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Calf Note #97 – BSE and calves

Introduction

In December, 2003, the first case of BSE (bovine spongiform encephalopathy), otherwise known as “mad cow disease” was reported in the United States. The resulting actions by the U.S. Department of Agriculture affected not only the dairy farm where the disease occurred (the “index” herd), but also affected a calf ranch to which offspring from the infected cow were sent. This Calf Note is intended to provide some information related to the actions of the USDA and why they would be interested in controlling offspring of cows infected with BSE.

The calf ranches

For readers unfamiliar with the calf industry in the western U.S., the industry has grown increasingly specialized, with farms designed to raise calves during various phases of production. These farms, called “calf ranches” can be quite large – some ranches raise more than 10,000 calves per year. Some farms raise heifers, some raise bulls, and many raise both. Some farms specialize in calves of particular ages. Others raise heifers to calving and bull calves to finishing. It is common for dairies to sell bull calves to calf ranches at birth. Calves are picked up daily at dairies and delivered to the ranches either by workers from the ranch or custom calf haulers. On some large ranches, it is common for more than a hundred calves to be delivered to calves every day.

Outbreak of BSE

NOTE: the information summarized here is current as of January, 2004. The first case of BSE was reported in December, 2003 was in a Holstein cow that was (apparently) imported from Canada into the U.S. in 2001. This animal had three calves prior to going to slaughter. One calf was stillborn, one was a heifer that stayed on the index farm and the third was a bull calf that went to a calf ranch in Washington. When the case of BSE was reported after the cow went to slaughter, both the index farm and the calf ranch were quarantined pending final disposition of affected animals. The calf, once identified, will likely be destroyed as part of the government’s program of eradicating the risk of infected (or potentially infected) animals entering the food chain.

How is BSE spread?

The only known method that animals can contract BSE is through the consumption of animal by-products contaminated with “specific risk materials” or **SRM**. The SRM include those parts of a cow’s body that have been shown to transmit the disease and include the brain and spinal column, basal ganglia, eyes and distal ileum. **It is important to note that other animal products, including meat, milk and by-products that do not contain SRM do not transmit the disease.**

Outbreaks of BSE in countries throughout the world were thought to have occurred when cows were fed ruminant meat and bone meal contaminated with SRM. Initially, the source of BSE was

thought to be scrapie (a similar disease in sheep), but this has not been determined conclusively.

BSE is not transmissible from cow to cow, and as such, it is not a “contagious disease”. Rather, cows become infected by consuming feed contaminated with SRM. So, why would the USDA be concerned about the calf born from a BSE infected cow?

The concept of maternal transmission

One way that a disease agent can pass from one animal to another is by maternal transmission (i.e., transmission from the mother to the calf). This is also referred to as “vertical transmission” and is a common vector for transmission of many diseases. A good example is transmission of *Mycobacterium paratuberculosis* (Johne’s disease) from cow to calf via colostrum.

Does BSE transfer from cow to calf? If so, what is the risk that calves from BSE-infected cows would themselves developed the disease? Can this be one method for the continuation of an outbreak of the disease? What are the implications for calf raisers?

The question of maternal transmission of BSE and other encephalopathies such as scrapie in sheep and chronic wasting disease in wild ruminants has been the subject of intense scientific debate and inquiry. This was particularly true after the BSE outbreak in the UK, since many thousands of cattle developed the disease and thousands of calves could be affected. The implications were huge. So, the question of maternal transmission needed to be addressed.

Research into maternal transmission

Researchers in the UK conducted studies on the role of maternal transmission beginning in 1989. The researchers studied two groups of animals with over 300 cattle in each group. One group consisted of calves of dams with confirmed cases of BSE, and the other group had animals born in the same herd and in the same calving season whose mother had reached at least 5 years old without showing clinical signs of BSE. Animals in the two groups were kept until the age of 7 or until they were culled due to BSE or another disease.

Of 273 calves born to mothers with BSE, 42 developed BSE. Of 273 other calves born to mothers who did not have BSE, 13 were confirmed with BSE. The disease showed up in both groups because the cattle studied were born around the time of the ruminant feed ban in 1988, and so some cows consumed infected feed. There did appear to be some time sensitivity to the data – that is, when cows showed clinical signs within six months of calving, the calves were at greater risk of having contracted the disease compared to cows that showed clinical signs more than six months from calving. Based on this information and studies evaluating the risks associated with artificial insemination and embryo transfer, the Scientific Steering Committee of the European Union (a scientific advisory group to the EU) concluded (1) that:

- The results of all epidemiological studies undertaken to date have been consistent with a rate of maternal risk enhancement of approximately 10% in the offspring of dams within 12 months of the onset of clinical signs of BSE. Where the time lapse between parturition and onset of clinical symptoms is longer than 12 months, the rate of maternal transmission is

reduced. Whether infectivity is transferred directly before birth or after birth by a variety of mechanisms (e.g., calve infection by contaminated material, environment contaminated with blood, feces, infected feed, etc.) is uncertain and should be further investigated.

