THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
Jan 2024 Vol.4(1), 204-210
Popular Article

Diagnosis and Management of *Bordetella bronchiseptica* in Dogs and Cats

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https://doi.org/10.5281/zenodo.10498455

Abstract

Bordetella bronchiseptica, well-known Gram-negative bacteria occur in different species. *B. bronchiseptica* cause a highly contagious respiratory disease in cats and dogs characterized by inflammation of trachea and bronchi. Proper diagnosis is required to find the etiology of the cause and further management with care and vaccination in a high-density population can reduce the probability of the animals in getting affected.

Keywords: *Bordetella bronchiseptica*, dogs, cats, diagnosis, vaccination

Introduction

One of the most prevalent illnesses affecting dogs and cats at boarding facilities, shelters, and multi-animal households is upper respiratory infections. *B. bronchiseptica* is the main pathogen that affects domestic dogs and cats, especially when there is a large population density. Chronic respiratory infections in humans, dogs, cats, rabbits, and pigs are caused by *B. bronchiseptica*. As the veterinary clinics' records show that bordetelllosis has become more

Published 12.01.2024

of an issue lately and that the illness itself, even with prompt treatment, frequently has a protracted course and may even be unsafe to human.

The organism from afflicted animals is mostly aerosolized during transmission, although contaminated fomites can also act as a source of infection. An upper respiratory tract pathogen called *Bordetella bronchiseptica* infects both domestic and wild animals as well as people when they present an opportunity. According to Melvin et al. (2014), Bordetella is linked to illnesses including atropic rhinitis in pigs and kennel cough in dogs.

Rather than *B. bronchiseptica*, cats who exhibit symptoms of upper respiratory disease are typically infected with rhinotracheitis (herpes virus), calici virus, or *Chlamydophila felis*. The environment (rescue catteries, multi-cat families), contact with canines suffering from respiratory illnesses, and coexisting respiratory infections are risk factors for feline bordetellosis.

DIAGNOSIS

When dogs or cats show indications of bordetellosis in addition to fever, lethargy, anorexia, respiratory distress, or other systemic symptoms, a diagnostic examination should be conducted. A complete blood cell count, chemical profile, urinalysis, heartworm test, and thoracic radiography can all help with the screening process for other conditions.

For a *B. bronchiseptica* infection to be definitively diagnosed, nasal, oropharyngeal, or tracheal wash samples must provide a positive culture. Interpreting culture data can be challenging, particularly if samples are obtained from the throat or nose, areas where both healthy and sick animals sometimes have mixed flora. It is necessary to notify the diagnostic laboratory about the potential for *B. bronchiseptica* infection in order to carry out specific isolation procedures and quantification. Specimens collected for culturing should additionally undergo cytology and Gram's stain. While cytologic signs of inflammation may be produced by other bacteria and agents, including mycoplasma, viruses, protozoa, or fungi, a neutrophilic inflammatory response in conjunction with intracellular bacteria indicates bordetellosis.

The *B. bronchiseptica* must first be isolated, and then the organism must be identified using biochemical testing, serological tests, and molecular techniques. Swabs from the throat and nose can be used to collect samples, which can subsequently be processed for isolation (Denes *et al.*, 2006). For diagnosis, *B. bronchiseptica* must first be isolated, and then the organism be can be identified using biochemical, serological, and molecular techniques (Abd Alfatah, 2019). History and clinical indicators alone can only suggest dealing with infectious tracheobronchitis brought on by *B. bronchiseptica*. Cooperation with public health diagnostic

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laboratories is frequently required since they have more advanced tools and can carry out more accurate diagnostic processes (Milanov *et al.*, 2018).

Blood agar, Bordet-Gengou agar, Smith-Baskerville culture media, and MacConkey agar are all excellent substrates for Bordetella species that grow quickly at 37°C. In terms of biochemistry, Bordetella are positive for the utilisation of oxidase, catalase, and citrate and negative for the creation of gelatinase, DNase and indole as well as the fermentation of any sugar (Gonazalez *et al.*, 2006).

