PREVENTING BRD IN CALVES

Managing Calves to Prevent Respiratory Disease

Bovine respiratory disease (BRD) syndrome is a complex of disease conditions that are manifested clinically as a combination of respiratory distress signs or, in severe cases, by death. Its ultimate economic impact is decreased growth and performance efficiency. The terms "shipping fever" and "enzootic pneumonia" are commonly used by producers and veterinarians to describe BRD.

Anyone who raises calves-the cow-calf producer, the feedlot owner, the veal grower, or the dairy farmer-is well aware of the major problem that BRD has been estimated to have cost the U.S. cattle industry over $624,000,000 in 1994. After the first 2 weeks of life, BRD is the most common as well as the most serious disease that affects cattle.

Agents that Cause BRD

Many different microorganisms cause BRD in calves. The most common viral agents are infectious bovine rhinotracheitis ("red nose"), bovine viral diarrhea ("mucosal disease"), parainfluenza 3, and bovine respiratory syncytial. Although explosive outbreaks of viral infections that are rapidly contagious and associated with severe clinical signs sometimes occur, these infections more typically begin with minor upper respiratory signs of coughing, rapid breathing, nasal discharge, and reddening of the eyes and nasal passage lining. Viruses are transmitted by direct contact between animals and are also carried on aerosol droplets in the air and equipment used on multiple animals (balling guns, dehorners, etc.). Infections with the BVD virus can be particularly troublesome for the calf as this virus can cause a generalized depression of the immune system, depriving the calf of its natural defense mechanisms.

Bacterial agents involved in BRD include Pasteurella haemolytica, Pasteurella multocida, and Haemophilus somunus. Although H. somunus is most commonly associated with thromboembolic meningoencephalitis (TEME) in feedlot cattle, it is occasionally implicated in outbreaks of BRD.

P. multocida can often be cultured from the nasal passages of healthy calves and is almost always a secondary invader of the lower respiratory tract following a primary viral or bacterial (P. haemolytica) infection. It can cause severe pneumonia and death in affected calves.

P. haemolytica can be cultured from the nasal passages of nearly two-thirds of healthy yearling feedlot calves and from 95% of dairy and veal calves. Normally, only a small number of these bacteria migrate to the lower respiratory tract (trachea, bronchi, and lungs). Many are trapped in the mucus that lines the tract and are cleared by normal defense mechanisms.

In modern cattle facilities, a large number of calves are often placed in close proximity to one another. When these calves are overly stressed (which can occur, for example, at weaning, when commingling in new groups, during movement between barns, farms, or the feedlot, or after a viral upper respiratory infection), P. haemolytica rapidly reproduces in the calf's nasal passages, overwhelms the clearing mechanisms of the trachea and bronchi, and colonizes the lungs. white blood cells congregate in the lungs and attempt to engulf and digest the bacteria. Unfortunately, P. haemolytica produces a special "poisonous" substance called a leukotoxin that can immobilize and kill the white blood cells. When these "defenders" die, they release protein-digesting enzymes into the lung tissue that cause much more damage than the effects of the P. haemolytica alone. Animals that recover from the infection are often left with scarred, compromised lungs. These so-called "respiratory cripples" or "poor doers" do not grow as quickly as normal animals and are much more likely to succumb to stress-induced diseases later in their lives.

Management Practices to Prevent BRD

Unquestionably, keeping calves clean, dry, well nourished, draft free, isolated from other cattle, and free of environmental and handling stress represents the ideal method for preventing BRD. In the intense husbandry conditions often seen in modern feedlots, veal barns, and dairy farms, however, some compromise in these ideals is usually required. Programs aimed at BRD prevention involve (1) administration of antibiotic medication in feed and (2) vaccination.

Medication in Feed

The strategy of adding antibiotic medication to feed is based on the assumption that the animals will eat an anticipated amount of feed to receive the required dose of antibiotic. It has been well documented that the stress of moving healthy calves into the feedlot causes them to eat only 0.5% to 1.5% of their body weight during the first week after arrival, compared to 2.5% to 3.5% of their body weight 2 to 4 weeks later. Sick calves eat even less. The stress of transporting cattle, weather change, weaning, commingling, and the like can be anticipated and the animals can be given antibiotic in feed a few days prior to the initiation of stress. This ensures an adequate blood and tissue level of antibiotic before the disease challenge.

