BOVINE GASTROINTESTINAL TRACT

In 43% of submitted bovine carcases the alimentary tract was the affected organ system in March 2018. Enteritis was the most commonly occurring diagnosis.

Neonatal calf diarrhoea is one of the major causes of economic losses in livestock. Several enteric pathogens are associated with diarrhoea in young calves. Detecting the particular agents associated with an outbreak of diarrhoea is essential given the specific therapy and prophylaxis required in these cases. In view of the age susceptibility to these organisms, when faecal samples are submitted to the RVLs the precise age of the calf is required for a correct selection of appropriate tests. Figure 1 presents a guide of pathogen and age predisposition in neonatal calf diarrhoea.

There were several cases of neonatal diarrhoea submitted to Sligo RVL, often with mixed infections. A one-month-old calf was submitted to Sligo RVL after showing diarrhoea and not responding to treatment. Necropsy revealed diffuse enteritis and multifocal pneumonia. Salmonella Dublin was isolated as the primary pathogen.

In a case from another holding, two calves aged 14 days which were bucket-fed and found dead suddenly without showing any previous signs of disease, were submitted for post-mortem examination to Sligo RVL. On necropsy, multifocal enteritis and multifocal pneumonia were apparent in one calf. The other presented with severe dehydration, diffuse enteritis. Rotavirus and Giardia spp were detected in the intestinal lesions. Histophilus somni was detected in the pulmonary lesions of the first calf. Zinc sulphate turbidity (ZST) was very low in both animals. A ZST result of 12 units or less is interpreted as inadequate and indicates that colostrum feeding has not been successful. Immunoglobulin levels change during illness and ZST results from dead animals may not reflect herd immunological status; however an investigation into herd colostrum-derived immunity may be warranted.

Giardia (G) spp is an intestinal-protozoan parasite. Infections are often asymptomatic but can cause disease in young dogs, cats and ruminants. The flagellate protozoa occupy the mucosal surface of the small intestine, typically the proximal portion, adhere to brush border and multiply by binary fission. Three primary morphological groups are described concerning mice, amphibians and warm-blooded animals. With respect to the last grouping G duodenalis (G intestinalis and G lamblia) being the most significant regarding production animals. There are no intracellular stages with trophozoites encysting in the large or small intestine followed by excretion. After uptake of the cyst in a susceptible host, the trophozoite's release is facilitated by low pH in the stomach and the effects of bile in the duodenum. The pre-patent period is approximately three to 10 days.

Table 1: Breakdown of diagnoses of cases in which the cause of death was located in the alimentary tract in submitted bovine carcases in March 2018.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Negative</th>
<th>Positive</th>
<th>% of Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotavirus</td>
<td>1,276</td>
<td>602</td>
<td>32.1</td>
</tr>
<tr>
<td>Cryptosporidium</td>
<td>1,501</td>
<td>363</td>
<td>19.5</td>
</tr>
<tr>
<td>Campylobacter jejuni</td>
<td>1,565</td>
<td>183</td>
<td>10.5</td>
</tr>
<tr>
<td>Giardia</td>
<td>923</td>
<td>66</td>
<td>6.7</td>
</tr>
<tr>
<td>Escherichia coli K99</td>
<td>1,248</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Salmonella culture</td>
<td>1,864</td>
<td>8</td>
<td>0.4</td>
</tr>
<tr>
<td>Coronavirus</td>
<td>1,856</td>
<td>6</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Table 2: Breakdown of the number of submissions and the percentages of positive results obtained from young calves tested for neonatal diarrhoea (Neonatal Calf Package) in 2017. The significance of Giardia and Campylobacter jejuni as a cause of calf enteritis is doubtful. Both are a common cause of gastroenteritis in humans and they are routinely surveyed in neonatal faecal samples. Source: Cosme Sánchez-Miguel.
The pattern of shedding can vary and may be continual over days to weeks. In the chronic phase shedding is often intermittent. Transmission is via the faecal-oral route. The cysts are very resistant, with increased environmental pressure, overcrowding and a low infective dose favouring transmission. High-humidity levels promote cyst survival. The cysts can be transmitted directly between hosts, or on various fomites including contaminated water and food. Notably, contaminated water is another potential infective source.

