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CASE REPORT

Bordetella bronchiseptica Infection in an Immunocompetent Adult and a Literature Review on this Rare Zoonosis

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Abstract

Introduction: *Bordetella bronchiseptica*, a Gram-negative coccobacillus, studied for its role in Canine Infectious Respiratory Disease and porcine atrophic rhinitis. It is an opportunistic pathogen with few reported cases of immunocompetent infection.

Aims: We will describe the demographic, clinical, radiological, diagnostic and therapeutic characteristics of a rare zoonosis in the literature, and outcomes.

Case: A 59 year old patient had presented due to non-resolution of her chronic productive cough.

Bronchoscopy revealed *Bordetella bronchiseptica,* her history of animal exposure was elucidated.

Conclusion: The majority of patients with this infection are HIV+ with low CD4 counts. Consolidations are the most common finding on imaging. Usually diagnosed by sputum culture and commonly treated by β-lactams. Our case shares significant overlap with the commonly found characteristics from the literature, and recovered. It is always important to consider zoonoses in the history-taking of immunocompromised and, even in immunocompetent patients.

Case Report

A 59 year old woman presented in February 2024 to the Outpatient Department due to non-resolution of her productive cough of 3 months. She had initially received a 7 day course of oral Clarithromycin, and mentioned some degree of symptomatic improvement. Her cough, however, persisted. She self-medicated with an inhaler containing fluticasone/vilanterol. This offered no further relief.

One month prior to her attendance in our hospital's outpatient department, she sought a second medical opinion. The result of this examination was a prescription for oral co-amoxiclav. On the third day of

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her regimen, she noticed an erythematous exanthem. Her prescribing doctor stopped the co-amoxiclav, and started her on a 7 day course of moxifloxacin in addition to singulair and rupatadine. A cardiological consult was sought, and no pathological findings were reported.

She presented to us several days after the end of this treatment with a subjectively improved yet persistent productive cough. She characterized the timing of it as a single episode coughing bout that produced a large volume of purulent sputum, with little to no symptoms for the rest of the day.

Our patient did not mention chest pain, dyspnoea, fever or symptoms from the upper airways. She provided us with laboratory results from a private lab, consisting of a sputum culture showing normal flora and a negative Interferon Gamma Release Assay (IGRA) result.

On examination, she presented well with no evidence of distress. She was afebrile, with an SpO2 of 97% on room air. On auscultation, she had a diffuse expiratory wheeze with scattered ronchi. Her examination was otherwise unremarkable.

The past medical history of our patient includes a radical hysterectomy 22 years ago that was complicated by disseminated intravascular coagulation, ileus secondary to abdominal adhesions that was operated 16 years ago and osteoporosis. She is an ex-smoker of approximately 30 years who quit successfully 3 years ago. Additionally she mentioned a tendency to self-medicate with inhalers of fluticasone-vilanterol when she feels unwell. Her smoking habit was irregular as she smoked socially and it was too irregular to quantify a pack-year value. She mentioned no known allergies.

A thoracic CT scan was ordered, which did not show any specific findings to explain her symptomatology. It only mentioned non-specific findings such as air-trapping in the expiratory phase in the upper lobes and right middle lobe, and small bi-basal linear atelectasis of no clinical significance.

In order to find an aetiological link to her chronic non-resolving cough, her auscultation findings and the lack of imaging findings for guidance, she was referred for bronchoscopy at Evangelismos General Hospital of Athens.

During the bronchoscopy, the inspection of the airways gave us clues to an underlying infective aetiology due to diffuse oedematous changes in the submucosa, mucus plugs and an area of anthracosis at a sub-segmental entrance of the posterior segment of the left lower lobe. Specimens were taken in the form of a bronchoalveolar lavage (BAL, neutrophilia of 44% on flow cytometry) and bronchial washings that were sent for flow cytometry and microscopy/culture/sensitivity testing. No other findings were reported.

The cultures reported the presence of *Bordetella bronchiseptica* > 15,000 CFU/ml, and the sensitivity testing gave Intermediate Sensitivity to each antibiotic tested, we report each tested MIC; Cefotaxime: 16 (IE), Gentamicin: 4 (IE), Ciprofloxacin: 0.5 (IE), Levofloxacin: 0.5 (IE), Moxifloxacin: 1.0 (IE), Tigecycline: < 0.5 (IE), Meropenem: 4 (IE), Piperacillin/Tazobactam; < 4 (IE), Ceftazidime: 2 (IE), Amikacin: 16 (IE), Colisin < 0.5 (IE).

Based on the above testing, she was started on a regimen of Levofoxacin 750 mg twice daily, per os, for ten days. As the regimen progressed, she did not report symptomatic improvement but by the end of treatment her sputum culture was negative for *B. bronchiseptica*, and gradually her symptoms resolved on subsequent follow-up.

It is important to underscore the following. When the culture results confirmed the presence of *B. bronchiseptica*, our patient volunteered the fact that not only did she have a pet dog, but 1 month prior to the start of all her symptoms, she adopted a stray dog that was ill with respiratory symptoms. The veterinarian prescribed several antibiotic courses and a course of steroids, and her dog still had difficulty in resolving the infection. By the time of the final follow-up, her dog had not completely recovered.

Literature Review

Introduction

The etiological agent under review, *Bordetella bronchiseptica* has been a known cause of respiratory veterinary disease for over a century. Initially a subject of interest to veterinarians for both the medical, and economic implications of communicable disease, especially in the pre-antibiotic era. With the advent of improved diagnostics, the first human hosts were documented, and a renewed interest in this pathogen would ferment.

Initially it was isolated under the name *Bacillus*

bronchicannis coined by Ferry himself in 1910 (and one of a significant series of name changes and re-classifications). This landmark paper is no longer available to us, published in the then American Veterinary Review (now known as JAVMA) titled "A preliminary report of the bacterial findings in canine distemper" [1]. In actual fact, this paper erroneously attributed[2] canine distemper to what would eventually be named *B. bronchiseptica*, only to be discovered later that this upper respiratory tract infection is caused by a paramyxovirus.

B. bronchiseptica is a small, Gram-negative, flagellated coccobacillus that measures 0.2-0.5 µm by 0.5-2.0 µm. Like other species of its genus, it is classified under the phylum of *Proteobacteria*, the class of *Betaproteobacteria*, the order of *Burkholderiales* and the family of *Alcaligenaceae*. The approved species within this genus is found in the List of prokaryotic names with standing in nomenclature (as regulated by the International Committee on Systematics of Prokaryotes). This zoonosis in particular has been studied extensively for its role in canine infectious tracheobronchitis (kennel cough, now known as Canine Infectious Respiratory Disease) or porcine atrophic rhinitis [3]. They currently stand at sixteen species.

