

Clinical Forum: Neonatal Diarrhoea



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ABSTRACT: *Diarrhoea is the most common disease in young calves, accounting for about 50% of all calf deaths. The disease can be easily recognised and it is important that treatment is administered rapidly in order to maximise the chance of survival. However, equally important is a thorough understanding of the underlying causes of the disease and the implementation of appropriate management steps to minimise the impact of the disease in the future. This article discusses the most common causes of neonatal diarrhoea and seeks the advice of the panel on how best to treat and manage them. DOI: 10.1111/j.2044-3870.2012.00160.x*

INTRODUCTION

Neonatal calf diarrhoea caused by infectious agents remains one of the biggest health issues in youngstock health; accounting for around 50% of all calf deaths and significant financial losses on both beef and dairy enterprises (Fig. 1). Diarrhoea can result from a number of different infectious and non-infectious causes and in the absence of diagnostic testing it is not possible to predict the specific cause based on clinical presentation alone (Fig. 2). Accurate

diagnosis is often further hampered by the fact that many outbreaks are caused by multiple pathogens

ROTAVIRUS

Rotavirus was one of the first identified viral causes of diarrhoea, and has since been found throughout the world with species specific rotaviruses being identified as significant pathogens of children and most other mammals. Calves become infected after ingesting the virus from faecal contamination of the



Fig. 1: Diarrhoea is a major cause of mortality in calves.



Fig. 2: Appropriate diagnostics are required to differentiate between the different causes of scour.

environment. After ingestion of the virus, the incubation period is approximately 24 hours, with resolution of diarrhoea in uncomplicated cases in two days. Clinical disease is typically seen in calves less than three weeks old, with a peak incidence at six days of age.

CORONAVIRUS

There is a lot of overlap in the epidemiology and pathophysiology of coronavirus diarrhoea in calves with that caused by rotavirus. Following environmental contamination by other calves or older cattle the virus enters the calf by ingestion. Clinical signs begin approximately two days after infection, with diarrhoea being mainly caused by intestinal cell loss and malabsorption. Coronavirus typically affects calves within the first three weeks of life, with peak incidence occurring between seven and ten days of age.

ENTEROTOXIGENIC ESCHERICHIA COLI (ETEC)

Epidemiological studies of both beef and dairy calves have implicated ETEC as the major cause of neonatal diarrhoea occurring in the first four days of life; however it rarely leads to diarrhoea in older calves or adult cattle. Immediately after birth, oral exposure to faecal coliforms leads to colonization of the gut with the normal commensal flora, and these organisms continue to move caudally through the gastrointestinal tract with ingesta. If environmental

contamination is high, ETEC organisms are ingested at this same time and are able to produce disease caused by the presence of two virulence factors: K99 fimbriae and heat stable toxin.

SALMONELLA

There are a number of salmonella serotypes that can cause diarrhoea in calves. In the UK the most commonly occurring serotype is *S. Dublin*. The disease usually occurs between two and six weeks after birth and can vary widely in clinical presentations; ranging from septicaemia and high mortality to mild disease which can almost go unnoticed.

CRYPTOSPORIDIOSIS

Cryptosporidium parvum is one of the most common gastrointestinal pathogens isolated from dairy calves. It is frequently identified alongside rotavirus in outbreaks of diarrhoea. Infection, like all the other pathogens discussed so far, is by the faecal-oral route. Once in the host, the organism goes through a complicated life cycle that involves multiple stages. The cycle starts when the oocyst is exposed to gastric acid and bile salts, resulting in excystation and the release of the first life stage, the sporozoite. The sporozoites invade the intestinal epithelial cells of the ileum, where the infection is typically concentrated. From this location, the sporozoites transform into trophozoites. At this stage, asexual reproduction occurs and Type I meronts are formed. Merozoites are then released into the gut lumen. These organisms can form additional Type I meronts or Type II meronts, which form micro- and macrogamonts. Micro- and macrogamonts reproduce sexually to create thin- and thick-walled oocysts. The thin-walled oocysts lead to autoinfection, whereas the thick-walled oocysts are excreted in the faeces resulting in environmental contamination. Oocysts shed into the environment are infective immediately, and remain viable in the environment for extended periods of time. Oocysts can be found in the faeces of calves as young as three days, although, peak shedding generally occurs at two weeks of age, and can continue to occur in adult cattle. Following infection, clinical signs typically peak at three to five days and last from between 4 to 17 days.

