REVIEW OF FEEDLOT PATHOLOGY

Robert D. Glock
Colorado State University
Veterinary Diagnostic Laboratories
Fort Collins, CO 80523

RESPIRATORY DISEASE

Classification

The term, bovine respiratory disease (BRD), is commonly used but has no specific meaning other than to describe a broad concept of various respiratory dysfunctions. Generally, respiratory disease can be classified as bronchial, interstitial, or metastatic pneumonias [1]. These categories include most types of respiratory disease that can be identified but obviously exclude some of the less commonly observed occurrences such as necrotic laryngitis and tumors.

Bronchial Pneumonia

Bronchial pneumonia encompasses the most common form of bovine pneumonia and includes the complex syndrome, "shipping fever." This is a complex infectious process with a typical end result. As observed by the pathologist, it is usually anterior and ventral in location. The lesions tend to progress through the stages of red and gray hepatization with progression toward the upper and posterior portion of the lung. The end result with regard to the animal is usually dependent on the stage at which this progress is arrested.

There are misconceptions regarding the time frame involved in the development of bronchial pneumonia. Many of the early processes include some of the less identifiable agents that set the stage for the final attack by bacteria (primarily Pasteurella spp. and Haemophilus somnus). These organisms are toxin producers and cause a severe inflammatory response within the lung tissue. This is characterized by congestion and edema initially. These lesions are typical of any inflammatory response. They can develop within a matter of hours and significant damage can occur within 1-2 days after the initial bacterial attack. As the lesions progress, there is frequently accompanying pleuritis and hydrothorax. Diffuse fibrinous pleuritis can develop within a matter of 1-2 days and confusion regarding the age of lesions often results from our inability to precisely establish the time of onset. The belief that fulminating and fatal bronchopneumonia takes more than 2-3 days to develop is a misconception based on the severity of the lesions.

As the lesions develop and mature, there are small necrotic foci that progress to larger coalescing lesions. This is characterized by gray or yellow discolored areas that may range in size from a few millimeters to one or more centimeters. This simply means that the tissue has been unable to cope with the toxins and has progressed to a necrotic state.

The conclusion of the bronchial pneumonia process is frequently abcessation of the areas that were initially necrotic. This stage

usually involves the presence of Actinomyces pyogenes as a secondary and final invader.

Interstitial Pneumonia

The most easily defined form is known as "fog fever" or "cow asthma." Interstitial pneumonias are generally not considered to be infectious in nature. They include acute and diffuse responses of the lung to some irritant. This may be the result of a series of events that involves the conversion of tryptophan to 3-methylindole.

Another version of this disease is the apparent result of poorly-defined allergic reactions. One often discussed but never proven theory is that some of the victims, often fat cattle, may experience some type of allergy following re-exposure to bacteria such as Pasteurella spp. These animals may be called "Honkers" because of the severe labored breathing. There are references to mycotoxins producing diffuse interstitial pneumonia.

Lesions are typically different from bronchopneumonia in that they are diffusely distributed throughout the lung. Lesions are dramatic in most cases and frequently include edema, emphysema, and areas of dark-red discoloration as well as firmness. The extent of these various components varies and the gross lesions reflect the histologic occurrence of accumulations of fluid and fibrin in the alveoli.

Interstitial pneumonias are usually acute and may develop within hours. The pathologist is often in the position of observing a clinical problem retrospectively and after there is any opportunity for significant clinical action.

While considering interstitial pneumonias, it is important to keep in mind that there is one common infectious agent (BRSV) associated with interstitial pneumonia. Differential from the non-infectious forms often requires knowledge of history and/or laboratory identification of BRSV.

Metastatic Pneumonias

This type of pneumonia is identified by multiple inflammatory and perhaps abscessed lesions scattered throughout the lungs indicating the hematogenous origin. The origin may be any number of infectious processes in other parts of the body. Liver abscesses are a frequent source.

Diagnosis

Differentiating the various types of pneumonia is usually possible with simple gross observation and histologic confirmation. More specific diagnostic efforts are often directed at trying to adjust prevention and treatment programs with regard to specific agents. Identification of causative agents may be hypothesized based on histopathology, but more specific etiologic diagnostic techniques are usually required.

Using Lesion Evaluations

One of the most useful applications of pathology in the field is the evaluation of treatment programs. Classification of non-survivors may be very useful in adjusting approaches to therapy. One of the observations that should be included in any necropsy is an attempt at identify-

ing the extensiveness of early versus chronic lesions. This can often be used to estimate whether an animal was simply treated too late or whether the disease was slowly progressive as a result of an ineffective treatment. These types of exercises are often very useful in educating animal handlers. For instance, rapidly developing bronchial pneumonia may appear as fairly uniform consolidation involving over half of the anterior ventral portion of the lungs. This suggests that the lesions were quite extensive before therapy was initiated and can be used in a discussion of the problems that may result from "late pull" (delaved treatment).

ENTERITIS

The term "enteritis" is used to encompass those conditions that are observed in the feedlot which result in diarrhea. This category of conditions is usually divided into groups based on type of etiologic agent.

Viral Enteritis

This condition is primarily the result of BVD virus infection. The gross lesions of digestive tract ulceration and hemorrhage are well-known and quite typical. The mucosal disease form of BVD is defined as involving persistent infections and produces diffuse mucofibrinous to hemorrhagic enteritis which requires laboratory confirmation.

Parasitic Enteritis

The predominant parasitic causes of enteritis are coccidia and GI nematodes. Coccidia tend to produce the most dramatic disease syndrome with mucohemorrhagic enteritis. These infections are confirmed through laboratory identification of large populations of coccidia. The less distinct nematode infections are frequently observed at necropsy and warrant a broad analysis of the environment and history of the animals with regard to clinical management.

