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NOTES ON BOVINE VIRAL DIARRHEA VIRUS INFECTION IN CATTLE

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Bovine Viral Diarrhea Virus (BVDV) Fact Sheet:

VIRUS = Flaviviridae, Positive sense, single stranded RNA, enveloped.
Noncytopathic or cytopathic biotypes (refers to cell culture behavior).

INCUBATION = 5 - 7 days from infection to development of clinical signs. Ingestion
or inhalation are the routes of inoculation.

CLINICAL SIGNS AND PATHOGENESIS =

A. Non-pregnant animal -

Acute infection with either biotype separately, most commonly NONcytopathic. Erosions and ulcers on the oral mucosa are the key sign. Other nonspecific signs of pyrexia, anorexia, leukopenia are often present. Diarrhea may or may not be seen, with severity and presence of blood also being variable. Acute infection with some strains results in a recently recognized fatal hemorrhagic syndrome.

B. Pregnant animal -

Outcome of infection in the dam is always seroconversion (unless the dam herself is persistently infected). Outcome of infection in the fetus is dependent primarily upon the time of gestation when the mother is infected (the virus readily crosses the placenta):

- a) Conception to 60 days; Usual outcome for the fetus is early embryonic death. The fetus may survive, often with some congenital deformity.
- b) 60 to 120 days gestation; Congenital malformations can occur during this period as well. Only during this time can **persistent infection** be established, through the mechanism of immunotolerance.
- c) 120 days to birth; The fetus itself is now capable of mounting its own immune response. The calf, if not aborted, is born seropositive to BVDV prior to colostrum ingestion. Congenital deformities still are possible.

Persistent Infection = Always NONcytopathic biotype. These individuals are carrier animals, and often display no clinical signs. They can display signs of diarrhea, poor growth, congenital deformities, etc.

Sample Submission -

Always check with the laboratory you are using prior to submitting any samples as to which tissues are preferred. Sending the wrong tissue or inadequate samples will only delay diagnosis and increase diagnostic costs.

In the **live animal**, the best tissue to submit for virus isolation is EDTA-anticoagulated blood (purple top). The virus, if present, will always be within the white blood cells. Some labs, for the sake of ease of processing, use serum to isolate the virus. This practice is acceptable, however there is a very small chance that, under specific conditions (such as serum from a 1 month old persistently infected calf who received colostrum from its mother), a false negative result will be obtained. If there is sufficient antibody in that serum to neutralize the virus, whether the antibody is derived from colostrum, or induced by a vaccine or natural infection, the persistently infected calf may be rendered temporarily non-viremic. Virus will always be present within the white blood cells of a persistently infected animal, regardless of its antibody status.

At **necropsy**, heart serum could be submitted for virus isolation or antibody titer determinations. For virus isolation, the best tissue to submit is the spleen, which should be sent on ice to the lab as soon as possible after death of the animal. Frozen tissue usually is less desirable, and may decrease the chances of a successful virus isolation. Additional tissues that should be sent include lung, colon, mesenteric lymph nodes, and feces.

Differentiation of acute versus persistent (Mucosal Disease) infections -

The clinical differentiation of acute infection with BVDV and Mucosal Disease has been a point of confusion for a long time. It is important to realize that these 2 syndromes can not be distinguished on the basis of clinical signs alone. Laboratory information concerning the biotype of BVDV (Noncytopathic or cytopathic) isolated, and the lab's ability (and luck!) of identifying 2 closely related strains of BVDV from a blood or tissue sample is essential in making the specific diagnosis of Mucosal Disease. The differentiation of these 2 syndromes has value for the veterinarian in designing recommendations for the herd, not for that affected individual animal. Identification of an acute infection in a herd can help to target those animals that were pregnant during the time when the virus was moving through the herd. Specific attention (meaning virus isolation) can then be paid to the calves born to these exposed pregnant cattle, as part of a protocol designed to prevent the introduction (or perpetuation) of a persistently infected animal into the herd. Testing this small, defined population of all cattle on the farm would be economically feasible, and their removal would help to prevent the virus from being incorporated into the herd in the form of persistently infected carrier animals.

If laboratory confirmation of the presence of a Mucosal Disease case is attained, the consequences for the herd are serious. If one persistently infected animal is present, there may be several more clinically normal carriers still present in the herd. Full-herd screening protocols are expensive, but can be done. When the diagnosis of Mucosal

Disease is made in one animal, I recommend that the whole herd be tested to identify any other carriers. This decision must be made by each owner to determine if such a whole-herd test would be economically feasible.

Herd Tests -

1. Virus Isolation - Cost-prohibitive.

2. Serum Microtiter Plate ELISA - Best at this time for this purpose. Send EDTA-anticoagulated samples to: Diagnostic Laboratory, College of Veterinary Medicine, New York State College of Veterinary Medicine, Cornell University, Ithaca, NY 14851. Please call 607-253-3900 prior to sending any samples. The cost currently is five dollars per sample, which detects presence of virus.

