Investigation of pregnancy losses in beef cattle herds associated with Neospora sp. infection

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There are many potential causes of abortion and fetal wastage in beef cattle; all can result in significant economic losses to the producer. Determination of the etiology is fundamental to developing recommendations regarding abortion control and prevention. Since it was first described as a cause of bovine abortion in New Mexico in 1987 (1), infection with Neospora sp. has emerged as a significant bovine reproductive disease. It is one of the most commonly diagnosed causes of bovine abortion in California (2), and has been identified worldwide (3).

Although most reports of significant numbers of abortions due to Neospora have been associated with dairy cattle (1,2,4,5), Neospora congenital infections and abortions have also been documented in beef cattle (6). This report presents the epidemiological and clinical observations of 2 beef herds with outbreaks of pregnancy loss associated with Neospora sp. infection.

The 2 herds involved were located in the Peace River district of British Columbia, but were separated by more than 100 km and had no contact with each other. Herd A consisted of approximately 100 commercial Simmental and Charolais cows, while herd B consisted of approximately 165 purebred and commercial Simmental cows. Both herds were vaccinated annually with a multivalent clostridial vaccine, a 4-way respiratory virus vaccine (Infectious Bovine Rhinotracheitis, Parainfluenza-3, Bovine Respiratory Syncytial Virus, Bovine Virus Diarrhea), and an Escherichia coli bacterin. Lasalocid sodium was included in the mineral salt as a coccidiostat from February to May. The owner of herd A had purchased 3 bred heifers in the fall of 1993 and 2 bulls in the spring of 1994, while there had been no recent additions to herd B. The 1994 calving season was reported to have been normal in both herds. In late April, each herd was separated into several breeding groups, which were bred either naturally or artificially over 60 to 90 d. In early July, all breeding bulls were removed, and cows from the various breeding groups were commingled. During the summer, the cattle grazed on tame and native pastures, and watered at dugouts and streams.

Herd A was pregnancy tested in early September. Seven cows were identified as nonpregnant, and 2 had recently aborted. Through September and October, several cows had a vaginal discharge, and some exhibited signs of estrus. In early October, a fetus was found and submitted to the Animal Health Center in Abbotsford, British Columbia; the diagnosis was abortion due to Neospora sp., based on histologic findings of focal areas of glosis in the cerebral cortex, and mononuclear cell infiltration of the epicardium, myocardium, renal cortical interstitium, and placenta. Two more mummified fetuses were submitted in early November; Actinomyces pyogenes was cultured from both. The herd was retested for pregnancy in mid-November. Fifteen cows that had been diagnosed pregnant in September were now identified as nonpregnant, for a total of 17 pregnancies lost since late August.

Herd B was pregnancy tested in early October, with 12 cows being identified as nonpregnant, including 1 that had retained fetal membranes. A fresh fetus was found a few days later, but not submitted. Because the owner of herd B noticed several cows exhibiting estrus in October and November, the herd was retested for pregnancy in mid-November. Fourteen cows that had been diagnosed pregnant the previous month were identified as nonpregnant.

Serum samples were collected in mid-November from most cows in both herds that had aborted, and from 3 cows that had not aborted. Samples were submitted to the Animal Health Center in Abbotsford, British Columbia. Antibody titers to Infectious Bovine Rhinotracheitis (IBR) and Bovine Virus Diarrhea (BVD) viruses were low or absent in all cows. In 4 cows with antibody titers to BVD virus of less than 1:4 (2 from each herd), buffy coat isolation of BVD virus was attempted, but was unsuccessful in all cases. A commercially available indirect fluorescent antibody (IFA) test (Veterinary Medical Research and Development, Pullman, Washington, USA) was used to test sera for antibodies to Neospora (Table 1). In herd A, 10 of 15 cows that had aborted and were available for testing were positive at a titer of 1:640. Three cows used as controls from this herd tested negative. In herd B, 6 of 14 sera were positive.

Serum sampling was repeated in late December on a number of animals from both herds. Two of 35 sera from herd A were positive for Neospora; both were from cows that had aborted and tested positive in November. Seven of 38 serum samples tested from herd B were positive; 4 were from cows that had aborted (3 had tested positive, and 1 negative, in November) and 3 from cows that were pregnant. No further losses of pregnancy were reported from either herd, and the calving season in 1995 was described as normal.

