Take Home Message

Pneumonic pasteurellosis in cattle is a disease complex caused by the interaction between bacterial and viral infectious agents, environmental conditions and management practices. *Pasteurella haemolytica* is the primary bacterial agent usually associated with mortality although *P. multocida* can be involved to a lesser degree. No single management practice will be effective in controlling this disease complex. The key to control is an integrated approach beginning on the ranch with vaccination and exposure to feedlot conditions followed by subsequent revaccination at entry into the feedlot. Prophylactic mass medication in the feedlot has been shown to be the most effective method for reducing losses due to Pasteurella infection. Management practices which reduce stress, as well as early diagnosis and antibiotic treatment, are the key methods of controlling disease within the feedlot, especially during the first two to three weeks after arrival.

Background

Pasteurellosis encompasses a number of disease syndromes in cattle, including both systemic and respiratory infections. *Pasteurella multocida* and *P. haemolytica* are the two bacterial species most commonly associated with pneumonia in feedlot cattle, although the latter is the most important in terms of prevalence and economic impact on producers. *Pasteurella haemolytica* is composed of over a dozen serotypes, although type A1 is most commonly associated with shipping fever pneumonia. The bacteria is a normal inhabitant of the upper respiratory tract of cattle and in normal unstressed animals, it does not usually cause disease. However, animals which are exposed to various stress factors (see Table 1) are more susceptible to growth of the organism in the lower respiratory tract, resulting in severe pneumonia (1, 2). While a number of infectious agents are involved with the bovine respiratory disease complex (BRD), the bacterial species are usually the cause of mortality and therefore contribute significantly to the economic losses estimated between $500 million and $1 billion annually in North America. However, respiratory viruses...
such as BHV-1, PI-3, BRSV and BVD are important in the disease process as they often predispose animals to infection with *P. haemolytica*. The incidence of *Haemophilus somnus* pneumonia has also increased over the past decade and it is an important cause of bovine respiratory disease.

Research conducted during the past ten to fifteen years has lead to a wealth of information regarding the mechanisms by which *P. haemolytica* causes disease as well as the immune responses against the organism (3). This has resulted in the ability to rationally develop new therapeutic and prophylactic products, as well as recommendations for management procedures which will minimize risk. The discovery of a toxin produced by the bacteria which destroys white blood cells (leucocytes), a primary line of defence during infection, was an important step forward in our understanding of the disease and explained why vaccines of the past were not effective (4). The vaccine products which contained *P. haemolytica* cells and no leucotoxin did not effectively confer protective immunity. Most new vaccines incorporate some form of the toxin as well other components and are generally more effective (5, 6, 7, 8). Preconditioning also has the potential to be an important tool in the prevention of this disease. While not new, there is now limited data which supports early vaccination (e.g. at branding) followed by a second immunization at entry to the feedlot (9). This is in contrast to earlier studies (13) which did not demonstrate this beneficial effect. Antibiotic therapy is the treatment method of choice but *P. haemolytica* is becoming increasingly resistant to multiple antibiotics. This may limit antibiotic therapy in the future, since the bacteria will continue to grow following therapy (10, 11).

### Table 1. Factors Involved in Pneumonic Pasteurellosis.

| 1. Environment | · Heat and cold stress, fluctuations in temperature  
|                | · Dust  
|                | · Humidity  
| 2. Management  | · Weaning  
|                | · Shipping  
|                | · Crowding and handling  
| 3. Infectious Agents | · Viral infections (BHV-1, BRSV, PI-3, BVDV) predispose animals to bacterial infection  
|                 | · Bacteria: *P. haemolytica*, *P. multocida* |
Control of *P. haemolytica*

Since pneumonic pasteurellosis is a multi-factoral disease, no single management technique will result in disease control. Vaccination, antibiotic treatment and changes in management conditions are all useful and should begin on the ranch rather than at the feedlot. Control of pasteurellosis should be viewed as an integrated process starting at birth of the animal, continuing all the way through to slaughter. Preconditioning can be important in that it spreads out many of the stressful procedures (*Table 1*) over a longer time frame and ensures that vaccines can be utilized to generate the greatest level of immunity when calves enter the feedlot. As part of this procedure, weaning should occur prior to shipping and anticipated poor weather in order to split the stresses associated with separation from the mother and entry into an unfamiliar environment.

In order to successfully treat pneumonic pasteurellosis, early diagnosis of infected animals is necessary. Cattle will often appear depressed, with a nasal discharge, exhibit inappetance and weight loss, and have temperatures in the 40°C - 42°C (>104°F) range. Most cases occur during the first two weeks in the feedlot and the course of disease can be rapid with death occurring before the above clinical signs of disease are observed. Calves exhibiting signs of BRD should immediately be separated from other animals. Early antibiotic therapy is usually effective, and a number of short- and long-acting compounds are available, including tilmicosin, trimethoprim/sulpha, oxytetracycline, cephalosporins, ampicillin, ampicillin-sulbactam and others. If improvement is not seen within 3 days after administration, another therapeutic agent should be used. Ampicillin-resistant bacteria are now very common and ampicillin-sulbactam has proven effective in the elimination of these strains of *P. haemolytica* (*12*). Mass medication has been demonstrated to be a useful control method, either at feedlot entry or in the face of a disease outbreak. Antibiotics such as long-acting oxytetracycline (20 mg/kg body weight) or tilmicosin (10 mg/kg), given at feedlot entry or 72 hours later, have been shown to reduce disease and increase feed conversion and weight gain significantly compared to untreated animals (*14, 15, 16, 17*). This method of disease control is one of the few which has been demonstrated to be cost effective and has been reviewed in the scientific literature (*14*). Likewise, in the face of an outbreak of respiratory disease, mass medication of comingled animals with long-acting oxytetracycline (20 mg/kg) can reduce disease in a cost effective manner (*18*) if treatment is initiated early. One
successful study initiated treatment when the pull rate reached 6-10% in a pen (18). Please consult with your herd veterinarian for a treatment and control program specific for your herd needs.

Vaccination

The most effective control measure for any infectious disease is the development of immunity, and prior exposure to \textit{P. haemolytica} usually provides protection against subsequent infection. Therefore, vaccination should be effective but some of the older vaccines did not perform well for the reasons mentioned above. A new generation of vaccines based on sound scientific principles and knowledge of the pathogenesis of \textit{P. haemolytica} infection are now available and some of these have been shown to be effective under field conditions, following either one or two administrations (5, 6). However, in order to realize the full potential of these products and ensure that optimal protection is induced, two immunizations are prudent for high risk calves. Ideally the first vaccination should occur on the ranch and the second either when the animal is shipped or at the feedlot, according to the manufacturer’s instructions. One study has suggested that vaccination at branding and time of shipping provides optimal immune responses to the particular vaccine (9). In the past, this approach has not shown a significant beneficial effect (13), but newer vaccines are now available which should prove to be more effective. However, their cost-effectiveness has yet to be determined.

Conclusions

Pasteurella infection has historically been the major bacterial pathogen associated with economic losses to the beef industry, although \textit{Haemophilus somnus} has rapidly gained ground within the past two years. Recent advances in molecular biology, immunology and epidemiology have made it possible to develop new, effective vaccines for the prevention of \textit{P. haemolytica}-associated pneumonia as well as conditions for their optimal use. Our understanding of the complex interaction between pathogenic organisms, the environment and stress indicates that preconditioning as well as other management practices which reduce stress will likely be the most effective means of controlling this disease.
References


