Case report

“Cat got your lung?”: Case of a trapped lung following cat bite

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ABSTRACT

Pasteurella multocida is a gram negative encapsulated facultative bacillus that has been reported to cause a wide variety of infections in humans. Empyema is rarely reported complication of P. multocida infection. Infection is usually acquired by inhalation or bite from a domestic animal, with cats and dogs being the most common sources. Isolation of organisms on culture remains gold standard for diagnosis. We describe a case of P. multocida related empyema in a patient who subsequently developed trapped lung requiring video assisted thoracoscopic surgical decortication. It was determined that the cause of this patient’s empyema was likely from a bite from his own cat.

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Introduction

Pasteurella multocida is a gram-negative, encapsulated, facultative, anaerobic, non-motile, coccobacillus that can be a rare cause of severe pneumonia and empyema. P. multocida is a zoonotic organism normally found in the oropharynx of healthy animals, with the highest carriage rates in cats and dogs [1,2]. Humans usually acquire soft tissue infections through bites by animals with oropharyngeal colonization. The prevalence of P. multocida infection is unclear, but reported annual incidence of emergency departments in the U.S. attributed to animal bites exceeds 300,000 and 20–30 deaths are credited to P. multocida infection annually worldwide [3]. Infections of the lungs and pleural space are rarely reported with P. multocida [1]. Most patients with P. multocida pneumonia and parapneumonic effusions have a history of immunocompromising conditions or immunosuppression treatment in the setting of underlying lung disease [1,2]. Here we report a case of P. multocida empyema in a patient with a history of prior chemotherapy who developed infection following a cat bite. We also present a review of treatment options in the current literature.

Case report

A 62-year-old male with a past medical history of chronic obstructive pulmonary disease GOLD stage II, peripheral arterial disease, non-small cell lung cancer (T-2, N3, M0) who received 12 months of combination chemotherapy and radiation therapy that had been completed more than a year prior to onset of current complaint, presented to the emergency department with progressively worsening shortness of breath beginning 2 days prior to admission with associated productive cough, chills and fever of 38 °C. The patient denied recent headaches, rash, travel, or exposure to sick contacts. Vitals revealed a heart rate of 123 beats per minute, respiratory rate of 22 breaths per minute, blood pressure of 88/52 mmHg, axillary temperature of 38.7 °C, and oxygen saturation of 90% on 3-L nasal cannula. Physical examination was significant for rales on the right side with decreased breath sounds in right lower lung field (Fig. 1). Labs showed white cell count of 14,000/μL (neutrophils 72%, lymphocytes 2%, and bands 17%), lactic acid of 2.6 mmol/L, creatinine of 2.03 mg/dL, and procalcitonin of 18.52 ng/mL. A diagnostic and therapeutic thoracentesis was performed with drainage of 700 mL of purulent fluid followed by insertion of a pigtail catheter chest tube. Gram stain showed moderate gram-negative bacilli. Pleural fluid studies demonstrated thick, viscous pleural fluid with a pH of 7.0, pleural fluid glucose less than 5, LDH 1,163 U/L, and 31,000 white blood cells (92% polymorphonuclear cells) (Table 1).

Following 24 h of incubation at 37 °C in 5% CO2, blood agar plates were notable for growth of non-microscopic, non-hemolytic, gray colonies resembling Enterobacteriaceae, but no growth was appreciated on the MacConkey agar plates. Two sets of blood cultures were both negative. A gram stain of the small, gray colonies revealed rod-shaped gram-negative coccobacilli with bipolar staining. The organism was identified as P. multocida by matrix assisted laser desorption time of flight ionization (MALDI-TOF). Subsequent Kirby-Bauer disk-diffusion antimicrobial susceptibility testing (AST) demonstrated the

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P. multocida to be a pan-susceptible strain: the zones of inhibition surrounding the ampicillin, ceftriaxone, erythromycin, tetracycline, levofloxacin and trimethoprim-sulfamethoxazole disks were: greater than 27 mm, greater than 34 mm, greater than 14 mm, greater than 23 mm, greater than 28 mm, and greater than 26 mm, respectively. The bacteria was also susceptible to ampicillin-sulbactam with a minimum inhibitory concentration of 0.125 mcg/ml based on E-test strip interpretation. Upon follow-up questioning, we learned that the patient had a pet cat, and had a history of numbers, recurrent scratches to the extremities, as well as a recent lower extremity bite.

