Bovine Viral Diarrhoea (BVD) Virus Breakdown in a Scottish Herd

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Paul works at Royal School of Veterinary Studies and he is employed to lead the farm clinical team and develop the services that are offered to current and new clients. The main aims are to ensure a thorough and complete clinical service that will benefit the teaching of veterinary students as well as the local farming community.

Farm background

- 83 cow Holstein Friesian dairy herd, with a 28 cow suckler herd.
- Closed herd; buys in replacements bulls.
- Three bulls are kept on farm for natural service of cows and heifers.
- Annual milk yield: 4,984 kg at 3.51% butterfat, 3.56% milk protein.
- Dairy cattle calve all year round, beef cattle calve in Spring.
- Replacement heifers are reared on the farm, with the aim to calve at two years old. Beef cross heifers are used as replacements for the beef enterprise. Otherwise beef cross heifers and bull calves are raised as stores (sold at two years old).
- Farm also has 200 North Cheviot ewes.

History

The farm had only recently become a client of the practice following the closure of their previous farm animal vet practice. An initial farm visit and meeting with the owners had been undertaken before the described case occurred. As part of the Scottish Government BVD Eradication scheme, the farm needed to have a yearly check test performed. Up to this point the farm had a 'negative' status for BVD. Due to the mixed cattle enterprise on the farm, the check test involved blood sampling ten dairy calves and five beef calves from each separately housed group. The calves tested were all over nine months of age. On this farm the beef calves and the dairy calves were kept as separate management groups. This check test revealed that the majority (12/15) of the calves had seroconverted to BVD. The farms status was therefore reverted to 'not negative' meaning animals could only be sold directly to slaughter. Due to the obvious economic effects that this would have on the beef side of the business the farmer was concerned as to how this would impact his farm. This concern prompted further investigations on the farm and a review of current management practices.

Herd Assessment

Following the discovery of multiple calves having seroconverted to BVD, a visit was made to the farm on 7th February 2017 to discuss the situation and reassess biosecurity protocols. The discovery of an 80% seroconversion rate in the calves tested was highly suggestive of the presence of a persistently infected (PI) animal in one or both groups of calves and so the focus of the initial investigation was on the possibility of this occurrence. Following discussions with the farmer, the presence of a PI animal in these groups was deemed unlikely. The farm operates as a closed herd (excluding occasional purchasing of BVD negative bulls) and has been BVD negative since the start of the Scottish Government BVD Eradication scheme. No cases of mucosal disease have been identified historically and the farmer reported no unexplained increases in calf morbidity/mortality. The current biosecurity protocols defined in the Herd Health Plan adhere to the Government recommendations for preventing BVD infection.

- Maintaining a closed herd.
- Purchasing individually BVD negative bulls.
- Preventing contact with cattle on neighbouring farms using double perimeter fencing.
- Equipment and personnel are not shared with other farms.
- Cattle not to graze pasture with sheep.

The on farm discussions yielded no obvious cause for the BVD breakdown and so further testing was instigated.

Due to the nature of the farm's enterprise and the farmer's determination to identify and resolve the problem thus regaining his 'negative' status, it was decided that all animals would be tag tested for virus antigen (PCR). By adopting this method, we could not only identify any PI animals on the farm but would also have an individual result for all cattle (allowing the sale of negative animals rather than sending all animals direct to slaughter).

Initial Problem List

- Failure of BVD check test.
- Seroconversion to BVD in 80% of calves tested for check test.
- Farm now has 'not negative' status; can only sell directly to slaughter.
- Will be unable to sell calves as stores.
- Unknown source of BVD infection.
- Potential effect on immune status of livestock and therefore susceptibility to disease.
- Potential breach in biosecurity.

Diagnostics

An initial herd screen for BVD antigen using the tag test method for BVD Antigen PCR was undertaken. This was completed on all calves and adult stock in March 2017. The results of these tests and the earlier check tests can be seen in Table 1.

One calf was reported as an insufficient sample. This animal was blood sampled on 20th March 2017 and tested for antigen. This individual was negative after the repeat sample.

Status AFTER test	Test type	Ab total	Ab pos.	Ab inc.	Ab Neg.	PCR total	PCR pos.	PCR inc.	PCR neg.
Negative	SG check test	10	0	0	10	0	0	0	0
Not negative	SG check test	15	12	0	3	0	0	0	0
Negative	SG check test	5	0	0	5	0	0	0	0
Not negative	SG calf screen	0	0	0	0	124	3	0	120
Not negative	SG part whole H	0	0	0	0	190	0	0	190

Table 1. Summary of herd diagnostic results - identifying three PCR positive calves.

