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Isolation of *Streptococcus pneumoniae* Type 3 from Equine Species

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***Streptococcus pneumoniae* type 3 was isolated from seven tracheobronchial aspirates and one pleural tap of seven adult horses and one foal. There was no direct evidence in these horses that isolation of the pneumococcus was related to a specific disease syndrome. Presenting complaints included two horses with chronic cough, two horses with decreased exercise tolerance, one horse with exercise-induced pulmonary hemorrhage, and three horses with pneumonia. Antibiotic therapy resolved the primary clinical complaint. This is the first report of the isolation of *S. pneuomoniae* type 3 from adult horses.**

Streptococcus pneumoniae is an alpha-hemolytic, gram-positive diplococcus and is easily differentiated from other alpha-hemolytic streptococci by its susceptibility to optochin. All 84 serotypes are pathogenic for humans. Pneumococcal infections have been documented in animals (6, 12), but this pathogen has received no attention in veterinary microbiology texts (4, 5, 8, 13).

Pneumococci are normal residents of the upper respiratory tracts of humans, with the carrier state ranging from 5 to 60%, depending on immediate environmental conditions and season (2). The upper respiratory disease induced by pneumococci is a well-defined clinical and pathological entity.

Pneumococcal infection in horses has not been reported in recent years, although a number of cases were reported during the early 1900s and have been summarized in a monograph on *Streptococcus* infections by Romer (12). These early reports were questioned because of a concern about the reliability and validity of the methodology used to identify the streptococcal species (12). The early reports present clinical data on foals, with no mention of a pneumococcal infection in adult horses or transmission of the microbe to humans. The most recent report of pneumococcal disease in horses appeared in 1941 (9) and described a pneumococcal septicemia concomitant with joint infections, pneumonia, pleurisy, and pericarditis with enlargement of spleen and liver in a foal. The serotype of the pathogen was not determined.

We have isolated *S. pneumoniae* type 3 from seven tracheobronchial aspirates and one pleural tap of seven adult horses and one foal that were referred to George D. Widener Hospital, New Bolton Center, University of Pennsylvania, Kennett Square. The type 3 encapsulated organism is one of the most virulent forms of the pneumococcus and produces a lethal infection in humans when left untreated (1). In contrast, acute pneumococcal infection was not obvious in the clinical histories of the horses described in this paper.

MATERIALS AND METHODS

The eight horses were referred to George D. Widener Hospital with different presenting complaints (see Table 1) between June 1981 and May 1983. The age range was 3 to 4 years old, except for horse 8 (6 months). The tracheobronchial aspirates and pleural fluid were obtained by routine methods that have been previously described (3, 10), and the specimens were plated directly onto both sheep blood agar and MacConkey agar plates (Scott Laboratories, Fiskeville, R.I.) Samples were placed into sterile thioglycolate broth and subcultured to blood agar and MacConkey agar after 48 h of incubation. *S. pneumoniae* was identified from the blood plates by standard procedures (7). Mucoid alpha-hemolytic colonies were transferred to another blood agar plate to test for optochin susceptibility. Bile-esculin broth (Scott Laboratories) was inoculated to rule out group D streptococci. Gram stains of the original colony and the blood agar subculture were examined for cell morphology, Gram reaction, and colony homogeneity. The capsule typing of suspected *S. pneumoniae* was performed in the laboratory of R. Austrian, School of Medicine, University of Pennsylvania, Philadelphia.

RESULTS AND DISCUSSION

The recovery of *S. pneumoniae* type 3 in tracheobronchial aspirates of seven horses and in the pleural fluid of one horse during a 2-year period at New Bolton Center was unexpected. Our laboratory receives 320 tracheobronchial and 62 pleural fluid aspirates for culture during an average year. Therefore, it is unlikely that the cultures were contaminated with the pneumococcus by one of the laboratory technicians. Although the different isolates were detected by the same laboratory technician, the plates were initially inoculated by several individuals.

The clinical data is summarized in Table 1. The variety of respiratory disease symptoms seen in several horses infected by the pneumococcus is in striking contrast to the acute disease of foals (9, 12) and humans (2). Although there is no direct evidence that isolation of the pneumococcus is related to a specific disease syndrome, the consistent isolation of serotype 3 warrants closer attention. The horses had come from different stables at staggered intervals during the preceding 2 years. A seasonal prevalence was not evident, and thus common sources of contamination or spread were not obvious. We have not found *S. pneumoniae* in normal healthy horses or in patients with acute respiratory infections.

Two of the eight horses (horses 1 and 2) had chronic coughs. Medical examination eliminated all the identifiable causes of cough in the horses, and the diagnosis was open. The only abnormal finding in these two horses, other than the slight increase in neutrophils in the tracheobronchial aspirate of horse 1 and isolation of other streptococcal species from horse 2, was the isolation of type 3 pneumococ-

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TABLE 1. Summary of eight horses infects with *S. pneumoniae* type 3[a]

Horse no.	Age (yr)	Breed[b]	Sex	Complaint[c]	Thoracic auscultation	Concomitant isolates	Diagnosis
1	4	TB	Gelding	Chronic cough	Rhonchi		Open
2	3	STD	Colt	DET and chronic cough	Normal	Alpha-hemolytic *Streptococcus* spp., Beta-hemolytic *Streptococcus* spp.	Open
3	3	TB	Colt	EIPH	Normal	Beta-hemolytic *Streptococcus* spp.	EIPH
4[d]	4	STD	Colt	DET	Coarse broncho-vesicular sounds		Bronchitis
5	3	TB	Gelding	DET	Normal	*Pseudomonas* spp., group D *Streptococcus* spp.	Open
6	3	TB	Colt	Poor racing performance	Rhonchi	*Pasteurella* spp. *Actinobacillus* spp.	Pneumonia
7[e]	4	Arabian	Colt	Abdominal pain and respiratory distress	Rales, pericardial and pleural friction rubs	Beta-hemolytic *Streptococcus* spp. *Pasteurella* spp.	Pleuritis, pneumonia, diarrhea
8	1/2	TB	Filly	Pneumonia	Rales, rhonchi	*Streptococcus zooepidemicus*	Pneumonia