It is a bacterium capable of forming biofilms and toxins, but not the pertussis toxin produced only by *B. pertussis.* It is a motile organism with a flagellum, whose role extends beyond motility as demonstrated by mutant strains in flagellar proteins that were unable to form mature biofilms under laboratory conditions [4]. The pathogenicity of *B. bronchiseptica* is still similar to that of *B. pertussis* that is more familiar to pulmonologists and pediatricians especially as the cause of whooping cough in children.

The BvgAs locus is a highly conserved region (between *B. bronchiseptica, B. pertussis* and *B.* parapertussis) encoding for virulence factors which despite obvert similarities, result in a pleomorphic infectious picture across a wide range of mammal species. They encode for agglutinins (FHA) and fimbreae (Fim2, Fim3) to assist in establishing infection, the Adenylate Cyclase Toxin which is implicated in inhibiting opsonization/killing as well as inducing macrophage apoptosis and the Dermonecrotic toxin implicated in the severity of porcine atrophic rhinitis severity. Additional genes include Lipopolysaccharides (LPS and O Antigen) that modulate innate immunity and specific secretion systems (T3SS and BteA) whose needle-like structure is a delivery system for bacterial protein products into the cytosol of its targets [5,6]. Additionally a Type 6 Secretion System, as found in various Gram-negative bacteria, is a transport system that has a role virulence factor as seen in Franciella tularensis and Vibrio cholera in its anti-eukaryotic cell functions. It is currently implicated and being studied as a virulence factor in the intracellular survival strategy of *B. bronchieseptica* [7]. Additionally, *B. bronchiseptica* has been demonstrated in its isolation from human hosts at different points in time for strains to undergo what appears to be a form of antigenic variation *In vivo* [8].

Characteristically a pathogen of canines manifesting Canine Infectious Respiratory Disease (CIRD) syndrome, it is since proven to be a far more significant pathogen in canines than originally thought [2]. CIRD has been observed to be caused by *B. bronchiseptica* as the primary pathogen, or secondary to Canine Adenovirus Type 2 (CAV-2), Canine Parainfluenza Virus (CPiV), Canine Herpesvirus (CHV) and Canine Respiratory Coronavirus (CRCoV). The tracheobronchitis in canines manifests with coughing and nasal discharge [9]. In porcine hosts, it is the cause of bronchopneumonia and atrophic rhinitis. The latter is complicated by co-infection by *Pasteurella multocida* and *Pseudomonas aeruginosa* amongst others [10]. *B. bronchiseptica* has been isolated from other hosts including cats, rabbits, horses, turkeys, seals, guinea pigs, koalas, sea otters [11], mountain voles[12], rats & mice [13], polar bears[14], baboons[15], sheep [16], sloths [17], and monkeys [18].

The first reported case of *B. bronchiseptica* in human beings dates back to the paper published by Brown in 1926 titled "*Bacillus bronchiseptica* infection in a child with symptoms of pertussis" in what was then, the *Johns Hopkins Hospital Bulletin* [1]. The paper is no longer available and the journal ceased publication in 1982.

B. bronchiseptica is very rarely encountered, in comparison to *B. pertussis*, a bacterium that causes pertussis (whooping cough) in children with over 150,000 new cases per year. Pertussis is communicable via droplet transmission mainly via coughing/sneezing. It is a cause of significant morbidity and mortality in infant populations. Pertussis classically appears as a mild fever and upper respiratory involvement with nasal discharge

and a cough after a 7-10 day incubation. The cough characteristically contains a "whooping" inspiratory component, hence its namesake [19]. The clinical characteristics of *B. bronchiseptica* differ in essence as it is an opportunistic pathogen with only a very few reported cases of immunocompetent infection in the entirety of the literature.

In the process of conducting a literature review of published human cases of this very rare zoonosis, the decision was taken to adopt a search strategy without any limitation by the introduction of search terms and boolean operators due to the very few publications that exist on this topic. The PubMed search of "*Bordetella bronchiseptica*" resulted in an output of results just shy of 1700. In order to approach the literature review, papers were accessed that would provide information into the microbiology, molecular biology, veterinary medicine, host types, and finally, all reported human cases.

From the papers downloaded, 87 were included in the references as they were case reports with one or more unique patient. In total, a spreadsheet with 147 unique patients was created containing information (Table 1).

In our review of the literature, 120 of 147 collected patients were adults and 25% of all patients were considered immunocompetent. The main category of immunocompromised or higher risk patients were due to HIV, of which 73% had CD4 counts lower than 250cells/μL and 21% had discontinued their antiretroviral therapy against medical advice. Other individual groups include malignancy, structural lung disease (mainly Cystic Fibrosis) organ transplants.

Results

Both immunocompetent and immunocompromised/higher risk adults had roughly equal distribution between acute and sub-acute/chronic presentations, with a distribution favoring longer symptom duration prior to presentation. Fever was present in 62% of immunocompetent adults as opposed to 42% of immunocompromised adults. Productive cough

Table 1: Patient data.

Basic Demographics		Immunocompromised/Higher Risk Patient Categories Based On Co-Morbitities	Clinical Data	
Sex (M/F)		Chronic Liver Disease [36-39] 4% of adults	Duration of presenting symptoms between immunocompetent/immunocompromised	
Immunocompentent 27 adults, 10 children 48%/52%	Immunocompromised 93 adults, 17 children 59%/41%		Duration < 7d prior to presentation Adults 45.5%/40% Children 87.5%/60%	Duration > 7d prior to presentation Adults 54.5%/60% Children 12.5%/40%
Age Group Stratification between immunocompetent and immunocompromised		Chronic Kidney Disease/ESRD/ dialysis [40-42] 6% of adults had CKD 8% of adults had ESRD or on dialysis	Presenting symptoms between immunocompetent/ immunocompromised	
Children 0-1 50%/6% 2-5 10%/18% 6-10 0%/24% 11-17 40%/54%	Adults 18-30 15%/18% 31-40 11%/16% 41-50 4%/15% 51-65 11%/28% > 65 59%/23%		Adults Dry Cough 15%/15% Productie Cough 54%/26% Chest Pain 8%/12% Dyspnoea 39%/29% Fever 62%/46%	Children Dry Cough 0%/21% Productie Cough 12.5%/64% Chest Pain 12.5%/21% Dyspnoea 25%/21% Fever 25%/21%
		HIV-AIDS (including columns if ART was discontinued against medical advice/not on ART, CD4) [35,43-62] 35% of adults, of whom 60% discontinued their ART and 73% had a CD4 < 250 cells/μL	Animal exposure history Adults/Children Immunocompetent 82%/100% YES Immunocompromised 66%/94% YES	
Immunocompetent Pediatric [34,94-101]		Malignancy [63-69] 27% of adults, 6% of children	Presence of respiratory failure Adults/Children Immunocompetent 40%/37.5% YES Immunocompromised 33%/31% YES	

Table 1: Patient data.