Small, Gram-negative rods with a coccobacillary appearance are *Bordetella bronchiseptica.* These bacteria are typically recognized by their growth traits, biochemical responses, and special capacity to agglutinate red blood cells. Serology and immunization records may be helpful in identifying the presence of respiratory viruses. For radiographic analysis, To obtain the most information, both right and left lateral views of the chest are necessary and to improve the quality of the radiographic examination of the lung fields, expose the radiograph at maximum inspiration if possible (Elgalfy *et al.*, 2022).

Lung patterns are merely the radiological manifestation of lung disease. Alveolar pattern, interstitial pattern, and bronchial pattern are examples of typical patterns. In cases of bronchitis and kennel cough, a bronchial pattern was seen, which was represented by a diffuse thickening of the airway lines and rings throughout the pulmonary tissue. In cases of pulmonary edema and pneumonia, an unstructured interstitial pattern was seen that was characterized by an increase in the soft tissue opacity that only partially obscured the blood vessel boundary. In cases of fungal pneumonia, soft tissue nodules with ovoid or rounded shapes that are dispersed throughout the lung tissue reflect an organized interstitial pattern. Alveolar pattern was seen in the same cases as interstitial pattern, but it is more severe. It is characterized by an area of increased soft tissue opacity in the lung tissues that totally block pulmonary blood vessels (Thrall and Robertson, 2022).

In cases of pneumonia and aspiration pneumonia, radiographic images showed a mostly interstitial pattern and alveolar infiltration, with some cases also exhibiting lung consolidation. Megaesophagus was a contributing factor in certain aspiration pneumonia cases. Some chronic infectious respiratory disease cases with radiographic views showed pneumonia mostly characterized by a bronchial pattern, whereas other instances displayed a mixed pattern. According to radiographic views of dogs with kennel cough, the pattern was primarily bronchial; however some cases had mixed patterns (Vindenes *et al.*, 2015).

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The onset of therapy should be determined by the clinical signs. Treatment should last for approximately two weeks, or seven days after health issues have been resolved (Leekha *et al.*, 2011). *B. bronchiseptica* can be specifically detected, using a proven PCR laboratory diagnostic approach.

Disease outbreaks in areas such as animal shelters, kennels, catteries, or research facilities may require a complete diagnostic workup to identify specific causes and determine therapeutic options and preventive measures. For the detection of *B. bronchiseptica*, Bhardwaj *et al*. (2013) hypothesized that PCR was more sensitive than the conventional approach as reported earlier in various investigations. Therefore, multiplex PCR may be suggested for quick diagnosis of suspected Bordetellosis cases.

Management

Infection with bordetella can be treated symptomatically. Maintaining a suitable caloric and fluid intake may be necessary to provide supportive care during the acute phase or extended severe phases occur. Antimicrobials should be administered to animals exhibiting clinical symptoms that last longer than a week or any indications of bacterial pneumonia, such as pyrexia, lethargy, decreased appetite, or an alveolar pulmonary pattern on thoracic radiographs. Because antibiotic resistance is increasingly being recognized, particularly among Bordetella isolates, treatment of bacterial infections, *B. bronchiseptica*, or opportunistic secondary pathogens is best guided by culture and susceptibility testing (Garca-de-la-Fuente *et al.*, 2015).

The primary therapeutic strategy is antibiotic therapy because secondary infections caused by a variety of microorganisms are frequently encountered. Antimicrobial drugs trimethoprim can be used to treat bacterial respiratory tract infections in animals (Pruiiler *et al*., 2015).

The most likely agent to be present should serve as the foundation for empiric antimicrobial therapy. For canines with a possible *B. bronchiseptica* infection, doxycycline is advised. Broad-spectrum antimicrobials are preferable if it is thought that a bacterial infection is caused by an underlying viral illness. (Ford, 2012). Common treatment choices for felines include tetracycline, enrofloxacin, and trimethoprim-sulfamethoxazole. Depending on the specific clinical facts of the animal, they could be administered for a varying length of time, ranging from 7 to 21 days.

Vaccines against *B. bronchiseptica* are administered orally and intravenously to dogs in veterinary settings. It is advised to vaccinate dogs who are at least three weeks old. Local antibody responses elicited by these mucosal vaccinations are not affected by maternal

Published 12.01.2024

antibodies. Although antibodies are also found in milk and may help to protect the intestinal mucosa, maternal antibodies are passed from mothers to their puppies via the colostrums (Decaro *et al*., 2004). In dogs, maternal antibodies can last up to 14 weeks (Day *et al*., 2016).

