Clinical and microbiologic findings in dogs with bronchoscopically diagnosed tracheal collapse: 37 cases (1990–1995)

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Objective—To investigate the role of bacteria in bronchoscopically diagnosed tracheal collapse in dogs by evaluating qualitative results of bacteriologic cultures.

Design—Retrospective study.

Animals—37 dogs with tracheal collapse.

Procedure—Clinical records for dogs with tracheal collapse confirmed with bronchoscopy were reviewed. A protected catheter brush was used to obtain samples for bacteriologic culture from the large airways.

Results—Results of bacterial culture were negative for 5 of 29 dogs. For 24 dogs, 1 (n = 10), 2 (6), or ≥ 3 (8) species of bacteria were isolated. Pseudomonas spp were isolated most frequently (17/29), and a single Pseudomonas sp grew in 7 samples. Other bacteria included Enterobacter spp (4/29), Citrobacter spp (3/29), and Moraxella spp, Klebsiella spp, Bordetella spp, or Acinetobacter spp (2/29 dogs each). Anaerobic and aerobic cultures yielded positive results in samples from 2 dogs. Cytologic results were available for 13 dogs with positive results of bacteriologic culture; epithelial cells were reported most commonly. Five samples had a small number of neutrophils; bacteria were identified cytologically in 2 of 5 samples that contained neutrophils. Bacteria were also seen in 2 samples that lacked inflammatory cells.

Conclusions and Clinical Relevance—Bacteria are commonly isolated from samples obtained via airway brushing in dogs with tracheal collapse; however, in the absence of cytologic confirmation of inflammation or infection, an association between bacteria and clinical signs of tracheal collapse cannot be established. (J Am Vet Med Assoc 2001;219:1247–1250)

Tracheal collapse is a common cause of coughing in small-breed dogs. Affected dogs are typically middle-aged, with a waxing and waning history of cough, respiratory difficulty, or both. Collapse occurs in the cervical or intrathoracic portion of the trachea or both; the principal bronchi and lower airways may also be involved. Investigations into the pathologic features of this disorder reveal hypocellular cartilage rings in some affected dogs. The resulting deficiency in glycosaminoglycans, calcium, and cartilage matrix allows collapse of the airway during the pressure changes that develop with inspiration and expiration. Although the pathologic defect in cartilage structure is persistent, it is clinically recognized that dogs have variable clinical signs of airway collapse. Possible explanations for exacerbations of signs associated with airway collapse include airway infection or inflammation, tracheal irritation associated with intubation or trauma, and cardiomegaly or congestive heart failure.

Dogs with tracheal collapse often receive antimicrobials, but the role of bacterial infection of the airways in this disease remains unclear. In a study of 100 dogs, tracheobronchial samples were examined in 14; positive results of aerobic bacteriologic cultures were obtained in 8 dogs, with growth of Pseudomonas spp, coliforms, and Staphylococcus spp. Tracheal samples collected during tracheobronchoscopy yielded positive results in 99% (84 of 85) of dogs treated surgically for tracheal collapse, with gram-negative bacteria and mixed populations of Staphylococcus spp, Pseudomonas spp, Corynebacterium spp, Pasteurella spp, and Escherichia coli isolated most commonly. The clinical importance of these findings is difficult to interpret, because the method used to collect respiratory tract samples and corresponding cytologic findings was not described. In addition, Pasteurella spp, Staphylococcus spp, Streptococcus spp, and Klebsiella spp have been cultured from the trachea of healthy dogs, and pharyngeal bacteria are commonly isolated from the lower airways. Because the trachea is not sterile, positive results of bacteriologic cultures from the large airways are difficult to interpret.

Bacterial infection of the airways is generally accompanied by cytologic evidence of supplicative inflammation and detectable intracellular bacteria. Substantial growth of a single bacterial species in culture media also suggests infection. A combination of microbiologic and cytologic results must be used to characterize pathologic processes in the airways. The purpose of the study reported here was to investigate the role of bacteria in bronchoscopically diagnosed tracheal collapse in dogs by evaluating qualitative results of bacteriologic cultures. We hypothesized that this information would assist clinicians in making diagnostic and therapeutic decisions for dogs with tracheal collapse.

Criteria for Selection of Cases

The endoscopy database at the University of Missouri Veterinary Teaching Hospital was searched from 1990 to 1995 for a diagnosis of tracheal collapse in dogs. Clinical information was collected only in dogs with bronchoscopically identified tracheal collapse.