The pathogenesis involves increased intestinal permeability, greater level of intraepithelial lymphocytes and activation of T-lymphocytes. Further toxins and T-cell activation instigate a shortening of microvilli in the brush border and affect the function of its enzymes. Lipase is especially affected. Further mucin production increases from goblet cells. Cumulatively, this perpetuates malabsorptive diarrhoea with compromised water and electrolyte absorption. Clinical signs in calves and lambs include inappetence, loose faeces and reduced live weight gain. Calves tend to have the highest excretion rate between four to 12 weeks, and mixed infection with Cryptosporidium have been reported.

The oval cysts can be detected in faeces concentrated by the centrifugation-floatation technique using zinc sulphate.

There is no licensed treatment for giardiasis in ruminants. However, there are reports of the efficacy of fenbendazole against giardiasis in calves and lambs.

BOVINE VIRAL DIARRHOEA

Three calves were submitted to Limerick RVL with a history of diarrhoea. On necropsy, all had large volumes of liquid intestinal contents. Rotavirus was found in the intestinal contents of one of the calves. Two had pneumonia affecting small volumes of the lungs; polymerase chain reaction (PCR) on these animals returned a positive result of pestivirus/bovine viral diarrhoea (BVD).

BVD or pestivirus can be detected in calves despite negative ear notches in cases of viraemia due to a transient infection with the virus at the time of sampling (TI) which is most likely in this case. In extremely rare cases false negative results can occur despite the high sensitivity of the used PCR or ELISA conducted on the ear notch as part of the national BVD eradication programme. Further investigation is required to determine the reason for the change in status in this case.

ABOMASITIS

A one-week-old Friesian calf was submitted to Athlone RVL with a history of a swollen abdomen and death despite treatment. On post-mortem examination, gastrointestinal-tract contents were free in the abdominal cavity; there was a ruptured abomasal ulcer; and the abomasal mucosa was very haemorrhagic. Clostridium sordellii was detected by anaerobic culture and fluorescent antibody test (FAT). On histopathology, there was an abomasitis associated with Sarcina-like bacteria; a neutrophil-dominated inflammatory response surrounded the bacteria, which were present in characteristic tetraremes/clusters in the superficial mucosa (see Figure 2).

Sarcina species and other organisms, notably Clostridium species, have been associated with abomasal disorders in young ruminants. It is thought that the presence of fermentable carbohydrates and the tolerance of low pH by Sarcina species are likely to enable them to outgrow most other bacteria in the abomasum. While the specific risk factors for the involvement of Sarcina species in abomasal disorders is not fully known, the practical advice is limited to maintaining good hygiene when preparing and handling milk feeds for young ruminants, and preventing the contamination of all feeds with soil.

FOREIGN BODY-IMPACTION

A three-year-old cow was submitted to Sligo RVL with a history of recumbency and not responding to treatment. The animal had to be euthanised subsequently. The carcase appeared very malnourished and dehydrated. Necropsy revealed a severe impaction of the rumen with shredded black plastic wrapping (see Figure 3). This plastic was most...
likely ingested silage wrapping which made the passage of any food impossible. Cattle, especially at a young age, are of a very curious nature and explore by chewing and tasting everything within their reach which may be plastic wrapping, baling twine, net wrapping etc. Moreover, they can eat hurriedly and don’t chew extensively before swallowing. Therefore, it is most important that silage wrapping, nets, baling twine, plastic bags are properly removed before feeding.