There are vaccines available for many prevalent chronic respiratory infections, including *B bronchiseptica*, CAV-2, CDV, CPIV, CIV H3N8, and H3N2. With the exception of CDV, these vaccinations reduce the severity of clinical symptoms and the amount of pathogen shedding rather than generating sterilizing immunity. In dogs at risk of exposure, the remaining immunizations are advised (Schulz *et al*., 2014).

There are parenteral and mucosally delivered (intranasal or transoral) vaccinations for CPIV, CAV-2, and *B bronchiseptica*. There is disagreement in the research over how these pathogens should be vaccinated and how that would affect the immune response. To enhance mucosal immune responses and enable quick onset of protection in crowded conditions, such as shelters, intranasal or intraoral vaccination has been advised. Vaccine-induced illness, however, has been known to occur after mucosal vaccination, and it can be challenging to determine whether an illness in a shelter environment is due to the vaccine or a natural infection (Johnson, 2020).

Despite the lack of scientific proof, there has also been concern that *B bronchiseptica* strains used in intranasal vaccines may be able to infect humans through immunosuppression. Intranasal immunisation results in the establishment of low serum immunoglobulin G (IgG) titers, whereas parenteral vaccination results in larger serum IgG responses. Intranasal immunisation may offer more clinical protection against challenge than oral vaccination, according to some studies (Reagan, 2021).

Although vaccination is a significant preventive measure, additional safety measures must be performed because immunisation does not offer complete immunity from all illnesses (Ellis *et al*., 2022).

In situations involving group housing, precautionary measures should be taken, such as isolation periods for dogs and cats before reentering the population, routine monitoring for the emergence of clinical signs with the group, and quarantine protocols for dogs displaying clinical signs linked to chronic infectious respiratory diseases in dogs. The population should not be overcrowded, and stress should also be avoided. Facilities should be available in the event of an epidemic, and there should be an infectious disease strategy in place to restrict exposure to other canines inside the facility, separating sick animals from the general population, and following the appropriate disinfection protocols (Regan and Sykes, 2020).

Published 12.01.2024

According to Rheinwald *et al.* (2015), the majority of cultivated bacteria are only weakly responsive to this standard antibiotic for canine respiratory tract infections. *B. bronchiseptica* is the sole isolate that is totally sensitive to doxycycline. Predisposing variables should be eliminated if they are found. *B. bronchiseptica*-based intranasal vaccinations produce local protective immunity and are unaffected by maternal antibodies. (Ford, 2012).

RECOMMENDED VACCINATIONS

TRADE NAME	Species	TYPE OF VACCINE	AGE	ROUTE AND DOSE	BOOSTER
NOBIVAC®INTRA-TRAC®KC	Canine	Canine Parainfluenza Virus (modified live virus), *Bordetella Bronchiseptica* (avirulent live culture)	3 weeks of age	0.4 mL dose in one intranasal	Annually
Intra-Trac®$_3$	Canine	Canine Adenovirus 2, Canine ParainfluenzaVirus (modified live viruses), *Bordetella Bronchiseptica* (avirulent live culture)	3 weeks of age	Intranasal single-nostril administration 0.5 mL	Annually
NOBIVAC® INTRA-TRAC®$_3$ ADT	Canine	Canine Adenovirus 2, Canine Parainfluenza Virus (modified live viruses), *Bordetella Bronchiseptica* (avirulent live culture).	3 weeks of age	0.5mL intranasal	Annually
FELINE-BB	Feline	*Bordetella bronchiseptica* (avirulent live culture), administered as a small dose to one nostril.	8 weeks of age	0.2 mL intranasal into one nostril	Annually

References

Abd Alfatah, M. E. (2019). A review on bacterial and fungal diseases in dogs. *JSM Veterinary Medicine*, 2(7).

Bhardwaj, M., Singh, B. R. and Vadhana, P. (2013). *Bordetella bronchiseptica* infection and kennel cough in dogs. *Advances in* Animal *and* Veterinary *Sciences*, 1: 1-4.

Chambers, J. K., Matsumoto, I., Shibahara, T., Haritani, M., Nakayama, H. and Uchida, K. (2019). An outbreak of fatal *Bordetella bronchiseptica* bronchopneumonia in puppies. *Journal* of Comparative *Pathology*, 167: 41-45.