Procedures

Medical records and bronchoscopy reports were reviewed for completeness and results of bacteriologic
culture. In some cases, the diagnosis of tracheal collapse was confirmed by review of bronchoscopy video-tapes, but technical difficulties precluded the viewing of many recordings. In these cases, the diagnosis of tracheal collapse was validated by assessment of the endoscopy report written by the attending clinician at the University of Missouri, who was a resident in training (68% of cases) or a faculty member (32% of cases). Clinical data were collected for all dogs with bronchoscopically diagnosed tracheal collapse, including history, signalment, bronchoscopy findings, and results of airway sampling.

All dogs had bronchoscopy performed under general anesthesia by use of a 5-mm bronchoscope. Tracheal collapse was identified as a reduction in the dorsoventral dimension of the airway in the cervical or intrathoracic segment according to standard descriptions, although collapse was not graded in all dogs. Collapse of the left or right principal bronchus was also recorded.

Following complete visual inspection of the airways, a guarded catheter brush was extended into the airways below the level of the principal bronchus. The brush was extruded and gently rotated across the surface of the mucosa to collect a sample for bacteriologic culture. The catheter brush was retracted into the bronchoscope and immediately withdrawn; sterile technique was used to insert the brush into thioglycolate broth. In 15 dogs, a brush cytology sample was collected from a similar region in the principal bronchus. A guarded catheter brush was extruded and gently rotated across the surface of the mucosa to collect a sample for bacteriologic culture. The catheter brush was retracted into the bronchoscope and immediately withdrawn; sterile technique was used to insert the brush into thioglycolate broth. In 15 dogs, a brush cytology sample was collected from a similar region in the principal bronchus. A guarded catheter brush was extruded and gently rotated across the surface of the mucosa to collect a sample for bacteriologic culture. The catheter brush was retracted into the bronchoscope and immediately withdrawn; sterile technique was used to insert the brush into thioglycolate broth.

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Bacterial involvement is often implicated in humans with chronic obstructive lung disease or chronic bronchitis when clinical signs worsen.
although considerable controversy surrounds the role of bacteria in exacerbation of these diseases.10,12 Bacteria that are detected in culture may be attributed to colonization of the airways without true infection or aspiration of oropharyngeal contents, and false-positive culture results may lead to inappropriate use of antimicrobials. It is important to clarify the role of bacteria in the pathogenesis of disease in order to use antimicrobial treatments judiciously. Clinical decisions regarding the use of antimicrobials in dogs with chronic respiratory tract disease must also be made on the basis of a rational diagnostic work-up, including bacteriologic culture and cytologic evaluation of properly obtained samples.

Bacteria are commonly isolated from dogs with tracheal collapse, but the methods used to confirm the presence of bacteria in lower airways are often lacking in detail. Recent reviews2,3 have included endoscopic criteria of tracheal collapse, but methods for collection and examination of respiratory secretions have not been clearly elucidated. In our study, bacteria were isolated from 83% of samples obtained with a sterile protected catheter. Use of the protected catheter brush through the endoscopic biopsy channel limits contamination of the sample, because the endoscope is passed through the oropharynx and large airways. In healthy dogs, a nonendoscopic method for obtaining respiratory tract samples used a similar protected catheter technique to obtain swab specimens from the lower portion of the trachea for bacteriologic culture, and 34% of dogs had bacterial growth, indicating that the lower airways are not sterile. In those healthy dogs, Pasteurella and Streptococcus spp were most commonly isolated from the trachea, whereas Pseudomonas spp and enteric bacteria were found more commonly in dogs with tracheal collapse in our study. In our study, all bacteriologic cultures were obtained after incubation in enrichment broth, whereas in healthy dogs, flora were determined after growth in agar plates or in thioglycollate broth. Our results indicate that bacteria can be isolated from the large airways more often in dogs with tracheal collapse, compared with healthy dogs, and that the spectrum of isolated bacteria differs somewhat from that found in healthy dogs.

In our study, qualitative bacteriologic cultures in 10 of 29 dogs yielded pure growth of a single organism in culture. Potential primary pathogens isolated in pure culture included P aeruginosa (2/10 dogs) and B bronchiseptica (2/10); other Pseudomonas spp isolated in pure culture could potentially be pathogenic in compromised hosts. However, the clinical importance of pure cultures of these bacteria remains unclear, because the density of bacteria in the airways is unknown when qualitative cultures are performed. Thioglycollate enrichment broth was used to ensure isolation of fastidious organisms,7 but the enrichment procedure could have resulted in clonal expansion of a single bacterial isolate. Despite the use of sterile technique, contamination of samples during collection or processing remains a possibility. In healthy dogs with positive results of pharyngeal and tracheal bacteriologic cultures, isolates were identical in 80% of dogs, suggesting that aspiration of oropharyngeal bacteria results in tracheal inhabitation by bacteria. Oropharyngeal bacteria were not obtained in the dogs examined here to rule out the possibility of oropharyngeal aspiration. Interestingly, Pseudomonas spp were the most common bacteria isolated from the oropharynx of dogs with tracheal collapse in a previous report,9 and it is possible that dogs with tracheal collapse commonly harbor Pseudomonas spp in the pharynx and larger airways, perhaps because of poor clearance of respiratory secretions.