Prevention and/or Follow Up

The whole herd screen identified three PCR positive calves. A 20 day old British Fresian (BF) female, a 44 day old BF male and an 11 month old BF male. The two youngest calves were euthanized and disposed of by a local Fallen Stock company. The 11 month old calf was intended to be sent to slaughter, however the farmer found it difficult to identify a slaughterhouse that was willing to receive it. The farmer was advised to keep this individual isolated until he had found somewhere or alternatively to dispose of the calf in the same way as he had the younger animals. A slaughterhouse was eventually found and the calf removed from the farm within seven days.

A follow up visit to the farm was made on 20th March 2017 to blood sample the animal that had produced an insufficient sample on the tissue tag. At this time additional questions were asked of the farmer to refine the original problem list.

- *Failure of BVD check test* ➜ whole herd test performed to identify PIs.
- *Seroconversion to BVD in 80% of calves tested for check test* ➜ three potential PI calves identified.
- *Farm now has 'not negative' status; can only sell directly to slaughter* ➜ 'not negative' status retained.
- *Will be unable to sell calves as stores* ➜ all animals now have an individual BVD result, so negative animals can be sold as stores.
- *Unknown source of BVD infection* ➜ further information needed as biosecurity breakdown is indicated.
- *Potential effect on immune status of livestock and therefore susceptibility to disease* ➜ still no significant increases in calf morbidity/mortality.

Refining the problem list identified that there must have been a breach in the biosecurity protocol of the farm. Further questioning of the farmer identified that last year his cattle were grazing pasture that bordered a roadway. A neighbouring farm of unknown BVD status (suspected 'not negative') had moved their cattle on this road whilst the naïve herd were grazing. This movement of cattle occurred over a prolonged timeframe and had the potential for nose to nose contact between the different farms' stock. No pregnant cattle have grazed this field since this incident. The farmer also noted that one of his grazing fields is downstream of a water course that runs through the neighbouring farm. Since the BVD breakdown he has stopped using this field for grazing cattle.

The biosecurity plan for the farm was reviewed to include this new information. It was advised that cattle were no longer grazed in the field sharing the water course (not as a BVD control measure but for other infectious diseases). Pregnant cattle would no longer be grazed in the field bordering the roadway and a double perimeter fence would be put in place alongside this boundary. All double fencing bordering neighbouring farms would be checked, prior to cattle grazing fields, to ensure it was still intact.

The 'not negative' status of the farm will be in place until 12 months have passed since the last PI animal was removed. Although at that point the farm could return to annual check tests, it has been advised to continue with the tag testing of all calves born. Since discovering the three PI animals in March, all tag tested calves have been negative on BVD tissue PCR. The farm is aware that even stillborn or aborted calves should be tested to ensure every calf born is tested.

Although the new biosecurity recommendations should reduce the risk of infection, a discussion was held with the farmer regarding vaccination of the whole herd. Due to the increased workload that this BVD breakdown had caused the farmer, he was amenable to starting a vaccination protocol. After consideration and discussion about the relative merits of the different vaccinations available and their administration protocols, it was decided that Bovela® (modified live BVDV-1 and modified live BVDV-2; Boehringer) would be used annually. The agreed plan involved vaccinating all cattle every year by 8th May. Home bred replacement heifers, aged older than three months, that would be joining the breeding herds would be vaccinated at least three weeks prior to breeding. They would

then join the annual vaccination programme. Purchased bulls will be vaccinated during their quarantine period and then annually with the herd thereafter. The potential risks of pregnant cows being vaccinated that already carry infected calves was discussed and deemed an acceptable risk to implement a more straightforward vaccination programme. Continued tag testing of all calves will identify any PI animals born. Due to recent information from Europe regarding a small number of vaccinated animals producing PCR positive (but not PI) calves, any calves that are PCR positive from cows vaccinated during pregnancy this year will be isolated with their dams and retested by blood sample immediately using a PCR test. Any animals testing negative on this retest will return to the herd and those testing positive will be removed as soon as possible.

We will reassess the farm test and vaccination protocol annually from the date that the farm regains its 'negative' status.

Discussion and conclusions

The problem on this farm was first discovered following an annual check test as part of the Scottish Government BVD Eradication Scheme. Cases such as the breakdown on this farm highlight not only the importance of continual monitoring and vigilance but also potential problems with the current herd screening methods.

