

Bordetella bronchiseptica isolation in chronic respiratory conditions: infection or colonization?

Isolamento de *Bordetella bronchiseptica* em pneumopatias crônicas: infecção ou colonização?



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ABSTRACT

We report two cases of *Bordetella bronchiseptica* isolation from bronchoalveolar lavage fluid in patients with pre-existing lung conditions. Case 1 describes a 75-year-old male with COPD, organizing pneumonia on high-dose steroids, and presenting hemoptysis with acute pulmonary consolidations on CT, who was successfully treated with targeted antibiotics. Case 2 describes a 71-year-old female with long-standing bronchiectasis and prior non-tuberculous mycobacterial (NTM) disease presenting with a persistent dry cough and new tree-in-bud opacities, managed conservatively without antimicrobial therapy. Specific interpretive breakpoints for clinical decision-making concerning the isolation of *B. bronchiseptica* are lacking; therefore, management remains challenging.

Headings: *Bordetella bronchiseptica*. Bronchiectasis. Bronchoscopy. Drug Resistance, Microbial. Case Report.

RESUMO

Relatamos dois casos de *Bordetella bronchiseptica* isolada em lavado broncoalveolar coletado de pacientes com pneumopatias pré-existentes. O Caso 1 descreve um homem de 75 anos com doença pulmonar obstrutiva crônica (DPOC) e pneumonia em organização tratada com corticoide em altas doses e um episódio de hemoptise acompanhado de consolidações pulmonares agudas, o qual foi tratado com sucesso através de antibioticoterapia direcionada. O Caso 2 descreve uma mulher de 71 anos com bronquiectasias de longa data e doença prévia por micobactérias não tuberculosas (MNT) apresentando tosse seca persistente e novas opacidades em árvore em brotamento, todavia conduzida de forma conservadora, sem terapia antimicrobiana. Faltam direcionamentos específicos e pontos de corte interpretativos para a tomada de decisões em relação ao isolamento de *B. bronchiseptica*, fazendo com que o seu manejo clínico permaneça desafiador.

Descritores: *Bordetella bronchiseptica*. Bronquiectasia. Broncoscopia. Resistência Microbiana a Medicamentos. Relato de Caso.

INTRODUCTION

Bordetella bronchiseptica is a Gram-negative, rod-shaped coccobacillus primarily recognized as a zoonotic pathogen [1]. It causes infectious tracheobronchitis (“kennel cough”) in dogs and cats, as well as atrophic rhinitis in swine [1]. Although human infections are relatively rare, reported cases have increased in recent years, particularly among immunocompromised hosts or patients with underlying structural lung pathology, such as severe chronic obstructive pulmonary disease (COPD), cystic fibrosis, lung transplantation, hematologic malignancies, Crohn’s disease and

advanced HIV infection [2, 3]. Bronchiectasis is a recognized risk factor for *B. bronchiseptica* infection, facilitating bacterial colonization and the onset of complications [3].

The clinical spectrum of human *B. bronchiseptica* isolation is highly heterogeneous, ranging from asymptomatic colonization to acute and fatal respiratory failure [3]. Radiological findings are nonspecific and typically manifest as lobar consolidations, interstitial or lobular infiltrates, or occasionally cavitation [3].

Clinical management is further complicated by the lack of standardized therapeutic guidelines and established interpretive breakpoints by regulatory bodies such as the Clinical and Laboratory Standards Institute (CLSI) and the European Committee on Antimicrobial Susceptibility Testing (EUCAST) [4]. Consequently, clinicians must rely on empirical evidence, non-standardized susceptibility profiles (generally showing sensitivity to antipseudomonal penicillins, carbapenems, fluoroquinolones, and aminoglycosides), and comprehensive clinical evaluation to guide management [4].

Herein, we present two similar clinical scenarios involving high-load isolation of *B. bronchiseptica* from bronchoalveolar lavage (BAL) fluid to highlight the diagnostic challenge of distinguishing pathogenic infection from incidental airway colonization.