THERAPEUTICS

The leading cause of mortality in affected calves is dehydration and electrolyte disturbance. It follows that the backbone of routine therapeutics should be fluid and electrolyte replacement that is custom designed on the clinical signs exhibited by a particular affected individual. Antimicrobials and antiprotozoals are best used sparingly and only when there is a specific indication.

Oral fluid therapy

Diarrhoea results in excessive faecal secretion of electrolytes and fluid. Some pathogens will cause secretory diarrhoea in which the small intestinal

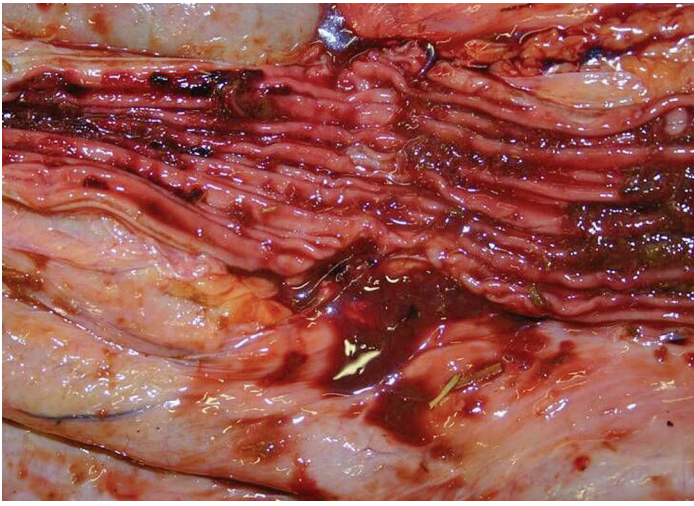


Fig. 3: Damage to the intestines results in a loss of their ability to absorb electrolytes and fluids.

enterocytes 'switch' from a net absorption of fluid to a net secretion of sodium, chloride and water into the intestinal lumen. In other cases the pathogens cause damage to the intestinal villi reducing the ability to absorb electrolytes and water (Fig. 3); this is termed malabsorptive diarrhoea. The average faecal losses are about 2L per day but can be as high as 6L per day.

The losses result in systemic hypovolaemia and then dehydration. In addition, a secondary acidosis develops; this is due to increased L-lactate concentrations due to anaerobic metabolism resulting from poor perfusion, faecal bicarbonate loss and the bacterial fermentation of nutrients in the gastrointestinal tract to produce D-lactic acid. In fact studies over the last 10 years have demonstrated that the clinical signs once attributed to metabolic acidosis, like depression and ataxia, are due to elevation of D-lactate levels rather than to acidosis *per se* (Lorenz, 2004).

Oral fluid therapy is one of the mainstays of any treatment protocol for neonatal calf diarrhoea and is widely adopted because it is cheap and easy to administer on farm. The primary objective of oral electrolyte therapy is to replenish fluid and electrolyte losses and then to maintain the calf in a positive balance; this is accomplished by three mechanisms:

1. Providing a source of additional water and electrolytes. Even if the fractional absorption of a given electrolyte is reduced, the total amount absorbed by the calf can be increased by simply increasing the quantities offered.
2. Improving absorption by providing agents such as glucose and amino acids to facilitate sodium absorption through co-transport mechanisms.
3. Providing nutritional support.

Less important objectives of oral electrolyte therapy include:

- the support of immune and enteric function
- the reduction of the potential negative impact on growth rates
- a reduction in the severity of the diarrhoea.

Oral electrolyte therapy can be administered either by a bottle fitted with a teat or by orogastric intubation. Absorption is slightly more rapid following suckling; however, orogastric intubation is frequently used because it is less time consuming. There are a large number of oral electrolyte products currently available and there is considerable variability in their constituent ingredients. Veterinarians are often not directly involved in the administration of oral electrolytes, therefore it is important that they are able to critically appraise the products being used on their clients' farms and provide advice where appropriate. When examining a product it is important to consider the following four requirements:

1. Provide sufficient sodium to normalise the extracellular fluid volume (90-130 mmol/L).
2. Provide agents such as glucose, citrate, acetate, propionate or glycine which will facilitate absorption of sodium and water from the intestine.
3. Provide an alkalinising agent (e.g. acetate, propionate or bicarbonate) to correct the metabolic acidosis.
4. Provide an energy source to correct the negative energy balance.

