Pasteurella multocida wound infection transmitted by a pet dog

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Abstract

Introduction **Human pasteurellosis is a severe human infection that accounts for 20-30 human deaths annually worldwide. Mucous secretions derived from pets comprise the primary source of infection, which are transmitted through animal scratches or bites.**

Case report **We describe a case of *Pasteurella multocida* wound infection in an immunocompetent adult with a decubitus ulcer of the lower extremity. The organism was also isolated from an oral swab of the patient's dog with which he reported close contact. The patient had a favorable outcome following aggressive surgical debridement, antimicrobial treatment and subsequent wound care.**

Conclusion **Our case illustrates that licking of open wound is an alternative source of infections by *Pasteurella multocida*, and emphasizes the need for avoidance of wound contact with animals.**

Keywords ***Pasteurella multocida*, wound infection, dog.**

Introduction

Pasteurella species are small, nonmotile, aerobic and facultative anaerobic, Gram-negative coccobacilli, first isolated from wild hogs and birds in 1878, and characterized two years later by Pasteur. *Pasteurella multocida*, the species most frequently isolated from humans, comprises three subspecies, *P. multocida* subsp. *multocida*, *P. multocida* subsp. *septica*, and *P. multocida* subsp. *gallicida*.[1]

P. multocida has a worldwide distribution and belongs to the normal flora of the nasopharynx and gastrointestinal tract of many domestic and wild animals. Carriage rates are reported at 50% to 90% in cats, 50 to 66% in dogs, 51% in pigs and 14% in rats.[2] Most commonly, carriage is asymptomatic in animals. However, a variety of infections, such as mastitis, respiratory tract infections, and septicemia have also been reported.[1]

In humans, *P. multocida* is isolated from soft tissue infections resulting from 50% of dog bites, 75% of cat bites or scratches, and less frequently from licks on injured skin by pet. However, there are rare cases in which no contact with animals was identified.[1,3]

We present a case of *P. multocida* decubitus ulcer infection in an immunocompetent adult patient resulting after close contact and licking by the patient's dog.

Case report

A 57-year-old male immunocompetent patient presented to our outpatient office because of the onset of infection of a heel decubitus ulcer, that developed after prolonged hospitalization in the Intensive Care Unit (ICU) due to a motorcycle accident. The ulcer had become infected one month after his discharge from the hospital.

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Physical examination revealed an ulcer in his right heel with warmth, erythema and pain. The patient was afebrile and had no signs of systemic infection. There was no clinical and radiologic evidence of osteomyelitis. Surgical debridement of the necrotic lesions was performed. Subsequently, biopsy specimens from the base of the wound were sent for culture and the patient was placed on empirical therapy with oral cefuroxime axetil (400 mg b.i.d). He was treated as an outpatient.

After 24 h of incubation at 36°C in 5% CO_2 atmosphere, pure growth of smooth opaque grayish colonies was observed on blood and chocolate agar plates. The isolated microorganisms were Gram-negative coccobacilli, nonmotile, oxidase and catalase positive, and were identified by standard procedures including API 20E system and the automated Vitek 2 system using GN cards (both products of BioMérieux, Marcy-l' Étoile, France), as *Pasteurella multocida*. Upon further testing with sorbitol and dulcitol fermentation, the strain was found to belong to *multocida* subspecies. Antimicrobial susceptibility testing was performed by the disk diffusion method and minimal inhibitory concentrations (MICs) were determined by the Etest method (BioMérieux). The results were interpreted according to the Clinical and Laboratory Standards Institute guidelines.[4] The organism was susceptible to all beta-lactams tested [penicillin (MIC=0.064 µg/mL), ampicillin (MIC=0.125 µg/mL), amoxicillin-clavulanate (MIC=0.125 µg/mL), and ceftriaxone (MIC=0.016 µg/mL)], to azithromycin (MIC=0.75 µg/mL), levofloxacin (MIC=0.023 µg/mL), moxifloxacin (MIC=0.012 µg/mL), tetracycline (MIC=0.5 µg/mL), doxycycline (MIC=0.38 µg/mL), trimethoprim/sulfamethoxazole (MIC=0.023 µg/mL), and resistant to erythromycin (MIC=2 µg/mL) and clindamycin (MIC=16 µg/mL).