Day, M. J., Horzinek, M.C., Schultz, R. D., Squires, R.A. (2016). Vaccination Guidelines Group (VGG) of the World Small Animal Veterinary Association (WSAVA). *Journal* of *Small Animal Practice*, 57(1): E1-E45.

Ellis, J., Marziani, E., Aziz, C., Brown, C. M., Cohn, L. A., Lea, C. and Taneja, N. (2022). AAHA Canine Vaccination Guidelines. *Journal* of the *American Animal Hospital Association*, 58(5): 213-230.

Ford, R. B. (2012). Canine infectious respiratory disease. Infectious Diseases of the Dog and Cat*; Sykes, J., Greene, CE, Eds*, 55.

Garbal. M., Adaszek, Ł., Łyp. P., Frymus. J., Winiarczyk M. and Winiarczyk S. Occurence of Bordetella bronchiseptica in domestic cats with upper respiratory tract infections. *Polish Journal of Veterinary* Sciences. 2016;19(2): 353-8. doi: 10.1515/pjvs-2016-0043. PMID: 27487509.

García-de-la-Fuente, C., Guzman, L., Cano, M. E., Agüero, J., Sanjuán, C., Rodríguez, C. and Martínez-Martínez, L. (2015). Microbiological and clinical aspects of respiratory infections associated with *Bordetella bronchiseptica*. *Diagnostic Microbiology* and *Infectious Disease*, 82(1): 20-25.

Gaskell R, Dawson S, Radford A. Feline respiratory disease. In: Greene CE, ed. Infectious Diseases of the Dog and Cat. 3rd ed. St. Louis, MO: Saunders/Elsevier; 2006:147.

González, G. M., Rosales, M. E., Morales, G. B. and Crespo, J. A. M. (2006). Isolation and characterization of *Bordetella bronchiseptica* strains from canine origin. *Veterinaria* Mexico, 37(3): 313-325.

Leekha, S., and Standiford, H. C. (2011). Empiric antimicrobial therapy for Gram-negative sepsis: back to the future. *Critical Care Medicine*. 39(8): 1995-1996.

Mercks animal health USA. https://www.merck-animal-health-usa.com/nobivac/nobivac-intra- trac3-adt

Melvin, J. A., Scheller, E. V., Miller, J. F. and Cotter, P. A. (2014). *Bordetella pertussis* pathogenesis: current and future challenges. *Nature Reviews Microbiology*, **12**(4): 274- 288.

Milanov, D., Dilas, M., Velhner, M. and Aleksic, N. (2018). Laboratory diagnosis of *Bordetella bronchiseptica* tracheobronchitis in dog. *Archives of Veterinary Medicine*, **11**(2): 33-41

Parkhill, J., Sebaihia, M., Preston, A., Murphy, L. D., Thomson, N., Harris, D. E. and Maskell, D. J. (2003). Comparative analysis of the genome sequences of *Bordetella pertussis*, *Bordetella parapertussis* and *Bordetella bronchiseptica*. *Nature Genetics*, **35**(1): 32-40.

Reagan, K. L. (2021). Greene's Infectious Diseases of the Dog and Cat. Bordetellosis. pp. 669-678.

Rheinwald, M., Hartmann, K., Hähner, M., Wolf, G., Straubinger, R. K. and Schulz, B. (2015). Antibiotic susceptibility of bacterial isolates from 502 dogs with respiratory signs. *Veterinary Record*, **176**(14): 357-3

Schulz, B.S., Kurz, S., Weber, K., Balzer, H.J., Hartmann, K. (2014). Detection of respiratory viruses and *Bordetella bronchiseptica* in dogs with acute respiratory tract infections. *Veterinary Journal*, **201**: 365–369

Thrall, D. E. and Robertson, I. D. (2022). *Atlas of Normal Radiographic Anatomy and Anatomic Variants in the Dog and Cat-E-Book. Elsevier Health Sci*.

Vindenes, T., Gillespie, W. B., Gawoski, J., Ooi, W. W. and Wener, K. (2015). Kennel Cough in a Dog and His Best Friend: *Bordetella bronchiseptica*: Causing pneumonia transmitted from Dog and a review of the literature. *Infectious Disease in Clinical Practice*, **23**(3): 118-122.