Calf scour: focus on cryptosporidiosis

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Neonatal diarrhoea is one of the most widespread diseases affecting cattle livestock enterprises, on both beef and dairy farms. Diarrhoea is a major concern for the farmer in the first weeks of a calf's life.

In Ireland, diarrhoea is the most common cause of death in calves from birth to one month of age submitted for post-mortem examination (Regional Veterinary Laboratories – Surveillance Report 2009).[1]

The financial impact is important: in addition to calf mortality, poor performance during convalescence and increased cost of labour, veterinary services and treatments – all of which increase the cost of the disease. Furthermore, on dairy farms, the genetic potential of heifers that were affected with diarrhoea in the neonatal period will be reduced and the age at first calving will be delayed.[2]

Effective prevention and treatment are based on rapid diagnosis of the pathogens in question. Rotavirus, *Cryptosporidium* spp, Coronavirus and *Escherichia coli*, collectively, are responsible for 75-95% of infections in neonatal calves worldwide. The relative frequencies of each of the four differ between locations, seasons and years.[3]

Cryptosporidium may occur in 30-50% of calves with diarrhoea on a worldwide basis[4] and, in some countries, is the most important cause of neonatal diarrhoea in young ruminants.[5]

EPIDEMIOLOGY OF BOVINE CRYPTOSPORIDIOSIS

The pathogen, *Cryptosporidium parvum*, is a widespread protozoan, not species specific and found in most mammals including humans. It is, thus, zoonotic.

The contamination is faecal-oral: the calf is infected during the neonatal period by ingestion of oocysts present in the environment, and excreted in the faeces of other infected animals. The carriers may be diarrhoeic or asymptomatic.

The oocysts found in the environment are directly infective and very resistant (they can remain viable for about 18 months).[6]

The explosive nature of the infection is due to the effective lifecycle of *Cryptosporidium*. After the ingestion of a small number of oocysts, which undergo asexual and sexual phases in the host gut, the calf can shed millions and millions of oocysts (10^8-10^{10} per gram of faeces).

CLINICAL FINDINGS

There are no clinical findings characteristic of cryptosporidiosis in calves. Diagnosis is based on the detection of faecal oocysts (usually days three to 12 of life). Infection can be detected as early as five days of age; with a peak of intensity between nine and 14[7] days of age.

The signs are variable: from little or no diarrhoea to profuse diarrhoea (malabsorption type), with varying degrees of apathy or dehydration. Morbidity is important but mortality is rare, in contrast to what is observed in goats and sheep. The clinical picture depends on the association (or not) with other pathogens.

While some signs, such as age of onset of diarrhoea, the appearance of the stool or the degree of dehydration indicate a diagnosis, a faecal analysis is essential to know with certainty the causal pathogen (s). Test kits now enable a rapid response on farm: strips designed to detect rotavirus, coronavirus, *E coli* and *Cryptosporidium*.

CRYPTOSPORIDIOSIS IN FARMS

The history of the farm is important in the diagnosis of cryptosporidiosis, which is often recurrent from year to year. Even when effective disinfection has been set up, the resistance of oocysts in the environment is such that it is unlikely that there aren't any in the environment. The disease generally occurs when the animals are housed and the pressure of infection increases during the calving season.

The first-born calves are quickly infected soon after birth from environmental oocysts. The parasites replicate and excrete, multiplying the challenge; the pressure of infection increases during the following births to a 'threshold'-triggering diarrhoea, reaching a peak in the second half of the calving season or beyond, depending on the hygienic conditions and management of operations.

The general hygiene conditions of the farm, the animal density and the gathering or not of animals into age groups are important factors.[8]

CONTROL OF CRYPTOSPORIDIOSIS

Prevention is essential and is based, firstly, on limiting exposure to oocysts and, secondly, on raising animals' defences.

Minimising transmission

- Among the preventive measures, a strict hygiene programme and a design of the livestock buildings allowing separation of animals by age group and isolation of affected calves are important.
- Oocysts are resistant to most disinfectants in commonly used concentrations and time of exposure. They are susceptible to desiccation and temperatures above 60°C:[9] high-pressure steam cleaning (carefully applied to avoid spreading to surrounding surfaces) followed by thorough drying appears to be the best method to use.[10]
- If some tested molecules have a relative effectiveness (ammonia 10% after minimum five hours, formalin and sodium hypochlorite after 24 hours[11]), the sufficient concentrations and exposures of time could present a hazard for humans and livestock.
- According to a French study,[12] the application of an amine-based disinfectant (Keno cox), combined with an appropriate method of cleaning, may be a useful tool to reduce cryptosporidial infectious load on farm level.
- *In vitro* efficacy of two cresolic compounds (Neopredisan 135-1 and AldecocTGE)[13] have been demonstrated and another's label (Prophyl75) mentions claims of efficacy against cryptosporidiosis (concentration: 3% , exposure time 18h).

Raising animal defences

Early intake of a quality colostrum (min 50g/L of IgG) is essential. It allows the strengthening of defences of calves through the intake of maternal antibodies from the dam. The 'colostrum 1-2-3 method' should be recommended for dairy calves:[14]

1. Colostrum from the first milking for the first feed.
2. Give colostrum within two hours from the calf's birth.
3. Ensure an intake of at least three litres.

Specific protection may be transmitted by vaccinated mothers against viruses (Rota, Corona) and certain strains of *E coli*. There is to date no vaccine against cryptosporidiosis but it is important to note that, after an infection, the recovered animals are immune.

Therapy

Due to the extreme resistance of the oocysts, avoidance of infection is not easily achieved and a therapy is often required to support affected calves.

- **Supportive**
  Diarrhoeic calves should be supported with fluids and electrolytes (orally or parenterally, if necessary). It is important to continue to feed milk (optimizing digestion, minimizing loss of body weight) despite the presence of diarrhoea.[12]
- **Specific**
  Therapeutic agents and treatment strategies for cryptosporidiosis have been pursued for over 40 years since *Cryptosporidium* was first identified in humans.

Several molecules have been evaluated but, up to now, only two have been assessed with satisfactory results in veterinary medicine: halofuginone and paromomycin sulphate.

Halofuginone lactate is a synthetic product of the quinazolinone group with antiprotozoal activity. Halofuginone is licensed for the treatment of bovine cryptosporidiosis in several countries, but care must be taken not to exceed the licensed dose. This agent is able to prevent clinical disease and reduces oocyst excretion, but calves may begin to shed oocysts soon after withdrawal of the drug.[15] The suitability of the prophylactic use of halofuginone lactate (Halocur) to reduce oocyst excretion is consistent but controversial concerning diarrhoea-treatment efficacy.[16]

Paromomycin is an aminoglycoside antibiotic poorly absorbed from the gut epithelium when given orally and achieving high concentrations in the gut lumen. Alongside antibacterial activity, published literature also supports that paromomycin has anti-protozoal properties and shows efficacy to control cryptosporidiosis in neonatal ruminants: calves,[17] lambs[18] and goats.[19] Paromomycin sulphate was successfully used in dairy calves where it reduced the duration and severity of diarrhoea.[15] Altogether, data suggests that paromomycin is efficient to control cryptosporidiosis.[13] Paromycin sulphate oral solution is now licensed iin the UK and Ireland.

CONCLUSION

Cryptosporidium has a worldwide distribution and this protozoan is considered the agent of an emerging zoonosis. Because of its substantial economic impact in farms and in preventing the spread of a zoonotic agent, the control of cryptosporidiosis remains a major challenge for a successful One Health response.

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