[a] All specimens were obtained by tracheobronchial aspirate; *S. pneumoniae* was isolated from all horses.
[b] Abbreviations: TB, Thoroughbred; STD, Standardbred.
[c] DET, decreased exercise tolerance; EIPH, exercise-induced pulmonary hemorrhage.
[d] Two tracheobronchial aspirates were obtained from this animal 7 days apart. The second aspirate was sterile.
[e] A pleural tap and a tracheobronchial aspiration was performed on horse 7. No growth was obtained from the tracheobronchial specimen.

cus. After treatment with penicillin, horse 2 no longer had a chronic cough, although this horse did not race to previous levels of performance. Horse 1 was never treated with penicillin and has continued coughing during the two years since the original *S. pneumoniae* isolate was found. Therefore, an association of *S. pneumoniae* type 3 with the cough is implied but not confirmed.

The history, admission complaints, and medical evaluation of horses 3, 4, and 5 were difficult to reconcile with *S. pneumoniae* as the etiological agent. Horses 6, 7, and 8 were diagnosed as having pneumonia, and the case of horse 7 was further complicated by pleuritis and pericarditis. Although the pneumococcus was isolated from the pleural fluid of horse 7, the organism was not recovered from the tracheobronchial aspirate. In a report involving 22 horses with pleuritis, the spectrum of the bacteria from concomitant cultures of tracheobronchial and pleural fluid were not identical in 50% of the cases (11). Therefore, isolation of *S. pneumoniae* only from the pleural fluid was not unusual. The tracheobronchial aspirates of horses 5, 6, and 8 and the pleural fluid of horse 7 contained other potential respiratory pathogens (Table 1). These horses were effectively treated with broad-spectrum antibiotics to cover the susceptibility patterns of all the organisms. The treatment procedures and clinical results are listed in Table 2. No tracheobronchial aspirates were available for bacteriological evaluation after treatment of the patients, owing to the resistance of the owners to the use of an invasive procedure on an apparently healthy animal. Within the limited number of cases in this study, antibiotic therapy successfully relieved the primary admission complaint.

S. pneumoniae type 3 may play a role as a secondary respiratory pathogen which complicates the primary microbial and physiological insult in these horses. We speculate that the type 3 pneumococcal capsular polysaccharide may accumulate in the alveolar spaces and further compromise lung capacity, as well as hinder the normal first-line nonspecific host defense mechanisms, e.g., cough reflex, motion of ciliary epithelium, and alveolar macrophages. Such interaction appears to be the situation in humans (2).

Alternative interpretations include primary infections by pneumococci, which predisposes to colonization by low-virulence microbes. In this situation, the superinfecting pathogen(s) may either overgrow the initial lesion and displace pneumococci or lead to a respiratory infection with a mixed etiology. The association of the pneumococcus with a specific disease syndrome in horses could represent nothing more than a transient infection with no overt clinical symptoms. In any instance, exposure of humans to equine pneumococcal carriers represents cause for concern for cross-species inoculation of the human contact. We did not have the opportunity to screen the handlers, trainers, or owners of the horses described in this study to determine a human carrier. The consistency of the isolate type is unexplained. On the basis of the volume of aerobic blood cultures initiated daily in our laboratory, it would be extremely difficult to understand how the tracheobronchial aspirate of only those horses with chronic cough would be contaminated with *S. pneumoniae*. The low incidence of recovery of *S. pneumoniae* (three to five cases per year) compared with the human carrier rate suggests that these horses acquired the infecting agent from a human source rather than that the horses served as the reservoir for human infections (2). The horses had come from a variety of farms, and there was no common contact, according to trainers, owners, and clinicians. The cases reported in this study were collected during a 2-year

TABLE 2. Results of therapy in horses infected with S. pneumoniae

Horse no.	Therapy	Results
1	None	Coughing persisted
2	Penicillin	Coughing ceased
3	None	Racing adequately
4	Rest (6 mo), oxytetracycline and sulfamethazine	Training adequately
5	None	No follow-up available
6	Trimethoprim-sulfadiazine	Training adequately
7	Penicillin and gentamicin	Normal
8	Penicillin and gentamicin	Normal

period (1981 to 1983), and there was no seasonal prevalence. The type 3 strain may be unique in its ability to colonize horses. However, this speculation can be valid only if other veterinary microbiology laboratories begin to seriously consider the possibility that veterinary pathogens are present among the alpha-hemolytic streptococci.

This is the first report of the isolation of *S. pneumoniae* type 3 from adult horses. The observations in our report are: (i) the isolation of a single pneumococcal serotype from equine species, (ii) the isolate is known to have high virulence in humans, and (iii) in all instances, the horses were not overwhelmed by the intimate association with this streptococcus. Further epidemiological studies are necessary to establish a broader data base for analysis and correlation to determine the clinical significance of these observations. We suggest that assessment of clinical cases of horses with decreased exercise tolerance and chronic coughs include bacteriological evaluation of tracheobronchial aspirates at the time of admission or first visit. We further suggest that a culture specimen be acquired several days after antibiotic therapy. Veterinary microbiologists should more carefully evaluate alpha-hemolytic streptococci for the phenotypic characteristics of pneumococci. Although horse-to-human transmission has not been shown, the potential for infection of the more susceptible human host does exist. Appropriate precautions are warranted.

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