Kennel cough is a persistent problem

New information on etiologic agents and innate host defenses may lead the way to better prophylaxis and treatment of this common upper respiratory disease complex.

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Although usually not life threatening, kennel cough, or canine infectious tracheobronchitis (CITB), is an irritating and occasionally prolonged problem for dogs and their owners. CITB continues to be a significant clinical problem despite both the use of single component and combination vaccines containing microbes implicated as etiologic agents, as well as frequent antibiotic therapy. What factors contribute to these less-than-optimal responses to prophylaxis and treatment, and how can new information allow practitioners to better control CITB?

What causes CITB?

Although *Bordetella bronchiseptica* has become synonymous with CITB in the minds of many, it is important to remember that CITB can be multifactorial, involving a variety of infectious, host, and environmental co-factors. Data from experimental and epidemiologic studies indicate that *B. bronchiseptica* can be a primary pathogen in dogs; however, it is also recognized that infection with *B. bronchiseptica* can be secondary to, or synergistic with, other pathogens.1-5*

In addition to recognized viruses, such as parainfluenza virus and canine adenovirus type 2 (CAV-2), which are contained in many CITB vaccines, recent investigations have implicated previously unrecognized or emergent pathogens as etiologic agents in CITB.2-4 Some of these include group two canine (respiratory) coronavirus (Figure 1), canine influenza virus, and *Mycoplasma* species, and more will undoubtedly be discovered. These agents can be difficult to diagnose clinically, and none of them are included in any currently available canine vaccines. These new data are consistent with the concept that CITB is often not a simple host-parasite relationship and demonstrate the complexity of managing CITB in the absence of appropriate vaccines.

Why do kennel cough vaccines fail?

Despite the frequent—and often mandated—use of vaccines before boarding, CITB continues to be a problem in many kennels. Vaccines against *B. bronchiseptica* and, to a lesser

*Figure 1: Bronchitis associated with canine respiratory coronavirus infection. Note coronavirus-infected bronchiolar epithelial cells (brown-stained) and inflammatory debris in the airway lumen.*

*Figure 2: Bordetella bronchiseptica* colonizing cilia of epithelial cells in a transtracheal wash.
extent, CAV-2 and parainfluenza virus, have shown efficacy in reducing disease in experimentally infected dogs, so why don’t they always work in a clinical situation?

There are two major reasons why these vaccines may fail in some situations. First of all, CITB vaccines are often administered on the day of boarding or a few days before. Although the data are conflicting regarding the onset of clinical immunity,6-7 it is likely that the interval between vaccination and exposure does not provide ample time for the development of an adaptive immune response after entering the kennel. Another more important possibility is that the available vaccines do not contain the most relevant pathogens involved in disease outbreaks. There is no more certain reason for vaccine failure than not including the appropriate etiologic agent in the vaccine, and this probably happens more often than not.

What really causes the clinical disease associated with CITB?

A major factor that can explain a poor response to antimicrobial therapy alone in CITB cases is that much of the clinical disease is caused by the host’s inflammatory response to the etiologic agents. This is certainly true in cases of *B. bronchiseptica* and *Mycoplasma* infection that do not invade beyond the mucosal surface (Figure 2) but have many proinflammatory molecules that induce inflammation in the respiratory tract. The paroxysmal coughing and retching characteristic of CITB are the dog’s attempt to rid the airways of the excess mucus and cellular debris that accumulate as a result of microbe-induced inflammation.

Consistent with this idea, several studies have documented clinical improvement following the use of various antitussives, with or without bronchodilators, as adjunct therapy in CITB.6 However, aside from some inconclusive data concerning the use of glucocorticoids, no controlled studies have examined the use of newer anti-inflammatory drugs, such as nonsteriodals, as adjunct therapy. A better examination of this therapeutic approach may provide improved control of clinical CITB.

Can current CITB vaccines enhance innate immunity?

Since the advent of vaccination to control infectious diseases, most interest and research in immunology has been focused on acquired immunity, including antigen-specific antibody and cell-mediated immune responses. In recent years, there has been a renaissance of interest in innate immunity and non-specific responses that occur early in an infectious disease process.9 It is now understood that infectious agents have generic danger signals that the vertebrate host recognizes in addition to the specific antigens that stimulate acquired immune responses. These danger signals are structural components of viruses and bacteria, such as unique DNA motifs, endotoxin, and single-stranded RNA, which vertebrates recognize as foreign. These microbial components interact with specific receptors, called Toll-like receptors, on the surface of a variety of cell types, including cells of the immune system. This interaction results in intracellular signal transduction and the secretion of a variety of cytokines, such as interferon. Interferon has direct antimicrobial effects and enhances innate immunity by stimulating neutrophil and macrophage activity.

Although it has not yet been examined in detail in dogs, it is likely that intranasal delivery of vaccines containing *B. bronchiseptica* or viruses can stimulate local innate immunity through interactions with several Toll-like receptors. This stimulation of the innate immune response may account for the observation that intranasal vaccine administration immediately before boarding can have an apparent sparing effect on the incidence and severity of CITB.7-10

By compiling the current knowledge about innate and acquired immunity, the best prophylactic approach for CITB may be to recommend routine vaccination for the maintenance of immunologic memory and acquired immunity, combined with intranasal administration of vaccines prior to boarding or co-mingling, to enhance innate immunity just before microbial challenge.

*References on page 3.*

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**Table 1: Additional vaccines to consider for boarding dogs**

In addition to vaccines for CITB, clients should be sure that their dogs are appropriately vaccinated for other important pathogens, such as:
- canine parovirus
- canine distemper virus.

These pathogens can cause severe and often fatal disease in populations of nonvaccinated or inadequately vaccinated dogs.

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References