There have been suggestions that continued milk feeding worsens diarrhoea and that treatment protocols should involve a period of 'resting the gut' during which milk is withheld. However, research has shown that milk feeding does not worsen or prolong diarrhoea nor does it slow down healing of the intestine (Garthwaite *et al.* 1994 and Fettman *et al.* 1986). The studies also showed that continuing to feed milk alongside electrolytes maintained growth and avoided the weight loss observed in calves limited solely to electrolyte solutions.

Intravenous fluid therapy

Intravenous fluid therapy is indicated in cases of severe dehydration (greater than 8% dehydration) or in situations where the calf is exhibiting signs of CNS depression, weakness, inability to stand and an absent suckle reflex.

In practice the rapid use of intravenous fluids can be an extremely useful tool in the treatment of calf diarrhoea, and they can be used to restore an animal to a state where it can take oral fluids. Fluid administration can be facilitated by the use of intravenous catheters, which are easy to place in the jugular veins of calves. If this is not possible, then the cephalic or auricular vein can be used, although this is dependent on the temperament of the patient.

Clinicians should not underestimate the amount of fluid required. Fluid rates commonly reported for administration to large animals are very conservative. If one estimates the fluid deficits for a 10% 'dehydrated' 50 kg calf they are 5 litres and this is before you add in the maintenance requirements and address ongoing losses.

Antimicrobials

The use of antimicrobials in the treatment of calf diarrhoea is controversial. There are concerns that use of antimicrobials in the treatment of calf diarrhoea promotes antimicrobial resistance in both pathogenic and commensal bacteria. At a time when the use of antimicrobials by veterinarians is under scrutiny we should ensure that we use and prescribe them prudently. Calves with diarrhoea have small intestinal overgrowth with *E. coli* bacteria regardless of the inciting cause and 20–30% of systemically ill calves will have a bacteraemia (Fecteau *et al.* 1997 and Lofstedt *et al.* 1999). The use of antimicrobials is thus indicated only in systemically ill animals and should be focused against *E. coli* and potentially *Salmonella* spp.

Use of NSAIDs

As diarrhoea can be accompanied by intestinal cramping and abdominal pain, the use of analgesics is indicated. Non-steroidal anti-inflammatory drugs decrease inflammation in the gastrointestinal tract and reduce the effects of the endotoxaemia and septicaemia.

Treatment of viral infections

There are no specific therapies for the treatment of viral infections and so treatment in cases of rotavirus and coronavirus should be based around supportive fluid therapy. Control of viral diarrhoea can be effectively achieved through a combination of good husbandry practices and the use of vaccination in cows prior to calving to increase the quantities of virus specific antibodies in the colostrum.

Antiparasitics

Halofuginone is the only product licensed for the treatment and prevention of cryptosporidial infection in cattle and acts upon the early stages of the parasite's life cycle. In practical terms it reduces

the replication of cryptosporidia during the period of administration, which reduces the scale of the parasitic burden in the calf, and also the shedding of oocysts into the environment. This gives the calf the chance to develop its natural, age-related immunity to *Cryptosporidium* whilst reducing the level of challenge to the other calves.

FARM MANAGEMENT PRACTICES

Irrespective of the identity of the causal agent, the route of infection is the same – ingestion or inhalation of the organism from an environment which is heavily contaminated by faeces. Thus hygiene and cleanliness are paramount and along with good colostrum management are the cornerstones of prevention and control of neonatal diarrhoea (Fig. 4). Good hygiene must start from the moment the calf is born, as many infections are picked up from the calving area. Hygiene and cleanliness must then be maintained throughout the calf rearing period, with specific care being taken to clean and disinfect feeding equipment between feeds and to thoroughly clean the environment on regular occasions and between batches of calves.

CONCLUSIONS

Calf diarrhoea is a multi-factorial disease and the rapid implementation of appropriate therapy is essential for a rapid recovery. Veterinarians should work with their clients to ensure that the economic



Fig. 4: Good hygiene is the key to controlling diarrhoea.

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impact of this disease can be reduced, through the rapid management of outbreaks and the implementation of good husbandry practices and appropriate control measures.