Basic Demographics	Immunocompromised/Higher Risk Patient Categories Based On Co-Morbitities	Clinical Data	
	Structural Lung Disease [70-72] 24% of adults, one immunocompetent adult, 82% of children	Imaging findings Immunocompetent/Immunocompromised	
		Adults Consolidation 69%/44% Necrotic Features 15%/23% Effusion 8%/8% Normal CXR 8%/10%	Children Consolidation 50%/35% Normal CXR 0%/6%
	Transplant patients [73-79] 14% of adults, 18% of children	Complications Immunocompetent/Immunocompromised	
		Adults Sepsis 4%/54% Intubation 19%/10% Opportunistic Infection 0%/14% Delay/Non resolution 4%/13%	Children Sepsis 0%/12% Intubation 20%/24% Opportunistic Infection 20%/53% Delay/Non resolution 20%/1%
	Auto-Immune disease under Treatment [33,34,35,80-87] 5% of adults	ICU Admission Adults 40% of immunocompetent and 19% of immunocompromised Children 37.5% of immunocompetent and 31% of immunocompromised	
	Congenital defects of the immune system [33,34,35,80-87] 2% of adults, 16% of children	Diagnostic method leading to diagnosis/identification for *B. bronchiseptica* table2.	
	Other Conditions [33,34,35,80-87] 12% of children	Admission duration between immunocompetent/ immunocompromised Adults Mean inpatient days 14%/20% Mean ICU days 22%/17% Children Mean inpatient days 15%/28% Mean ICU days 0%/0%	
	Immunocompromised Pediatric [35,88-95]	Treatment table 3.	
		Outcome table 4.	

was encountered in 54% and 26% respectively. Children tended to present acutely (87% in immunocompetent and 60% in immunocompromised children), and only the immunocompromised/higher risk group favored productive cough (64%), largely due to the presence of children with cystic fibrosis in this category. Animal exposure was a significant presence in the history of infected individuals. There was a case of transmission between patients [85] within a paediatric hematology transplant ward. Immunocompetent patients also had less respiratory failure, shorter inpatient stay and less complications including septic shock, delayed or non-resolving pneumonia or secondary opportunistic/hospital acquired pathogen isolation.

The main imaging finding in patients was consolidation, and it was seen the most in immunocompetent individuals. Immunocompetent individuals had less necrotic features, and an equal chance of developing a pleural effusion.

The investigations leading to identification of the pathogen in adults or immunocompromised/higher risk children was by sputum culture (Table 2).

The population of immunocompetent children arrived to their diagnosis more commonly by tracheal aspirates, with sputum cultures coming a close second. More immunocompromised/higher risk patients underwent bronchoscopy and underwent BAL.

In terms of therapeutics, β-lactam based antibiotics and quinolone were the mainstay of adult prescriptions followed by macrolides and tetracyclines (Table 3).

Immunocompetent children largely received β-lactams, followed by macrolides, tetracyclines and trimethoprim-sulfamethoxazole. Immunocompromised/higher risk children mainly received β-lactams, followed by quinolone, linezolid and aminoglycosides reflecting a more serious, hospital-based course of treatment.

Table 2: Diagnostic method for *B. Bronchiseptica* only.

	Immunocompetent	Immunocompromised or At Higher Risk
Adults	*n* = 27	*n* = 10
Bal	19%	31%
Sputum Culture	48%	43%
Tracheal Aspiration	11%	10%
Blood Culture	7%	6%
Washing/Brushing	7%	2%
Fna/Biopsy	4%	5%
Nasal Swab	0%	3%
Others	22%	5%
	Maxillary sinus swab culture, cervical smear culture, ear swab culture, nasopharyngeal lavate culture	CSF culture, peritoneal dialysis culture, sinus swab culture, stool culture
Children	*n* = 93	*n* = 17
Bal	10%	17%
Sputum Culture	20%	82%
Tracheal Aspiration	30%	0%
Blood Culture	10%	6%
Washing/Brushing	0%	0%
Fna/Biopsy	0%	0%
Nasal Swab	0%	0%
Others	30%	6%
	Nasopharyngeal lavate culture, CSF culture	Throat swab culture

BAL: Bronchoalveolar Lavage; CSF: Cerebrospinal Fluid; FNA: Fine Needle Aspirate.

Table 3: Treatment.

	Immunocompetent	Immunocompromised or At Higher Risk
Adults	*n* = 27	*n* = 10
B-LACTAMS	56%	53%
Quinolones	26%	37%
Carbapenems	7%	15%
Linezolid	4%	2%
Clindamycin	7%	12%
Macrolides	11%	11%
Tetracycline	15%	18%
Amynoglycosides	11%	18%
Glycopeptides	7%	6%
Trimethoprim-Sulfamethoxazole	7%	17%
Anti Tb Group 1 Medications	4%	5%
Anti-Fungals	4%	3%
Anti-Virals	0%	2%
Children	*n*=93	*n*=17
B-LACTAMS	33%	53%
Quinolones	7%	41%
Carbapenems	0%	0%
Linezolid	0%	35%
Clindamycin	4%	6%
Macrolides	11%	21%
Tetracycline	11%	6%
Amynoglycosides	7%	35%
Glycopeptides	0%	18%
Trimethoprim-Sulfamethoxazole	11%	24%
Anti Tb Group 1 Medications	4%	6%
Anti-Fungals	4%	12%
Anti-Virals	7%	0%

Outcomes are displayed in table 4. All immunocompetent children recovered fully, and the immunocompromised/higher risk pediatric group had a 13% fatality rate. The adult groups both had a 72% full recovery rate, with a slightly higher fatality rate of 24% in immunocompetent adults compared to 20%.

Discussion

The discrepancy seen in the higher mortality rate observed in immunocompetent individuals is not easily explained. This is an unexpected finding from

Table 4: Outcome of *B. Bronchiseptica* infection.

	Immunocompetent	Immunocompromised or At Higher Risk
Adults		
Recovery	72%	72%
Death	24%	20%
Recurrence	4%	1.5%
Persistent infection	0%	5%
Lost to follow up	0%	1.5%
Children		
Recovery	100%	87%
Death	0%	13%
Recurrence	0%	0%
Persistent infection	0%	0%
Lost to follow up	0%	0%

the data. One possible explanation can be attributed to a confounding effect due to the fact that four of the six adult immunocompetent deaths occurred in individuals in the > 65yrs age group, while the remaining two occurred in the 50-65 group. Thus, co-morbidity can be a possible cause. Additionally, it cannot be directly inferred from the literature if there were any delays in presentation that could have resulted in a more advanced infection at presentation, thus affecting prognosis. Difficulties in patient management were also not inferred. It is also worth noting that immunocompetent adults did not have any cases of persistent infection, although they did demonstrate slighter recurrence of infection.

Like the large majority of our collected cases, our case report follows the pattern of an individual who mentioned a history of infected animal exposure, developed symptoms and presented with a chronic productive cough. Her imaging was normal, unlike the majority of patients that presented with consolidations. In our case, the diagnostic identification occurred via bronchial washings instead of sputum cultures, and her treatment differed in the antibiotics used as she was initially treated with co-amoxiclav, but had to switch to levofloxacin based on sensitivity results. Her outcome of full recovery is consistent with the overall findings.