Vaccination Recommendations

Points to remember =

1. Extent of serotypic variation among the different strains of BVDV isolates is not known.
2. Most vaccines are made from cytopathic laboratory strains of BVDV that are never isolated in the field.
3. Some vaccines are made using as a component of the vaccine a Noncytopathic strain of BVDV. This gives the vaccine an advantage in theory over the vaccines using only a single cytopathic strain of BVDV. Such vaccines using multiple strains have not been experimentally proven to cause in the vaccinee resistance to multiple strains of BVDV as tested by cross-protection challenge studies.
4. Modified live vaccine (MLV) can not be used in pregnant animals, or given to animals who will then be mingled with pregnant animals.
5. In general, modified live vaccine produces better (higher antibody titer, longer lasting antibody titer) immunity than killed vaccines.

Specific Vaccination Guidelines -

A. Dairy:

1. Most commercial herds are best served by vaccinating **lactating animals** with a killed BVDV product, or with a vaccine product having the BVDV component in a multivalent vaccine in a killed form. This eliminates the

possibility of creating potential vaccine-induced disease seen with MLV products. Use of a modified live vaccine in a heifer, for example, that will be mingled with other cows who are pregnant includes the risk of aborting one or more pregnant animals via attenuated virus shed by the vaccinated heifer. I recommend twice a year vaccination, before breeding and before calving. Also, rotation of vaccine brands every couple of years may help.

2. Calf vaccination:

Hutch -

Modified live vaccine given at 6 months of age, providing the calves are separated from the pregnant herd. If the neonatal management, and especially the colostrum management, of the farm is adequate no calf should be without some antibody to BVDV obtained through the colostrum. Calves are isolated in the hutch, but most will begin to become susceptible to BVDV infection around 6 months of age, as humoral immunity wanes. Prior to mixing with other calves in a superhutch or equivalent system, this booster of humoral immunity should keep herd levels adequate during mingling with calves of similar age. If a MLV is used, be careful to keep these calves separated from the pregnant cows and heifers.

Veal -

Many of these calves are colostrum-deprived. Since the management of these calves involves filling a barn in a short period of time, vaccination once with a MLV product would give the best protection in the most economical fashion. Risk of immunosuppression in these stressed animals must be weighed against the labor and vaccine cost of a second vaccination with a killed product, if such a vaccine is selected.

B. Beef:

Feedlot -

Killed vaccine should be given at arrival to the feedlot, in order to boost immunity enough to maintain protective antibody titer until slaughter. Immunosuppression induced by a MLV product would make the choice of a MLV product less desirable.

Cow-calf -

Vaccinate cows with a killed product before turning the bull out. Vaccinate again when cattle are run through the chute for the palpation check. Calves should be adequately protected via colostrum immunity.

Bovine Neosporosis

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Neospora is a recently emerging protozoal parasite of cattle. Infection is most often manifested as abortion. This report will review current opinion on the life cycle/transmission, clinical presentation, management and diagnosis of *Neospora sp.* abortion in the bovine.

The life cycle of *Neospora* is unknown but is probably similar to *Toxoplasma gondii*. In Toxoplasmosis, a carnivore host passes oocysts in feces. The intermediate host can be infected by consumption of feed or water contaminated with oocysts. Ingestion of tachyzoites or bradyzoites in the tissues of infected animals can also cause infection. The fetus is infected by transplacental migration of the *Toxoplasma* organisms. Experimental and natural transplacental transmission of *Neospora caninum* has been documented in dogs and cats. Transplacental infection has been the only reported route of infection. An oocyst stage for *Neospora* has not been identified. Initial infection with *Neospora* tachyzoites is characterized by invasion of the central nervous system (CNS) and muscle macrophages.

Clinically, infection with *Neospora* is characterized by abortion at 3-8 months of gestation with most abortions occurring at 5-6 months (fetal death and reabsorption has been described in experimentally infected dogs). Abortions can occur sporadically or in storms. Subsequent calves from previously infected cows are usually normal; however, cows with repeated *Neospora* abortions have been described. Gross lesions are non-specific and the fetus is usually autolyzed. Cows that have aborted appear clinically normal, usually don't have metritis or a retained placenta and continue milking. Cows that abort have higher antibody titers to *Neospora* when compared to non-aborting herd mates. Occasionally, infected calves are born alive and are recumbent at birth or within a few days. Presenting signs in these calves are hindlimb weakness and paralysis. The prognosis in these calves is poor.

Management to prevent or control *Neospora* abortions should include protection of feed and water from fecal contamination and elimination of domestic and feral animal contact with water and feed. There is no known treatment. Pyrimethamine and trimethoprim are effective in ameliorating *Neospora* infection in puppies, sulfadiazine is effective in ameliorating disease in experimentally infected mice if given early.

Specimens for the diagnosis of *Neospora* abortions should include stomach content and thoracic fluid with fresh and formalin (neutral buffered) fixed brain, heart, skeletal muscle, liver, lung, kidney, thoracic fluid, stomach content, spleen, and placenta. Multifocal, necrotic, non-suppurative encephalitis, mononuclear myocarditis and mononuclear myositis are the characteristic microscopic lesions. An

immunohistochemical stain specific for *Neospora* is used to identify the organism in tissue sections. Tissue not fixed in neutral buffered formalin may result in false negative reactions. Serum antibodies to *Neospora* can be detected with an indirect fluorescent antibody test; however, serologic testing is not widely available.

Neospora sp. is a major abortifacient of cattle and should be considered as a differential diagnosis for bovine abortion and neonatal calves with rear limb paralysis.