BABESIOSIS

Red water or Babesiosis is a disease caused by Babesia spp, a protozoan parasite (apicomplexa), which infects erythrocytes. Babesia spp can affect a wide range of wild and domestic mammals including people and is reported nearly worldwide; however, the major economic impact of the disease appears in the cattle industry. While worldwide there are several Babesia species that are pathogenic in animals, only Babesia divergens appears to play a role in the occurrence of red water in Ireland.

Babesiosis is a tick-borne disease. The main vector for Babesia in Europe and on the island of Ireland is the castor-bean tick, Ixodes ricinus. In contrast to Anaplasma spp infections, there is no evidence of transmission via other biting insects or contaminated instruments (eg. needles). In general, the susceptibility of cattle breeds to ticks and Babesia infections varies; Bos indicus breeds (eg. Zebu/ Brahman cattle) cattle have been reported to be more resistant to ticks and the effects of Babesiosis infection than Bos Taurus–derived breeds (typical European beef and dairy cattle). Calves younger than nine months show some age resistance to clinical disease partially due to maternal antibodies; however, during this time the young animal can develop their own immunity following exposure. Animals that are older than six to nine months are highly susceptible to infection and serious illness if they are introduced from a non-endemic area into an endemic area. Furthermore, animals which survived the disease are usually immune for their commercial life.

Most clinical signs of Babesiosis relate directly to erythrocyte destruction. In mild cases, fever, anorexia, anaemia, muscle tremors, tachypnoea and tachycardia can be observed. In severe cases, extensive erythrocyte destruction is present causing marked anaemia, jaundice, severe dehydration, (pipe stem) diarrhoea and haemoglobinuria (hence red water). Late-term abortions and temporary infertility in bulls have been reported. A fatality rate of 10% in cases of Babesiosis has been reported in the past for Ireland but will vary in outbreaks depending on severity of infection and animal susceptibility. The diagnosis is usually achieved by the occurrence of clinical symptoms especially haemoglobinuria, epidemiology and the examination of blood smears in which Babesia sp can be detected microscopically within the erythrocytes. On necropsy, the diagnosis can be supported by polymerase chain reaction (PCR) technique. For diagnosis, the DAFM laboratories recommend a fresh ethylenediamine tetraacetic acid (EDTA) blood sample. There are two equally important factors in controlling the occurrence of Babesiosis. Firstly, tick control on affected pastures is needed. This can be achieved by good pasture management with reduction of tick habitats (rushes, gorse, bracken). Additionally, acaricidal treatment of susceptible cattle is recommended, eg. pyrethroid pour-ons protect cattle for two to three weeks depending on the product. Secondly, chemoprophylaxis of susceptible cattle in affected areas may be necessary. Imidocarb dipropionate provides protection from clinical disease for up to four weeks but allows concurrent development of immunity if used correctly. Note should be taken of the extensive withdrawal period of 213 days for meat and 21 days for milk. A live vaccine had been developed in the past, but is currently not available. Despite best efforts in grassland management, tick control and chemoprophylaxis, clinical cases of Babesiosis can still occur and expert stockmanship and vigilance in tick season are needed.

While over the last 20 years, a decline in the incidence of Babesiosis to 0.06% in 2013 has been noted in Ireland, private veterinary practitioners (PVPs) and farmers should...
stay vigilant. There are a small number of records reporting *B. divergens* infections in humans in the whole of Europe to date. However, these infections are extremely rare, but potentially life threatening.

**BOVINE**

The respiratory tract was the most commonly affected organ system in carcases of all ages except adults submitted to the DAFM RVL network. In adult bovines (>12 months) neurological disease was the most common cause of death.