Conclusion

While it is good clinical practice when taking a history to fully document all environmental factors a patient has, it is essential to do so when assessing populations that are immunocompromised or otherwise vulnerable. The fact that a rare zoonosis has been seen in approximately 25% of the studied population who are fully immunocompetent, shows that this is not only a significant possibility, but the true prevalence of *Bordetella bronchiseptica* may even be underreported due to successful empirical treatment with β-lactams as a simple community-acquired lower respiratory tract infection whose aetiological agent is never isolated, perhaps making this a far more common infection that we think.

References

1. Goodnow RA. Biology of Bordetella bronchiseptica. Microbiol Rev. 1980 Dec;44(4):722-38. doi: 10.1128/mr.44.4.722-738.1980. PMID: 7010115; PMCID: PMC373201.
2. Ellis JA. How well do vaccines for Bordetella bronchiseptica work in dogs? A critical review of the literature 1977-2014. Vet J. 2015 Apr;204(1):5-16. doi: 10.1016/j.tvjl.2015.02.006. Epub 2015 Feb 10. PMID: 25747699.
3. Kadlec K, Schwarz S. Antimicrobial Resistance in Bordetella bronchiseptica. Microbiol Spectr. 2018 Jul;6(4):10.1128/microbiolspec.arba-0024-2017. doi: 10.1128/microbiolspec.ARBA-0024-2017. PMID: 30027886; PMCID: PMC11633599.
4. Cattelan N, Dubey P, Arnal L, Yantorno OM, Deora R. Bordetella biofilms: a lifestyle leading to persistent infections. Pathog Dis. 2016 Feb;74(1):ftv108. doi: 10.1093/femspd/ftv108. Epub 2015 Nov 19. PMID: 26586694; PMCID: PMC4830220.
5. Miguelena Chamorro B, De Luca K, Swaminathan G, Longet S, Mundt E, Paul S. Bordetella bronchiseptica and Bordetella pertussis: Similarities and Differences in Infection, Immuno-Modulation, and Vaccine Considerations. Clin Microbiol Rev. 2023 Sep 21;36(3):e0016422. doi: 10.1128/cmr.00164-22. Epub 2023 Jun 12. PMID: 37306571; PMCID: PMC10512794.
6. Mattoo S, Foreman-Wykert AK, Cotter PA, Miller JF. Mechanisms of Bordetella pathogenesis. Front Biosci. 2001 Nov 1;6:E168-86. doi: 10.2741/mattoo. PMID: 11689354.
7. Bendor L, Weyrich LS, Linz B, Rolin OY, Taylor DL, Goodfield LL, Smallridge WE, Kennett MJ, Harvill ET. Type Six Secretion System of Bordetella bronchiseptica and Adaptive Immune Components Limit Intracellular Survival During Infection. PLoS One. 2015 Oct 20;10(10):e0140743. doi: 10.1371/journal.pone.0140743. PMID: 26485303; PMCID: PMC4618060.
8. Gueirard P, Le Blay K, Le Coustumier A, Chaby R, Guiso N. Variation in Bordetella bronchiseptica lipopolysaccharide during human infection. FEMS Microbiol Lett. 1998 May 15;162(2):331-7. doi: 10.1111/j.1574-6968.1998.tb13017.x. PMID: 9627969.
9. Chambers JK, Matsumoto I, Shibahara T, Haritani M, Nakayama H, Uchida K. An Outbreak of Fatal Bordetella bronchiseptica Bronchopneumonia in Puppies. J Comp Pathol. 2019 Feb;167:41-45. doi: 10.1016/j.jcpa.2018.12.002. Epub 2019 Jan 14. PMID: 30898296; PMCID: PMC7094580.
10. Zhao Z, Wang C, Xue Y, Tang X, Wu B, Cheng X, He Q, Chen

H. The occurrence of Bordetella bronchiseptica in pigs with clinical respiratory disease. Vet J. 2011 Jun;188(3):337-40. doi: 10.1016/j.tvjl.2010.05.022. Epub 2010 Jul 2. PMID: 20598597.

11. Register KB, Ivanov YV, Jacobs N, Meyer JA, Goodfield LL, Muse SJ, Smallridge WE, Brinkac L, Kim M, Sanka R, Harvill ET, Losada L. Draft Genome Sequences of 53 Genetically Distinct Isolates of Bordetella bronchiseptica Representing 11 Terrestrial and Aquatic Hosts. Genome Announc. 2015 Apr 23;3(2):e00152-15. doi: 10.1128/genomeA.00152-15. PMID: 25908122; PMCID: PMC4408323.

12. Jensen WI, Duncan RM. Bordetella bronchiseptica associated with pulmonary disease in mountain voles (Microtus montanus). J Wildl Dis. 1980 Jan;16(1):11-4. doi: 10.7589/0090-3558-16.1.11. PMID: 6990019.

13. Bemis DA, Shek WR, Clifford CB. Bordetella bronchiseptica infection of rats and mice. Comp Med. 2003 Feb;53(1):11-20. PMID: 12625502.

14. Ellis J, Gow S, Pilfold N, Lacoste S, Lunn NJ, Richardson ES, McGeachy D, Owen M, Rideout B. Bordetella bronchiseptica-reactive antibodies in Canadian polar bears. Can Vet J. 2021 Jul;62(7):725-728. PMID: 34219781; PMCID: PMC8218947.

15. Clemmons EA, Chavez D, Condel L, Dutton JW 3rd, Price S, Lanford R. Comparison of oral, nebulized and combination antibiotic treatment of Bordetella bronchiseptica in baboons (Papio spp.). J Vet Pharmacol Ther. 2021 Sep;44(5):836-841. doi: 10.1111/jvp.12975. Epub 2021 May 8. PMID: 33963570; PMCID: PMC8429229.

16. Badhai J, Das SK. Genomic plasticity and antibody response of Bordetella bronchiseptica strain HT200, a natural variant from a thermal spring. FEMS Microbiol Lett. 2021 Apr 22;368(6):fnab035. doi: 10.1093/femsle/fnab035. PMID: 33856450.

17. Hammond EE, Sosa D, Beckerman R, Aguilar RF. Respiratory disease associated with Bordetella bronchiseptica in a Hoffmann's two-toed sloth (Choloepus hoffmanni). J Zoo Wildl Med. 2009 Jun;40(2):369-72. doi: 10.1638/2008-0086.1. PMID: 19569489.

18. Good RC, May BD. Respiratory pathogens in monkeys. Infect Immun. 1971;3(1):87-93. doi: 10.1128/iai.3.1.87-93.1971.

19. World Health Organization. Pertussis.

20. Reina J, Bassa A, Llompart I, Borrell N, Gomez J, Serra A. Pneumonia caused by Bordetella bronchiseptica in a patient with a thoracic trauma. Infection. 1991 Jan-Feb;19(1):46-8. doi: 10.1007/BF01643760. PMID: 2013509.