Recently, quantitative bacteriologic cultures of bronchoalveolar lavage (BAL) fluid have been recommended to detect clinically important bacterial loads in the lower respiratory tract.2 The BAL technique isolates a wedge of lung, including small bronchioles and alveoli, and collects representative airway lining fluid from that lung segment. Airway samples with ≥1.7 X 103 colony-forming units/ml of BAL fluid can be considered indicative of infectious processes.17 In our study, quantitative bacteriologic cultures from the airways of dogs with tracheal collapse would provide evidence for or against a role for bacterial infection in the clinical signs of disease.

In the large airways of healthy dogs, growth of mixed bacterial species developed in 17% of samples; however, in dogs with tracheal collapse in our study, 59% of cultures had growth of >1 species of bacteria. Growth of mixed bacterial species could be indicative of a compromised respiratory tract or true infection of the lower respiratory tract. In transtracheal aspirates from dogs with lower respiratory tract infection, standard bacteriologic culture revealed growth of mixed bacteria in 43% of samples, with enteric organisms primarily E.coli, Pasteurella spp, and anaerobes isolated most commonly.13 Also, in a clinical review14 of bacterial pneumonia, tracheal aspirates resulted in mixed aerobic bacterial growth for 11 of 28 (39%) dogs, with Pasteurella spp, E.coli, Moraxella spp, and gram-positive organisms predominating. The dogs with tracheal collapse did not have a clinical diagnosis of infection of the lower respiratory tract, suggesting that mixed bacterial species do not always cause damage to the host.

Bronchoscopy and BAL have recognized importance in the diagnosis of disease of the lower respiratory tract, and reference ranges have been established for differential cell counts in BAL fluid from healthy dogs.34 Abnormal cell distribution characterizes the type of respiratory disease present,3,15 and the presence of inflammatory cells with intracellular bacteria is characteristic of infection.3 However, little is known about the usefulness of brush cytology in the diagnosis of diffuse airway disease, respiratory infection, or pneumonic processes.16 In our study, brush cytologic examinations revealed respiratory epithelial cells in most dogs (10/13), and inflammatory cells were seen in samples from a small number of dogs. No intracellular bacteria were detected that would support a role for bacteria in tracheal collapse. These unremarkable results may be attributed to the absence of pathologic changes in airways of dogs with tracheal collapse or to the limited region of the airway sampled by mucosal...
brushings. Brush cytology appears to be best suited for characterization of isolated mucosal lesions, whereas BAL is useful for evaluating diffuse or widespread lower airway disease.

Dogs identified in this study were similar to those in other reports of tracheal collapse. More than 75% were small-breed dogs, with no sex or age bias represented, and a wide age range was affected (3 months to 14 years). Coughing and dyspnea were common clinical complaints, and many dogs had clinical signs for years prior to the diagnostic work-up. Although isolated cervical tracheal collapse was found frequently (13/37 [35%] dogs), involvement of both the cervical region and the intrathoracic segment or principal bronchi was detected most commonly (17/37 [46%] dogs).

Qualitative bacteriologic cultures from enrichment broth yielded positive results in 24 of 29 (83%) samples; however, the role of bacteria in development of clinical signs in these dogs remains difficult to define. The possibility of expansion of a single bacterial isolate in samples that yielded pure culture cannot be ruled out. The protected catheter brush technique limits oropharyngeal contamination of culture samples, but use of enrichment broth for culture makes it impossible to make quantitative assessments of bacterial numbers. Cytologic specimens were obtained in less than half the dogs examined by use of bronchoscopy, and brush cytologic examination was performed, which has not been critically evaluated for documentation of airway infection or inflammation. In the dogs reported here, positive bacteriologic culture results were not associated with cytologic evidence of infection or inflammation, suggesting that the bacteria were not pathogenic. Presently, a clear indication for the use of antimicrobials in dogs with tracheal collapse has not been established.

References