Neonatal calf diarrhoea: a case study

This article describes the investigation of a neonatal calf diarrhoea outbreak in a dedicated tuberculosis isolation unit. Like many calf rearers purchasing young calves, this farmer did not have control over the first 7 days of their lives. Focus therefore was on treatment of sick animals, reducing the risk of spread of pathogens and diagnostic testing to aid management. Longer term an all-in all-out programme followed by disinfection, and a review of purchasing policy to help selection of source farms was established.

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Every farm animal veterinary clinician will have encountered an outbreak of neonatal calf diarrhoea. It is generally the most common cause of morbidity and mortality in pre-weaned calves (Lorenz et al, 2011), accounting for up to 50% of the mortality in pre-weaned dairy calves (Aldridge and Potter, 2011). Early and aggressive treatment of diarrhoeic calves is essential due to life-threatening fluid and electrolyte losses. Most outbreaks are multifactorial and are an interaction between the environment, management, feeding and microorganisms (Andrews, 2004). The clinician must therefore take into account all these factors in order to minimise economic loss and animal welfare impact, and ultimately to implement management steps to reduce disease incidence in the future.

Background

This case study focuses on a dedicated tuberculosis (TB) isolation unit with 26 calves in one shed. Calves had been purchased from three different sources over the previous 2–3 weeks. On 6th June 2012, veterinary assistance was sought as in the last 10 days, eight animals had developed diarrhoea. In addition several others were reported to have dry coats, with depression and lethargy.

Figure 1. Calf housing shed.

Purchasing policy

The farm client was very strict in his purchasing policy and insisted on seeing all animals on their farm of origin before purchasing calves, which was excellent. The majority of calves were purchased at 7 days of age, but a group of ten, from 7 days to 7 weeks were purchased from one farm into the current batch. Mixing of age groups is not ideal and will increase the risks of spreading disease from older to younger animals in the group. It was advised to purchase from as few farms as possible, and to ensure all animals were of a similar age. An all-in and all-out policy with a more consistent group would allow better management.

Calves arrived with an unknown colostral or vaccination status. This is a serious difficulty in any calf-rearing enterprise where newborn calf management is out of the purchaser's control. Young, stressed calves mixing with others from different sources increases the risk of disease, but with an inadequate immune status they are at an even greater risk. As calves usually arrived at 7 days of age, there is the opportunity in future of blood sampling on arrival to assess passive transfer from colostrum. Calves with a total protein >5.2 g/dl have adequate passive transfer (Weaver et al, 2000). Those calves with adequate passive transfer demonstrate better management on the farm of origin and so improved performance for the purchaser. This will also allow improved selection of source farms. Purchasing calves from farms that demonstrate effective control of neonatal disease such as Rotavirus, Coronavirus, *E. coli* K99 and Bovine Viral Diarrhoea (BVD) will further minimise risk. Many calf purchasers will be prepared to pay a premium for animals of known health and vaccination status, and this should encourage calf producers to produce these animals.

Figure 2. Inside the calf housing shed.

Figure 3. Calves penned in pairs or threes.

Figure 4. Clean fresh water and feed in front of every pen.

Housing

Calves were housed in a large former cubicle shed (*Figures 1* and 2). On arrival they were put into spacious pens in pairs or threes with others from their farm of origin (*Figure* 3). While managing animals individually to reduce disease would be preferable it simply was not possible in this system. Calves had clean, fresh, straw bedding, fresh water and pellets in front of them at all times (*Figure 4*) plus clean straw in racks as a source of roughage (*Figure* 5). Each received 2 litres of milk per feed; this was bucket fed and made up from a skimmed milk powder twice daily. Weaning was to take place at 8 weeks of age when a calf was eating more than 1 kg pellets a day.

Nose to nose contact was possible between pens (*Figure 6*) and so therefore was the transmission of infectious enteritis. A solid divider between pens to reduce this risk was recommended. These need to be light for easy removal and easily disinfected.

Bedding-up of calves was done by going from pen to pen. This enabled the transfer of faeces and associated microorganisms, so had to stop immediately. The farmer was doing an excellent job of keeping everything clean, tidy and regularly bedded, but then acting as a walking fomite between pens. It was advised to bed-up from outside, behind the pens.

Sick calves

At least ten calves had diarrhoea on the day of investigation (*Figures* 7 and 8). Several others were dull, lethargic with dry, stary coats. Many animals remained lying in their pen on entry, and required encouragement to stand. Six affected animals were examined. four calves had temperatures >39.5°C suggesting severe diarrhoea with systemic disease, all had weak suck reflexes and poor gut fill. Most significantly all had sunken eyes, a prolonged skin tent >3 seconds, and pale, tacky mucous membranes, consistent with dehydration. A faecal sample was taken from each and submitted to the Animal Health and Veterinary Laboratories Agency (AHVLA).