21. Llombart M, Chiner E, Senent C. Neumonía necrosante por Bordetella bronchiseptica en una mujer inmunocompetente [Necrotizing pneumonia due to Bordetella bronchiseptica in an immunocompetent woman]. Arch Bronconeumol. 2006 May;42(5):255-6. Spanish. doi: 10.1016/s1579-2129(06)60457-6. PMID: 16740243.

22. Fernández Vecilla D, Roche Matheus MP, Iglesias Hidalgo G, Unzaga Barañano MJ, Díaz de Tuesta Del Arco JL. Neumonía asociada a derrame parapneumónico en paciente inmunocompetente causado por Bordetella bronchiseptica [Pneumonia associated with parapneumonic effusion in an immunocompetent patient caused by Bordetella bronchiseptica]. Rev Esp Quimioter. 2023 Oct;36(5):533-535. Spanish. doi: 10.37201/req/006.2023. Epub 2023 Jun 1. PMID: 37256910; PMCID: PMC10586747.

23. Papantoniou S, Tsakiris A, Ladopoulos T, Kranidiotis G, Tamvakos C. A Case of Bordetella bronchiseptica Bacteremia in a Patient With COVID-19: Brief Report. Cureus. 2021 Jun 27;13(6):e15976. doi: 10.7759/cureus.15976. PMID: 34336468; PMCID: PMC8318613.

24. Katzenstein DA, Ciofalo L, Jordan MC. Bordetella bronchiseptica bacteremia. West J Med. 1984;140(1):96-98.

25. Barcala Salido JM, Mora-Delgado J, Lojo-Cruz C. Bordetella bronchiseptica pneumonia in an immunocompetent pig farmer. IDCases. 2022 Feb 1;27:e01435. doi: 10.1016/j.idcr.2022.e01435. PMID: 35145865; PMCID: PMC8819078.

26. Clements J, McGrath C, McAllister C. Bordetella bronchiseptica pneumonia: beware of the dog! BMJ Case Rep. 2018 Apr 27;2018:bcr2018224588. doi: 10.1136/bcr-2018-224588. PMID: 29703836; PMCID: PMC5926600.

27. Tamion F, Girault C, Chevron V, Pestel M, Bonmarchand G. Bordetella bronchoseptica pneumonia with shock in an immunocompetent patient. Scand J Infect Dis. 1996;28(2):197-8. doi: 10.3109/00365549609049077. PMID: 8792492.

28. Petrocheilou-Paschou V, Georgilis K, Kostis E, Prifti H, Zakopoulos N, Stamatelopoulos S. Bronchitis caused by Bordetella bronchiseptica in an elderly woman. Clin Microbiol Infect. 2000 Mar;6(3):147-8. doi: 10.1046/j.1469-0691.2000.00034-1.x. PMID: 11168091.

29. Tessier S, Longo S, Turki M, Numeir M, Le T, Ido F. Fatal hemorrhagic bronchopneumonia caused by Bordetella bronchiseptica in an immunocompetent patient. Germs. 2023 Jun 30;13(2):172-176. doi: 10.18683/germs.2023.1381. PMID: 38144244; PMCID: PMC10746337.

30. Gueirard P, Weber C, Le Coustumier A, Guiso N. Human Bordetella bronchiseptica infection related to contact with infected animals: persistence of bacteria in host. J Clin Microbiol. 1995 Aug;33(8):2002-6. doi: 10.1128/jcm.33.8.2002-2006.1995. PMID: 7559937; PMCID: PMC228324.

31. Woolfrey BF, Moody JA. Human infections associated with Bordetella bronchiseptica. Clin Microbiol Rev. 1991 Jul;4(3):243-55. doi: 10.1128/CMR.4.3.243.

32. Lo Re V 3rd, Brennan PJ, Wadlin J, Weaver R, Nachamkin I. Infected branchial cleft cyst due to Bordetella bronchiseptica in an immunocompetent patient. J Clin Microbiol. 2001 Nov;39(11):4210-2. doi: 10.1128/JCM.39.11.4210-4212.2001. PMID: 11682564; PMCID: PMC88521.

33. Ducours M, Rispal P, Danjean MP, Imbert Y, Dupont E, Traissac EM, Grosleron S. Bordetella bronchiseptica infection.

Med Mal Infect. 2017 Nov;47(7):453-458. doi: 10.1016/j.medmal.2017.05.012. Epub 2017 Sep 22. PMID: 28943167.

34. Wernli D, Emonet S, Schrenzel J, Harbarth S. Evaluation of eight cases of confirmed Bordetella bronchiseptica infection and colonization over a 15-year period. Clin Microbiol Infect. 2011 Feb;17(2):201-3. doi: 10.1111/j.1469-0691.2010.03258.x. PMID: 20459438.

35. García-de-la-Fuente C, Guzmán L, Cano ME, Agüero J, Sanjuán C, Rodríguez C, Aguirre A, Martínez-Martínez L. Microbiological and clinical aspects of respiratory infections associated with Bordetella bronchiseptica. Diagn Microbiol Infect Dis. 2015 May;82(1):20-5. doi: 10.1016/j.diagmicrobio.2015.01.011. Epub 2015 Feb 2. PMID: 25703895.

36. Chan KH, Ajao SO, Farouji I, Slim J. A Case of Bordetella bronchiseptica Bacteremia in a Patient With Decompensated Liver Cirrhosis. Cureus. 2021 Mar 17;13(3):e13938. doi: 10.7759/cureus.13938. PMID: 33880278; PMCID: PMC8051530.

37. Williams J 3rd, Chao A, Fakess J, Imam A. Bordetella bronchiseptica empyema in patient with chronic alcohol use disorder. Respir Med Case Rep. 2022 Jul 30;39:101712. doi: 10.1016/j.rmcr.2022.101712. PMID: 36060638; PMCID: PMC9428849.

38. Matic NA, Bunce PE. Isolation of Bordetella bronchiseptica from blood and a pancreatic abscess. J Clin Microbiol. 2015 May;53(5):1778-80. doi: 10.1128/JCM.00175-15. Epub 2015 Mar 4. PMID: 25740781; PMCID: PMC4400742.

39. Dlamini NR, Bhamjee A, Levick P, Uniacke E, Ismail H, Smith A. Spontaneous bacterial peritonitis and pneumonia caused by Bordetella bronchiseptica. J Infect Dev Ctries. 2012 Jul 23;6(7):588-91. doi: 10.3855/jidc.2074. PMID: 22842947.

40. Byrd LH, Anama L, Gutkin M, Chmel H. Bordetella bronchiseptica peritonitis associated with continuous ambulatory peritoneal dialysis. J Clin Microbiol. 1981 Aug;14(2):232-3. doi: 10.1128/jcm.14.2.232-233.1981. PMID: 7276151; PMCID: PMC271941.

