A |


**Figure 7.** X-ray of right lower extremity (X-ray showed no acute fracture or dislocation, mild to moderate osteoarthritis changes, and soft tissue swelling)

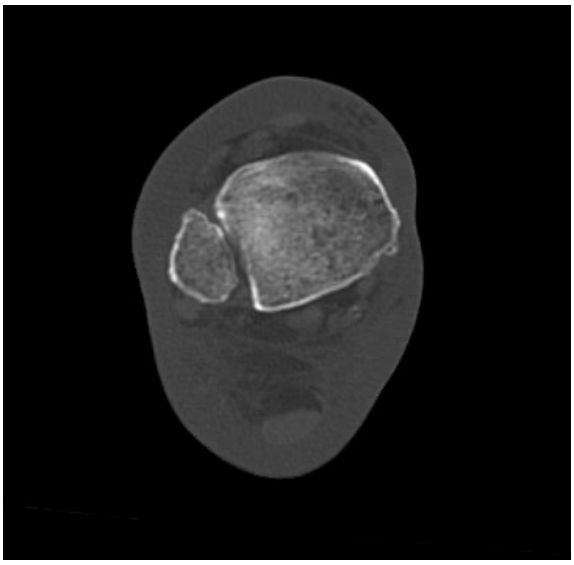

**Figure 8.** Computed tomography of right lower extremity (Computed tomography revealed soft tissue edema, lymphedema, and venous stasis.)

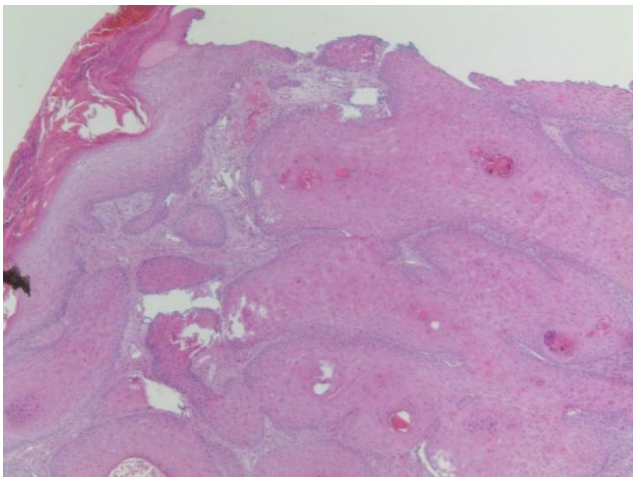

**Figure 9.** Histology of punch skin biopsy of posterior calf (This punch skin biopsy demonstrated endophytic growing atypical squamous lesions made of large keratinocytes and detached angulated nests of squamous cells with desmoplastic stroma that extended to the peripheral and deep edges of the biopsy. This was consistent with well differentiated and invasive squamous cell cancer)

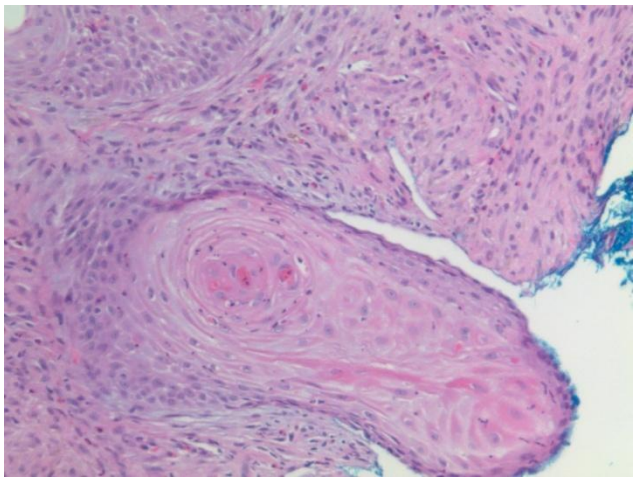

**Figure 10.** Histology of punch skin biopsy of posterior calf with magnification on detached nests (Magnification of second punch skin biopsy showed detached angulated nests of squamous cells with desmoplastic stroma)

