Rare Zoonotic Pulmonary Infection in Humans: Bordetella bronchiseptica - A Case report

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Abstract

Bordetella bronchiseptica is a zoonotic Gram-negative coccobacillus that commonly causes respiratory infections in animals but is rarely implicated in human disease. The patient presented with recurrent hemoptysis for one month and a history of two previous presentations of pulmonary tuberculosis, treated with antitubercular therapy. In view of persistent symptoms, the patient was evaluated for other causes of chronic pulmonary infection. Differential diagnosis, including chronic pulmonary aspergillosis, non-tuberculous mycobacterial infection and subacute invasive aspergillosis was considered and ruled out by appropriate investigations. Microbiological culture of respiratory samples, bronchoalveolar lavage (BAL), revealed non-lactose fermenting colonies, and Gram staining showed small, gram-negative coccobacilli and the isolate was identified as Bordetella bronchiseptica by MALDI-TOF mass spectrometry. The patient had a history of close exposure to dogs, suggesting zoonotic transmission. In the absence of established treatment guidelines and CLSI-defined breakpoints for Bordetella bronchiseptica, treatment was guided by antimicrobial susceptibility testing with results interpreted using surrogate criteria for non-fermenting gram-negative bacilli. The patient showed clinical improvement with cefoperazone–sulbactam followed by cotrimoxazole. This case highlights the importance of considering rare zoonotic pathogens in patients with underlying lung disease and the role of advanced diagnostic techniques in accurate identification.

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Introduction

Bordetella bronchiseptica is a small, aerobic, Gram-negative coccobacillus belonging to the genus Bordetella spp, primarily known to cause respiratory tract infections in a wide range of animals, including dogs, cats, and pigs (1). It is a well-recognised etiological agent of kennel cough in dogs and is transmitted through respiratory droplets or close contact (2).

Human infections caused by Bordetella bronchiseptica are rare, as the organism is considered to have low virulence in immunocompetent individuals (3). However, cases have increasingly been reported in patients with underlying comorbidities, immunosuppression or structural lung diseases such as bronchiectasis and prior pulmonary tuberculosis (4).

Clinical manifestations in humans vary widely, ranging from mild upper respiratory tract infections to severe pneumonia and chronic pulmonary disease (5). Due to its rarity and overlapping clinical presentation with more common respiratory pathogens such as Mycobacterium tuberculosis, non-tuberculous mycobacteria and fungal infections, complicate the diagnostic process. (6,7).

Microbiologically, Bordetella bronchiseptica is a non-fermenting Gram-negative bacillus that may be confused with phenotypically similar organisms such as Pseudomonas aeruginosa, Burkholderia cepacia complex, Achromobacter xylosoxidans and Alcaligenes faecalis unless advanced diagnostic methods are employed (8,9). As syndromic molecular panels such as the BioFire FilmArray Respiratory Panel include only Bordetella pertussis and Bordetella parapertussis, definitive identification in this case relied on matrix-assisted laser desorption ionization–time of flight (MALDI-TOF) mass spectrometry.

Here, we report a rare case of pulmonary infection caused by Bordetella bronchiseptica in a patient with a history of treated tuberculosis, highlighting the importance of considering uncommon zoonotic pathogens in chronic respiratory illness.

Case Presentation

A 48-year-old female presented to the Pulmonology department with complaints of recurrent hemoptysis for one month without associated fever, significant weight loss or other constitutional symptoms.

History was significant for two prior occurrences of pulmonary tuberculosis. During the first occurrence, the patient was sputum AFB positive and completed a 6-month course of antitubercular therapy (ATT). During the second presentation, tuberculosis was diagnosed clinically based on CT chest findings showing left upper lobe opacities; AFB smear and NAAT were not performed, and the patient completed another 6-month course of ATT. Whether this second presentation represented true recurrence of tuberculosis or an unrecognised alternative chronic infection, such as Bordetella bronchiseptica remains uncertain. Reliance on radiological findings without microbiological confirmation may have contributed to diagnostic delay and inappropriate empiric therapy.

In view of persistent symptoms, the patient was evaluated for possible surgical management and was planned for left upper lobe lobectomy. However, the patient was not considered fit for surgery due to ongoing active disease.

Further evaluation was carried out to identify the cause of persistent hemoptysis. Differential diagnosis, including chronic pulmonary aspergillosis, non-tuberculous mycobacterial infection, and subacute invasive aspergillosis, was considered. Serum IgE was negative. Nucleic acid amplification test (NAAT) for mycobacteria and Nocardia was negative. Bronchoalveolar lavage (BAL) samples were negative for fungal elements on potassium hydroxide (KOH) mount and fungal culture.

Bacterial culture of respiratory samples revealed non-lactose fermenting colonies on MacConkey agar, smooth, mucoid, non-haemolytic colonies on blood agar [Figure 1], and smooth, mucoid colonies on nutrient agar [Figure 2]. Gram stain showed small, Gram-negative coccobacilli [Figure 3], and the organism was actively motile on hanging drop preparation. The isolate was identified as a non-fermenting Gram-negative bacillus (NFGNB) based on standard biochemical reactions. Further identification using matrix-assisted laser desorption ionisation–time of flight (MALDI-TOF) mass spectrometry confirmed the organism as Bordetella bronchiseptica.

On further history, the patient reported close exposure to dogs, suggesting a possible zoonotic source of infection.

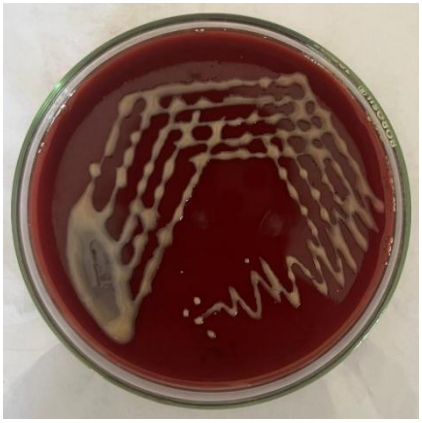

Figure 1: Blood agar showing mucoid, non-haemolytic colonies.