41. Borràs Sans M, Bonal J, Bonet J, Arnal J, Roca F, Caralps A. Bordetella bronchiseptica septicemia in a hemodialysis patient. Nephron. 1991;59(4):676. doi: 10.1159/000186673. PMID: 1766517.

42. Won KB, Ha GY, Kim JS, Kang HJ, Tak WT, Lee JH. Relapsing peritonitis caused by Bordetella bronchiseptica in continuous ambulatory peritoneal dialysis patient: a case report. J Korean Med Sci. 2009 Jan;24 Suppl(Suppl 1):S215-8. doi: 10.3346/jkms.2009.24.S1.S215. Epub 2009 Jan 28. PMID: 19194556; PMCID: PMC2633208.

43. García San Miguel L, Quereda C, Martínez M, Martín-Dávila P, Cobo J, Guerrero A. Bordetella bronchiseptica cavitary pneumonia in a patient with AIDS. Eur J Clin Microbiol Infect Dis. 1998 Sep;17(9):675-6. doi: 10.1007/BF01708357. PMID: 9832276.

44. Qureshi MN, Lederman J, Neibart E, Bottone EJ. Bordetella bronchiseptica recurrent bacteraemia in the setting of a patient with AIDS and indwelling Broviac catheter. Int J STD AIDS. 1992 Jul-Aug;3(4):291-3. doi: 10.1177/095646249200300413. PMID: 1504164.

45. Washington MA, Agee WA, Kajiura L, Hawley-Molloy JS, Staege CM, Barnhill JC. A Case of Bordetella brochiseptica at a Military Medical Facility in Hawai'i: Phenotypic and Molecular Testing of an Uncommon Human Pathogen. Hawaii J Med Public Health. 2015 Jul;74(7):230-3. PMID: 26225268; PMCID: PMC4507362.

46. Mazumder SA, Cleveland KO. Bordetella bronchiseptica bacteremia in a patient with AIDS. South Med J. 2010 Sep;103(9):934-5. doi: 10.1097/SMJ.0b013e3181ebcdbc. PMID: 20689480.

47. Jimenez-Lucho V, Shulman M, Johnson J. Bordetella bronchiseptica in an AIDS patient cross-reacts with Legionella antisera. J Clin Microbiol. 1994 Dec;32(12):3095-6. doi: 10.1128/jcm.32.12.3095-3096.1994. PMID: 7883914; PMCID: PMC264242.

48. Dworkin MS, Sullivan PS, Buskin SE, Harrington RD, Olliffe J, MacArthur RD, Lopez CE. Bordetella bronchiseptica infection in human immunodeficiency virus-infected patients. Clin Infect Dis. 1999 May;28(5):1095-9. doi: 10.1086/514761. PMID: 10452641.

49. Woodard DR, Cone LA, Fostvedt K. Bordetella bronchiseptica infection in patients with AIDS. Clin Infect Dis. 1995 Jan;20(1):193-4. doi: 10.1093/clinids/20.1.193. PMID: 7727654.

50. Gujju VR, Akram B, Shibib DR, McGhee MA, Drevets DA. Bordetella bronchiseptica infections in patients with HIV/AIDS: A case report and review of the literature. Medicine (Baltimore). 2021 Dec 23;100(51):e28244. doi: 10.1097/MD.0000000000028244. PMID: 34941094; PMCID: PMC8702113.

51. Viejo G, de la Iglesia P, Otero L, Blanco MI, Gomez B, De Miguel D, Del Valle A, De la Fuente B. Bordetella bronchiseptica pleural infection in a patient with AIDS. Scand J Infect Dis. 2002;34(8):628-9. doi: 10.1080/00365540210147697. PMID: 12238585.

52. Gupta S, Goyal P, Mattana J. Bordetella bronchiseptica pneumonia a thread in the diagnosis of human immunodeficiency virus infection. IDCases. 2019 Feb 19;15:e00509. doi: 10.1016/j.idcr.2019.e00509. PMID: 30847280; PMCID: PMC6389593.

53. Galeziok M, Roberts I, Passalacqua JA. Bordetella bronchiseptica pneumonia in a man with acquired immunodeficiency syndrome: a case report. J Med Case Rep. 2009 Oct 15;3:76. doi: 10.1186/1752-1947-3-76. PMID: 19946552; PMCID: PMC2783075.

54. Libanore M, Rossi MR, Pantaleoni M, Bicocchi R, Carradori S, Sighinolfi L, Ghinelli F. Bordetella bronchiseptica pneumonia in an AIDS patient: a new opportunistic infection. Infection. 1995 Sep-Oct;23(5):312-3. doi: 10.1007/BF01716297. PMID: 8557395.

55. Lorenzo-Pajuelo B, Villanueva JL, Rodríguez-Cuesta J, Vergara-Irigaray N, Bernabeu-Wittel M, Garcia-Curiel A, Martínez de Tejada G. Cavitary pneumonia in an AIDS patient caused by an unusual Bordetella bronchiseptica variant producing reduced amounts of pertactin and other major antigens. J Clin Microbiol. 2002

Sep;40(9):3146-54. doi: 10.1128/JCM.40.9.3146-3154.2002. PMID: 12202545; PMCID: PMC130797.

56. Sameed M, Sullivan S, Marciniak ET, Deepak J. Chronic cough and cystic lung disease caused by Bordetella bronchiseptica in a patient with AIDS. BMJ Case Rep. 2019 Apr 16;12(4):e228741. doi: 10.1136/bcr-2018-228741. PMID: 30996069; PMCID: PMC6506123.

57. Mesnard R, Guiso N, Michelet C, Sire JM, Pouëdras P, Donnio PY, Avril JL. Isolation of Bordetella bronchiseptica from a patient with AIDS. Eur J Clin Microbiol Infect Dis. 1993 Apr;12(4):304-6. doi: 10.1007/BF01967267. PMID: 8513824.

58. Rampelotto RF, Hörner A, Hörner C, Righi R, Hörner R. Pneumonia caused by Bordetella bronchiseptica in two HIV-positive patients. Sao Paulo Med J. 2016 May 13;134(3):268-72. doi: 10.1590/1516-3180.2015.02492701. PMID: 27191248; PMCID: PMC10496598.

59. Decker GR, Lavelle JP, Kumar PN, Pierce PF. Pneumonia due to Bordetella bronchiseptica in a patient with AIDS. Rev Infect Dis. 1991 Nov-Dec;13(6):1250-1. doi: 10.1093/clinids/13.6.1250. PMID: 1775865.

60. Amador C, Chiner E, Calpe JL, Ortiz de la Table V, Martinez C, Pasquau F. Pneumonia due to Bordetella bronchiseptica in a patient with AIDS. Rev Infect Dis. 1991 Jul-Aug;13(4):771-2. doi: 10.1093/clinids/13.4.771. PMID: 1925302.

