DIARRHOEA IN CALVES AND YOUNG CATTLE

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The most relevant diseases in calf rearing are diarrhoea followed by respiratory tract disease. Further problems arise with disease of the umbilicus and joints. Other problems occuring regularly in the time from birth to weaning can be ruminal drinking and abomasal ulceration. There are many causes of calf diarrhoea and the disease varies considerably in its severity. Infectious as well as non infectious factors contribute to the disease. The most commonly encountered microorganisms are viruses, bacteria, protozoa as well as fungal infections. In the majority of cases more than one enteropathogen is responsible in the development of diarrhoea. Non infectious causes of diarrhoea include management factors like hygiene, feeding and immune status of the animal. The main clinical symptoms shown by the calves are results of the diarrhoea. These signs are dehydration, metabolic acidosis and energy deficiency. However diagnosis of the causative agents should be performed if a herd problem is evident. Therefore it is important to sample more predisposed animals at the farm including clinical healthy neighbour calves, as many pathogens are just detectable in the faeces at the beginning of disease. Therapy and general management strategies do not differ widely between diarrhoea caused by different enteropathogens. Therefore therapy is based on rehydration and the supply of buffers and energy. Calves with mild diarrhoea still drinking should additionally be fed with electrolyte fluids including buffers between milk feeding times. To improve the passive immunisation of calves against rota- and coronavirus as well as against different strains of E. coli vaccination of the pregnant dam can be proposed. This management strategy can only be successful if colostrum management as well as hygiene is improved.

Key words: diarrhea, calves, cows, vaccine

Diarrhoea is the most important disease in young calves and accounts for approximately 75 % of the mortality of dairy calves within the first 3 weeks of age [9]. Prevalence differs between farms; up to all calves can be affected.

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Bovine Rota- and bovine Coronavirus are the most frequently detected viruses in diarrhoeic calves. Others like Breda-, Parvo-, Calici-, Herpes-, Adeno-, Picobirna-, Noro- and Astrovirus as well as Pestivirus could be detected in the faeces of diseased animals.

The most important bacteria relating to calf diarrhoea are *Escherichia coli* (K 99 antigen, EPEC, ETEC, EHEC, EIEC), *Clostridium perfringens, Clostridium difficile* and *Salmonella spp*. Moreover Chlamydia, Pasteurella, Pseudomonas, *Campylobacter spp*., *Proteus spp*. as well as *Klebsiella spp*. can be relevant.

In the group of protozoa *Cryptosporidia* (esp. C*ryptosporidium parvum*) are of great importance. Furthermore *Coccidia*, *Giardia* and gastro-intestinal worms are discussed.

Rarely Candida, Mucor, Aspergillus or Absidia can be found in the faces of calves with diarrhoea.

Haschek et al. (2006) revealed in an Austrian study the highest prevalence for

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bovine Coronavirus with 25.7 %, followed by *Cryptosporidia* with 11.7 % and Rotavirus and *Clostridium perfringens* with 9.1 %. This is to a large extent in accordance with the literature stating that enterotoxigenic *E. coli*, bovine Rotavirus, bovine Coronavirus and *Cryptosporidium* sp. are the major causes of diarrhoea and are responsible for 75 to 95 % of enteric infections of calves worldwide [9, 14]. In contrast to our study [8] many examinations worldwide revealed a higher prevalence for Rotavirus are than for bovine Coronavirus [14, 5, 6]. The low prevalence of *E. coli* F5 (0.4 %) in Austria [10] is in accordance to current reports from other countries [3].

Non infectious causes of diarrhoea include management factors like hygiene (calving, housing), feeding (composition and quality of food, feeding hygiene and technique) and immune status of the animal (passive transfer of immunoglobulins, nutritional status).

However diagnosis of the causative agents should be performed if a herd problem is evident. Therefore it is important to sample more predisposed animals at the farm including clinical healthy neighbour calves, as many pathogens are just detectable in the faeces at the beginning of disease.

Samples should be taken directly from the rectum and cooled for transport to the laboratory. To avoid transports whereas many pathogens are destroyed and to obtain a result at the time of animal examination rapid assays on an immunochromatographic bases for the use in the field have been developed to detect the most important enteropathogens such as *E. coli* F5, *Cryptosporidium parvum*, Rota- and Coronavirus. Evaluation of the tests for detection of *E. coli* F 5 and *Cryptosporidium parvum* revealed excellent sensitivity and specificity but the other two tests to examine for the two viruses are in their current form not sensitive enough with 72 and 60 %, respectively [11].

Clinical signs are dependent on different factors such as virulence and combination of enteropathogens as well as on age and immune status of the animal [7].

