A Review of Postmortem Findings in Cases of Pneumonia in California Racehorses

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Pneumonia is an important cause of mortality and morbidity in racehorses. Thoroughbred racehorses, in particular, appear to be at an increased risk of developing clinical pneumonia. While *Streptococcus* spp. and *Actinobacillus* spp. were the most commonly isolated organisms from pneumonia cases, mixed infections of aerobic and anaerobic organisms were not uncommon. Almost one-third of the cases where pneumonia was found on postmortem examination apparently had not been diagnosed antemortem. Authors' address: California Veterinary Diagnostic Laboratory System, School of Veterinary Medicine, University of California, Davis, CA 95617-1770. © 1999 AAEP.

1. Introduction
Since 1990 the California Veterinary Diagnostic Laboratory System has performed a complete necropsy on every horse that dies or is euthanized on racetracks or training facilities governed by the California Horse Racing Board (CHRB). This program provides a unique opportunity to study causes of mortality in California racehorses. Through this program, a great deal has been learned regarding musculoskeletal injuries in racehorses, but to date the significance of respiratory disease in this population has not been determined. The objective of this study was to evaluate the case reports from the CHRB Postmortem Program to determine whether there are specific aspects to pneumonia in racehorses which may contribute to the morbidity and mortality in this population.

2. Materials and Methods
For this study, CHRB postmortem case reports from 1990 to 1998, where pneumonia and/or pleuritis were diagnosed on the basis of postmortem findings, were reviewed. The reason for submission, clinical and therapeutic histories, results of bacterial cultures, antibiotic sensitivity testing, and other pertinent information was recorded.

3. Results
From February 1990 to December 1998, a total of 71 horses was submitted to CVDLS through the CHRB postmortem program with a primary complaint of pneumonia and/or pleuritis. On postmortem examination, however, pneumonia and/or pleuritis were found in an additional 30 horses that were submitted for nonrespiratory causes. As shown in Fig. 1, the number of horses submitted each year with a primary complaint of pneumonia or pleuritis varied from a low of 5 in 1990 and 1991 to a high of 11 in 1993. The total number of pneumonia and/or pleuritis cases diagnosed on postmortem examination per year varied as well, from a low of 8 in 1990 and 1991 to a high of 16 in 1993 (Fig. 1). Of the total 101 cases, more than 80% were Thoroughbreds (n = 85); the remaining cases were Quarter Horses (n = 8),
Standardbreds (n = 4), Appaloosas (n = 3), and an Arabian. In addition, more than half of the submitted horses were either 2 or 3 years of age (n = 59), but cases included horses up to 7 years of age. Finally, in the total 101 cases, there were twice as many geldings and stallions as mares.

Aerobic bacterial isolates were obtained in the majority of cases where cultures were attempted (n = 103 total isolates). As shown in Table 1, multiple bacterial species were isolated from these cases. Streptococcus equi subsp. zooepidemicus and Actinobacillus suis–like spp. were isolated from 38 and 17 of the cases, respectively. Overall, single isolates were rare, with most cultures yielding multiple organisms. Streptococcus equi subsp. zooepidemicus was, however, the single aerobic isolate from 13 cultures. In addition, Actinobacillus, Pasteurella, Klebsiella, and Pseudomonas were also rarely cultured as single isolates. Anaerobic cultures usually yielded multiple isolates, but Fusobacterium spp. and Bacteroides spp. were the single anaerobic isolates in 8 and 3 cases, respectively.

Antibiotic sensitivity testing on the isolated bacteria was not routinely performed (n = 18). The results of antibiotic sensitivity testing on Streptococcus spp. isolates, however, demonstrated a fairly consistent pattern. All of the isolates (15/15) were either resistant or had intermediate sensitivity to tetracycline, and one-third (5/15) were either resistant or had intermediate sensitivity to sulfonamides. Occasionally, Streptococcus spp. isolates were also resistant to trimethoprim/sulfonamide combinations (2/15) and enrofloxacin (4/15). All of the Streptococcus spp. isolates, however, were sensitive to ceflurofur, erythromycin, and penicillin.

The Actinobacillus spp. isolates demonstrated a fairly variable sensitivity pattern. Isolates were consistently sensitive to ceflurofur and gentamycin and resistant to sulfonamides and beta-lactam agents.

A history of specific antibiotic therapy was provided in 20 cases submitted with a primary complaint of pneumonia. Penicillin was used as the sole antibiotic therapy in 5 cases and was used in combination with other agents in 4 cases. The combination of penicillin and gentamycin was only used in 2 cases. Chloramphenicol was used as the sole antibiotic agent in 3 cases and in combination with other agents in 6 cases. Finally, metronidazole was not used alone, but was used in combination with other agents in 6 cases. Other antibiotic agents listed included tetracycline, sulfonamides, ceflurofur and vancomycin.