Bacteria

A number of bacteria may become involved in enteric disease in the feedlot animal, but the most common is Salmonella spp. Salmonella spp. (most frequently S. typhimurium) are opportunists and frequently participate in feedlot enteritis secondary to other debilitating diseases such as any of those discussed above. Salmonellosis produces a variety of lesions that vary from non-descript to hemorrhagic enteritis. There are frequently secondary lesions such as inflamed mesenteric lymph nodes and swollen visceral organs. Diagnosis is almost entirely dependent on culture but histopathology is often quite typical and supportive. This is a commonly overlooked cause of persistent diarrheal problems. It is frequently a secondary invader, but should not be discounted as contributing to losses due to reduced performance and death.

SUDDEN DEATH SYNDROME

Sudden deaths and "pen-deads" in the feedlot are abhorred by feeders because of their unpredictability. Early in the feeding period, these may result from a combination of factors and may be animals that have been overlooked or "pulled late". The volume of incoming cattle sometimes leads to some delays which allow an animal with observable illness to miss treatment.

The animal that dies later in the feeding period represents greater loss to the feeder and usually involves poorly defined causes of death. A variety of causes of sudden death have been described [2,3]. The animal that is found dead in the pen without any opportunity for treatment remains as a problem.

Bloat

Rapid bloat, a sporadic cause of death in heavy cattle, is often difficult to differentiate in the dead animal because of the rapid production of gas in the rumen after a heavy animal dies. The so-called "bloat line" is often the product of post-mortem bloat.

Clostridial Enterotoxemia

Enterotoxemia is caused by Clostridium perfringens toxins and is possible to diagnose specifically if an animal is discovered immediately after death and if some laboratory is willing to embark on identification of toxins in intestinal fluid. The reason for this difficulty is that the intestinal tract normally harbors Clostridium perfringens and it's simply an overgrowth of this organism that causes some rapid deaths. There may be some intestinal inflammation but lesions are rarely diagnostic.

Acidosis

Acidosis is common, interactive with bloat or enterotoxemia, and is difficult to define or to identify. There may be some rumenitis in very severe cases but the majority of the animals have no specific visible lesions. Evaluation of rumen pH can be useful if diagnosticians observe them frequently and if patterns for individual feeding operations are established.

Acute Clostridial Disease

Acute clostridial diseases, such as Black Leg, are infrequent but can be established as causes of death with careful necropsy examination.

Liver Abscesses

Occasional ruptured liver abscesses may lead to acute death and these may be identified at necropsy.

Atypical Interstitial Pneumonia

Atypical interstitial pneumonia or adenomatosis is frequently observed in "wheezers" or in animals found dead. There is a period when these can occasionally be treated successfully but many die during the

night without observation. Gross and microscopic lesions are usually diagnostic.

Summary

Many of the above conditions are difficult to identify but regular diagnostic necropsies can help lessen confusion. Predictable influences that can cause an increase in sudden deaths are sudden changes in the environment and feeding practices. History of such influences may be the key to a presumptive differential diagnosis. Bunk management is frequently the only causative factor that can be objectively evaluated and even that is a matter of more art than science.

CNS DISEASE

Feedlot conditions that cause obvious CNS damage are often difficult to specifically categorize prior to the death of an animal. There are various clinical parameters that can be evaluated to attempt to classify CNS disease, but these often fail in actual application. Necropsy of affected animals is the most productive with regard to specific diagnosis.

Polioencephalomalacia

This common feedlot disease is best diagnosed by gross and microscopic observation of the brain. Lesions may or may not be grossly evident, and illumination with ultraviolet light may help to identify malacic areas that will fluoresce. This is not a totally consistent test, but may be helpful. Ultimate differential depends on histopathology. The lesions are most prominent over the posterior portion of the cerebrum, so submission of these tissues is essential. It is becoming more evident that sulfur metabolism becomes involved in polioencephalomalacia. Diagnosis should include evaluation of rations and water for possible sources of excess sulfate or sulfide.

Thromboembolic Meningoencephalitis

Careful examination of the mid-brain and brain stem usually results in observation of hemorrhagic areas around vessels. However, there are many animals that die before gross lesions become obvious or with minimal discoloration of meninges. Diagnosis, therefore, is dependent on histopathology and culture. Many animals die with very mild lesions which may consist only of occasional inflammatory cells in the meninges. Culture is an essential portion of the process of ruling Haemophilus somnus in or out as a possible agent.

Listeriosis

This condition is rarely observed in modern feedyards. It is frequently characterized by typical clinical signs and is confirmed by histopathology and microbiology to identify lesions and organisms which are usually concentrated in the brain stem.

Bacterial Meningitis

This is the most overlooked category of CNS disease because there are no visible gross lesions and microscopic lesions may be extremely minimal. This tends to be an acute and rapidly fatal disease based on bacteremias secondary to pneumonia or enteric disease. The most frequently isolated organisms are Pasteurella spp. Diagnosis is based entirely on the lack of lesions typical of other CNS diseases and the ability to aseptically obtain good culture materials for identification of pathogens.

REFERENCES

1. Pierson, R.E., Kainer, R.A., Clinical Classification of Pneumonias in Cattle. The Bovine Practitioner (15):73-79, November, 1980.

2. Pierson, R.E., Jensen, R., Lauerman, L.H., Sudden Deaths in Yearling Feedlot Cattle. JAVMA 169(5):527-529, 1976.

3. Glock, R.D., Cheney, J.C., Sudden Death in Finishing Cattle. Beef Sciences Newsletter, Colorado State University, Fort Collins, CO, March, 1991.