CASES REPORT

Case 1: A 75-year-old male with a history of severe COPD managed with inhaled triple therapy presented to the emergency department in January 2025 with an initial episode of hemoptysis. His medical history was notable for essential hypertension, type 2 diabetes mellitus, dyslipidemia, bronchiectasis (with previous isolation of *Pseudomonas aeruginosa* on BAL) and organizing pneumonia diagnosed two years ago, treated with high-dose systemic corticosteroids. On evaluation, the patient was hemodynamically stable without acute respiratory failure. Baseline laboratory parameters were unremarkable. Chest computed tomography (CT) revealed some scattered acute parenchymal consolidations localized predominantly in the right lung (Figure 1), and an area compatible with congenital pulmonary sequestration in the left lower lung (image not included). No pulmonary embolism or endovascular defects were observed. Flexible bronchoscopy was performed, and BAL fluid culture yielded the growth of *B. bronchiseptica* (10⁶

CFU/mL) alongside *Aspergillus ochraceus*. Regarding epidemiological exposure, the patient lived in an urban environment, denied direct contact with domestic animals, and had no history of recent (less than 10 years ago) adult pertussis vaccination. However, given his history of diabetes, systemic corticosteroid exposure, new clinical symptoms (hemoptysis), and acute CT consolidations, it was determined that the isolates represented an active pathogenic *B. bronchiseptica* non-severe infection alongside a fungal colonization (serum total IgE and *Aspergillus*-specific IgE titers were negative). Therefore, the patient was discharged home on a 7-day course of intramuscular piperacillin/tazobactam [Table 1]. Follow-up CT after 4 months demonstrated resolution of the acute parenchymal consolidations. The patient remained clinically stable with no further respiratory symptoms, obviating the need for repeat microbiological sampling.

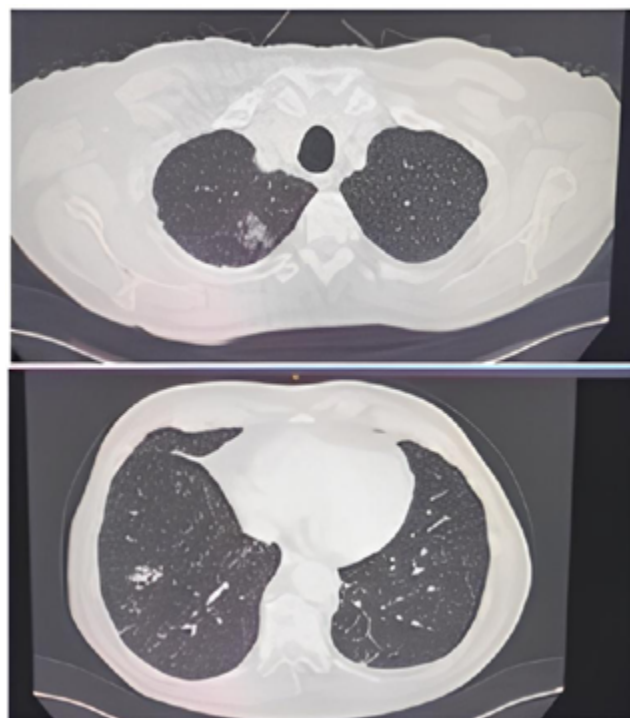


Figure 1: First chest CT scan of Case 1 showing consolidations throughout the right lung.

Table 1: Drug susceptibility test for Case 1. Sample: Bronchoalveolar lavage. Culture growth: *Bordetella bronchiseptica* 1.000.000 CFU/ml. EUCAST 2019 criteria applied: S = Susceptible at standard doses; I = Susceptible at high doses; R = Resistant; NAI = Not Available Interpretation.

Antibiotic	Drug susceptibility	MIC (mg/L)
Ampicillin	R	24
Benzylpenicillin	R	256
Ceftriaxone	R	32

Antibiotic	Drug susceptibility	MIC (mg/L)
Ciprofloxacin	R	0.75
Meropenem	NAI	0.047
Piperacillin/Tazobactam	NAI	1
Tetracycline	NAI	0.75
Sulfamethoxazole-trimethoprim	NAI	0.023

Case 2: A 71-year-old female presented for evaluation due to worsening of a persistent dry cough. Her medical history was significant for long-standing cylindrical bronchiectasis involving the right upper lobe, middle lobe, and lingula (diagnosed approximately 30 years ago) and a 10-year-history of right-sided breast cancer status-post mastectomy, chemotherapy, and radiation therapy. A more recent non-tuberculous mycobacterial (NTM) infection was characterized by historical isolations of *Mycobacterium intracellulare* (5 years ago) and *Mycobacterium abscessus* (3 years ago) from BAL, for which she had completed a targeted multidrug regimen for approximately two years (treatment ended about one year ago). Physical examination and routine blood tests were normal, with no evidence of systemic inflammation or acute respiratory failure. Spirometry demonstrated normal respiratory function near the lower limit for obstruction and mild air trapping. Chest CT revealed new areas of tree-in-bud opacities in both lungs (Figure 2).

