CLINICAL VIGNETTE

The Dog Has a Cough

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Case Presentation

A 46-year-old female with severe persistent steroid dependent Asthma complicated by allergic bronchopulmonary aspergillosis (ABPA), presents to pulmonary with new onset cough for 3 weeks. She reports that cough is productive of yellow sputum and endorses low grade fevers, and chills. She has had no recent travel or sick contacts, denies nausea, vomiting, radiating chest pain, and abdominal pain. She is a lifelong nonsmoker. She recently moved into a new apartment, and the apartment manager has one dog and three cats. The dog, who she frequently plays with, has a chronic cough. Family history was unremarkable. Past medical history was remarkable for gastroesophageal reflux disease and allergic rhinitis. Vital signs were normal. Physical exam was normal. Computed tomography (CT) chest showed confluent left perihilar and upper lobe airspace opacities concerning for bronchopneumonia (Figure 1). Sputum sample was obtained and sent for bacterial culture, and returned positive for moderate *Bordetella bronchiseptica*.

Discussion

Bordetella bronchioseptica causes kennel cough in dogs and rabbits, and atrophic rhinitis in piglets.[1] Healthy dogs may be colonized by a small number of bacteria in their oropharynx. Evidence also suggests that *B. bronchiseptica* may occasionally be encountered as a commensal of the human respiratory tract and, rarely as a pathogen in human disease.

Bacteriology

There are eight species in the genus *Bordetella*: *B. pertussis, B. parapertussis, B. bronchiseptica, B. avium, B. hinzii, B. holmesii, B. trematum,* and *B. petrii. Bordetella* are pleomorphic, non-spore-forming, Gram-negative, aerobic coccobacillus. *B. pertussis* is the major cause of whooping cough,[2] and *B. parapertussis* has been implicated as a minor cause of whopping cough, particularly a milder form than that caused by *B. pertussis*.[3] In the early 1900s several microbiologists[4-6] observed the association of a small gram-negative coccobacillus with outbreaks of respiratory tract illnesses in dog, cat, rabbit, and guinea pig. In 1952 this bacteria was placed in the genus *Bordetella* and assigned as *B. bronchiseptica.*

Pathology and Clinical Experience

B. bronchiseptica is pathogenic in mammalian species and produces an endotoxin that is similar to those of other gram-negative microorganisms. It adheres to the respiratory epithelial cells by using fimbriae and filamentous hemagglutinins,[7] and invades respiratory epithelial cells and alveolar macrophages, producing the enzyme adenylate cyclase and diminishing their overall bactericidal ability. The organism is then able to successfully colonize the respiratory tract.

In 1911, Toumanen and associates[8] suggested that *B. pertussis* adheres preferentially to human ciliated respiratory tract cells, whereas *B. bronchiseptica* adheres preferentially to those of rabbits, mice, and hamsters. In dogs, the infectious process is largely limited to the tracheobronchial tree, and characterized by adherence of the bacteria to cilia and surface structures of the respiratory epithelial cells.[9] The infection is accompanied by mild infiltration of neutrophils and lymphocytes in the submucosa and by moderate hyperplasia of adjacent lymphoid tissues.[9,10] However, over 60 cases of *B. bronchispetica* infection have been reported in humans since it was identified in 1911.[11] Infections appear to occur primarily in patients with underlying immunocompromised state such as hematologic malignancy, organ transplantation, chronic alcoholism, and AIDS.[12-15] A history of exposure to animals is often present, but not always.[16] Clinical *B. bronchiseptica* infection in healthy adults is unusual, and very few cases have been reported.

In a review of 25 cases of human infection thought to be associated with *B. bronchiseptica*,[1] the infections encountered were acute maxillary sinusitis, nosocomial tracheobronchitis, acute pneumonia, and whooping cough. No definitive radiographic features associated with *B. bronchiseptica* were identified. Most of the verified cases were in immunocompromised patients. Only one of the patients had contact with a sick animal. In all cases, the outcome of antimicrobial treatment was difficult to assess. There was a higher mortality rate in the immunocompromised patients, this was likely due to the underlying disease process, rather than isolated *B. bronchiseptica* infection.

Treatment

The optimal therapy for *B. bronchiseptica* infection has not been clearly established.[17] In-vitro antimicrobial susceptibility of *B. bronchiseptica* is similar to that for nonfermentative gram-negative bacilli, particularly *Pseudomonas aeruginosa*. These include the aminoglycosides amikacin, gentamicin, and tobramycin, as well as the quinolones ciprofloxacin and ofloxacin.

The antipseudomonal penicillins such as piperacillin and ticarcillin also show effectiveness. Both chloramphenicol and imipenem appear to be effective.[1] However, despite good in vitro activities of these antibiotics, the clinical response to them has been disappointing.[18,19] This suggests that in vitro testing may not translate directly to in vivo effectiveness. Some have suggested that prolonged therapy may be needed to completely eradicate the organism, but data are lacking.

Conclusion

Despite considerable exposure of humans to animal sources of *B. bronchiseptica*, the microorganism has rarely been isolated from humans. Most evidence, albeit limited, suggests the microorganism may occasionally be encountered as a colonizer of the human respiratory tract, and rarely as a pathogen.[1] When encountered as a pathogen, it is most often in patients who are immunocompromised.

Case Outcome

Patient was prescribed a fourteen-day course of the quinolone Levofloxacin, with resolution of her symptoms. Repeat imaging post treatment showed resolution of left perihilar opacities.

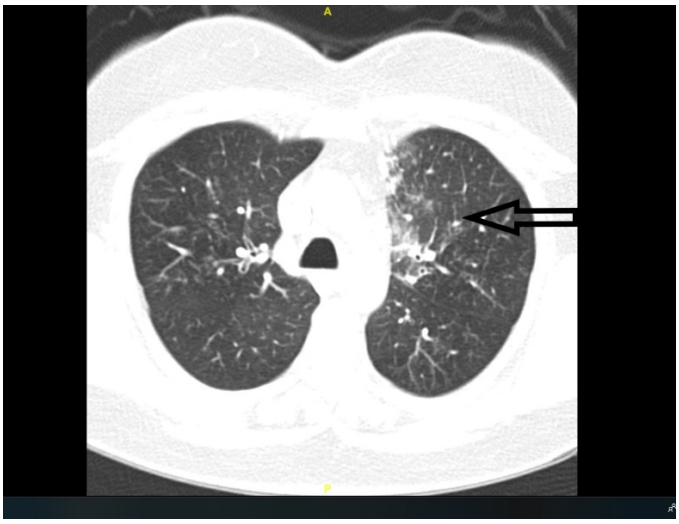

Figure 1: Confluent left perihilar / upper lobe airspace opacities (black arrow)

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