Infectious diseases are the primary cause of mortality in young dairy calves. Most calves tend to become infected with certain diseases at particular times of their lives. During the first 90 days of life is when most infectious problems arise in dairy calves. Knowing what disease affect calves during different stages of their life can make managing these disease problems easier. This discussion will cover some of the more important calfhood diseases during the first 90 days of life of the hutch-raised dairy calf.

I. The Newborn Calf

Newborn calves that are born blind, ataxic, fail to stand, or have hydrocephalus (domed shaped heads) often suggest that the calf was infected and damaged by an in-utero viral infection from the dam, or possibly developed a nutritional deficiency (rare cases) in the dam which caused developmental abnormalities in the fetus. Two major infectious agents that are known to cause these clinical presentations (blindness, ataxia and hydrocephalus) are Bovine Viral Diarrhea virus (BVDV) and Blue Tongue virus (a rare occurrence). The clinical features seen in these calves are due to viral associated damage to the brain. Since these infections are in utero, animals affected, particularly with BVD, may become persistently infected (PI) animals. Evaluating these newborn calves for the possibility of them being PI animals may assist the dairyman in determining the extent of active BVD infection in his herd.

Blind calves may also be due to a Vitamin A nutritional deficiency. This is a primary problem of first calf heifers that have been fed marginal diets (diets particularly lacking in green forage). The cause of the blindness is due to two problems noted in vitamin A deficient animals. These are (1): damage to the retina due to a lack of vitamin A dependent occular neurotransmitters and (2) the optic nerve damage due to bone remodeling of the bones of the skull of the growing fetus.

Failure to thrive calves are often associated with complications due to dystocia. These calves may have brain damage due to anoxia during parturition. Calves that may have had oxygen deprivation may be dummy calves, blind calves, or calves that cannot seem to drink properly. Aspiration of meconium into the lungs due to fetal stress at the time of delivery may cause pneumonia in affected calves. Often these calves do poorly and die during the first week of life. Examination of these calves at necropsy often fails
to identify any serious infectious agents or other lesions which can be attributed to their clinical presentation.

Aspiration of milk or other fluids given to the calf through a stomach tube is another common cause of death to newborn calves. It is always important to prevent the stomach tube from being placed in the trachea and lungs. Calves that have had the stomach tube placed in the trachea or lungs may die immediately after intubation or survive several days and develop a severe necrotizing pneumonia. These pneumonias are often refractive to treatment with antibiotics.

II. Diarrhea

Diarrhea is the primary cause of death of most of young calves between 1 and 21 days of age. In order to administer proper treatment for these conditions, it is important to identify the causative agents.

K99 E. coli is the primary diarrhea disease of calves between 1 to 5 days of age. The reason calves are affected with this bacteria only between 1 and 5 days, is because the intestinal epithelial cells of this age of calf have certain attaching proteins on the intestinal surface that allows for this bacteria to attach to the epithelium causing the intestine to secrete tremendous volumes of fluid into the intestinal lumen. This leads to severe diarrhea, dehydration, and death of the affected calves. The diarrhea can become so watery that herdsman cannot recognize the watery diarrhea from urine. Since these bacteria attach to the intestinal epithelium but does not cause damage to the intestinal wall lining, it is difficult to demonstrate lesions in the intestines other than severe watery diarrhea. Sometimes the calves are so dehydrated at the time of death that the intestine does not have copious amounts of fluid present. To identify K-99 E. coli, fecal samples can be submitted for testing. Fortunately, special bacterial detection procedures are available for laboratory detection of the bacteria. Also, the bacteria are easily identified on histopathological examination of the intestines in infected calves presented for necropsy. Calves older than 5 days of age have lost the attachment mechanism on the intestinal epithelial cells rendering these bacteria non-infective to the older calves.

Rotavirus and coronavirus are two of the primary viral agents that cause diarrhea in neonatal calves. Rotavirus usually affects calves between 3 and 15 days of age. Older calves maybe become infected but often have less severe disease. The virus tends to affect the tips of the small intestine villi, leading to malabsorption and diarrhea. Coronavirus can cause a severe diarrhea in calves between 5 and 21 days of age. Most severe diarrheas tend to be in younger calves between the ages of 5 and 15 days of age. Older calves can become infected but tend to have less severe diarrhea and often recover from the affects of this virus. Coronavirus affects the intestinal crypts of both the small and large intestine. Damage to this area of the intestine leads to severe loss of fluids into the intestine, diarrhea, dehydration and death. Of the two viruses mentioned, coronavirus is felt to cause the most severe diarrhea. Diagnosis of rotavirus is commonly done by finding the virus on examining the feces. Coronavirus is diagnosed
primarily by examining the intestines of the dead calf and performing special procedures on the intestine (fluorescent antibody testing) to determine if virus is present in the affected intestine. Electron microscopy evaluation of fecal material looking for viral particles can also be done to determine if coronavirus is present in the affected animals.

