



## Case report

Pneumonia and disseminated bacteremia with *Pasteurella multocida* in the immune competent host: A case report and a review of the literatureJason Ferreira<sup>\*</sup>, Kasey Treger, Kirsten Busey

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## A B S T R A C T

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*Pasteurella multocida* is primarily an opportunistic infection, most commonly of skin and soft tissue following animal bites particularly in the elderly and immunocompromised. While invasive disease with *P. multocida* has been documented in patients at high risk, such as those with organ transplants, malignancy, and cirrhosis, infections other than cellulitis associated with this pathogen are exceedingly rare in the immunocompetent population. We report a 70 year old Caucasian female with occurrence of a *P. multocida* pneumonia and resultant bacteremia in an immunocompetent host. Similar to prior case studies, the patient presented with a history of having significant exposure to animals at her residence. We undertook a review of the literature for reports of disseminated *P. multocida* in immunocompetent hosts in the absence of the typical presentation of cellulitis. Literature has suggested the possibility of nasal and oropharyngeal colonization of patients with frequent interactions with domestic animals, in whom periods of suppressed immune function may lead to activation of infection. *P. multocida* is commonly susceptible to most beta-lactams, including those utilized for the treatment of community acquired pneumonia. The utilization of macrolides should be avoided in these patients as susceptibilities are unpredictable, however fluoroquinolones maintain activity and may be an alternative therapy.

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## Introduction

*Pasteurella multocida* is a gram-negative bacillary organism that is commonly isolated from the oral secretions of felines and canines [1,2]. A number of *Pasteurella* species have been identified including strains such as, *Pasteurella canis*, *Prunus avium* and *Pasteurella septica*. However, *P. multocida* accounts for the most common infecting strain of *Pasteurella* in humans. In humans, *P. multocida* is primarily an opportunistic infection, most commonly of skin and soft tissue following animal bites particularly in the elderly and immunocompromised [1]. While invasive disease with *P. multocida* has been documented in patients at high risk, such as those with organ transplants, malignancy, and cirrhosis, infections other than cellulitis associated with this pathogen are exceedingly rare in the immunocompetent population [3]. We report a case of a 70 year old Caucasian female presenting with a *P. multocida* pneumonia, parapneumonic effusion and resultant bacteremia

with no risk factors for invasive disease other than exposure to domestic cats.

## Case summary

A 70 year old Caucasian female presented to our emergency department with complaints of worsening shortness of breath. She complained of 2–3 days of productive cough, nasal congestion and multiple episodes of diarrhea and vomiting. Her past medical history was significant for hypertension and tobacco use. She had no significant surgical history or family history.

On physical exam she was in distress and appeared pale. Her vital signs included oxygen saturation of 77% on room air, blood pressure of 94/53 mmHg, heart rate of 122 bpm, and temperature of 36.8 °C. Respiratory exam revealed poor air movement with diminished breath sounds at the bases bilaterally and no audible wheezing or crackles.

Arterial blood gas on room air showed pH of 7.30, pCO<sub>2</sub> of 43 mmHg, pO<sub>2</sub> of 48 mmHg. The chemistry panel was significant for lactic acid 4.4 mmol/L. All other values were within normal limits. Complete blood count showed leukocyte count of 25,000/

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mm<sup>3</sup> with 21% bandemia, hemoglobin 13.2 g/dL, hematocrit 40.2%, and platelet count of 199,000/mm<sup>3</sup>.

A chest x-ray was performed with findings of hazy bibasilar opacities right side greater than left. No pleural effusion or pneumothorax was identified. The patient was placed on full face noninvasive bi-level ventilation. Her oxygen saturation increased to 93%, and her shortness of breath improved. She expressed desire not to be intubated or resuscitated.

Blood and urine cultures were obtained along with a respiratory virus and influenza panel and urine streptococcal and legionella antigens. Initially she received piperacillin-tazobactam and vancomycin for empiric antibiotic coverage and was admitted to the medical intensive care unit. Antimicrobial coverage was changed to ceftriaxone and azithromycin given the lack of health-care associated pneumonia risk factors.