One or more coexisting diseases, in addition to pneumonia, were found in numerous cases. In cases that were submitted with a primary complaint of pneumonia and/or pleuritis (n = 71), laminitis was present in 6 horses and colitis in 4. In horses submitted for nonrespiratory disease, in which pneumonia and/or pleuritis was diagnosed on postmortem examination, colitis (n = 9), laminitis (n = 5), and severe musculoskeletal injuries (n = 5) were the most common reasons for submission. Other reasons for submissions included exercise-induced pulmonary hemorrhage, neurologic disease, and sudden death.

4. Discussion

A review of cases submitted through the CHRB Postmortem Program to the CVDLS indicates that pneumonia is a significant cause of mortality in California racehorses. Every year on California racetracks anywhere from 3 to 11 horses die or are euthanized because of pneumonia or its complications, which include pleuritis, colitis, and laminitis. The average number of horses submitted through the CHRB Postmortem Program each year from
1990 to 1998 was 237 ± 19 SD. Pneumonia and its complications, therefore, account for approximately 3% of the mortality in California racehorses (n = 8 ± 2.4 horses/year). The average incidence of pneumonia in racehorses submitted to CVDSL, which includes cases submitted for nonrespiratory disease, was over 4% (n = 11 ± 2.5 horses/year). The total morbidity due to pneumonia, however, is likely significantly higher, as these numbers do not include horses suffering from pneumonia that were subsequently shipped from the track environment.

The profile of the horse most likely to be submitted with a primary complaint of pneumonia is a 2- or 3-year-old Thoroughbred gelding or stallion. This profile is not surprising, as it would also describe the largest proportion of California racehorses. Nevertheless, it would appear that the Thoroughbred is most at risk for developing significant lower respiratory disease.

Based on the findings of this study, the organism most likely to be isolated from racehorses suffering from pneumonia is *Streptococcus equi* subsp. *zooepidemicus*, which was isolated from nearly 40% of all of the cultures. In previous studies, *Streptococcus spp.* were generally among the most common isolates. Actinobacillus suis–like *spp.* were isolated from 16% of the cases, often in conjunction with *Streptococcus spp.* This finding is also consistent with the results of other studies. Other mixed Gram-negative and Gram-positive cultures and single Gram-negative organisms were isolated in 27% of the cases. Single and mixed anaerobic isolates were obtained in 17% of the cases. In addition, although cultures were negative, anaerobic infections were suspected in a number of cases based on post mortem findings.

The history of antibiotic therapy was provided in 20 cases submitted with a primary complaint of pneumonia. As expected, penicillin, either alone or in combination, was one of the most common agents used in these cases. The culture and antibiotic sensitivity testing results obtained in these cases support the use of penicillin as an empiric treatment for pneumonia in horses. All of the *Streptococcus spp.* that were tested were sensitive to penicillin. Nevertheless, in the majority of cases, organisms, such as *Actinobacillus suis* and other Gram-negative aerobics, which are relatively resistant to penicillin, were also present. Therefore, a broad-spectrum approach would appear to be warranted in most equine pneumonia cases. The combination of penicillin and gentamycin, however, was listed in only two cases. As synergy between aminoglycosides and beta-lactam antibiotics has been well-documented, it is surprising that this combination was not more widely reported.

Chloramphenicol was also commonly used, either alone or in combination with other agents in these pneumonia cases. Chloramphenicol is considered a broad-spectrum agent with efficacy against aerobic and anaerobic organisms and with a wide distribution due to its high lipophilicity. Nevertheless, it is a bacteriostatic agent, and therefore, its use in life-threatening infections, such as acute and/or severe pneumonia, is questionable. It is unclear from the histories, however, whether chloramphenicol was used after treatment with other agents was deemed unsuccessful. In addition, chloramphenicol rarely has been shown to cause irreversible bone marrow suppression in humans, and so its use also presents a human health hazard for personnel handling the drug.

Commonly, metronidazole was also used in these cases. Considering the fairly common isolation of anaerobic organisms in this study, the inclusion of this agent would appear to be prudent therapy.

The results of this study also demonstrate that co-existing diseases are commonly found in the presence of pneumonia. In cases that were submitted for primary respiratory disease, laminitis and/or colitis were frequently reported to have developed subsequent to the pneumonia. In addition, numerous horses that were submitted for primary complaints of colitis or laminitis were also found to have pneumonia on postmortem examination. In many of these cases, it is unknown which condition was present initially. Finally, postmortem examination revealed the presence of pneumonia in a number of cases that had been submitted for nonrespiratory diseases. These findings indicate that clinically significant cases of pneumonia in racehorses can remain undiagnosed for some time.

References