Cryptosporidia is another severe cause of diarrhea in calves. This organism tends to affect calves primarily between 5 and 21 days of age. Most severe cases tend to be in calves 7 to 16 days of age. Older calves and cows may have subclinical infections with shedding of the organism in the feces. Cryptosporidia is a protozoa parasite that attaches to multiple regions of the intestines. We often find the protozoa in the small intestine, however, infections of the abomasum and large intestine can occur. Diarrhea caused by this organism can be either mild or severe. Severe infections often lead to dehydration and death of the calf. The herdsman must be aware that this disease has zoonotic (transmitted from animals to man) potential. Individuals who have not worked with calves before often become infected and develop a severe gastrointestinal infection which can last from 7 to 10 days. People who are immune compromised (undergoing cancer treatment, organ transplants, or HIV positive) should be discouraged from working with these young animals due to the chance of contracting a Cryptosporidia infections. Diagnosis of Cryptosporidia can be accomplished by examining feces or the intestines at necropsy. On gross examination of the dead calf, there are no specific intestinal lesions to separate Cryptosporidia from rotavirus or coronavirus infections. Management of Cryptosporidia infections is one of cleanliness and good hygiene. Thorough cleaning of equipment and hutches is important in keeping this organism under control. Preventing contamination of calves through proper cleanliness of bottles, calf hutches and calf areas is critical to keep infections low. Workers should continually monitor their own personal cleanliness and be sure that when working with calves they work with the youngest first and then work up to other age groups of calves. The disinfection of boots, changing outer work cloths and washing hands should be completed before working with healthy animals.

Salmonella infections are also known to cause severe diarrhea in calves. Salmonella Newport and Salmonella Typhimurium most often occur in calves between 5 and 21 days of age. Salmonella Dublin tends to occur in older calves, usually between 30 and 60 days of age. Salmonella Newport and Salmonella Typhimurium infections are often associated with feeding contaminated colostrum, and/or unpasteurized or poorly pasteurized milk. Salmonella Dublin is the cattle adapted Salmonella and tends to infect calves at the time colostral antibodies wane. Diarrhea associated with salmonella is often bloody or fibrin flecked. Affected animals can develop a septicemia from all of these three salmonellas. Salmonella infection can be diagnosed by culturing the feces of live calves or culturing the intestinal content of dead calves present for necropsy.

Attaching and effacing E. coli is also responsible for severe diarrhea in calves. There are many different strains of E. coli in the animal environment with many being nonpathogenic. Consequently it is very difficult to identify these pathologic E. coli in the feces alone. To make a diagnosis of attaching and effacing E. coli, it important to submit
dead or dying calves to the diagnostic lab. Most of the E. coli infections rarely
demonstrate severe gross lesions in the intestine. However, some red streaking of the
intestinal or colonic wall can occur. Infections with attaching and effacing E. coli often
occur between 3 and 21 days of age. The E. coli can also be associated with rotavirus,
coronavirus, and Cryptosporidia infections. Occasional these organisms may cause
severe septicemia in calves.

Coccidia infections are rarely seen in calves that are still in hutchs. Coccidia
infections most often occur in calves between 60 and 120 day of age when they are
housed in group pens. Calves affected with coccidia often develop severe diarrhea,
which may turn bloody. Occasionally nervous signs may be seen (head pressing,
depression, tremors) in these affected calves (nervous coccidiosis). Submissions of
dead animals for necropsy or feces from affected live animals are samples that should
be submitted for the identification of coccidial infections.

III. Bacterial and viral Septicemias

Bacterial septicemias also kill many calves. E. coli septicemias often occur
between calves 3 and 21 days of age. They may be associated with bacterial infections
in the intestine or possibly from a navel infection. Salmonella septicemias caused by
Salmonella Newport and Salmonella Typhimurium occur primarily in calves between 7
and 21 days of age. Salmonella Dublin septicemias often occur in calves between 30
and 60 days of age. All of these infections may or may not be associated with diarrhea.
Necropsy examination of these animals often identifies fibrin over the surface of the
intestines or lungs, swollen joints, and encephalitis. In Salmonella Dublin infections, an
enlarged spleen, swollen liver, and hemorrhages and edema of the lungs are common
findings.

Viral septicemias caused by IBR infections are rare occurrences. These calves
often found dead between 3 and 10 days of age. Gross examination of these calves
does not reveal any lesions. However, on histological examination, we will find
microscopic lesions consistent with disseminated IBR infections. It is unknown why
newborn calves get systemic IBR infections; however, it is possible these infections
represent infections of the calf at parturition as the calf passes through the birth canal of
the dam.

IV. Pneumonia

Pneumonia rarely occurs in calves less than 30 days of age. Most respiratory
infections occur in calves between 30 and 90 days of age. BRSV is the prominent viral
pathogen seen in dairy calves. This virus may cause mild to severe respiratory disease;
however, it often predisposes calves to more severe bacterial pathogens. The most
common acute bacterial pathogens that are commonly associate with or without BRSV
infections are Pasteurella multocida, Mannheimia haemolytica, and Histophilus somni.
Mycoplasma bovis infections tend to be more chronic and not associated with viral
infections. Often Mycoplasma infected calves not only express respiratory distress but
also joint infections and head tilt due to ear infections. The drinking of unpasteurized or poorly pasteurized hospital milk is a predisposing factor in *Mycoplasma* infections. The diagnosis of both viral and bacterial pneumonias all require the presentation of sick or dead calves for necropsy and culturing in order to determine which bacteria is the cause of the pneumonia.

*Salmonella Dublin* is also known to cause pneumonia in calves. Infected calves often develop respiratory signs prior to the development of septicemia. The lungs of these calves often are hemorrhagic and wet.

IBR is another common viral respiratory pathogen of beef cattle but is rarely seen in dairy calves. It is felt that this is primarily due to the heavy vaccination of calves and cows for the virus. However, when it does infect dairy calves it causes lesions primarily in the nasal cavity, trachea, and bronchi. Ruminal infections are also seen in some calves.

Unlike beef cattle, BVD does not tend to be a serious problem leading to respiratory disease in dairy calves.

V. Conclusion

Raising calves to maturity is a constant battle against diseases. However, with proper sanitation, quality care, and management, raising these young animals to adulthood can become easier. Submitting diagnostic samples to the herd veterinarian or to your regional animal diagnostic laboratory for the identification of disease problems can assist you in identifying and correcting disease issues and aid in managing your calves.