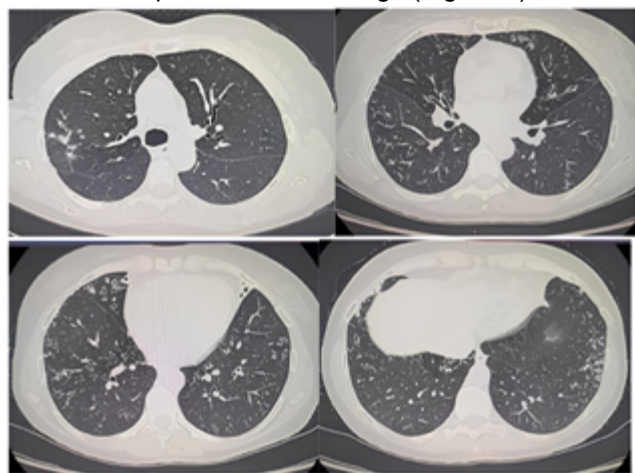


Figure 2: First chest CT scan of Case 2 showing cylindrical bronchiectasis of the right upper lobe, middle lobe and lingula, and new areas of tree-in-bud in both lower lobes.

A new elective flexible bronchoscopy yielded pure growth of *B. bronchiseptica* (10^6 CFU/mL) in BAL fluid and the antibiogram is shown in Table 2. Epidemiological assessment revealed that she kept a pet dog outdoors in her garden, but the animal exhibited

no acute respiratory symptoms and had not received veterinary *B. bronchiseptica* vaccines, while the patient herself had no documented history of recent pertussis vaccination. Considering her prior microbiological isolates, multiple previous antibiotic therapies, structural bronchiectasis favoring colonization, and the absence of a worsening clinical respiratory status, the isolate was judged to represent airway colonization rather than acute invasive infection.

Table 2: Drug susceptibility test for Case 2. Sample: Bronchoalveolar lavage. Culture growth: *Bordetella bronchiseptica* 1.000.000 CFU/ml. EUCAST 2019 criteria applied: S = Susceptible at standard doses; I = Susceptible at high doses; R = Resistant; NAI = Not Available Interpretation.

Antibiotic	Drug susceptibility	MIC (mg/L)
Amoxicillin	R	256
Amoxicillin/Clavulanic acid	R	24
Benzylpenicillin	R	256
Ceftriaxone	R	32
Ciprofloxacin	R	32
Meropenem	NAI	1
Piperacillin/Tazobactam	NAI	4
Sulfamethoxazole-trimethoprim	NAI	0.094

Consequently, systemic antibiotic therapy was withheld. Management focused on conservative measures, including airway clearance physiotherapy, mucolytics, immune system supplements, and inhaled anticholinergic bronchodilators, which led to mild symptom improvement. At follow-up, a new chest CT after 8 months demonstrated persistent tree-in-bud areas and a repeat diagnostic bronchoscopy with BAL was performed, but microbiological cultures were all negative while cytological analysis was nonspecific. Repeat spirometry evidenced mild obstruction, and her dry cough substantially improved following step-up to dual bronchodilator therapy.

In both cases, BAL specimens were collected via flexible fiberoptic bronchoscopy following standard clinical protocols. Samples were inoculated onto routine culture media for respiratory pathogens and incubated aerobically at 35–37 °C in a 5% CO₂ atmosphere. Microbial growth was evaluated at 24 and 48 hours. Bacterial identification was confirmed using Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS) via the VITEK® MS system (bioMérieux, Marcy-l'Étoile,

France). Antimicrobial susceptibility testing was performed using manual gradient test (bioMérieux, Marcy-l'Étoile, France) to determine minimum inhibitory concentrations (MIC). The susceptibility profile was assessed for selected antimicrobial agents commonly directed against Gram-negative respiratory pathogens. In the absence of species-specific interpretive breakpoints for *B. bronchiseptica*, MIC values were evaluated according to the general EUCAST (European Committee on Antimicrobial Susceptibility Testing) 2019 Guidance for bacteria lacking cut-off values in standard tables.

DISCUSSION

Bordetella bronchiseptica belongs to the “classical *Bordetellae*” group alongside *B. pertussis* and *B. parapertussis* [5,6]. While all three species share close genomic homology and key virulence mechanisms regulated by the *bvgAS* locus, their epidemiological niches and clinical behaviors differ significantly [6]. Unlike *B. pertussis* and *B. parapertussis*, which infect only humans, *B. bronchiseptica* can colonize a wide range of mammals and humans, may cause chronic respiratory infections, and survives in the environment outside a mammalian host [6]. Nonetheless, *B. bronchiseptica* rarely acts in humans as a primary pathogen in healthy individuals [7]. Transmission to humans typically occurs through direct or indirect contact with infected animals via inhalation of respiratory droplets emitted during coughing or sneezing [5]. Animals can be asymptomatic carriers, transmitting the bacteria even when appearing perfectly healthy, though transmission risk increases with active symptoms [5].