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### RESPIRATORY TRACT

A 2.5-month-old calf was delivered to Sligo RVL for necropsy after being found dead. Post mortem examination revealed approximately 90% consolidation of the lung with multifocal variably sized abscesses throughout. *Pasteurella multocida* and *Histophilus somni* were detected in lung tissue by PCR and *Trueperella pyogenes* was additionally cultured from lung tissue and abscess material. Histologically, there was a chronic active suppurative bronchopneumonia with bronchiolitis obliterans, marked peribronchial fibrosis and intra-lesional colonies of basophilic coccobacilli. It is possible that the bacterial infection was preceded by a viral or other insult. A diagnosis of multifactorial bronchopneumonia was concluded.

A four-week old calf was submitted to Limerick RVL with a history of ill-thrift. Grossly, the animal was anorexic and had some degree of hair loss along the back legs. Necropsy revealed considerable pulmonary changes, specifically, a large portion of both lungs was consolidated. There were multifocal abscesses in the affected areas. Approximately 75% of both lungs were affected. *Mycoplasma bovis* *Histophilus somnus* and *Mannheimia haemolytica* were isolated from the lung, and bovine herpesvirus 4 (BHV4) was also detected by PCR. These agents confirmed a chronic, multifactorial pneumonia.

BHV4 is a member of the herpesvirus family. Upon initial classification, it was deemed to have little or no clinical effect in cattle. But in recent years, the agent has been shown to have a marked predilection for endometrial cells in cattle. It has been associated with abortion outbreaks and has been linked with bovine mastitis. The importance of BHV4 as a primary pathogen in outbreaks of respiratory disease is uncertain. However, it is likely that it may have a role in facilitating multifactorial disease by exacerbating bacterial infections.

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### VERMINOUS PNEUMONIA

The first cases of parasite-related pneumonia have been delivered to Sligo RVL. In one case, a one-year-old heifer was submitted for post-mortem examination. It had been noticed coughing a few days prior and displaying anorexia. The animal had been on grass for six weeks. Necropsy revealed a diffuse emphysematous interstitial pneumonia associated with the presence of myriad of *Dictyocaulus sp* nematodes in the airways.

It is important to consider lungworm infestation as a differential diagnosis at this time of the year in respiratory disease outbreaks and to keep in mind that relatively low numbers of parasites can cause severe clinical signs and death.

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### GASTROINTESTINAL TRACT

**IATROGENIC PERITONITIS**

A three-week-old calf was presented to Limerick RVL with a history of recurrent bloat. Intervention using a rumen trochar had been attempted but the animal had died three to four days later. Necropsy revealed diffuse fibrinous peritonitis. Rumen cannulation had occurred but there had been leakage of rumen material into the peritoneum leading to a severe acute bacterial peritonitis.

**RUMINAL CANDIDIASIS**

A two-week-old calf was submitted for necropsy to Sligo RVL with a history of diarrhea and not responding to treatment. The carcase was in very poor condition and showed signs of severe dehydration. There were white adhesions on the rumen and reticulum mucosa as well as abomasal oedema. The intestinal contents appeared soft and pale. A moderate infection with cryptosporidia and giardia was detected. *Candida albicans* was cultured from rumen contents. Histopathology revealed severe, diffuse, acute, necrotising fungal ruminitis with abundant fungal conidia and hyphae. Rumen candidiasis was diagnosed.
Candida spp belong to the natural microflora of the rumen and the intestinal tract. Candidiasis occurs mainly in young animals (piglets, calves, foals) where it is predominantly a disease of the keratinised epithelium. Mucosal or microflora changes caused by antimicrobial treatment, especially if prolonged, malnutrition, environmental or social stress or anti-inflammatory treatment can lead to the yeasts becoming invasive. In older animals, Candida spp can also occasionally invade other mucosal lesions anywhere in the alimentary tract. In calves, Candidiasis is often associated with rumen putrefaction and is most common in the ventral sac of the rumen, but can extend to reticulum, omasum and abomasum.

The diagnosis in the living animal is usually based on history. In cases of visible infected areas (eg. in the mouth) stained direct smears or skin scrapings can be used to reveal the organism. There is no specific treatment for young calves with enteric candidiasis. Supportive care and withdrawal of antimicrobial/glucocorticoid treatment as well as the use of probiotics have been described as treatment attempts.