REFERENCES

- PECTEAU, G., VAN METRE, D. C., PARE, J. *et al.* Bacteriological culture of blood from critically ill neonatal calves. *The Canadian Veterinary Journal* 1997a; 38:95-100.
- FETTMAN, M. J., BROOKS, P. A., BURROWS, K. P. *et al.* Evaluation of commercial oral replacement formulas in healthy neonatal calves. *Journal of American Veterinary Medicine Association* 1986; 188:397-401.
- GARTHWAITE, B. D., DRACKLEY, J. K., MCCOY, G. C. *et al.* Whole milk and oral rehydration solution for calves with diarrhoea of spontaneous origin. *Journal of Dairy Science* 1994; 77:835-843.
- LOFSTED, J., DOHOO, I. R., DUIZER, G. Model to predict septicaemia in diarrheic calves. *Journal of Veterinary Internal Medicine* 1999; 13:81-88.
- LORENZ, I. Investigations on the influence of serum D-lactate levels on clinical signs in calves with metabolic acidosis. *Veterinary Journal* 2004; 168, 323-327.

QUESTIONS

1. What advice do you give for the treatment and control of cryptosporidiosis?



David Barrett replies:

This is perhaps the most problematic of all the causes of calf diarrhoea, being a zoonotic disease, a major cause of calf morbidity and mortality and one for which we have no reliable specific treatment. In short, my response to Question 4 will cover treatment and much of the response to Question 3 will cover control. Control is via excellent colostrum management, impeccable hygiene and calf group management to break cycles of infection, while treatment revolves around the use of oral fluid therapy in the most part. Halofuginone in my opinion may be employed as an adjunct to good husbandry, hygiene and aggressive fluid therapy when disease occurs, but it is neither an effective treatment nor control when used alone without other measures being taken. It is also worth remembering that *Cryptosporidium* infection very often causes its worst problems when present in combination with one of the viral pathogens, especially rotavirus. For that reason specific control measures such as vaccination of the dam for these pathogens and high quality colostrum management should also be considered.



Kat Bazeley replies:

We find that cryptosporidiosis is common and often causes severe disease, particularly when in conjunction with other (usually viral) pathogens. Halofuginone has some effect in reducing diarrhoea

in affected calves, but treatment mainly rests on rehydration, provision of electrolytes and nutritional support, and nursing care (heat lamp, dry bed) to enable the calf to recover from the disease. Removal of the affected calf into an isolation unit allows for extra TLC and may reduce the risk of disease spread. Non-steroidal anti-inflammatories are probably useful because they reduce gut pain and improve calf demeanour. Once disease occurs in a unit, cryptosporidia are difficult to eliminate because the oocysts are highly resistant. The scouring calf may be shedding vast numbers of oocysts, so the environment is quickly contaminated and spread throughout the group of calves is almost inevitable. Halofuginone can be used prophylactically, but it is more important to improve hygiene to reduce the challenge to calves. All-in, all-out policy with thorough cleaning and disinfection followed by resting of calf buildings until dry will reduce contamination, but is not always practical. The general calf diarrhoea control measures outlined below should all be followed.



Rob Drysdale replies:

In terms of crypto I wholeheartedly believe that this is an issue related to poor management practices and lack of understanding of the disease process by the farmer. Recent developments with 'calf side' ELISA testing kits have made quick, and usually straightforward, diagnosis possible so that treatment can be implemented for the affected calf or group of calves. However, education and management changes are probably the most important control measure I feel a vet could introduce to their farmer.

Large calving yards under constant throughput along with automatic milk machines in group penning systems are, in my opinion, the biggest reason for the upsurge in what is really a parasitic infestation that all ruminant neonates have to be exposed to in early life. Excretion curves of crypto oocysts rise to a peak by 14 days old and by 21 days old there will be few/if any present in a healthy calf's muck. This suggests that natural immunity works well in the face of minimal exposure; overexposure to large numbers of oocysts is the issue.

Personally I see crypto as a game of exposure mitigation - take a HACCP approach to the exposure to oocysts and improvements often will be seen that reduces, even stops, the need for intervention with halofuginone. Indeed I only use actual treatment as a last resort whilst reviewing management with the farmer or in a commercial calf system where prophylaxis may be needed.

Calving yard management can help but calving pens with good biosecurity would help alongside improving cleansing and disinfection to this area of the farm. Oro-faecal spread between calves on

common items such as poorly cleaned and disinfected partitions or milk-machine teats would be a major risk. Encouraging the use of proper steam cleansing followed by oocide disinfection will give the cheapest and most consistent returns for investment of time and money.

