Respiratory Pathology

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Introduction

This discussion will focus on personal observations and impressions resulting from involvement in an extensive practice-laboratory group over the last few years. This group works primarily with large cattle feedyards and some cow-calf operations. The setting is in the southwestern United States. An effort will be made to avoid repetition of the information available in pathology texts.

Pneumonia Classification

1. *Infectious*—This most common category includes all forms of transmissable agents with a variety of resulting lesions.
2. *Interstitial*—This is a lesion classification. Causes of interstitial pneumonis are generally not infectious. Bovine respiratory syncytial virus (BRSV) may be an exception.
3. *Dust*—This is simply an often-discussed category.
4. *Aspiration*—Caused by some foreign product.

Infectious Respiratory Disease

This category includes all of a large number of agents which have been described as having a potential or demonstrated role in the bovine respiratory disease complex. This discussion will deal only with those manifestations that can be differentiated with reasonable effort.

Agents such as *Mycoplasma* spp., chlamydia, and some viruses usually play a predisposing role in identifiable disease processes. Gross lesions, if these were to be seen without secondary bacterial damage, are generally non-suppurative consolidation with mottled or erratic distribution atypical of the usual bacterial or interstitial pneumonias.

Infectious bovine rhinotracheitis (IBR) is a readily identifiable and extremely common viral disease which can be a devastatingly expensive cause of losses in the feedyard. Unfortunately, outbreaks are not limited to incoming cattle. The good news is that severe outbreaks rarely occur if a good vaccination program is routinely followed before shipping feeder cattle or shortly after arrival in the feedyard. Diagnosis is based on inflammation of extensive portions of the trachea with loss of normal epithelium observed as a roughened surface which lacks the shiny appearance of normal epithelium. Extensive, adherent exudate may be a feature in later stages. Diagnostic errors often result from improper interpretation of the severe hypermia often seen as an agonal change or extensive exudate which may have its origin in an exudative pneumonia. The condition is identified by severe dyspnea. Lesions may involve variable amounts of the lung with redness, firmness, and a moist "meaty" appearance similar to interstitial pneumonias. Laboratory confirmation is frequently necessary. This condition is rarely observed in southwestern feedyards. However some performance data would suggest that it may play a more important role as part of the predisposing factors in shipping fever.

Pasteurella spp. primarily *P. haemolytica,* are the most common final destructive pathogens in the shipping fever complex. In the acute fulminating disease, the lesions are typified by swelling, redness, and edema in the anterior ventral lung. Lesion borders are somewhat indistinct because the affected area is usually continuing to expand. Within a day or so the edema may diminish and small, pale necrotic foci may appear. Severe fibrinous pleuritis is often present. After a few days lesions may shrink, develop more distinct boundaries, and become atelecatatic. These areas may then gradually heal. If the animal is unable to cope with the infection, abcesses may form often with *Corynebacterium pyogenes* present. This results in the condition known as "chronics" which may result in persistent poor performance. Another possibility is progression with succeeding zones of new lesions until so much lung is damaged that the animal dies.

Evaluation of these various possibilities at necropsy can tell us a great deal about treatment programs. Too many chronics or progressive lesions may indicate inadequate response to therapy perhaps due to inadeqeuate dosage or too short a treatment period. If acute involvement includes a large portion of the lungs, it may mean that poor observation resulted in delayed initiation of treatment.

Unfortunately, the use of vaccines after arrival and our current therapeutic effectiveness permit *Pasteurella haemolytica* to continue to be the major ultimate cause of deaths. We shouldn't overlook the prevalence of *P. multocida* in persistent unresponsive pneumonias.

Haemophilus somnus can be a cause of extensive respiratory disease in some feedyards. It is less obvious as a major factor in typical shipping fever. Lesions may be quite similar to those of *Pasteurella spp.* but they tend to be atelectatic in the early stages probably because of the tendency toward severe bronchiolar damage. Lesions are edematous but the necroticfoci of pasteurellosis are usually absent. Laboratory isolation and histopathology may be

needed to completely sort out the role of *H. somnus* in some respiratory disease outbreaks.

Interstitial Pneumonia

Interstitial pneumonia associated with feed change is less identifiable in feedyards than in pasture cattle or breeding stock. These peracute respiratory problems result in acute, usually fatal, dyspnea. Necropsy reveals the classical "meaty", often-mottled, firm lung with diaphragmatic lobe involvement. Diagnosis in the feedyard may be aided by histopathology. The specific etiology of these is rarely known but some favor some type of hypersensitivity reaction. Keep in mind that BRSV lesion and acute verminous pneumonias may result in interstitial pneumonias. Our traditional concepts on atypical interstitial pneumonia (pulmonary adenomatosis) simply don't serve to describe all the observations in the feedyard. Deaths frequently occur in animals well into the feeding period which makes the cost even greater.

Dust Pneumonias

Dust can be shown to influence performance but this author simply can't define a gross or microscopic lesion that can be associated with dust.

Aspiration Pneumonia

These are usually the result of dosing errors. Some are difficult to differentiate from shipping fever while others produce unusual patterns and massive necrosis. Differences are apparently related to quantity, type of foreign material and degree of bacterial contamination.

Differential Diagnosis

Some methods of differentiating various categories of respiratory disease have been discussed. These categories can often be differentiated by gross observations and laboratory support to provide information on agents present and microscopic pathology. Necropsy observations may be just as useful in evaluating treatment methods as in making specific diagnoses.

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Abstracts

The efficacy of sulbactam–ampicillin in the therapy of respiratory disease associated with ampicillin resistant *Pasteurella* species in housed calves

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Sulbactam-ampicillin is a combination of sulbactam, a beta-lactamase inhibitor, and ampicillin, a broad spectrum beta-lactam antibiotic. The efficacy of sulbactam-ampicillin was evaluated in the treatment of calf respiratory disease associated with ampicillin-sensitive and ampicillin-resistant strains of *Pasteurella haemolytica* and *Pasteurella multocida*. Treatment with sulbactam-ampicillin was compared with treatment with ampicillin alone in 123 Friesian calves, between three and five weeks old, exhibiting clinical signs of respiratory disease. Seven of the 59 calves treated with ampicillin died whereas only one death occurred in the 64 calves treated with sulbactam-ampicillin. In the calves which survived, treatment with sulbactam-ampicillin resulted in a significantly better clinical response, as measured by the reduction in severity of clinical signs. The results of bacteriological examinations indicated that there was a marked increase in the proportion of ampicillin-resistant isolates of *P haemolytica* subsequent to treatment with ampicillin, whereas the proportion of ampicillin-resistant isolates of *P haemolytica* recovered from calves treated with sulbactam-ampicillin had declined. The superior efficacy of sulbactam-ampicillin observed in this study is explained by the inhibitory effect of sulbactam on beta-lactamases produced by resistant bacteria, thus rendering them susceptible to the ampicillin.

Vitamin E

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Vitamin E activity was first identified as a dietary factor essential for reproduction in the rat. It is now known that this vitamin has a far wider range of functions in the body than its role in fertility. It interacts with selenium-containing glutathione peroxidase to prevent the oxidative breakdown of tissue membranes associated with the hydroperoxides of polyunsaturated fatty acids. Relationships with other factors such as stress and vitamin C, have been proposed. The symptoms of deficiency of vitamin E vary according to species. With so many variables it is difficult to estimate the optimum allowances of the vitamin for the many types of livestock diets. These problems are discussed and the calculation of allowances of vitamin E in rations for both monogastric and ruminant animals is explained.