The patient was initially treated with standard broad-spectrum antimicrobial treatment for sepsis with intravenous vancomycin and piperacillin-tazobactam, which was adjusted to ampicillin-sulbactam once the sensitivity results were available. Following Chest CT imaging revealed trapped lung, and the patient was taken to the operating room for video assisted thoracoscopic decortication. Pathologic examination of tissue from the right lung pleural peel demonstrated extensive fibrous and reactive tissue, but special stains (including Gram stain) were negative for organisms. The patient ultimately completed a total of 21 days of intravenous treatment, followed by a 7 day course of oral amoxicillin-clavulanate potassium, with return to full function. To our knowledge the patient continues to co-habitate with his cat.

**Discussion**

*P. multocida* is a well described zoonotic pathogen, with reports in the medical literature of infections related to animal vectors dating back to 1913 [4,5]. *P. multocida* has been reported to cause a wide variety of infections in humans including superficial skin infections such as cellulitis, deep muscle abscess, meningitis, peritonitis, septic arthritis, osteomyelitis, pericardial effusions, pneumonia and bacteremia [2].

*Pasteurella* exists as normal flora in a wide variety of domestic animals including cats, dogs, pigs, and various other domestic and wild animals. Infection is usually acquired by traumatic inoculation (animal bite or scratch) or via inhalation, with skin and soft tissue infections being the most common manifestation of infection. *P. multocida* is the most common species associated with zoonotic Pasteurella infections. Oropharyngeal and lower respiratory tract infections including pharyngitis, epiglottitis, tracheobronchitis and pneumonia have been reported. Pneumonia is the most common clinical presentation of patients presenting with respiratory tract involvement [5]. Patients who are immunocompromised, elderly or who have chronic lung disease are at highest risk of *Pasteurella* pneumonia, also known as ‘cat cuddlers cough’ [6]. In a retrospective study involving more than 600 patients, 73% of *Pasteurella* infections were present in patients over the age 50 and 21% were in patient 21–50 years of age [9]. The presence of a polysaccharide capsule is believed to increase its virulence in immunocompromised populations [8].
History of exposure and physical exam should provide important diagnostic clues in patients with suspected Pasteurella pneumonia even before isolation of the organism in culture. Sputum Gram stain and cultures are not necessarily helpful as organism could be a normal colonizer of respiratory tract, unless intra-cellular bacterial staining gram negative bacteria are appreciated on Gram stain of a purulent sputum sample [2]. In cases of parapneumonic effusion and empyema, thoracentesis and pleural fluid studies play a pivotal role in diagnosis. Jogani et al., studied the pleural fluid characteristic of 21 patients presenting with Pasteurella empyema. The effusions were universally purulent in nature as in our case, with a mean pH of 6.8, elevated protein, LDH, and low glucose. Pleural fluid cultures have a high sensitivity, and were positive in 90% (18/20) of the cases that had cultures performed in this cohort [1]. Unlike other zoonotic pathogens such as Versinia or Francisella, isolation of Pasteurella does not require use of specialized media or extended incubation in the microbiology laboratory. The organisms grow well on blood and chocolate agar, at varying temperatures and in a wide variety of atmospheric conditions. Pasteurella should be suspected when a bipolar staining pattern is appreciated on Gram stain and growth of small, non-hemolytic, gray colonies resembling Enterobacteriaceae is appreciated on blood and chocolate agars, but characteristically not on MacConkey agar [7].

Penicillin is the drug of choice for treatment of Pasteurella infections, but resistance remains a concern in an era of increasing prevalence of beta-lactamase production by pathogenic strains of Pasteurella multocida which has increased 15% in the U.S. Antimicrobial treatment alternatives to penicillin for patients with allergies or infection by a beta-lactamase producing strain include fluoroquinolones, tetracyclines, azithromycin, but these antibacterials should only be used for treatment of isolates following confirmation of susceptibility by AST performed in a certified diagnostic clinical microbiology laboratory [5]. Early diagnosis and initiation of antibacterials is crucial as the mortality rate associated with P. multocida related empyema has been reported to be as high as 45% [1].

In conclusion, P. multocida related empyema should be considered in the differentials in a patient presenting with empyema especially in elderly immunocompromised and in patients with chronic lung disease. History and physical could provide important diagnostic clues. Early recognition and treatment is crucial in improving outcomes.

Disclosure statement

The authors declare no conflict of interest. There was no grant support. Informed written patient consent was obtained for the publication.

Contributions

SW, MA wrote the manuscript and reviewed the literature. EH and JF reviewed the literature and made critical revisions to the manuscript.

CRediT authorship contribution statement

Saqib Walayat: Writing - review & editing. M. Asghar: Writing - review & editing.

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