Where prophylaxis is required I recommend use of decoquinate added to the milk daily. In the US this is often seen on commercial calf ranches – from one day old I use a daily 2 mg/kg dose of decoquinate for the first 10 days or so. This is twice the usual dose for control of cocci but as a safety margin of more than 50 mg/kg has been shown I feel this is justified. A commercial product with high levels of decoquinate pre-milled in milk powder is available for substitution to the daily feeding. I use this at a rate of 2 mg/kg dose for the first 7–10 days then 1 mg/kg for a further 4–5 weeks.



Ingrid Lorenz replies:

Firstly, cryptosporidia are often only part of a diarrhoea problem. Mixed infections, especially with rotavirus, are very common. However, the involvement of cryptosporidia complicates the situation, insofar as immunity against cryptosporidia is not as well transferred via colostrum as against other infectious agents. Also, cryptosporidia are very stable in the environment and very difficult to kill with disinfectants. For these reasons, the most important measures to control cryptosporidiosis concentrate on increasing the general resistance of the calves and reducing the infectious pressure on them. Besides good colostrum intake, the subsequent nutrition plan is vital for the calf's resistance to disease. This is especially an issue in dairy calves. Dairy calves that are still fed according to traditional recommendations, about 10% of their body weight, are only getting enough energy for maintenance, which means they will not have sufficient energy to fight disease. It is generally acknowledged now that this level of nutrition is not favourable for the health and future performance of the calves, and that dairy calves should be fed at least 15% of their birth weight in milk or an equivalent amount of good quality milk replacer. Decreasing the infectious pressure starts with clean calving pens and taking the calf out of the calving area immediately into a clean, well bedded pen or hutch. In problem herds it is a good idea to keep the calves individually housed for the first few weeks, when they are most susceptible. Good hygiene with regard

to the feed preparation and the feeding equipment is also paramount. Halofuginone can be used preventatively in problem herds, but it is unlikely to solve the problem if the husbandry conditions are not improved simultaneously.

2. In your view what is the role of antimicrobials in the treatment and management of neonatal calf diarrhoea?

David Barrett replies:

I would go as far as to say there is no role for antimicrobials in the treatment and management of almost all calf diarrhoea. Clearly there will be a very small number of calves with *E. coli*, or bacteraemic/septicaemic calves that have been colostrum deprived that may benefit from some antimicrobials but these are very much the exception rather than the rule. The situation is rather different when one is faced with a *Salmonella* spp. outbreak, in which culture, sensitivity and a rational antimicrobial treatment protocol based on evidence may be instigated. However, these outbreaks are thankfully rare and should be managed closely by a veterinary surgeon to ensure biosecurity and minimise antimicrobial use.

Kat Bazeley replies:

If diarrhoea is severe and/or the calf is systemically sick, I always use a broad-spectrum antimicrobial agent, usually amoxicillin/clavulanic acid, to protect the calf from secondary infection. While I agree that we should only use antimicrobials when necessary, the scouring neonatal calf is weak, its gut lining is damaged and it has often received inadequate colostrum protection, so I believe that the use of antimicrobials is justified. The best way to reduce use of these drugs in the calf unit is to prevent further cases using the control measures outlined elsewhere in this discussion.

Rob Drysdale replies:

Many farmers jump straight for antimicrobials in a calf scour case and in some situations this may be merited but the majority, in my opinion, are not. RUMA suggests that we consider the case by case basis for antibiotics use if we are to maintain the right to prescribe and the current breadth of available active agents – and one family I very rarely use are the fluoroquinolones. Age of the calf, the appearance of the scouring and the morbidity plus any other concurrent signs are my guides for using an antibacterial.

On dairy farms where a 'closed' situation is in operation the rules I follow are:

- In single cases with an apparently healthy, yet scouring, calf, fluid therapy only with continued milk feeding is always my advice.
- If a scouring calf is under five days of age I would always use a broad spectrum parenteral injectable agent such as florfenicol for a three day minimum course.

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- If a calf is older than seven days old with no obvious haemorrhage and minimal systemic signs I would never advise using an antibiotic.
- Sampling of scouring initially with a calf side test can help make quick decisions if the outbreak is viral, parasitic or bacterial in origin. Lab testing however is still advised.
- If multiple calves are involved or several sudden deaths have occurred then I would always add a broad spectrum therapy whilst awaiting results of testing.