The patient's blood cultures grew *Pasteurella multocida* in both sets of bottles. The organism was sensitive to all antibiotics tested and the patient was de-escalated to monotherapy with ceftriaxone. All other cultures and viral panels returned negative. Upon further questioning, the patient admitted to owning sixteen indoor cats. She denied any recent scratches or bites that she could recall. Her skin was fully inspected and found to be intact with no evidence scratches or bites. Because of the absence of signs or symptoms of scratch a tetanus shot was not administered during this admission.

By hospital day 3 noninvasive ventilation was weaned and transitioned to venturi mask. Hemodynamics remained stable off vasopressor support, her leukocytosis significantly improved, and lactic acidosis had resolved. Bilateral pleural effusions were visualized on both x-ray and ultrasound with the right effusion being more prominent than the left. Diagnostic thoracentesis was performed with removal of 1000 mL of straw-colored fluid. Analysis revealed a transudate by Light's criteria and both gram stain and culture returned negative.

By hospital day 6 she remained hypoxic requiring oxygen so the decision was made to perform a CT angiogram to rule out

pulmonary embolism as well as further visualize pulmonary parenchyma. The CT findings were significant for multifocal pneumonia within right middle lobe as well as right lower lobe and left lower lobe with a moderate sized right pleural effusion. No pulmonary embolism was found. She was able to be successfully discharged home with home oxygen and IV ceftriaxone to complete 14 days of treatment.

## Discussion

*P. multocida*, a commensal gram-negative coccobacilli, is a commonly isolated pathogen from the oral and nasopharynx of a number of mammals including humans. As an encapsulated pathogen, *P. multocida* expresses an inherent virulence, especially in asplenic patients [1,4]. However, pathogenic mechanisms of the bacteria are poorly understood as it causes a wide array of illnesses across the animal kingdom. *P. multocida* disease syndromes in humans are most commonly isolated to skin and skin structure infections following a feline or canine bite [1]. Reports of disseminated infections in humans by *P. multocida* are increasing, ranging from joint infections to meningitis [3]. Pneumonia caused by *P. multocida* is extraordinarily rare in immunocompetent patients, with most documented infections being isolated to case reports. Disseminated infection occurs significantly more frequently in the immunocompromised host, with a relatively high mortality of roughly 30% [3]. Most disseminated cases have been identified in patients with malignancy, AIDS/HIV, liver cirrhosis or congenital immunodeficiency [3–5]. Literature has suggested the possibility of nasal and oropharyngeal colonization of patients with frequent interactions with domestic animals, in whom periods of suppressed immune function may lead to activation of infection [4]. The rate of dissemination or complication of infection was relatively common, with 65% of the population developing bacteremia or empyema complicating the course [3]. (Table 1)

**Table 1**  
Review of *P. multocida* pneumonia in immunocompetent hosts.

Infection	Age	Past medical history	Smoking history	Animal interaction	Susceptibility
Pneumonia [6]	75	Bronchiectasis and diabetes	Unknown	Yes, 1 dog No signs of scratches or bites Genomic correlation with isolate found in canine oropharynx	S- cefazolin
Pneumonia [11]	60	Severe COPD	60 pack-year smoking history	2 cats No signs of scratches or bites	S- to all tested antibiotics
Pneumonia [12]	75	Hypertension	Unknown	Yes, 1 cat No signs of scratches or bites	S- cefazolin, chloramphenicol, PCN, and tetracycline
Paranasal disease and pneumonia [4]	58	Asthma/COPD	No, previously worked in wood processing	Yes, cats and rabbits	S- amoxicillin/clavulanate
Pneumonia with bacteremia [2]	85	Structural lung disease	Yes, non-current	Yes, owned 16 cats No signs of scratches or bites	S-PCN, ampicillin and levofloxacin
Pneumonia with bacteremia [7]	87	COPD, hypertension, atrial fibrillation, heart failure, and myocardial infarction	Unknown	Yes, owned 6 cats and 1 dog No signs of scratches or bites	S- beta-lactams, quinolones, tetracyclines, SMX/TMP R- macrolides, aminoglycosides
Paranasal disease, pneumonia, and bacteremia [3]	20	Diabetes insipidus	Unknown	Yes, 1 cat Some scratches but without signs of cellulitis	S-PCN, ampicillin, piperacillin, cefotaxime, imipenem, minocycline, levofloxacin
Pneumonia with bacteremia [8]	65	Diabetes	Unknown	Yes, cat Reported scratch with signs of cellulitis. CT revealed interstitial pneumonia	S- ceftriaxone
Pneumonia with bacteremia [9]	43	None	No	Yes, dog No signs of scratches or bites	S- amoxicillin
Pneumonia with bacteremia [10]	85	Epilepsy and venous insufficiency	Unknown	Yes, cats No signs of scratches or bites	S- amoxicillin/clavulanate
Pneumonia with empyema and bacteremia [5]	85	None	Unknown	Yes 3 cats and 1 dog No signs of scratches or bites	S- ceftriaxone, amoxicillin/clavulanate