The complete life cycle of Neospora is not known. Similarities between this organism and Toxoplasma sp. suggest that an unidentified carnivorous definitive host passes an oocyst-like organism in its feces, and cattle serve as intermediate hosts after ingesting these oocysts (2). Attempts to identify the definitive host have not yet succeeded (6). At this time, transplacental transmission is the only known natural route of infection (7).

The only clinical sign observed in cows infected with Neospora is abortion (3), which typically occurs between 4 and 6 mo of gestation (4). Aborted fetuses


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Reprints are not available.
have no specific gross lesions; however, autolysis and mumification are commonly seen in outbreaks of Neospora-associated abortions (1,5). Microscopic lesions in aborted fetuses consist of nonsuppurative encephalitis, myocarditis, myositis, hepatitis, placentitis, and other lesions (1,2,5). Only a few tachyzoites are present within these lesions, and detecting them without the aid of immunohistochemical staining is difficult (3).

Antemortem identification of Neospora-infected cattle has become possible with the development of an IFA test (8). Cows that abort infected fetuses and congenitally infected calves generally have high titers. It has been suggested that the IFA test may be useful in monitoring herd status and identifying congenitally infected calves. However, the test is difficult to interpret for individual cattle (9), partly because of the subjectivity inherent in interpreting the results. The sensitivity of the IFA test has been reported to be only 76.5% at a cutoff titer of 1:640 (9). Recently, an enzyme-linked immunosorbent assay (ELISA) has been developed for the serological diagnosis of Neospora sp. infection in cattle; it has high sensitivity, specificity, and an overall correct classification of 92.9% (10). This assay will help in future epidemiologic investigations, as it is more likely to accurately identify the immune status of individual animals.

Interpreting the results of the findings in these herds is difficult. There is good evidence that herd A experienced infections with Neospora. It is not surprising that only 1 of 3 submitted fetuses was positively diagnosed as a Neospora abortion, because the number of organisms in the fetal tissues is small (3,4,7). The IFA titers determined in November also supported a diagnosis of Neospora, as 67% (10 out of 15) of aborting cows had positive titers, while none (0 out of 3) of the control group were positive. The sera collected in December show that antibody titers decreased substantially over the 5-week period between samples.

The results of the investigation of herd B are more difficult to interpret. No pathological samples were submitted; serological results are the only basis for diagnosis. Only 6 of the 14 cows (43%) that aborted had positive Neospora titers in November. This may be a reflection of the relatively low sensitivity of the IFA test, an indication that not all the cattle seroconverted, or because, perhaps, Neospora was not the cause of some (or all) of the abortions. The positive status of 3 pregnant cows at the December sampling may indicate seroconversion subsequent to an infection that did not cause abortion, or it may indicate that they were congenitally infected with Neospora.

If infection with Neospora was the cause of the pregnancy losses in these herds, exposure to the parasite likely would have occurred over a relatively short time period, while the cattle were on pasture. A source of oocysts would be very difficult to determine, since the cattle were on several different pastures, and had access to several different water sources. Anecdotally, the owner of herd A stated that the number of mice present on pastures during the summer of 1994 was greater than he had ever seen previously. Although Neospora coccidia have not been recovered from mice experimentally infected with bovine Neospora sp. (6), one could speculate that mice, or carnivores that ate mice, could be a possible source of oocysts. If Neospora is transmitted in a similar manner as Toxoplasma gondii, it is possible that infection could result from exposure to a fetus or placenta aborted by an infected heifer or cow (11).

Until the biology of Neospora is more fully understood, it will be difficult to recommend specific control programs. Aborted fetuses and placentas should be promptly disposed of to prevent ingestion by potential definitive hosts. Food and water sources should be protected from contamination by feces from other animals (11). Producers and veterinarians should be aware that repeated abortions or repeated congenital infections might occur in animals that have had an abortion caused by Neospora (12). The interpretation of serological results requires further research. It is unclear whether Neospora antibodies provide protection against abortion (10). The activity of several drugs, including monensin and lasalocid, against Neospora in cultured cells has shown some promising results (13); however, administration of these drugs to cattle as a prophylaxis or treatment has not been evaluated. It is interesting to note that these 2 herds did use lasalocid as a coccidiostat for approximately 3 mo prior to the breeding season.

