

Kennel Cough Facts

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Introduction

Kennel cough (KC) is a common term used to describe infectious tracheobronchitis in dogs. Kennel cough is the most common cause of sudden-onset, paroxysmal, “honking” or hacking cough (often in association with gagging and retching behavior) in dogs.¹¹ Recent contact with a single or group of infected dogs (with or without clinical signs) predisposes your dog to developing KC. The disease is usually mild and self limiting and often resolves with no, or minimal, medical intervention. Under certain circumstances such as immunocompromised dogs, dogs with chronic abnormalities of the respiratory tract, or dogs with increased exposure to infectious agents outside of the KC complex, the disease can be more severe and necessitate a thorough physical examination and diagnostic evaluation of the animal. A comprehensive review of the diagnosis and treatment of KC is available in the literature¹⁵ and will not be covered in detail here.

A discussion of the infectious agents involved in the KC complex, as well as methods of immunization against these agents, should minimally include *Bordetella bronchiseptica*, canine parainfluenza virus (CPIV), and canine adenovirus type 2 (CAV-2). Most routine canine vaccination programs include CPIV as well as CAV-2. Parenteral (injectable) vaccination with CAV-2 protects dogs against both infection and disease because local immunity is induced in the respiratory tract.¹ Additionally, parenteral (as well as intranasal) vaccination with CPIV provides protection against CPIV induced disease.^{9,16} As such, the unique characteristic of a kennel cough vaccination program is often the selection of an appropriate type of *B. bronchiseptica* vaccine.

Bordetella bronchiseptica is a well adapted pathogen of the canine upper respiratory tract. This bacterial organism produces several virulence factors that are responsible for its ability to cause disease. *B. bronchiseptica* produces proteins on its exterior that allow it to adhere to the surface of the respiratory tract tissue^{20,22,24} and it secretes toxins that destroy or inhibit functions of normal cells within the respiratory tract and the immune system.^{7,13,14} *B. bronchiseptica* can also invade cells.²⁵ This ability to enter host cells can offer bacterial pathogens several survival advantages³⁰ and may be of special importance in the pathogenesis of canine *B. bronchiseptica* infections.

Bordetella bronchiseptica is the most common bacterial isolate from dogs with KC^{2,8,11} and can be responsible for causing the disease in the absence of any prior or concurrent viral respiratory tract infections.^{5,27,29} Additionally, *B. bronchiseptica* can survive for periods of up to 24 weeks when inoculated into lake water and buffered saline solution.²³ The effect of these findings on the overall epidemiology of KC remains to be seen. At the least, they question the idea that *B. bronchiseptica* is an obligate respiratory tract pathogen that is unable to survive outside natural

hosts. As such, vaccination could become increasingly important and efforts to improve vaccine effectiveness should continue.

Vaccines

The types of vaccines available to control KC include, avirulent live cultures, whole cell bacterins, and antigenic extracts. The avirulent live vaccines contain *B. bronchiseptica*, with or without modified live CPIV and CAV-2 (*Table 1*). Avirulent live kennel cough vaccines are administered intranasally and have the benefit of being effective in the face of maternal antibodies (antibodies originating in the mother and passed to her puppies through absorption of ingested colostrum).⁴ This effectiveness in the face of colostrum immunity makes their use in young dogs more appealing as reimmunization may not be required. Some product variability exists in this regard and the specific recommendations of the manufacturer should be followed. The ability of these products to prevent both infection and disease is due to the production of local secretory antibodies within the surface of the respiratory tract and antibodies in the systemic circulation.⁶ However, this protection can only be accomplished if the vaccination-induced immunologic response matches the characteristics involved in the disease. Vaccination with an intranasal product results in the production of specific secretory antibodies in the nasal secretions within 4 days. These dogs are 96% protected from post vaccine challenge with virulent, non-vaccine strains of *B. bronchiseptica* and CPIV.⁶ Unfortunately, the duration of this immune response was not definitively determined in this study. In a similar study, the isolation of virulent CPIV and *B. bronchiseptica* from challenged dogs was shown to be significantly reduced in vaccinated as compared to unvaccinated dogs.¹⁶ Because these are live organism vaccines, careful consideration should be given to their use in animals with compromised immune systems.³ Precautions should also be taken to prevent the inadvertent subcutaneous injection of these products as serious consequences have been reported.²⁸

One whole-cell bacterin of *B. bronchiseptica* is marketed for the immunization of dogs (*Table 2*). Vaccines of this type induce systemic antibodies and prevent disease in 67-75% of dogs experimentally challenged with *B. bronchiseptica*.^{18,19} This systemic antibody response is responsible for protecting dogs from disease, however, the ability of bacterins to stimulate local secretory immunity has not been evaluated. In fact, findings consistent with rhinitis, bronchitis, or tracheitis were noted in 50-100% of vaccinated dogs following exposure to *B. bronchiseptica*.^{18,19} Consequently, these products may protect the dog from disease, but not necessarily from infection. A second consideration in choosing a bacterin as a means of immunization is the presence of maternal antibodies. Colostral antibodies can necessitate multiple vaccinations in young puppies by interfering with the development of a systemic immune response.⁴ In addition, bacterins may contain endotoxin, a component of gram-negative bacterial cell walls. Endotoxin contamination can lead to systemic vaccination reactions and occasionally death.²⁶