The aim of therapy is to help the calf survive the episode of diarrhoea in as good a shape as possible. Treatment involves replacement of pathological losses, correcting acidosis, meeting nutritional requirements, tender loving care and, in some instances, the administration of antibiotics (Lorenz and Klee, 2007).

Treatment of sick calves up until the point the author became involved had been one animal with Synulox boluses (Pfizer Animal Health), two with Resflor (MSD Animal Health), and two with Lectade oral fluids (Elanco Animal Health) – once each. Treatment of diarrhoeic calves had to be formalised:

- Oral fluids 4 x daily – 2 litres Lectade, 2 litres milk, 2 litres Lectade, 2 litres milk, spread throughout the day. Tube Lectade if necessary
- Resflor 2 ml/15 kg subcutaneous (SC) single dose
- Attend to sick calves last of all — after dealing with healthy calves
- If no improvement or if a calf becomes recumbent contact the veterinary surgeon
- If a calf looks unwell do not wait to see if it develops diarrhoea, but act straight away and treat with fluids initially.

In neonatal calf diarrhoea, oral rehydration therapy (ORT) is the single most important therapeutic measure to be carried out by the farmer and is usually successful if instigated immediately after the diarrhoea has developed (Lorenz et al, 2011). ORT is formulated to correct or prevent hydro-electrolytic deficits and metabolic acidosis. In early ORT, feeding whole cow's milk to diarrhoeic calves is usually recommended. Considering the natural antimicrobial properties of fresh milk (i.e. lactoferrin, lactoperoxydase, lysozyme etc) and its great digestibility, milk is the ideal nutrient support for the diarrhoeic calf (Nappert, 2008).

The neonatal calf with diarrhoea can lose between 2–6 litres of fluid a day and so the addition of two extra feeds of 2 litres ORT was recommended by the author in this case. Each ORT feed needs to be separated from milk feeding by at least 2–3 hours. Whole cow's milk was not available so continued milk powder feeding was used instead. It has also been demonstrated that continued feeding of milk with ORT to diarrhoeic calves has beneficial effects on weight gain, physical appearance and recovery rate (Nappert, 2008).

Figure 5. Clean straw in racks as a source of roughage.

Figure 6. Nose to nose contact possible between pens.

A florfenicol/flunixin meglumine injection (Resflor, MSD Animal Health) was administered to all diarrhoeic calves with systemic disease — demonstrated by depression and fever. In calves with diarrhoea and severe systemic involvement antimicrobial therapy must be pondered carefully as intercurrent disease is not uncommon and the risk of bacteraemia or septicaemia is increased (Lorenz, 2007). Flunixin meglumine, a non-steroidal anti-inflammatory drug, will decrease inflammation in the gastrointestinal tract and reduce the effects of endotoxaemia and septicaemia. This should encourage feeding and aid recovery, but only when a dehydrated calf is receiving ORT.

Twenty-four hours after submitting faecal samples to the AHVLA *Cryptosporidium parvum* oocysts were identified in a pooled sample. *C. parvum*, a protozoan pathogen, has been the most commonly diagnosed cause of diarrhoea in calves under 1 month of age in Great Britain 2007–2011 (45.6%) (Veterinary Investigation Surveillance Report (VIDA), 2011). Care has to be taken with the interpretation of results, since the enteropathogens most commonly implicated in calf diarrhoea outbreaks can also be found in faecal samples from healthy calves (Lorenz et al, 2011).

There is currently no effective treatment for cryptosporidiosis, but the development of halofuginone lactate has helped its control (Head, 2008). All healthy animals and any with diarrhoea that had been present for less than 24 hours were treated with Halocur (Halofuginone lactate, MSD Animal Health). Calves 35 kg up to 45 kg received 8 ml of Halocur once a day for 7 consecutive days. Calves 45 kg up to 60 kg received12 ml of Halocur once a day for 7 consecutive days. This is the recommended dose (National Office of Animal Health Compendium, 2012). Calves were to be given Halocur after feeding at the same time each day.

The infective dose of cryptosporidia is very low; an inoculum of five oocysts has resulted in infection (Head, 2008). This low dose contrasts greatly with the parasite's ability to produce huge numbers of infective oocysts; over the 7–10 day duration of a typical infection, infected individuals may shed 10^{10} oocysts, with faecal oocyst counts in the order of a million/g (Head, 2008). The oocysts are resistant to most commercially available disinfectants and can stay alive on the farm for many months; therefore hygiene is very important for control (Mason et al, 2012).