S – sensitive, R – resistant, PCN – penicillin, SMX/TMP – sulfamethoxazole/trimethoprim.

We report the occurrence of a *P. multocida* pneumonia and resultant bacteremia in an immunocompetent host. Similar to prior case studies, the patient presented with a history of having significant exposure to animals at her residence [3]. There are similarities throughout all reported cases in an immunocompetent hosts, likely signifying the presence of risk factors associated with this infection. Patients reported in the literature almost exclusively displayed some form of structural lung disease, diabetes mellitus, advanced age and exposure to domesticated animals. Smoking has been suggested to have an association with *P. multocida* infections, and the patient reported in this case had a 20 year smoking history and had recently taken up electronic cigarette use [2]. This brings to question the role of smoking in the pathogenesis of *P. multocida* pneumonia. Inhalants may have a multitude of effects on suppressing the function of the mucociliary escalator or pulmonary immune system, a pro-inflammatory response, direct inoculation of bacterium, or potentially the association with structural lung disease.

*P. multocida* appears to be responsive to antimicrobial therapy and a number of antimicrobial options are available. Disseminated infections still carry an impressive mortality rate of approximately 30% even with appropriate antimicrobial therapy; however this may be related to the immunocompromised state of the host in which the bacteria most commonly affects [3]. Penicillin remains the drug of choice; however, beta-lactamase production has been identified in some species [3,6]. The pathogen isolated in our case was similar to those reported in the literature in immunocompetent hosts, susceptible to penicillin, cephalosporins, sulfamethoxazole/trimethoprim, levofloxacin and tetracycline. Interestingly, published cases report a number of macrolide treatment failures in *P. multocida*. Given the rise in reported cases of *P. multocida* community acquired pneumonias, specifically in patients with structural lung disease, consideration should be made to avoid the use of macrolide therapy, especially as monotherapy, in patients with regular exposure to domesticated animals [12]. Most strains appeared to have responded favorably to a third generation cephalosporin, amoxicillin/clavulanate, ampicillin/sulbactam, and fluoroquinolones. While penicillin remains the drug of choice for treatment of *P. multocida*, amoxicillin clavulanate is a suitable oral alternative depending on the site of infection. Third generation cephalosporins and newer fluoroquinolones such as levofloxacin may be another alternative in the rare occurrence of penicillin resistance or those patients unable to take penicillin [1–13]. Given

the excellent bioavailability and serum concentrations of levofloxacin it is an attractive therapeutic option even in the presence of bacteremia [13].

In conclusion, in patients with risk factors such as household pets, lung disease and the advanced age with community acquired pneumonia, *P. multocida* should be considered as a potential pathogen. *P. multocida* can be a potentially invasive and advanced disease complicated by bacteremia and empyema [1,4]. *P. multocida* is commonly susceptible to most beta-lactams, including those utilized for the treatment of community acquired pneumonia [3,6]. The utilization of macrolides should be avoided in these patients as susceptibilities are unpredictable; however, fluoroquinolones maintain activity and may be an alternative therapy for patients unable to receive beta-lactams or requiring oral therapy [12].

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