Preventative strategies and cross-protection remain complex issues [8-10]. The acellular pertussis vaccine (aP), administered to adult humans in combined formulations (DTaP/Tdap) according to WHO schedules with 10-year boosters, contains antigens (such as FHA, pertactin, and fimbriae) that cross-react with *B. bronchiseptica* [9,11,12]. Evidence suggests pertussis vaccination may offer cross-protection against *B. bronchiseptica* [10,12]. Conversely, veterinary vaccines against *B. bronchiseptica* (administered intranasally, orally, or subcutaneously) reduce symptom severity and progression to pneumonia in pets but do not provide sterile immunity [11]. Despite the presence of these specific vaccines, the spread of *B. pertussis* and *B. bronchiseptica* seems to be increasing in both humans

and mammals [6-8]. Candidate vaccines providing broader protection against disease, colonization, and transmission are currently in clinical trials [10].

A major clinical challenge highlighted by our cases is distinguishing between true pathogenic **infection** (tissue invasion triggering an immune response and clinical symptoms), **coinfection** (simultaneous infection by two or more distinct pathogens), and benign **colonization** (microbial presence without host immune response or tissue damage). In Case 1, acute CT consolidations, clinical hemoptysis, and underlying immunosuppression (corticosteroids/diabetes) strongly supported active infection requiring targeted antimicrobial intervention [4]. Conversely, in Case 2, despite tree-in-bud opacities, the patient's clinical stability, long-standing structural bronchiectasis, prior NTM treatments, and apparent clearance of the microorganism without targeted antibiotics reinforced airway colonization [8].

The concomitant isolation of *Aspergillus ochraceus* in BAL from Case 1 was interpreted as a colonizing agent. In fact, it has been suggested that other microorganisms and pathogens often accompany *B. bronchiseptica* isolates [3]. *A. ochraceus* is an opportunistic fungus rarely implicated in active invasive pulmonary disease and is more frequently associated with airway colonization in non-immunocompromised hosts or in patients with asthma [13]. Radiologically, active infection should be supported by the presence of a cavity (often containing a fungal mass) and persistent nodules associated with recurrent positive sputum cultures [13]. Given the absence of pulmonary cavitations or asthma in our case, the negative serum total and *Aspergillus*-specific IgE titers supported the diagnosis of fungal colonization rather than active aspergillosis [13].

The management of human *B. bronchiseptica* infections is hampered by the absence of standardized EUCAST or CLSI (Clinical and Laboratory Standards Institute) interpretive MIC breakpoints [4,14]. Although the organism is generally sensitive to antipseudomonal penicillins, carbapenems, fluoroquinolones, and aminoglycosides [4], empirical selection remains challenging. Digital health tools and business intelligence (BI) systems, such as MicroBI technology, have recently been utilized to analyze institutional MIC data and guide appropriate empirical therapy (identifying agents like meropenem and imipenem as suitable options) for these infrequent microorganisms [14].

CONCLUSION

Our study has several limitations, including the small sample size (only two clinical cases) and the lack of molecular strain typing to establish definitive zoonotic causality [5, 11]. Nevertheless, among the numerous challenges in interpreting the real significance of *B. bronchiseptica* isolated from pulmonary specimens, clinicians should take into consideration the patient's immunological vulnerability, epidemiological factors such as close contact with household pets, and pertussis immunization status (considering potential cross-protection), as well as clinical and radiological trends [11,12]. Crucially, even high-load isolation of *B. bronchiseptica* from BAL does not invariably signify invasive tissue damage or require targeted (and frequently aggressive) antimicrobial treatment.

"This case report deserved an official declaration of acknowledgement and ethical approval by its institution of origin and was peer-reviewed before publication, whilst the authors declare no fundings nor any conflicts of interest concerning this paper. It is noteworthy that case reports provide a valuable learning resource for the scientific community but should not be used in isolation to guide diagnostic or treatment choices in practical care or health policies. This Open Access article is distributed under the terms of the Creative Commons Attribution License (CC-BY), which allows immediate and free access to the work and permits users to read, download, copy, distribute, print, search, link and crawl it for indexing, or use it for any other lawful purpose without asking prior permission from the publisher or the author, provided the original work and authorship are properly cited."

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