61. Ng VL, Boggs JM, York MK, Golden JA, Hollander H, Hadley WK. Recovery of Bordetella bronchiseptica from patients with AIDS. Clin Infect Dis. 1992 Aug;15(2):376-7. doi: 10.1093/clinids/15.2.376. PMID: 1520777.

62. Baptista RJIR, Costa JMSSD, Badura RA. Severe cavitary pneumonia caused by Bordetella bronchiseptica in an HIV-infected patient. Enferm Infecc Microbiol Clin (Engl Ed). 2020 Oct;38(8):404-405. English, Spanish. doi: 10.1016/j.eimc.2020.02.014. Epub 2020 Mar 17. PMID: 32192778.

63. Meis JF, van Griethuijsen AJ, Muytjens HL. Bordetella bronchiseptica bronchitis in an immunosuppressed patient. Eur J Clin Microbiol Infect Dis. 1990 May;9(5):366-7. doi: 10.1007/BF01973748. PMID: 2373090.

64. Papasian CJ, Downs NJ, Talley RL, Romberger DJ, Hodges GR. Bordetella bronchiseptica bronchitis. J Clin Microbiol. 1987 Mar;25(3):575-7. doi: 10.1128/jcm.25.3.575-577.1987. PMID: 3571462; PMCID: PMC265999.

65. Stoll DB, Murphey SA, Ballas SK. Bordetella bronchiseptica infection in stage IV Hodgkin's disease. Postgrad Med J. 1981 Nov;57(673):723-4. doi: 10.1136/pgmj.57.673.723. PMID: 7339608; PMCID: PMC2426191.

66. Buggy BP, Brosius FC 3rd, Bogin RM, Koller CA, Schaberg DR. Bordetella bronchiseptica pneumonia in a patient with chronic lymphocytic leukemia. South Med J. 1987 Sep;80(9):1187-9. doi: 10.1097/00007611-198708090-00028. PMID: 3629325.

67. Monti M, Diano D, Allegrini F, Delmonte A, Fausti V, Cravero P, Marcantognini G, Frassineti GL. Bordetella bronchiseptica pneumonia in a patient with lung cancer; a case report of a rare infection. BMC Infect Dis. 2017 Sep 25;17(1):644. doi: 10.1186/s12879-017-2736-7. PMID: 28946850; PMCID: PMC5613318.

68. Shimoni Z, Niven M, Mosenkis M, Greif J. Fatal pneumonia due to Bordetella bronchiseptica. Isr Med Assoc J. 2000 May;2(5):402-3. PMID: 10892400.

69. Redelman-Sidi G, Grommes C, Papanicolaou G. Kitten-transmitted Bordetella bronchiseptica infection in a patient receiving temozolomide for glioblastoma. J Neurooncol. 2011 Apr;102(2):335-9. doi: 10.1007/s11060-010-0322-6. Epub 2010 Jul 30. PMID: 20676728.

70. Karamooz E, Yap VL, Barker AF, Metersky ML. Bordetella bronchiseptica in non-cystic fibrosis bronchiectasis. Respir Med Case Rep. 2018 Aug 28;25:187-188. doi: 10.1016/j.rmcr.2018.08.023. PMID: 30191122; PMCID: PMC6125826.

71. Faqihi F, Alharthy A, Pirompanich P, Noor A, Shahzad A, Nasim N, Balhamar A, Memish ZA, Karakitsos D. Co-infection of SARS-CoV-2 and Bordetella bronchiseptica in a young man with idiopathic non-cystic bronchiectasis and vitamin D3 deficiency. Respir Med Case Rep. 2020;31:101203. doi: 10.1016/j.rmcr.2020.101203. Epub 2020 Aug 28. PMID: 32874904; PMCID: PMC7452825.

72. Wallet F, Perez T, Armand S, Wallaert B, Courcol RJ. Pneumonia due to Bordetella bronchiseptica in a cystic fibrosis patient: 16S rRNA sequencing for diagnosis confirmation. J Clin Microbiol. 2002 Jun;40(6):2300-1. doi: 10.1128/JCM.40.6.2300-2301.2002. PMID: 12037116; PMCID: PMC130795.

73. Goldberg JD, Kamboj M, Ford R, Kiehn TE, Gilhuley K, Perales MA. 'Kennel cough' in a patient following allogeneic hematopoietic stem cell transplant. Bone Marrow Transplant. 2009 Sep;44(6):381-2. doi: 10.1038/bmt.2009.22. Epub 2009 Feb 23. PMID: 19234511.

74. Echeverri-Toro L, Arango A, Ospina S, Agudelo C. Bacteriemia recurrente por Bordetella bronchiseptica en un paciente con trasplante de medula ósea [Bordetella bronchiseptica recurrent bacteraemia in a patient with bone marrow transplantation]. Biomedica. 2015 Jul-Sep;35(3):302-5. Spanish. doi: 10.7705/biomedica.v35i3.2494. PMID: 26849691.

75. Powers HR, Shah K. Bordetella bronchiseptica bloodstream infection in a renal transplant patient. Transpl Infect Dis. 2017 Dec;19(6). doi: 10.1111/tid.12774. Epub 2017 Oct 25. PMID: 28865149.

76. Bauwens JE, Spach DH, Schacker TW, Mustafa MM, Bowden RA. Bordetella bronchiseptica pneumonia and bacteremia following bone marrow transplantation. J Clin Microbiol. 1992 Sep;30(9):2474-5. doi: 10.1128/jcm.30.9.2474-2475.1992. PMID: 1401019; PMCID: PMC265527.

77. Gisel JJ, Brumble LM, Johnson MM. Bordetella bronchiseptica pneumonia in a kidney-pancreas transplant patient after exposure to recently vaccinated dogs. Transpl Infect Dis. 2010 Feb;12(1):73-6. doi: 10.1111/j.1399-3062.2009.00451.x. Epub 2009 Oct 28. PMID: 19874567.

78. Nagarakanti S, Bishburg E. Coinfection of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Bordetella bronchiseptica Pneumonia in a Renal Transplant Patient. Cureus. 2021 Feb 3;13(2):e13113. doi: 10.7759/cureus.13113. PMID: 33728132; PMCID: PMC7935691.

79. Pierce M, Slipke W, Biagi M. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Bordetella bronchiseptica Co-Infection in a Stem Cell Transplant Patient. Antibiotics (Basel). 2022 Sep 5;11(9):1200. doi: 10.3390/antibiotics11091200. PMID: 36139980; PMCID: PMC9495116.

80. Mulkoju RC, Rajuri V, Leo S, Kolan RR. A tale of three in symbiosis: TB-COVID-19-Bordetella coinfection. Int J Mycobacteriol. 2022 Oct-Dec;11(4):463-465. doi: 10.4103/ijmy.ijmy_166_22. PMID: 36510937.