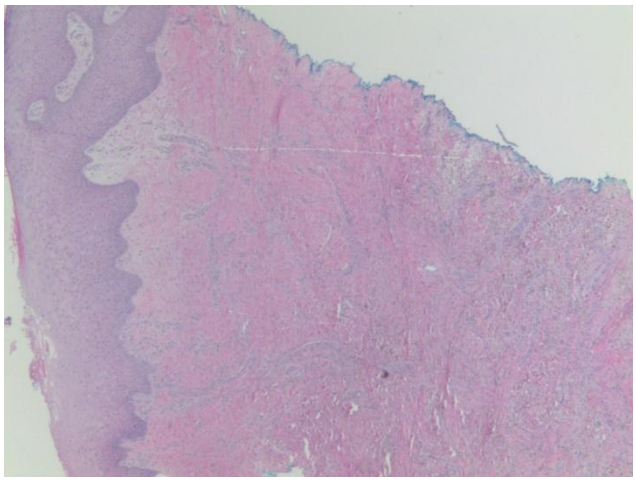

**Figure 11.** Histology of punch skin biopsy of anterior shin wound (This punch skin biopsy illustrated overlying hyperplastic epidermis, reactive proliferation of capillaries within the dermis, and collection of hemosiderin laden macrophages. This was consistent with chronic wounds and superimposed stasis dermatitis)

## 3. Discussion

A majority of cellulitis cases are caused by normal flora of the skin. Although most cases are unculturable, *Staphylococcus aureus*, beta hemolytic *Streptococcus*, and *Streptococcus pyogenes* are commonly culturable. [11] In immunocompromised patients, *Pseudomonas aeruginosa* is also commonly seen in cellulitis cases.[12] Common risk factors for developing immunosuppression include elderly age, cirrhosis, malignancy, organ transplantation, human immunodeficiency virus, and diabetes mellitus. [7,13] Other predisposing factors are foreign objects, such as joint and breast prosthetics, as well as underlying lung pathologies, such as chronic obstructive pulmonary disease in respiratory infections. [9,14] This patient's invasive SCC and non-alcoholic cirrhosis that both required treatment in the past lead him to be at high risk for a suppressed immune system. Though malignancies can create a state of immunosuppression, a case was reported in which a patient's skin SCC on the forearm directly led to the development of cellulitis. The authors proposed that a deposit of metastatic SCC could undergo cystic degeneration. [15] Therefore, this patient had immunosuppression from his chronic diseases, but the possibility of the invasive skin SCC leading to the development of cellulitis should also be considered. However, it is unlikely as the anterior punch skin biopsy did not indicate SCC.

*P. canis* is an encapsulated gram negative coccobacillus that is normal flora for cats and dogs within the oropharyngeal and gastrointestinal tracts. [1] Therefore, animal bites are pathogenic for transferring *P. species*, especially *P. multocida*, into humans and cause soft tissue infections. [1,2,3,4,16] *P. species* have been isolated from 20-30% of dog bites and more than 50% of cat bites. [17] This patient's dog is a mix breed of a papillon, a type of spaniel, and a german spitz (Figure 12); however, current evidence suggests that all breeds of dogs and cats are equally implicated in transferring *P. species* to humans. Soft tissue and wound infections are equally distributed amongst the various *P. species*, which include *P. multocida*, *P. canis*, and *P. dagmatis*. After soft tissue infections, *P. species* are most often found in the respiratory tract. [7] A study evaluated 44 patients with *P. multocida* and found that patients without animal bites were more commonly bacteremic versus those with animal bites (37%, 7/19 versus 4%, 1/25). [18] Therefore, due to the absence of a point of entry for the infection and the association in patients with severe comorbidities and impaired host defences, it has been proposed that these patients only need a weaker bacterial inoculum. [12,19] Moreover, the mortality rate of *P. species* bacteremia has been reported at 34.3% (34/99). [19]