- There are no scientific data to support the hypothesis that infected calves are unduly sensitive to infection on a genetic basis.
- On the basis of the limited data available, it appears that there is no enhanced risk of the development of BSE in the offspring of sires who developed BSE. It is therefore unlikely that semen constitutes a risk-factor for BSE transmission.
- Preliminary results from the incomplete embryo transfer study suggest an extremely low risk of transmission (95% confidence limits: 0-1.5%). These results are consistent with maternal transmission being mediated later in the gestational period either during or following birth of the animal.
- transmission of BSE by artificial insemination is unlikely for semen derived from BSE-affected bulls early in their incubation period.
- transmission of BSE by *via* embryos is unlikely provided International Embryo Transfer Society protocols are used.

While the above research suggests that there is some means of maternal transmission of BSE in cattle, other researchers in the UK are much more skeptical of a cow to calf link. Indeed, in a web-based article (2), Drs. R. M. Ridley and H. F. Baker of Cambridge University wrote: “*reexamination of the source data reveals that these data are extremely scanty, unreplicated, and probably subject to ascertainment bias. The probability of maternal transmission of spongiform encephalopathy in any species should be viewed with the greatest skepticism.*” They question the research done to document maternal transmission in sheep with scrapie, which was done with small numbers of animals and was conducted prior to our understanding of the method of transmission of the disease. These authors also wrote (2) “*Nationwide surveillance [in the UK] of bovine spongiform encephalopathy has shown no greater incidence in the offspring of dams with bovine spongiform encephalopathy than in animals in the same herd whose dam did not have the disease, the incidence in both being consistent with foodborne contamination within these herds.*” Clearly, these authors question whether maternal transmission actually does occur, or whether the problems are associated with the experiments that have been conducted to date.

How is BSE transmitted to the calf?

Although epidemiological studies show a statistical relationship between BSE in cows and their calves, these studies provide no information as to how the disease might be transmitted from cow to calf. There are several possible vectors, including in utero, during the birthing process and consumption of colostrum. However, no research has been able to show how BSE is transmitted from cow to calf, if in fact the disease is transmitted in this manner.

The actions of the USDA

The actions of the USDA to limit movement of calves from the affected calf ranch were made to assure the public that the government was taking every reasonable precaution to protect the public. Their actions to identify and isolate the bull calf were based on the probability that calves born to cows that develop BSE are more likely to develop the disease themselves. As indicated above, there are at least some data that suggest a link between cow and calf regarding BSE. In this context, the

actions of the USDA appear to be justified and reasonable.

What can you do?

It is impossible to identify calves that come from cows that may develop BSE, so prescreening of calves that arrive on your calf ranch is impossible. BSE is not spread by animal to animal contact, so no special animal handling precautions are necessary. Rather, the most important thing a calf rancher can do is to maintain detailed records on the source of each calf and when it arrived at the ranch. In this way, it will be possible to quickly and certainly identify animals if it is required by government agencies. This effort will be greatly enhanced by a universal animal ID system, which appears likely to be implemented in the U.S. Of course, complying with existing feed regulations is critical to eliminating the risk calves consuming the infective SRM.

A final comment

Our understanding of BSE and how it is spread has progressed tremendously in the past 10 years. Regulations that are in place in the U.S. – especially the ban on feeding SRM to cattle – are essential to keeping our beef supply safe and have eliminated the risk of BSE becoming an epidemic like that observed in the UK. The safeguards in place today will keep our beef supply safe. I wholeheartedly believe that American beef is safe and wholesome. My family and I have eaten beef since the first report of BSE in the U.S. and we will continue to do so.

References:

1. Scientific Steering Committee of the European Union. Opinion on the possible vertical transmission of bovine spongiform encephalopathy (BSE) adopted by the Scientific Steering Committee at its meeting of 18-19 March, 1999.
2. Ridley, R. M. and H. F. Baker. The myth of maternal transmission of spongiform encephalopathy. <http://bmi.bmjournals.com/collections/bse/myth.htm>.

Written by Dr. Jim Quigley (04 January 2004)
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