TRANSPORT-ASSOCIATED RESPIRATORY DISEASE IN HORSES

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INTRODUCTION

Pleuropneumonia is a common disease of equids, especially young racehorses. Although several risk factors for the development of pleuropneumonia have described, including strenuous exercise, upper respiratory viral disease, general anesthesia and esophageal obstruction, long-distance transport is probably the most common inciting cause. During the First World War, horse deaths from pneumonia exceeded mortality from other causes by a factor of three until provisions to improve the conditions of long-distance shipping were improved.

ETIOLOGIC AGENTS ASSOCIATED WITH TRANSPORT-ASSOCIATED PLEUROPNEUMONIA

Pleuropneumonia in the horses is generally not caused by specifically contagious organisms, but rather is associated with an opportunistic infection with organisms commensal to the oropharynx. Of these, by far the most common bacteria isolated from the lower respiratory tract of horses with transport-associated pneumonia is *Streptococcus equi ssp. zooepidemicus*. In a recent study, *Streptococcus equi ssp. zooepidemicus* was isolated from 94.5% of tracheal samples. There are many protein variations of *Streptococcus equi ssp. zooepidemicus* that have been isolated from horses with clinical disease, but no association between protein sequence and particular clinical manifestations of infection in horses. Despite the ubiquity of *Streptococcus equi ssp. zooepidemicus* in this disease, most infections yield a mixed culture of organisms, with *Corynebacterium* spp., *Mannheimia hemolytica*, *Actinobacillus* sp., *Pasteurella* ssp., *E. coli*, *Klebsiella pneumonia*, *Staphylococcus* sp., and alpha-hemolytic *Streptococcus* sp. are cultured sporadically as co-infections. Anaerobic bacteria are also frequent isolated, especially *Bacteroides* and *Clostridium* ssp., and are associated with a worse prognosis. Viruses have not been isolated from pneumonic lesions at necropsy from horses with transport-associated pneumonia, and no studies have been performed that specifically evaluated the role of mycoplasma ssp. in this disease.

PATHOPHYSIOLOGY OF TRANSPORT-ASSOCIATED PLEUROPNEUMONIA

The pneumonia that occurs after shipping is characterized by predominantly ventral disease including consolidation, abscessation, pleuritis and necrosis of the cranio-ventral portion of the caudal lung lobe, especially of right lung. Post-mortem lesions in one experimental study of transport-pneumonia revealed with serous hemorrhagic pneumonia and multifocal coagulative necrosis which were associated with *Streptococcus equi ssp. zooepidemicus* infection. In vivo inoculation of healthy lung *Streptococcus equi ssp. zooepidemicus* recapitulated these pathologic changes over time. There is considerable consensus that transport-associated pneumonia is largely a result of prolonged confinement with the head
maintained in an elevated position, as is typical in horses being shipped in trailer, truck, boat or airplane tie-stalls. Prolonged elevated head position results in a reduction in tracheal mucociliary clearance, and maintaining the head in an elevated position even without shipping results in tracheal inflammation and bacterial contamination in 75% of horses. In addition to effects on the respiratory tract, long-distance road transport has also been shown to lead to changes in muscle metabolism, stress indices, hydration status, immune parameters, and body weight.

**TREATMENT OF TRANSPORT-ASSOCIATED PLEUROPNEUMONIA**

Treatment is generally started empirically before the results of culture and sensitivity from tracheal washes are known. Based on the likelihood of a mixed bacterial infection including anaerobes, broad spectrum coverage is typically recommended. Despite their poor penetration into necrotic tissue, gentamicin and penicillin are often the first choice for serious infections, and the vast majority of *Streptococcus equi ssp. zooepidemicus* isolates are susceptible to penicillin. However, despite the overall good anaerobic spectrum, pencillin is generally ineffective against *Bacteroides fragilis*, a common anaerobic isolate in equine pneumonia. Ceftiofur, a parenteral cephalosporin, has also shown good efficacy against naturally occurring respiratory infections at a dose of 2.2mg/kg/day when compared to ampicillin, with 79% of patients treated with ceftiofur and 59% of horses treated with ampicillin showing complete resolution of signs. Despite its appeal as a relatively safe, bacteriocidal, once-daily antimicrobial, enrofloxacin has poor efficacy in most cases of transport-associated respiratory disease as *Streptococcus equi ssp. zooepidemicus* generally not sensitive. Davis *et al.* showed that at doses ranging from 1.25-7.5mg/kg/day, it was not substantially more effective than placebo; furthermore, 21% of affected horses required “rescue therapy” with gentamicin and penicillin to resolve the clinical signs.

Prognosis for pneumonia is guarded, although much of the published data is over 20 years old; it is reasonable to hope that advances in treatment may have improved the reported survival of 53%. In addition to appropriate antimicrobial therapy and supportive care, the addition of therapeutic broncho-alveolar lavage has been reported in one study to improve outcome significantly. If thick pleural peels or extensive abscession and large areas of tissue necrosis exist, the use of open debridement via standing rib resection, or intrapleural fibrinolytic therapy with tissue plasminogen activator are also possibilities, although the outcomes have not been compared to conservative management.

**PREVENTION OF TRANSPORT-ASSOCIATED PLEUROPNEUMONIA**

Prevention or a reduction of prevalence in transport-associated pneumonia is probably most definitively tackled by altering transport techniques to include longer rest periods, loose boxes rather than tie stalls, and better air quality within the vehicle. A study directly comparing tied versus loose horses during long-distance transport found significantly higher indices of stress in the tied group. However, although horses being shipped unrestrained had normal BAL fluid that did not contain higher numbers of bacteria, in a more recent study of 80 unrestrained horses subjected to road transport of >1000 miles, 41% developed signs compatible with lower respiratory tract disease. The effect of orientation (rear facing or
forward facing on the trailer) has not been shown to affect the risk of respiratory disease, although increasing the rest time and removing manure from the vehicle during rest stops reduced transportation stress that may lead to respiratory compromise. Despite (or perhaps because of) the low-tech nature of these modifications, there does not seem to be a dramatic shift in transportation techniques in the equine industry. Pharmacologic interventions to prevent transport-associated pneumonia have focused on specific risk factors. As the main etiologic agent, *Streptococcus equi ssp. zooepidemicus* is exquisitely sensitive to penicillin, the prophylactic use of this antimicrobial agent was investigated using a long-distance transport model (head elevation for 48 hours), but had no significant effect on airway contamination. Clenbuterol, an oral beta-2 agonist that has been shown to increase tracheal mucociliary clearance in the horse, was also evaluated using a 48 hour head elevation protocol. Six horses enrolled in a crossover designed study received either clenbuterol (0.8 µg/kg PO BID) or placebo, and tracheal mucociliary clearance, tracheal wash cytology and quantitative culture, rectal temperature, CBC, fibrinogen, and serum TNFα, IL-10 and IL-2 levels were measured before and after simulated shipping. The study found a trend towards faster tracheal mucociliary clearance in horses receiving clenbuterol, and also a small reduction (0% versus 33%) in tracheal β hemolytic *Streptococcus* spp. numbers after clenbuterol versus placebo.