In this dedicated TB unit all animals leave at the same time. When the current batch of calves leave the building, the farmer was advised to thoroughly steam clean, then use a disinfectant effective at killing *C. parvum* oocysts such as Kenocox (CIDLINES) or Sorgene 5 (Sorex). Then rest the building for as long as possible

Figure 7. Calves with diarrhoea.

Figure 8. Calf with diarrhoea.

(a minimum of 1 hour). Assessing the results of a comprehensive investigation by the National Animal Disease Information Service (NADIS) into calf diarrhoea, Andrews (2004) found that occurrence was 3.2 times more likely when calves were reared in groups, 1.9 times more likely when wet bedding was present and 0.6 times as likely when there was disinfection between groups.

Further faecal analysis identified rotavirus within the pooled sample. The advice of purchasing calves from farms that demonstrate effective control of neonatal disease such as rotavirus was reinforced by this finding, but ultimately management changes would control development of disease.

Follow up

A full written report was e-mailed to the farmer 2 days after the initial visit with all the findings of the investigation and subsequent recommendations. A follow-up phone call was made a week later and the farmer reported significant improvement in all animals.

Discussion

A holistic approach is required for any disease outbreak, and neonatal calf diarrhoea is no exception. In this case the farmer and veterinary surgeon did not have control over all variables, as the first 7 days of the calves' lives were out of their control. An expert clinician is able to identify and weigh up the hazards contributing to specific risks and use this to design a programme to minimise those factors with the greatest impact and to achieve maximum health and economic benefit (Aldridge and Potter, 2011).

With this in mind it was necessary to focus on what aspects could be controlled to reduce the impact of the diarrhoea outbreak. The immediate priority was to formalise a treatment programme for diarrhoeic calves. This had to be straightforward and clearly explained to the farmer so he understood not only how, but why calves were treated.

The next step was to improve hygiene and cleanliness. To limit faecal transmission by minimising contact of the farmer with calves — by bedding up from outside pens and minimising contact of calves with each other — with the use of solid dividers between pens. Many husbandry measures will reduce the risk of diarrhoea and such measures carry little in the way of additional costs. Control focuses on reducing exposure to the infectious agents and optimising the calves' resistance to them (Mason et al, 2012).

Diagnostic tests were also used. Diagnostic testing is only worthwhile if it is going to influence treatment, prevention and control strategies (Mason et al, 2012). The diagnosis of *C. parvum* allowed treatment of all healthy animals and any with diarrhoea that had been present for less than 24 hours with Halocur (Halofuginone lactate) to help control the outbreak.

In the longer term policy changes by the farmer are also needed. Such as, ensuring all-in all-out programmes followed by steam cleaning, a disinfectant effective at killing *C. parvum* oocysts and then resting the building where disease outbreak has occurred. Plus a review of purchasing policy is required – ideally this would mean purchasing calves of the same age, from as few sources as possible, and blood sampling animals on arrival (<8 days old) to determine passive transfer, but also to help in selecting source farms.

KEY POINTS

- Neonatal calf diarrhoea is generally the most common cause of morbidity and mortality in pre-weaned calves.
- Most outbreaks are multifactorial and are an interaction between the environment, management, feeding and the micro-organisms.
- Many calf rearers purchasing young calves do not have control over the first days of the calf's life.
- Focus in an outbreak of neonatal diarrhoea in these circumstances is on treatment of sick animals, reducing the risk of spread of pathogens and diagnostic testing to aid management.
- Longer term, introducing all-in all-out programmes followed by disinfection, and reviewing purchasing policy will enable selection of source farms.

Conclusion

The approach to any disease outbreak including neonatal calf diarrhoea is unique to each farm and circumstances. A holistic view is required to take into account the multifactorial nature of any disease. This must include in the short term treatment and management changes to reduce morbidity and mortality, and in the longer term preventative strategies. LS

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Adjunctive tests

1. **What percentage of the mortality in pre-weaned dairy calves does neonatal calf diarrhoea account for?**
   a. 30% b. 40% c. 50% d. 60%

2. **Adequate passive transfer in calves is achieved at:**
   a. >1.0g/dl b. >2.8g/dl c. >5.2g/dl d. >10.0g/dl

3. **Which of the following infectious causes of neonatal diarrhoea can a dam not be vaccinated for?**
   a. *Cryptosporidium parvum* b. Rotavirus
   c. Coronavirus d. *Escherichia coli* K99

For answers please see page 94