81. Berkowitz DM, Bechara RI, Wolfenden LL. An unusual cause of cough and dyspnea in an immunocompromised patient. Chest. 2007 May;131(5):1599-602. doi: 10.1378/chest.06-1541. PMID: 17494814.

82. Bhargava A, Eisenstadt R, Shih JA, Sueblinvong V. A Good Case of Recurrent Pneumonia. J Investig Med High Impact Case Rep. 2018 Sep 29;6:2324709618802869. doi: 10.1177/2324709618802869. PMID: 30283805; PMCID: PMC6166300.

83. Yacoub AT, Katayama M, Tran J, Zadikany R, Kandula M, Greene J. Bordetella bronchiseptica in the immunosuppressed population - a case series and review. Mediterr J Hematol Infect Dis. 2014 Apr 7;6(1):e2014031. doi: 10.4084/MJHID.2014.031. PMID: 24804004; PMCID: PMC4010603.

84. Radcliffe C, Lier A, Doilicho N, Parikh S, Kaddouh F. Bordetella bronchiseptica: a rare cause of meningitis. BMC Infect Dis. 2020 Dec 3;20(1):922. doi: 10.1186/s12879-020-05668-2. PMID: 33272197; PMCID: PMC7713019.

85. Huebner ES, Christman B, Dummer S, Tang YW, Goodman S. Hospital-acquired Bordetella bronchiseptica infection following hematopoietic stem cell transplantation. J Clin Microbiol. 2006 Jul;44(7):2581-3. doi: 10.1128/JCM.00510-06. PMID: 16825386; PMCID: PMC1489478.

86. Patel AK, Prescott-Focht JA, Kunin JR, Essmyer CE, Rosado-de-Christenson ML. Imaging findings in human Bordetella bronchiseptica pneumonia. J Thorac Imaging. 2011 Nov;26(4):W146-9. doi: 10.1097/RTI.0b013e31820209a1. PMID: 21263355.

87. Ito Y, Uemura K. Successful treatment of Bordetella bronchiseptica pneumonia by minocycline in anti-neutrophil cytoplasmic antibodies-associated vasculitis patient. J Infect Chemother. 2016 Dec;22(12):808-810. doi: 10.1016/j.jiac.2016.06.008. Epub 2016 Jul 11. PMID: 27424791.

88. Woods P, Ordemann K, Stanecki C, Brown J, Uzodi A. Bordetella bronchiseptica Pneumonia in an Adolescent: Case Report and Review of the Pediatric Literature. Clin Pediatr (Phila). 2020 Mar;59(3):322-328. doi: 10.1177/0009922819897355. Epub 2019 Dec 26. PMID: 31876162.

89. Word BM. Cough and apnea in a young infant. Semin Pediatr Infect Dis. 2006 Apr;17(2):54, 105-6. doi: 10.1053/j.spid.2006.04.007. PMID: 16822465.

90. Rath BA, Register KB, Wall J, Sokol DM, Van Dyke RB. Persistent Bordetella bronchiseptica pneumonia in an immunocompetent infant and genetic comparison of clinical isolates with kennel cough vaccine strains. Clin Infect Dis. 2008 Mar 15;46(6):905-8. doi: 10.1086/528858. PMID: 18260750.

91. Belen O, Campos JM, Cogen PH, Jantausch BA. Postsurgical meningitis caused by Bordetella bronchiseptica. Pediatr Infect Dis J. 2003 Apr;22(4):380-1. PMID: 12712975.

92. Barrio VR, Darmstadt GL. Rash and opportunistic pneumonia in a malnourished infant adopted from China. Clin Infect Dis. 2000 Feb;30(2):408-9. doi: 10.1086/313673. PMID: 10671361.

93. de la Torre MJ, de la Fuente CG, de Alegría CR, Del Molino CP, Agüero J, Martínez-Martínez L. Recurrent respiratory infection caused by Bordetella bronchiseptica in an immunocompetent infant. Pediatr Infect Dis J. 2012 Sep;31(9):981-3. doi: 10.1097/INF.0b013e31825d2e84. PMID: 22572751.

94. Ner Z, Ross LA, Horn MV, Keens TG, MacLaughlin EF, Starnes VA, Woo MS. Bordetella bronchiseptica infection in pediatric lung transplant recipients. Pediatr Transplant. 2003 Oct;7(5):413-7. doi: 10.1034/j.1399-3046.2003.00074.x. PMID: 14738306.

95. Brady C, Ackerman P, Johnson M, McNamara J. Bordetella bronchiseptica in a pediatric Cystic Fibrosis center. J Cyst Fibros. 2014 Jan;13(1):43-8. doi: 10.1016/j.jcf.2013.08.002. Epub 2013 Sep 4. PMID: 24011471.

96. Bille E, Lesage F, Guiso N, Quesne G, Berche P, Le Monnier A. Syndrome thoracique aigu associé à une infection àBordetella bronchiseptica chez un enfant drépanocytaire [Bordetella bronchiseptica-associated acute chest syndrome in a child with sickle cell disease]. Arch Pediatr. 2011 Jan;18(1):41-4. French. doi: 10.1016/j.arcped.2010.09.015. Epub 2010 Oct 30. PMID: 21036565.

97. Gomez L, Grazziutti M, Sumoza D, Beran M, Rolston K. Bacterial pneumonia due to Bordetella bronchiseptica in a patient with acute leukemia. Clin Infect Dis. 1998 Apr;26(4):1002-3. doi: 10.1086/517630. PMID: 9564496.

98. Register KB, Sukumar N, Palavecino EL, Rubin BK, Deora R. Bordetella bronchiseptica in a paediatric cystic fibrosis patient: possible transmission from a household cat. Zoonoses Public Health. 2012 Jun;59(4):246-50. doi: 10.1111/j.1863-2378.2011.01446.x. Epub 2012 Jan 2. PMID: 22212633; PMCID: PMC3323701.

99. Ting YJ, Ho PL, Wong KY. Bordetella bronchiseptica Pneumonia in an Extremely-Low-Birth-Weight Neonate. AJP Rep. 2011 Dec;1(2):83-6. doi: 10.1055/s-0031-1284223. Epub 2011 Aug 1. PMID: 23705092; PMCID: PMC3653527.

100. Choy KW, Wulffraat NM, Wolfs TF, Geelen SP, Kraaijeveld CA, Fleer A. Bordetella bronchiseptica respiratory infection in a child after bone marrow transplantation. Pediatr Infect Dis J.

1999 May;18(5):481-3. doi: 10.1097/00006454-199905000-00022. PMID: 10353531.

101. El Khatib N, Ferroni A, Le Bourgeois M, Chedevergne F, Clairicia M, Avril H, Guiso N, Sermet-Gaudelus I. Persistent Bordetella bronchiseptica infection in a child with cystic fibrosis: Relationship to bacterial phenotype. J Cyst Fibros. 2015 Sep;14(5):E13-5. doi: 10.1016/j.jcf.2015.03.014. Epub 2015 Apr 18. PMID: 25900817.

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