The 1997-1998 Compendium of Veterinary Products lists 3 extracted antigen vaccines for the prevention of canine bordetella infections and to aid in the control of KC (*Table 3*). These products are prepared by extracting the desired antigen(s) from whole *B. bronchiseptica* cells with the remaining cell debris and toxins (endotoxin) being discarded.²⁶ Unfortunately, the

protective antigens of canine *B. bronchiseptica* infections are uncertain and information regarding the antigen(s) included in these vaccines is not available. As is the case with whole cell bacterins, the immunologic response to antigenic extracts is inhibited by the presence of colostral antibodies. Again, for this reason multiple vaccinations are required in young dogs. Studies using antigenic extracts demonstrate their ability to significantly reduce the shedding of *B. bronchiseptica* in experimentally infected dogs.²⁶ Additionally, vaccinated dogs are able to eliminate the organisms from their respiratory tract more rapidly than unvaccinated dogs.²⁶

The question still remains as to the proper vaccine to select for your dog or kennel situation. Perhaps the best suggestion that can be made at this time is to keep all the options in mind and select the appropriate vaccine for each individual set of circumstances. Avirulent live organism vaccines are not an appropriate selection for dogs with compromised immune systems or chronic diseases of the respiratory tract.⁴ These products are not affected by the presence of maternal antibodies, however, and therefore may be the best option for dogs between 2 and 14 weeks of age.¹⁰ Additionally, the combined use of different classes of *B. bronchiseptica* vaccines in a vaccination program may optimize protection.^{3,4} The idea of maximizing systemic immunity and mucosal immunity at the same time certainly deserves additional research. Consider discussing the options available with your veterinarian.

Kennel Cough Outbreaks and Current Research

Several outbreaks of KC have occurred in Greyhounds over the last few months (late fall 1998-early winter 1999). While these outbreaks did result in many dogs being temporarily unable to perform, to our knowledge, no deaths can be attributed to the pathogens associated with the KC complex. Additionally, these outbreaks should not be a concern for owners of companion Greyhounds and should not discourage anyone from considering adoption of a retired racing Greyhound. As always, if you are considering adding a recently retired Greyhound to your household, and if you already have dogs in the house, you should make every attempt to isolate the new arrival from your pets for a minimum of two weeks. This observation period allows you to make sure the new dog is not showing clinical signs of infectious disease and minimizes the chance of exposing other animals to infectious agents.

The recent KC outbreaks occurred in well-vaccinated dogs and reinforces our position that improvements in KC vaccines are overdue. With the support of the Kansas Racing Commission, our research is directed towards identifying the protective immunological response associated with this disease in dogs. Similar advances in medicine have resulted in a new and more effective vaccine for the control of whooping cough in humans.^{12,17} Whooping cough is caused by the closely related bacteria *Bordetella pertussis*.²¹ The new acellular vaccines for the prevention of whooping cough are as much as 48% more effective.¹² In addition, these studies demonstrate that the effectiveness of the standard whole cell whooping cough vaccines (similar to those currently used in veterinary medicine) are unexpectedly low.¹² The remarkable similarities between whooping cough and KC suggests the same may be true for most of the KC vaccines currently being used. Identification of the protective antigens associated with KC will allow us to better control this disease.²⁰ Funding sources for companion animal research are

increasingly difficult to find. As such, the need does exist for the continued financial support of advanced research on infectious diseases of dogs.

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Table 1: Avirulent live vaccines

Product Name	Composition	Manufacturer or Distributor
Bronchi-Shield III	CAV-2, CPIV, Bb	Fort Dodge Laboratories, Fort Dodge, IA
Intra-Trac-II	CPIV, Bb	Schering-Plough Animal Health Corporation, Kenilworth, NJ
Intra-Trac-II ADT	CPIV, Bb	Schering-Plough Animal Health Corporation, Kenilworth, NJ
Naramune-2	CPIV, Bb	Bio-Ceutic Division, Boehringer Ingelheim Animal Health Inc., St. Joseph, MO
Nasaguard-B	Bb	Pfizer Inc., North American Animal Health, Exton, PA
Progard-KC	CPIV, Bb	Intervet Inc., Millsboro, DE

CAV-2 = canine adenovirus type 2

CPIV = canine parainfluenza virus

Bb = *Bordetella bronchiseptica*

Table 2: Whole cell bacterin

Product Name	Composition	Manufacturer or Distributor
CoughGuard-B	Bb	Pfizer Inc., North American Animal Health, Exton, PA
Vanguard-5B	Bb, CPIV, CAV-2, CDV, CPV	Pfizer Inc., North American Animal Health, Exton, PA

CAV-2 = canine adenovirus type 2

CPIV = canine parainfluenza virus

Bb = *Bordetella bronchiseptica*

CDV = canine distemper virus

CPV = canine parvovirus

Table 3: Nonadjuvanted antigenic extract

Product Name	Composition	Manufacturer or Distributor
Performer Borde-Vac	Bb	Bayer Corporation, Shawnee, KS. Distributed by Agri Laboratories Ltd., St. Joseph, MO
Camune B (Discontinued)	Bb	Bayer Corporation, Shawnee, KS
Bronchicine	Bb	Bayer Corporation, Shawnee, KS

Bb = *Bordetella bronchiseptica*