Ingrid Lorenz replies:

The major players in neonatal calf diarrhoea are viruses and parasites, which means that antibiotics are not an appropriate treatment in the first place. However, calves with severe diarrhoea and systemic disease (marked depression, anorexia, fever, recumbency) have an increased risk of developing bacteraemia or septicaemia. In such circumstances, administration of injectable broad-spectrum antimicrobials is recommended. The situation with antibiotic resistant bacteria is becoming very serious, so we have to be very careful only to use them if it is really necessary, which is definitely not the case if a calf has only scour and is otherwise doing fine. Also, antibacterials used as a last resort in human medicine (e.g. fluoroquinolones, 3rd/4th generation cephalosporins) should only be used in single animals for a limited number of strict indications where other antibiotics fail.

3. What in your opinion are the key steps to controlling calf diarrhoea?

David Barrett replies:

There is little new to report or discuss here, we have known the key steps for decades. Reduce the risk of dystocia, feed good quality colostrum as soon as possible after birth (10% of body weight or 4 litres within the first 4-6 hrs as a minimum), continue feeding (or suckling) colostrum for 2-3 days. Impeccable hygiene, this may involve snatch calving or individual calving boxes, farm circumstances will dictate the precise practices but the underlying principles are always the same: hygiene and colostrum. The pooling of milk or colostrum is no longer considered best practice; nevertheless feeding all the milk produced by the cow in the first 48-72 hrs after calving to her calf over a longer period of time is to be encouraged. The use of waste and antibiotic contaminated milk to feed calves is to be discouraged. Where necessary and appropriate, specific colostrum antibodies may be stimulated in the cow by the use of vaccination, colostrum substitutes and supplements may also be used but in my opinion are rarely likely to be beneficial. It is always worth checking the immunoglobulin transfer to calves via some recognised test, for example the Zinc Sulphate Turbidity (ZST) test, gamma-GT, Total Protein or Globulin, on a regular basis. While many of these tests are less than perfect, and may even be an

indirect measure of colostrum transfer, they do focus the mind of both the vet and stockman. Many calves are also underfed on milk and may even be deprived of water. It is well worth looking at the feeding regimen for calves as they develop through the first few weeks and months of life and monitoring growth rates of both those with diarrhoea and those that remain healthy. If they are not reaching target growth rates (probably in the region of 0.6-0.7 kg/day) then the whole nutritional programme should be reassessed.

Kat Bazeley replies:

In a nutshell, control of neonatal calf diarrhoea hinges around improved attention to detail. The balance between the calf's defences and the pathogen must be tipped in favour of the calf. I advise the farmer to:

- Ensure that every calf receives adequate colostrum protection within 4-6 hours after birth. Without this, there is no prospect of reducing the incidence of neonatal disease in calves. A refractometer can be used to estimate serum total protein to screen calves for Failure of Passive transfer (FPT). The average calf (approximately 40 kg) must receive at least 4L good quality colostrum within 6 hours after birth, either by suckling from its dam or by bottle or stomach tube. Colostrum quality can be checked using a colostrometer, and in many herds colostrum quality is inadequate from many cows, related to yield, parity and health of the cow. Colostrum quality begins to fall soon after calving, so that if the calved cow is not milked for several hours, colostrum quality may be inadequate. Colostrum should be cooled immediately to reduce overgrowth of bacteria, and frozen colostrum must be thawed gradually. Only colostrum from Johne's negative cows should be pooled for feeding to other heifer calves. FPT is generally less common in suckler herds because colostrum quality is usually good; problems may occur with overcrowding or mismothering or where heifers fail to bond with their calves.
- Maintain excellent hygiene. The infectious agents that cause neonatal diarrhoea in calves are shed in the faeces of older animals. Contamination begins immediately after birth, so the calving environment must be clean (a dry paddock at low stocking density or a clean straw bed over sand are probably ideal). Calf housing should be thoroughly cleaned between occupants to prevent build-up of infectious organisms. This is often difficult or impossible where calf sheds are in constant use, so temporary accommodation can sometimes be found so that new calves don't have to be added into a shed where diarrhoea is prevalent. Milk feeding utensils must be scrupulously cleaned after each use.
- Feed milk to the calf carefully and keep the routine constant. Milk powder should be stored

dry and mixed thoroughly at the correct temperature and concentration. It is more difficult to keep the composition of whole milk constant, though many herds feed whole milk to calves without diarrhoea problems. Milk should be fed at the same time interval every day. The suckler calf is fortunate: it has a constant supply of (more or less) sterile milk at the correct temperature available whenever it is hungry, so unless teats are badly contaminated, milk should not be a source of disease. Suckled calves may occasionally gorge on milk and start a nutritional scour.