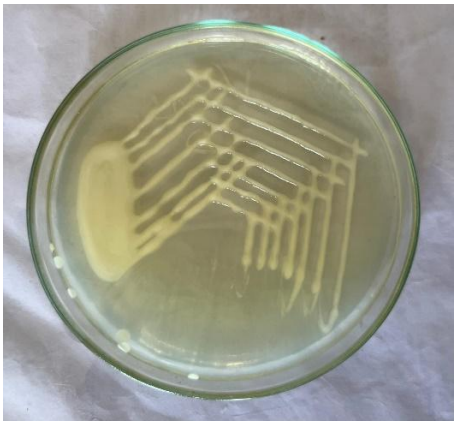

Figure 2: Nutrient agar showing smooth, mucoid colonies

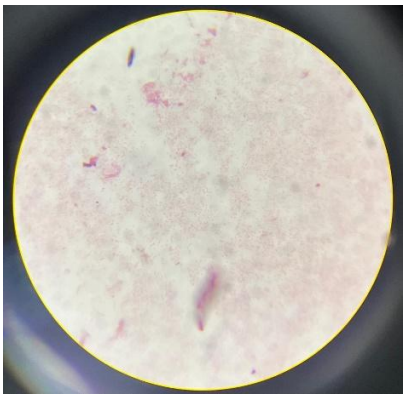

Figure 3: Gram stain showing small, Gram-negative coccobacilli.

Management and outcome

The patient was treated initially with intravenous cefoperazone–sulbactam for 7 days, followed by oral cotrimoxazole. Significant clinical improvement was noted with a reduction in hemoptysis.

Discussion

Human infection due to Bordetella bronchiseptica is uncommon but increasingly recognised, particularly in patients with underlying lung disease. In the present case, the patient had a history of treated pulmonary tuberculosis, which likely resulted in structural lung damage, predisposing her to secondary infection. Similar associations have been reported in previous studies, where chronic lung disease and post-tuberculous sequelae were identified as important risk factors (3,10,11).

Zoonotic transmission is a well-established mode of infection, especially through close contact with dogs. This has been consistently observed in both global and Indian studies, and the history

of dog exposure in our patient supports this finding (2,11). This case emphasises the need to elicit animal exposure in unexplained respiratory infections, particularly when uncommon zoonotic pathogens are considered.

Clinically, Bordetella bronchiseptica infection can present with nonspecific respiratory symptoms such as cough, hemoptysis, and pneumonia. Previous reports have highlighted its ability to mimic tuberculosis, non-tuberculous mycobacterial infections and fungal diseases, leading to diagnostic challenges, particularly in endemic settings (12,13). In our case, these differentials were systematically excluded before establishing the diagnosis.

Microbiologically, the organism is identified as a non-fermenting Gram-negative bacillus and may be misidentified as other non-fermenters like Pseudomonas aeruginosa, Burkholderia cepacia

complex, Achromobacter xylosoxidans and Alcaligenes faecalis. Studies have emphasised the role of advanced diagnostic methods such as MALDI-TOF mass spectrometry for accurate species-level identification, as was done in our case (9,14). Accurate identification is clinically important because misidentification may affect both antimicrobial selection and recognition of this rare zoonotic pathogen.

A major challenge in managing infections caused by Bordetella bronchiseptica is the absence of standardised treatment guidelines and organism-specific breakpoints defined by the Clinical and Laboratory Standards Institute (CLSI). As a result, AST becomes crucial, and results were interpreted using surrogate criteria for non-fermenting gram-negative bacilli. This approach has been adopted in several published studies due to the lack of specific interpretive standards (15,16).

Commonly used agents include fluoroquinolones, aminoglycosides and cotrimoxazole, while resistance to β-lactams has been reported. The favourable clinical response observed in our patient with cefoperazone–sulbactam followed by cotrimoxazole is consistent with previous reports (17,18).

This case also underscores the importance of diagnostic stewardship in chronic pulmonary infections. In tuberculosis-endemic settings, recurrent respiratory symptoms and radiological abnormalities may be repeatedly attributed to tuberculosis, sometimes leading to empiric retreatment without microbiological confirmation.

In our patient, the second clinical diagnosis of tuberculosis was based solely on imaging findings without bacteriological evidence, raising the possibility of diagnostic anchoring and missed alternative etiologies (19,20).This highlights the need for a structured diagnostic approach incorporating microbiological confirmation, systematic exclusion of differential diagnosis, and judicious use of advanced identification methods such as MALDI-TOF to avoid misdiagnosis, unnecessary antimicrobial exposure, and delays in appropriate therapy (21,22). The case illustrates how diagnostic stewardship can prevent inappropriate attribution of chronic pulmonary disease solely to tuberculosis and facilitate recognition of rare pathogens.

This case highlights the importance of considering Bordetella bronchiseptica in patients with chronic respiratory symptoms, especially those with prior tuberculosis and relevant exposure history, to ensure timely diagnosis and appropriate management.

Conclusion

Bordetella bronchiseptica is a rare but important zoonotic pathogen that can cause pulmonary infection in humans, particularly in individuals with underlying lung disease such as prior tuberculosis. This case highlights the need to consider uncommon non-fermenting Gram-negative bacilli in patients with persistent respiratory symptoms and relevant exposure history. Accurate identification using advanced diagnostic techniques such as MALDI-TOF is essential to avoid misdiagnosis and ensure appropriate therapy. Timely identification and specific intervention can result in positive clinical results.

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