This is the first report of outbreaks of abortion associated with Neospora infection in beef herds in central British Columbia. Practitioners should be aware of the role of Neospora in bovine abortions, and, as in all cases of abortion, producers should be encouraged to submit fetuses and placentas to a diagnostic laboratory to establish a definitive diagnosis.
COMING EVENTS

ÉVÉNEMENTS À VENIR

CVMA Conventions/ Congrès de l’ACMV

1996
Charlottetown, Prince Edward Island
July/juillet 3–6

1997
Saskatoon, Saskatchewan
July/juillet 9–12

1998
Toronto, Ontario
July/juillet 8–11

JULY/JUILLET 1996
CVMA 48th Annual Convention. July 3–6, 1996 in Charlottetown, Prince Edward Island. Three days of continuing education in all areas of veterinary medicine. Specialty conferences pre- and post-convention include: CAVD, CAVO, CAVP, CAYEMP, CALAS, and AHT’s. Aquaculture program featured with wet labs and field trips. Plenary I: Poisoned Roots — Practice Troubles and Client Complaints; Plenary II: Special Report on The Economic Future of Veterinarians. Social programs for adults, children and teens. Contact: Angie Herzog. Canadian Veterinary Medical Association; 339 Booth Street, Ottawa, Ontario K1R 7K1; tel.: (800) 567-2862 (in Canada) or (613) 236-1162; fax: (613) 236-9681; e-mail: ahcvma@magi.com.


35th CALAS/ACTAL Annual Conference. July 8–10, 1996 in Charlottetown, Prince Edward Island. The theme is: Prawns to Primates — Back to the Future. Workshops include: fish handling and anesthesia, fish diseases and histopathology, post-operative analgesia in laboratory animals, facility design and operational considerations in the use of cage isolation equipment, documentation and reports for an effective animal care and use program. Contact: Dr. Don McKay, CALAS/ACTAL National Office, Biosciences Animal Service, CW 401 Biological Sciences Building, Edmonton, Alberta T6G 2E9; tel.: (403) 492-5193; fax: (403) 492-7257; e-mail: dmckay@gpo.srv.ualberta.ca.


Mauritius Veterinary Association Regional Conference. July 31–August 2, 1996 in Mauritius. Contact: Dr. M.R. Jaumally, MVA Secretary, tel.: 454-1067; fax: (230) 4568893/4648749.

AUGUST/AOUT 1996
International Symposium on Hypothyroidism. Early August, 1996 at University of California in Davis. Topics include: genetic implications of the disease; dermatologic, neurologic, and reproductive effects of the disorder. Contact: Tino Garcia, American Kennel Club, 51 Madison Avenue, New York, New York 10010; tel.: (212) 696-8236; fax: (212) 696-8299.


Association of Avian Veterinarians Annual Conference & Expo. August 27–31, 1996 in Tampa, Florida. Conference will highlight: avian medicine and surgery; with sessions on ratites, infectious diseases, aviculture, practice management, and environmental practice. Contact: Association of Avian Veterinarians Conference Office, 2121 S. Oneida St., Suite 325, Denver, Colorado 80224 USA; tel.: (303) 756-8380; fax: (303) 759-8861; e-mail: AAVConfOC@aol.com.

SEPTEMBER/SEPTEMBRE 1996
Genetic Engineering and Animal Welfare: Preparing for the Twenty-First Century. September 5–6, 1996 in Chicago, Illinois. Topics: IACUC review of genetic engineering protocols; ethical issues; assessment of animal safety: immediate and long-term effects; transgenics and the media: the public relations aspect; agricultural animals and genetic engineering; scientists' concerns with genetically altered animals. Contact: Conferences, SAW, Golden Triangle Building One, 7833 Walker Drive, Suite 340, Greenbelt, Maryland 20770; tel.: (301) 345-3500; fax: (301) 345-3503.

References