- d. Vaccinate cows against BVD and (if a diagnosis is confirmed) *Salmonella*, and consider vaccination against rota-, corona-virus and ETEC.

Rob Drysdale replies:

Education and management, follow a HACCP approach to identify areas of concern/risk and implement management changes to mitigate these risks. Too few vets are trained in calf management so CPD in youngstock, especially neonate, health will help also. Vaccination and prophylaxis have their place, but never allow economics to overcome welfare where young calf health is concerned.

Farmers should not be encouraged, or allowed, by the vet to manage calf scour alone without health planning and protocols. These protocols must include an intervention point and monitoring such as weekly diary checks and graphs/charts on the wall for quick reference. In smaller units record cards for each calf can be kept from the calving yard i.e. colostrum and calving record, through to the weaning period for quick reference. Data management and monitoring will make the difference in farms where problems do exist.

Using milk machines is another area for better management with veterinary inputs. These modern devices can work in the right system but also in the wrong hands I have seen mortality rates of up to 30% year on year. Simple management changes can be brought in to see mortality of less than 1% and daily liveweight gains of 1 kg from birth to weaning. These include:

- Smaller penning numbers - maximum 20 calves per pen, not per teat.
- Quick fill - maximum of 14 days from first to last calf in to avoid bullying and reduce disease spread.
- All in and all out - a more consistent group throughput will allow for easy management i.e. vaccinations, but also later on as calves form group bonds for the rest of their lives.
- Decoquinate in milk - may be contentious but controlling crypto and cocci in these larger groups is made easier. This can be worth up to 200 gm per day in one study we undertook over a large number of calves compared to other calves given oral drenches.

Ingrid Lorenz replies:

Calves get scour when the infectious pressure exceeds the resistance of the calf against infection. That means every measure that increases the resistance/immunity of the calf or decreases the infectious pressure will help. Particularly important for the calf's immunity is proper colostrum management. The colostrum quality of our modern dairy cows decreased with increasing milk yields. Therefore, normal sized Holstein dairy calves should get 3 litres of the first milking of the dam within two hours of birth (Colostrum 1-2-3). It is also important that colostrum is harvested immediately after calving, since it rapidly gets diluted otherwise. For dairy calves the proper nutrition following colostrum feed is also of high importance for the resistance of the calf. Traditional feeding systems of 10% of the calf's body weight in milk leaves calves underfed and, therefore, susceptible to disease. Dairy calves should at all times get at least 15% of their birth weight in whole milk, or an equivalent amount of milk replacer. Cleanliness is important in all cases, but as mentioned before especially on farms where cryptosporidiosis is a problem, since the colostrum does not transfer good immunity against cryptosporidia.

4. Fluid therapy is a key component of the treatment of calf diarrhoea, how do you approach the management of fluid therapy on farm?

David Barrett replies:

The key to oral fluid therapy is temperature, concentration, volume and frequency. There are many proprietary products and although they differ, most contain sufficient sodium to carry the water across the gut and either glucose or glycine to co-transport. They need to be fed at the appropriate temperature and concentration, frequently and between milk feeds. This is labour intensive but vitally important. Milk feeding should continue since this is the nutrient source, the fluid therapy should be considered only to supply fluid to replace excess losses and NOT to be food for the calf. In twice daily bucket fed calves I would advise at least two extra feeds a day of fluid spaced between the milk feeds (do not mix the milk with the rehydration fluids). In some cases more than 2 x 2 litre of extra fluid will be required to maintain hydration. In machine reared calves it may be necessary to remove diarrhoeic calves to a 'hospital area' to feed them oral fluids. This may be required anyway to reduce disease spread amongst a group. If aggressive oral fluid therapy protocols are in place and acted upon rapidly the need for intravenous fluids should be very rare.