By considering the history of the farm and the results of further testing following the check test, we can identify the most likely candidate which led to the seroconversion of the check test calves. In the whole herd tag test, an 11 month old Hereford cross heifer calf was identified as a PI (Calf 1). This animal would have been born in March 2016, just over one month after the annual check test that year (07/01/2016). As the farm was assumed to be negative following this check test no further testing of new born calves was undertaken in the following 12 months. This meant that this PI was not identified until March 2017, allowing it to not only cause potential transient infections in in-contact animals but also risking further infections of pregnant cows. The initial check test results reveal evidence of a large number of calves having seroconverted demonstrating that they were exposed to BVDV. As well as the potential effects on production of an acute infection with the virus, the immunosuppressive effects could have led to secondary disease (i.e. pneumonia, coccidiosis etc.) in these calves. It is likely that these secondary diseases could have additional long term effects on productivity. Infection of pregnant cows was also evident due to the other two PI animals discovered during the herd test. These calves were 20 days and 45 days old indicating that their dams (tested antigen negative) were not pregnant at the time of the original exposure that led to Calf 1 being a PI. Their exposure must have occurred between the previous 6-7 months (based on calf age at testing, window of susceptibility [30-120 days of gestation], and a normal gestation length). This timeframe fits with the presence of Calf 1 on the farm. Although there is still the chance of further contact with infected neighbouring cattle being the cause, transmission from a PI within the herd is more likely (Houe, 1995; Lanyon et al, 2014).

These findings highlight problems with the annual check test where only a small subset of calves are sampled resulting in PI animals being left to infect the herd for several months without being identified.

Due to the farm's previous negative status and being managed as a closed herd, the history and test results are most suggestive of infection occurring from horizontal transmission from an external source. The movement of neighbouring cattle past land grazed by the farm is the most likely source of this transmission. Horizontal transmission by direct contact or over short distances by aerosol from a PI or transiently infected animal has been suggested (Houe, 1995). The data from our farm suggests that only one pregnant cow was infected at the stage of gestation that led to the development of a PI calf. Houe (1995) also states that horizontal transmission from an 'over the fence' contact with a PI is likely to cause only limited spread.

The control of BVD relies on excellent biosecurity measures, careful herd management and strategic use of vaccination programmes. Although a good biosecurity plan was in place on this farm not all potential sources of infection were considered. Discussions with the farmer regarding the field bordering the

road revealed that he did not consider cattle moving down it and so had not implemented the suggested double fencing. Rather than implement this change now the farmer is intending not to graze cattle in this field but if grazing in this location is necessary he will only graze non-pregnant animals. He had also identified a field that had a shared water course (downstream) with the neighbouring farm. Although transmission of BVD via this route is unlikely (Houe, 1995) this may be a source of contamination of other potentially damaging diseases such as Johnes or leptospirosis. By opting not to graze any of his cattle in this field the farmer is reducing his risks of infectious disease. Theoretically other ruminant species may play a role in the spread of BVD (SRUC, 2017), so our farmer has been advised to refrain from grazing his pregnant cattle with his sheep flock. By implementing all of these measures and ensuring that those already in place are maintained, we should be able to lower the risk of a BVD incursion into the farm.

Until 12 months has passed from the last PI leaving the herd our farm will keep the 'not negative' status. Initially this would have had huge financial implications due to an inability to sell stores to any source other than direct to slaughter. Although the initial whole herd tag testing may have been time consuming and costly it has enabled the farm to gain an individual test result for every animal. This means that he can sell his stock as normal (Scottish Government, 2017) which will minimise the economic impact of this outbreak.

Once the biosecurity measures were revised and in place the farmer was keen to consider vaccination as a longer term investment for the prevention of a BVD incursion. Once all programmes were considered the use of Bovela® was agreed as the programme which best fit the management of the farm. Concerns were raised regarding the use of the vaccine in pregnant cows (a small number of the dairy cows would be pregnant at that time of year) and the use in breeding bulls (license states that vaccine product should not be used in breeding bulls). Although the license does not include use in breeding bulls, publications have demonstrated that it is safe (Tunney, 2016). The vaccine is also safe to use in pregnant animals however there is a risk that these cows may already be carrying PI calves. This information was discussed with the farmer and the vaccination protocol was agreed.

There is recent, unpublished data that some calves born to cow that were vaccinated with a live modified vaccine during pregnancy have been found to be PCR positive on the tag test. When these animals have been blood sampled and retested the new result has been negative. This has only so far been reported in a very small number of calves in Germany. However, if we see any similar tag test results on our farm we will submit blood samples for testing.

This case demonstrates the importance of monitoring for infectious disease and having clear protocols in place for managing an infectious disease outbreak if it occurs. Without annual testing to identify this problem and rapid interventions, this farm may have suffered a much more significant problem which would have had dire implications on herd fertility, productivity, health and economics.

References

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