Faeces can be different in consistency, colour, odour and volume. Admixtures like mucus, fibrin or blood can be seen. Nevertheless studies have shown that neither character of faeces nor clinical signs have a correlation with the enteropathogen involved [4].

The main symptoms shown by the calves are results of the diarrhoea. These signs are the clinical signs of dehydration, metabolic acidosis and energy deficiency.

Typical signs of dehydration are sunken eyes and reduced skin turgor. Fall in arterial blood pressure due to fluid loss further leads to peripheral vasoconstriction and therefore to poor tissue perfusion with local ischemia and lower metabolic activity resulting in cold body surface. An increase of inner body temperature in contrast is mostly associated with accompanying disease like respiratory tract disease, umbilical infections and/or arthritis.

A detrimental consequence of diarrhoea is metabolic acidosis. It is the result of loss of bicarbonate via faeces and absorption of acids produced by microbial fermentation of lactose in the large intestine.

Further loss of extracellular fluid leads to decreased perfusion of the kidney. Thus resulting in a reduced renal function and therefore in decreased excretion of hydrogen ions by the kidney.

Finally, lactic acidosis may develop because of an increased lactate production following peripheral hypoxia and reduced utilisation of lactate due to increased delivery of lactate to the liver. The ability of the liver to use lactate may be impaired because of high hydrogen ion concentration in the liver cells.

This fall in blood pH-level leads to movement of hydrogen ions into the cells in exchange of potassium resulting in hyperkaliaemia. Reduction of the ratio of intracellular to extracellular potassium results in a reduction of the resting potential of cell membranes. This can have negative effects upon cardiac muscle function.

Animals further regularly suffer from hypoglycaemia. Signs are weakness resulting in insecure standing, increased lying times to an extends of decumbency.

Therapy and general management strategies do not differ widely between diarrhoea caused by different enteropathogens.

Therefore therapy (A, B) is based on rehydration and the supply of buffers and energy.

A. Oral treatment: calves with mild diarrhoea, still drinking, should additionally be fed with electrolyte fluids including buffers between milk feeding times.

B. Parenteral treatment: calves which stop drinking should be treated intravenously. The composition of a solution for drop infusion can be seen in table 1.

Table 1 solution for drop infusion for a calf (40 kg BW) suffering from severe diarrhoea

Composition of solution	quantity (ml)
NaCl 0.9 %	5.000
$NaHCO_3$ 8.4 %	500
glucose 40 %	500
total volume	6.000
infusion rate: 25 ml/kg BW/h	

Milk feeding times should not be skipped in diseased animals as milk provides the animals with energy and fluid. But milk should be fed at small amounts more times per day.

If the animal suffers from more severe disease and/or stops drinking it is necessary to provide the animal with an infusion including fluid, buffer and energy.

Next to this treatment it is important that calves are bedded on fresh and dry material. Animals should be stood up more times per day and gently forced to drink several times per day. Additional warmth for example with infrared lamps should be provided.

For prevention and control it is important to decrease the exposure of calves to pathogens, to increase the immunity of the calf and to reduce stress on calves [2].

The reduction of pathogens is possible by improving hygiene starting at calving [13]. In problem herds calves should be moved in dry and clean single calf hutches immediately.

Housing material should have a plain surface easy to clean and disinfect. It is proposed to use synthetic single calf hutches ("igloos") outside the stable. This kind of calf hutch provides semi-isolation and a good climate and further reduction of exposure to microorganisms. If sufficient bedding is provided calves can stay outside even during low temperatures below freezing (up to –30°C).

After each calf the hutch should be cleaned and disinfected and left empty for at least one week before housing another newborn animal. Especially cryptosporidia are resistant to most common disinfectants; stables should therefore be cleaned using a high preassure washer.

In Austria calves have to be grouped at the latest of 8 weeks by law (Animal Protection Act, 2004). As grouping means stress for the animals it should never be combined with other stressful procedures such as weaning, prophylactic treatments or dehorning and calves should always be grouped within the same age group.

Calves should be handled with clean hands at any time and work should always be started at the stable of the youngest animals.

The colostrum intake and supply respectively is the most important factor for immunity of the calf. An amount of 100 to 200 g immunoglobulin must be ingested and absorbed by the newborn calf [5,6]. It is proposed to feed 1.5 to 2 litres within the first hours of calving and another 1.5 to 2 litres within the next 3 hours of life. The minimal amount of colostrum administered should be 4 litres within the first 12 hours.

To improve the passive immunisation of calves against rota- and coronavirus as well as against different strains of *E. coli* vaccination of the pregnant dam can be proposed. Usually cows are vaccinated twice (6 to 8 and 2 to 3 weeks) before parturition to stimulate the production of specific antibodies. This management strategy can only be successful if colostrum management as well as hygiene is improved.

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