URINARY/REPRODUCTIVE TRACT
URONITRITIS
Sligo RVL received a six-month-old calf for post mortem examination. The farmer had noticed the animal appearing slow and with an enlarged abdomen for the past two weeks. The animal appeared only to dribble when trying to urinate. The animal died despite treatment attempts. On post mortem examination the carcase was very dehydrated. There was uroperitoneum associated with the rupture of the bladder. The urethra was distended. The penis tip was necrotic and there was associated cellulitis extending from the necrotic area to the sigmoid flexure. Escherichia coli was isolated from the lesions. Urolithiasis or trauma with subsequent stranguria and bladder rupture was deemed the most likely cause of the chronic lesions and clinical signs observed.

CARDIOVASCULAR SYSTEM
BABESIOSIS
Sligo RVL received a yearling heifer for post mortem examination. The animal was found dead in a field where she had been moved to six to eight weeks prior to death. The carcase appeared anaemic, dehydrated and icteric. There was haemoglobinuria. There was splenomegaly and black stained kidneys. The most common cause of this pathology is infestation with Babesia divergens (red water). Ticks were present on the hide.

CARDIAC ABSCESSION
A yearling bull was submitted to Sligo RVL after being treated for lameness in both back legs for approximately two months. Both back feet were swollen and there was proliferative interdigital inflammation. Necropsy revealed septic arthritis in the fetlock joints, several myocardial abscesses and pericarditis. Pasteurella multocida was detected in the cardiac abscesses. It was hypothesised that the cardiac lesions were of embolic nature, most likely originating from or concurrent with the septic arthritis.

MUSCULOSKELETAL
CLOSTRIDIAL DISEASES
Two four-month old suckler calves were submitted to Kilkenny RVL from the same farm. The first animal was found dead. The owner reported clinical signs of lameness in the second calf prior to being found dead. Muscle fibres in multiple locations appeared necrotic and dark red to black (heart, psoas muscle, neck and hind limb muscles). Lesions were suggestive of blackleg. Clostridium chauvoei was detected using fluorescent antibody technique (FAT) in both animals. Herd vaccination with a multivalent clostridium vaccine was recommended.
POISONINGS
RAGWORT POISONING
A 16-month-old bullock was presented to Kilkenny RVL with recent history of being very active, walking a lot and behaving unusually with head pressing a prominent clinical sign. Furthermore, the animal had diarrhoea a few weeks previously and weight loss was noted despite the animal having a good food intake. Other deaths were reported in the herd with similar clinical signs. Grossly, the abdominal viscera were oedematous. The liver was very hard with rounded edges. The gall bladder wall was thickened. On histology, there was chronic hepatitis with megalocytosis. Clinical history, gross lesions and histopathology findings were indicative of severe chronic toxic liver disease which resulted in weight loss and eventual behavioural changes due to hepatic encephalopathy. Pyrrolizidine alkaloid toxicity, due to ragwort ingestion, was considered the most likely toxic agent involved.

Pyrrolizidine alkaloid is a toxin that typically results in chronic liver damage. It is caused by many toxic plants. In Ireland, the plants most often implicated include common ragwort (Senecio jacobaea). Under normal conditions these plants are avoided by grazing animals; however, they may be eaten during drought conditions. On extremely lush pasture, some animals may eat these plants preferentially as roughage. Animals are also poisoned by eating the plant material in hay and silage. Cattle, horses, farmed deer, are most susceptible. Sheep and goats, although susceptible, may require higher doses.

In the liver, the alkaloids are metabolized to highly reactive pyrroles, which produce cytotoxic effects. Acute intoxication is relatively rare because the poor palatability of these plants makes ingestion of large quantities of the toxins uncommon. More chronic exposure is typical. Clinical signs may not be seen for months after initial ingestion. In these cases, it is thought the ongoing hepatic damage is due to the recycling of toxic pyrroles as they are released from one dying cell and taken up by another.