Upon further questioning, the patient reported that he had close contact with his pet dog, including licking of the wound on several occasions. Oral swabs taken from the patient's dog grew *P. multocida* subsp. *multocida*, with a biochemical and antimicrobial susceptibility pattern that matched the pattern produced by the isolate from the patient. Clonality was further assessed by comparison of total DNA sequence of the genomes using next generation sequence. By using the BLAST sequence comparison tool at https://blast.ncbi.nlm.nih.gov/Blast.cgi, it was found that the 2 genomes were 100% identical in both the chromosomal and plasmid content. Genomes' sequence and assembly data were submitted to the NCBI database and assigned the accession numbers SAMN07109565 and SAMN07109566 for the human and the dog strain, respectively.

Cultures of the biopsy material incubated under anaerobic conditions yielded a Gram-negative bacillus that was identified as *Bacteroides ovatus*. The isolate was susceptible to penicillin, amoxicillin-clavulanate, cefoxitin, rifampicin, chloramphenicol, tetracyclines and clindamycin. The laboratory results (identification and susceptibility testing of both microorganisms) were reported four days after initiation of empirical treatment. Based on the profile of antimicrobial susceptibility tests, oral clindamycin (300 mg every 6h) was added to the antibiotic regimen that was administered for a total of 15 days. The wound stopped displaying signs of infection within 10 days of antimicrobial treatment. At his last follow-up appointment 5 weeks after discontinuation of antimicrobials the wound was healing well with complete resolution of the infection.

Discussion

Pasteurella infections in humans range from localized soft tissue infections to systemic diseases, including septicemia, meningitis, brain abscess, endocarditis, pericarditis, peritonitis, pneumonia, empyema, and lung abscess, mostly occurring in immunocompromised patients with underlying diseases.[1]

Cellulitis, abscesses and purulent wounds are the most common manifestations of skin and soft tissue infections by *P. multocida*. Regional adenopathy, lymphangitis and fever are rare, occurring in fewer than 20% of cases.[2,5] Complications include tenosynovitis, osteomyelitis, and septic arthritis.[1,2] Talan et al.

found *Pasteurella* spp. to be the most common species isolated from dog bites.[3] In our case wound infection resulted after licking by the patient's dog. Clonal analysis has been traditionally performed by different molecular methods, such as pulsed-field gel electrophoresis (PFGE), ribotyping, amplified fragment length polymorphism (AFLP), or multilocus sequence analysis.[6] However, next-generation whole-genome sequencing is the most accurate method to definitely establish the source of the infection.[7] Molecular analysis of both the human and the canine isolates by next-generation whole-genome sequencing indicated the genetic identity of the two strains, thus confirming the zoonotic origin of the infection.

Bacteroides ovatus isolated in mixed culture with *Pasteurella multocida* is considered to act synergistically in the pathogenic process.[8] Several investigators found that *Fusobacterium, Bacteroides, Prevotella*, and *Porphyromonas* are major components of the oral anaerobic flora of dogs, associated with bite wound infections.[3,9] Goldstein reported that dog bite wounds become contaminated with a mixture of aerobic and anaerobic bacteria, often including *Pasteurella* spp.[5]

Management of infected ulcers include prompt surgical debridement to remove the necrotic tissue and antimicrobial coverage. Pasteurellae are generally susceptible to beta-lactams, tetracyclines, quinolones and cotrimoxazole.[1] Only six beta-lactamase producing *P. multocida* strains have so far been isolated from humans, five originating from the respiratory tract,[10] and one originating from the exudate of a dog-bite wound.[11] Penicillin or ampicillin are the most effective antimicrobials against *Pasteurella* species and second and third-generation cephalosporins, tetracyclines, and chloramphenicol are suitable alternatives in case of penicillin allergy.[1] In our case cefuroxime was administered in combination with clindamycin for the coverage of both isolates, *Pasteurella* and *Bacteroides*. De-escalation to penicillin was not applied after receiving the results of laboratory susceptibility testing because the clinical doctors were concerned about concomitant-synergistic infection with other bacteria.

Conclusion

The potential for significant morbidity associated with deep tissue infection due to *Pasteurella* spp. highlights the importance of proper wound care and avoidance of wound contact with animals.

Consent: Written informed consent was obtained from the patient for publication of this case report.

Authors' contributions statement: SM wrote the article and supervised the microbiological analysis. GK and PK took care of the patient's management, wrote the case history, and were involved in the clinical follow-up of the patient. DS and SM collected the data, performed the microbiological analysis and critically edited the manuscript. ES was involved in writing the article and performing molecular analysis. All authors read and approved the final version of the manuscript.

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