Kat Bazeley replies:

Dehydration, even if it is only mild, causes any animal to feel terrible, so it is essential to maintain fluid and electrolyte balance in scouring neonatal calves. Dai Grove-White always used to maintain that it didn't matter what was coming out of the

back-end of the calf, provided you replaced it either by oral or IV rehydration. Maintaining the electrolyte balance of scouring calves is hard work and requires dedication, and the recovery rate of affected calves is mainly determined by the quality of stockmanship provided. At a time when heifer calves are valuable, time spent on care of the scouring calf is highly cost-effective. We have found that Rehydion gel (Ceva) seems to work best and can be mixed with milk. I advise that it is fed mixed with a small (1L) milk feed twice a day, with at least 2 x 2L electrolyte feeds in between – total 6L fluid. It is worthwhile to check that a functional stomach tube is available and that the stockperson knows how to use it correctly. Fresh water must also be supplied and should always be available for all calves of all ages – the calf that is mildly affected will regulate its fluid balance by drinking extra water, provided it is accessible, palatable and clean.

I always feel that we don't use IV fluids as much as we should, even though results are usually good. We start with 8.4 g (some use 12.6 g) sodium bicarbonate dissolved in 0.5L normal saline, then run in 5L compound sodium lactate fairly fast, then continue IV fluids until the calf is bouncing about so enthusiastically that the drip line won't stay in. I have found that if the jugular vein is so flat that I can't place a catheter, 3L directly into the peritoneum (via a surgically prepared site) will improve circulation enough to identify the jugular vein. A colleague, Uwe Mueller, always found that the auricular vein was the easiest to use, with a small catheter.

Rob Drysdale replies:

I believe that removal from milk can only make things worse in many instances. With modern management practices seeing the larger groups and milk machines where individual medicine is difficult to manage: isolation is rare on larger farms especially and TLC is often a thing of the past in many farmer's eyes. Using two hurdles to create a small pen within the pen can help alongside additional feeds of fluid replacers.

Oral rehydration using products such as Rehydion allow for the calf to remain either on milk i.e. with the suckler cow dam or on the milk machine.

I/V fluids are reserved for severely dehydrated (>5%) calves where quick, and then consistent, addition of fluid can make all the difference. In this instance a heat lamp, individual penning for additional TLC and a couple of days extra attention can see most cases recover. I am not using hypertonic saline in calves but do ask that the farmer also continues to feed milk and oral rehydration to the sick animal as soon as it shows a suck reflex.

Ingrid Lorenz replies:

It is important for the farmer to understand that oral rehydration therapy is not a cure for diarrhoea, but is meant to replace the additional losses in fluid and electrolytes that the scouring calf suffers. For this to work, the calf needs to get one or two feeds of an oral rehydration solution additional to the normal milk feedings from the time the scour is first observed up to the point where the faeces are back to normal. It is important that the farmer continues to feed milk to diarrhoeic calves as long as they are drinking, since they are not getting sufficient energy and nutrients out of the rehydration solutions alone. It is also very important to make sure that the oral rehydration solution used has sufficient buffer capacity. Calves tend to get more acidotic, while they have diarrhoea, than humans. However, many of the commercially available solutions are still based on recommendations from human medicine. Oral rehydration solutions suitable for calves should have an alkalinising capacity of 60 to 80 mmol/L from bicarbonate or bicarbonate precursors (the strong ion difference (SID) can be calculated as follows: $SID = \text{alkalinising capacity} = [Na^+] + [K^+] - [Cl^-]$). Oral rehydration solutions can safely be given by stomach tube, however, if the calves are not drinking for more than a day, or if their eyes are sunken they will need to get veterinary attention and most likely intravenous fluid therapy.

NEWS REVIEW

CEVA INJECTS PROGRESS INTO ANTI-INFECTIVES RANGE

Ceva Animal Health has continued to expand its Large Animal team with the appointment of Stephenie Clarke as Marketing Manager. With extensive knowledge of bovine reproduction, Stephenie will be primarily responsible for progressing the company's innovative Cevolution anti-infectives range as well as their cattle reproduction portfolio.

Stephenie completed a PhD in bovine ovarian function, after which she gained considerable sales and marketing experience in the life science industry. During this time Stephenie also achieved a Professional Diploma from the Chartered Institute of Marketing.

She said: My new role gives me the opportunity to combine my specialist technical knowledge with my marketing experience. I am particularly looking forward to launching Ceva's new Cevolution range of anti-infectives and enhancing the ReprodAction campaign that uniquely encompasses all hormones for cattle fertility treatment.²

Ceva has a comprehensive injectable anti-infectives range which includes Marbox[®], Florkem[®] and Cevaxel[®] RTU and a full range of cattle hormones.

For further information contact Ceva Animal Health Ltd, Unit 3, Anglo Office Park, White Lion Road, Amersham, Bucks, HP7 9FB, Tel: +44 (0) 1494 781510