Veterinarians can recommend products and dosage schedules that will optimize this type of prevention program.

Vaccination

The importance of vaccinating calves against viral respiratory disease has been well established. There are a myriad of combination viral vaccines on the market. These vaccines include killed virus products, modified-live (nonvirulent) products, and combinations of both killed and modified-live viruses. The killed products are often believed to be safer and less immunosuppressive, but they require at least two doses to be effective. In contrast, the modified-live products are felt to impart greater immunity; they may require only one dose to be effective, because a number of these vaccines contain modified-live viruses that replicate in the animal. Whereas most of these vaccines are given via intramuscular of subcutaneous injection (requiring at least 7 to 14 days for immunity to develop), some can be given intranasally (which provides protection to the lining of the nasal passages within 2 to 3 days). A number of the intranasal vaccines have also been shown to stimulate the production of interferon, a general antiviral protein.

The use of vaccines to immunize calves against Pasteurella-induced pneumonia has been more controversial. Historically, whole cell bacterins were used for this purpose. Pasteurella bacteria were grown in the laboratory, killed, bottled, and injected into calves. The ability of these products to impart effective immunity was not always well established, and these bacterins often contained many extraneous protein antigens that led to complications that included abscess development at the injection site and vaccine reactions (e.g., anaphylaxis). Furthermore, in the early 1980s, it was discovered that P. haemolytica bacterins actually **worsened** the bacterial disease. Because the immunization targeted the capsule that surrounded the P. haemolytica organism, the body's "first-line defenders" (neutrophils and macrophages) were better able to locate and attack the organisms in higher numbers. Unfortunately, this created more targets for the leukotoxin produced by P. haemolytica. The killed neutrophils and macrophages released large amounts of enzymes, resulting in extensive lung damage. In recent years, subunit vaccines have been developed to circumvent the problems associated with P. haemolytica vaccination.

Proper selection of vaccines and the timing for immunization vary with the disease challenge faced by different herds and different husbandry situations. The use of a veterinarian in planning the best immunization strategy for each particular situation cannot be overemphasized.

The Immune System

There are two major pathways by which immunity develops: (1) humoral immunity (antibody development-primary immune response) and (2) cell mediated immunity (activated lymphocyte development-secondary immune response). Both of these pathways begin when the body comes in contact with some type of foreign material ("antigen"). The antigen is engulfed, digested, and processed by the neutrophils and macrophages and presented to specialized cells that react to the antigen in different ways: the B cells produce antigen-specific antibodies, whereas the T cells produce activated lymphocytes. Following their first encounter with the antigen, the B and T cells are programmed to respond to the antigen in the same way. Usually only after the second encounter with the antigen, however, are the programmed cells stimulated to create **large numbers** of antibodies and activated lymphocytes. Although producers and veterinarians usually discuss the more easily monitored levels of antibody ("titer") that are produced by vaccinations, both immune system pathways can be important in eliminating the foreign material.

The success of the immune process depends on a number of different variables. Each animal has its own inherent (genetically controlled) strengths and weaknesses. Coupled with these genetic factors are the developmental events that occurred prior to birth (congential effects). Thus, there is a great deal of variation among calves in their ability to mount an immune response as early as the day of birth. From that point, stress or inadequate nutrition (subminimal or excessive levels of energy, protein, vitamins, or minerals) can greatly affect immune system function. Immune response is deeply dependent on the individual animal and its environment. From this perspective, vaccination response is viewed as an idiosyncratic reaction to the vaccine, and variations in level of protection can thus be better understood.

Conclusion

Bovine respiratory disease syndrome will probably never be entirely eradicated. With the careful use of good management practices (good husbandry techniques to minimize stress and reduce disease challenge, proper use of preventive levels of antibiotics in feed, and programmed immunization of calves against the major viral and bacterial BRD pathogens), however, the severity of BRD and its economic impact on the producer can be minimized.