**Figure 12.** Patient's dog (The dog is a mix breed of a papillon, a type of spaniel, and a german spitz)

**Table 2. Summary of *Pasteurella canis* bacteremic patients found on literature review**

| Reference | 5 | 6 | 7 | 8 | 9 | This case |
|---|---|---|---|---|---|---|
| Publication Date | 2010 | 2011 | 2015 | 2016 | 2017 | 2021 |
| Age | 74 years | 21 months | 70 years | 56 years | 89 years | 59 years |
| Sex | Male | Unknown | Male | Female | Male | Male |
| Risk Factors | -Alcoholic cirrhosis<br>-Chronic lymphedema<br>-Metal scratch | Unknown | Chronic obstructive pulmonary disease | Hypothyroidism | -Unknown chronic respiratory disease<br>-Stroke<br>-Atrial fibrillation | -Non-alcoholic cirrhosis<br>-Invasive squamous cell carcinoma |
| Animal Exposure | Dog licked open wounds | Rabbit secretions | None reported | Casual exposure to cats | None reported | Dog licked open wounds |
| Cultures | -Blood: *Pasteurella canis*<br>-Wound: coagulase positive *Staphylococcus* and *Acinetobacter* | -Blood: *Pasteurella canis* | -Blood: *Pasteurella canis* | -Blood: *Pasteurella canis* | -Blood: *Pasteurella canis* | -Blood: *Pasteurella canis*<br>-Wound: No growth |
| Diagnosis | Cellulitis of left leg | Unknown | Lower respiratory tract infection | -Pleural empyema<br>-Hemorrhagic septicemia | -Community acquired pneumonia<br>-Parapneumonic pleural effusion | Cellulitis of right leg |
| Final antibiotic regimen | -Amoxicillin<br>-Clavulanate | Unknown | Doxycycline | -Piperacillin<br>-Tazobactam | -Doxycycline for 10 days<br>-Levofloxacin for 11 days | -Levaquin for 10 days<br>-Metronidazole for 10 days |
| Prognosis | Favorable | Unknown | Favorable | Favorable | Favorable | Favorable |

An extensive literature review spanning three different databases revealed five total cases of *P. canis* bacteremia (Table 2). [5,6,7,8,9] One case report was only printed in Spanish, but 'Google Translator' was used to convert it into English. Unfortunately, an article written in Hebrew was not able to be accessed, except for the abstract. As for age, three patients were elderly, one middle aged adult, and one infant. With regards to sex, there were three males, one female, and one case did not report the gender. Three patients had exposure to animals and none of them reported animal bites, but one did indicate that the dog licked the patient's open wounds. As for the risk factors and diagnoses along with *P. canis* bacteremia, one patient with alcoholic cirrhosis had a cellulitis infection, two out of the three patients with respiratory infections had underlying respiratory diseases, and in one patient the underlying diagnosis was unknown. Though, *P. multocida* bacteremia has a high mortality rate, all of these cases had a favorable prognosis after antibiotic treatment as per the culture's sensitivities.

This patient illustrates the sixth overall case of *P. canis* bacteremia and the second of cellulitis. Furthermore, it illustrates the second youngest patient at 59-years-old, the second with a history of cirrhosis, although non-alcoholic, and the first with an invasive SCC that was within close proximity. As with the other five cases, this patient responded well to appropriate antibiotics.

The most effective therapies against the *P. species* are beta-lactams with beta-lactamase inhibitors or fluoroquinolones, since polymicrobial infection should be considered when there is contact with an animal's oropharyngeal and gastrointestinal tract. The alternative antibiotics for patients with penicillin allergies or resistant strains are doxycycline and metronidazole or cephalosporins, specifically the second and third generations. In pediatric cases, clindamycin and ciprofloxacin or trimethoprim and sulfamethoxazole are preferred. In pregnant women, ceftriaxone is suitable. [13,20] In addition to antibiotics, other recommendations are to prevent *P. species* bacteremia by educating individuals on appropriate hand hygiene after handling pets, not allowing pets to have direct contact with uncovered or open wounds, and regular follow up with medical professionals for chronic medical conditions. [13]

## 4. Conclusion

This case report illustrates only the sixth case of *P. canis* bacteremia. Additionally, it demonstrates facts that might be unknown to the general practitioner. Patients without animal bites more commonly have bacteremia compared to those with animal bites, especially those with severe comorbidities and immunosuppression. Despite a high mortality rate with P. multocida bacteremia, all P. canis bacteremia - five in the literature and ours - had favorable prognosis with the appropriate antibiotics.

## Abbreviations

P., Pasteurella; RLE, right lower extremity; SCC, squamous cell carcinoma

## Conflict of Interest

The authors have no conflicts of interest to disclose.

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