Clinical signs include anorexia, dullness, and diarrhoea. Constipation and tenesmus can occur, which can be followed by rectal prolapse. Cattle and sheep occasionally show photosensitisation and there can be ascites and icterus. Pica can be present and some cases may develop hepatic encephalopathy characterised by nervous clinical signs such as aimless wandering and head pressing.

A presumptive diagnosis is often made based on clinical signs, a history of exposure, and compatible changes in biochemical parameters. Further ingestion of toxic plant material must be prevented. Animals showing signs rarely recover, and subclinical lesions present in asymptomatic animals may progress resulting in further losses over several months especially in animals with concurrent metabolic or parasitic liver disease.
SHEEP
GASTROINTESTINAL TRACT
CHRONIC-ACTIVE FASCIOLOSIS AND PARASITIC GASTROENTERITIS
A two-year old ewe was submitted to Sligo RVL after being found dead. Post mortem examination revealed severe ascites and evidence of severe chronic active fluke infection in the liver. Adult nematodes were present in faeces. Faecal egg counts revealed 7,400 eggs per gram (epg) for strongyle eggs. A diagnosis of chronic-active fasciolosis leading to hypoproteinaemia and concurrent parasitic gastroenteritis was reached.

URINARY/REPRODUCTIVE TRACT
MASTITIS
An adult ewe was delivered to Sligo RVL after being found dead. The farm had experienced five deaths in ewes recently. This ewe was in fairly good condition and was reasonably well preserved, but dehydrated. There was a locally extensive necrohaemorrhagic mastitis with secondary sepsis. *M. haemolytica* was isolated from the lesions.

NERVOUS SYSTEM
CEREBRAL ABSCESS
A three-month old lamb was delivered to Sligo RVL for necropsy. The animal had been observed with seizure before dying despite treatment attempts. There was a large (1cm in diameter) abscess in the cerebrum. *T. pyogenes* was isolated from abscess material.

POISONINGS
PLANT POISONING
Three sheep were presented to Limerick RVL for post mortem examination. All had been found dead and had been grazing a large paddock for some time. A fourth ewe was sick, dull and inappetant. The group had originally contained 12 pedigree ewes, some with lambs. Cattle were also grazing in the field but were unaffected. The field had a boundary with some houses. On post-mortem examination all three sheep were in good body condition. No gross evidence of disease was seen. A large number of suspicious but unidentifiable leaves were present in the rumen contents. Vitreous humour samples taken for magnesium showed no evidence of hypomagnesaemia. Kidney lead and liver copper results were normal.

Plant poisoning was suspected, and this was communicated to the private veterinary practitioner (PVP) and flock owner. Further investigation by the owner revealed the possibility of some sheep entering the garden of one of the houses bounding the field, through a small gap. One of the trees in the garden was identified as yew and there was some evidence that animals had been eating some of the leaves. The sheep were removed from the field. The sick ewe was housed separately and made a full recovery, with no treatment.

A tentative diagnosis of yew tree poisoning was made at time of post mortem examination which was later confirmed. A sample of foliage from the tree was sent to the National Botanical Gardens in Glasnevin where it was identified as juvenile-type foliage of yew (*Taxus baccata*).

Table 3: Causes of death in sheep (excl. foetuses) submitted to DAFM RVLs broken down by organ system in June 2018.

**Figure 8:** Juvenile foliage of Yew (*T. baccata*) associated with the death of three ewes (Photo: flock owner).

COPPER POISONING
Two three-month old lambs were submitted to Athlone RVL with a history of sudden death. Eight in total had died, five in one night, from a flock size of over one hundred ewes. On gross examination the carcasses were markedly jaundiced with haemoglobinuria and dark kidneys. Sections from the renal cortex and liver of both lambs had toxic copper levels. Histopathology revealed hepatic necrosis and renal nephrosis with haemoglobin casts. Traces of copper were confirmed in sections using a rubeanic acid stain. Copper poisoning was diagnosed as cause of death based on gross and histopathologic findings.