tissue culture system and takes a week to be completed. At our laboratory we are in the process of implementing the complement fixation test[4]-especially for BVD. This test can be conducted in a shorter period of time and the antibodies measured are more likely to be directly related to the abortion. Consequently, some serological information can be obtained even when a convalescent serum sample cannot be obtained.

Additional valuable information can be obtained when neonatal calves born near the time of the abortion problem are tested for viral antibodies. The blood sample must be taken prior to the ingestion of colostrum. The fetal immune system is capable after 90-120 days of age of responding to viral infections.

3. Examination of the entire fetus and placenta: Fetuses that we examine are often retained 1-2 days before expulsion, consequently they usually have undergone extensive autolysis.

Gross examination reveals extensive extravasation and lysis of red blood cells. This hemolyzed blood accumulates in the subcutaneous tissue, perirenal tissue and all body cavities.

Microscopic examination of formalized tissue, cut and stained with hematoxylin-eosin, may be helpful. In the case of IBR, foci of necrosis are found in several fetal organs-especially the liver. Reticuloendothelial hyperplasia may occur, especially in portal areas of the liver. The BVD virus causes a vasculitis that may be evident microscopically.

4. Virus isolation and FA tests:

Tissues are pooled, frozen and studied through the methods of virus isolation and immunofluorescence. We attempt to recover the BVD virus, although it is rarely isolated. The IBR virus can often be isolated from the placental cotyledon and also found with the FA test-especially in kidney tissue. Of all the viral abortions, IBR is most frequently and easily diagnosed. However, the BVD virus may also be important and widespread even though it is not diagnosed as often. The effect of the BVD virus depends upon the stage of gestation. During the first trimester the fetus often dies and is aborted without being noticed. Mummification also occurs during this time period. The fetuses that survive become carriers of the virus. Immunocompetence usually eliminates the virus. During the second trimester, especially between 100-180 days, BVD virus infection may result in neurological defects such as cerebellar hypoplasia and retinal deficits. Fetuses infected during the last 90 days usually recover and are not aborted.

BVD infection during the last 180 days usually results in a high level of antibody to the BVD virus at birth. However, occasionally some animals are born that are immunologically tolerant[5]. These individuals are viremic and may develop mucosal lesions. They often die from diarrhea or respiratory disease. The BVD-type lesions are found especially as linear ulcers in the esophagus.

In the future other viruses such as Parvovirus may take on added significance as causes of abortion and/or neonatal disease of cattle. However, for the present time the viruses of BVD and IBR remain the ones of most concern.

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Calf Coronavirus and Rotavirus infections: An Update

C.A. Mebus, *D.V.M. Ph.D.*
Plum Island Animal Disease Center
SEA, AR, USDA
P.O. Box 848, Greenport, NY 11944

Since the initial report of rotavirus causing diarrhea in human infants, the literature on rotavirus has become voluminous. Rotaviral infection has been recorded in many species: mouse, cattle, sheep, deer, pig, horse, monkey, prognhorn antelope, impala, Thomson's gazelle, addax, rabbit, cat and dog.

Rotavirus from different species, and in some cases different isolates from the same species, can be distinguished biochemically. The importance of cross species infection is not known. The U.S. calf rotavirus did not infect piglets, while the U.K. calf isolate caused diarrhea. The mouse rotavirus did not infect calves. Human infant rotavirus caused diarrhea in calves, but the severity of illness and amount of virus shed was less than that caused by infection with the U.S. calf rotavirus.

Several methods are now available for detecting antigen or antibody. Antigen, or virus in feces, can be detected by electronmicroscopy, fluorescent antibody techniques,

immunodiffusion, counterimmunoelectrophoresis, and ELISA (enzyme-linked immunosorbent assay). Antibody can be measured by virus neutralization, complement fixation, and ELISA.

Intestinal lesions in other species are similar to those described for the calf. In the field, a synergestic action of rotavirus and *Escherichia coli* is believed to occur, but this has not been proven under controlled conditions. Dr. Torres at the University of Nebraska is currently working on this relationship and has been able to show the enhancing effect of viral infection on *E. coli* growth.

In a study in Canada on 55 calves submitted for necropsy in their first two weeks of age because of calf diarrhea, 46% of 35 calves on which a diagnosis was made had an etiologic diagnosis of rotavirus alone or in combination with *E. coli,* coronavirus, cryptosporidium, and IBR. No diagnosis was made on 20 calves; 19 of the 20 calves in this group were submitted dead.

Coronavirus infection has not received the amount of attention as rotavirus. A counterimmunoelectrophoretic test has been developed for detection of antigen in feces.

In the Canadian study previously mentioned, 37% of 35 calves on which a diagnosis was made had an etiologic diagnosis of coronavirus alone or in combination with rotavirus, cryptosporidium, IBR, and mycotic abomasitis. In a South Dakota study of 689 calves from one day to three months old, 16.4% had a coronavirus infection. Incidence of infection in 412 calves from one to 14 days old was 22%.

Neonatal calf diarrhea caused by an agent that morphologically resembled a coronavirus but was serologically unrelated has been reported. The clinical picture and lesions for this new agent were also different than those described for the first bovine coronavirus.

Malignant Catarrhal Fever

C.A.Mebus, *D.V.M.*
M. Kalunda, *D.V.M.*
D.H. Ferris *D.V.M.*
Plum Island Animal Disease Center
SEA, AR, USDA
Greenport, NY 11944

Malignant catarrhal fever (MCF) is a disease of cattle, buffalo, American bison, and deer caused by a herpesvirus. The disease can occur in one or in a combination of 4 forms - peracute, head and eye, intestinal and mild. The most commonly recognized natural disease is the head and eye form. Generally MCF has a low morbidity and high mortality.

Etiology - An etiologic agent for MCF was first isolated in 1964 in Africa from a wildebeest cow and was characterized as a herpesvirus. In 1978, herpesviruses isolated from a European bison in a zoo in the Netherlands and from a cow in Minnesota were shown to be related to the African MCF virus. The wild virus is difficult to isolate in cell culture.

History - Malignant catarrhal fever occurs world wide. The disease is usually sporadic, but once it occurs in a herd there is a tendency for it to recur. However, epizootics of MCF involving large numbers of cattle or deer have been reported. In the winter of 1972-1973, a herd of 231 cattle in Colorado lost 87 head (37%) over a period of 68 days.

The association of MCF in cattle to contact with sheep, particularly lambing ewes, was first recognized in Europe in 1878. In the mid 1800's hunters in Southern Africa noted that MCF in cattle was associated with calving wildebeest.

Signs

Clinical features - Four forms of the disease are described - peracute, head and eye, intestinal and mild, but in reality there is considerable overlap; the clinical signs can be quite variable and the diagnosis elusive.

Peracute form: Severe inflammation of the oral and nasal mucosa and hemorrhagic gastro-enteritis are observed. The course of this form is 1-3 days.

Head and eye form: This is the typical clinical syndrome of MCF. The first sign of infection is a serous nasal and ocular discharge which may occur 2-7 days before pyrexia. Pyrexia is a common sign of the disease and is often biphasic. The temperature is usually high, 104-107°F, and remains high until shortly before death at which time, it is subnormal. The bilateral nasal discharge soon becomes mucoid and then mucopurulent. Accumulation and drying of nasal exudate is common in late stages of disease, and causes partial or complete blockage of nostrils resulting in dyspnoea. At this stage the sick animal breathes through its mouth and usually drools saliva.

The oral mucosa is reddened and has necrotic foci. Because the stratum germitivum is rarely involved, the necrotic lesions are designated as erosions rather than ulcers.