RESPIRATORY TRACT

BOVINE HERPES VIRUS TYPE 1
A 13-month-old bull was submitted to Athlone RVL with a history of sudden death. Necropsy revealed bilateral cranioventral pulmonary consolidation with copious mucus in the airways especially the trachea and petechial haemorrhages in the tracheal mucosa and a hyperaemic tracheal mucosa. Bovine herpesvirus-1 (BHV-1 or IBR virus) was detected by PCR. On histopathology there was a suppurative bronchopneumonia and a fibrinosuppurative necrotising tracheitis.

PNEUMONIA
A five-week-old calf was submitted to Limerick RVL with a history of pneumonia. Multiple deaths had occurred in the group, calves were becoming affected from 10 days of age. Necropsy disclosed diffusely congested and consolidated lungs; all but the very caudo-dorsal tips of both lungs were involved. Bacterial culture from the lungs found *E. coli* but *Histophilus somni* and *Mycoplasma bovis* were also detected by PCR.

In a similar case in two calves that were submitted to Limerick RVL, whose gross necropsy disclosed signs of congested consolidated pneumonia with a cranio-ventral distribution in both animals. *Bibersteinia trehalosi* was isolated on culture from the lungs of one calf, and *Pasteurella multocida* from the other. *M. bovis* was detected by PCR from both calves, *Histophilus somni* from one.

The cases above highlight the multifactorial nature of respiratory infections in young calves. Viral agents were not detected in these cases but are considered likely to have contributed during acute phases of infection. The importance of prompt treatment of acute cases, vaccination, correct housing, ventilation, stress reduction and biosecurity is essential to prevention and control of similar outbreaks.

METABOLIC ACIDOSIS
There were several cases of dystocia and subsequent acidosis in neonates submitted to Sligo RVL.

In one case, the calf was very large and full term. It stayed recumbent after birth and was vocalising. On necropsy, there were no visible lesions apart from severe dehydration.

In a further case another large calf, whose delivery was assisted using a calving jack, stayed recumbent and died despite being tubed with colostrum. On necropsy, there was extensive subcutaneous and intra- and subcostal haematoma. Severe dehydration was present.

All neonates suffer metabolic and respiratory acidosis immediately after birth, but are usually able to compensate within the first 24-48 hours if the extent of acidosis is not too severe. Cases of severe acidosis in the neonate, excluding cases due to diarrhoea, occur mostly in fetal-maternal size mismatch and dystocia leading to hypoxia/anoxia. Respiratory acidosis develops due to trauma of a forced extraction and cessation of oxygen supply via placenta/umbilical cord and intensifies consequently in prolonged paturition. If the hypoxia is severe, foetal tissues are forced to derive oxygen from anaerobic glycolysis leading to an additional metabolic acidosis. Acidotic calves are weakened and have a reduced impetus to achieve natural survival behaviour like standing and suckling. There is a significant inverse relationship between venous partial pressure of CO$_2$, at birth and 12-hour, post-feeding serum-IgG concentration.
MISCELLANEOUS
HAEMORRHAGE
A 13-year-old cow was submitted to Limerick RVL with a history of swelling caudal to her mammary gland. Necropsy disclosed a large (approx 15L to 20L) blood clot subcutaneously in the perineum over the caudo-dorsal aspect of mammary. The source of the haemorrhage was not identified but was likely to be a ruptured major vessel following trauma.

SHEEP
Disease of the alimentary tract was the most common cause of death in submitted ovine carcases in March 2018.

GASTROINTESTINAL TRACT
ENTERITIS
Two four-week-old lambs were submitted to Sligo RVL after being found dead with abdominal distension. In one lamb, watery intestinal contents were apparent on necropsy and the kidneys appeared to be in an advanced state of autolysis. Necropsy of the second lamb revealed an intestinal strangulation by a fibrous band of tissue originating from the bladder apex (most likely an urachus remnant). There was also a persistent Meckel’s diverticulum in the jejunum (see Figure 4), which was considered most likely asymptomatic. Rotavirus and Clostridium perfringens were detected in intestinal contents; however, none of the toxins associated with C perfringens could be detected. Enteritis, most likely due to rotavirus, was diagnosed. The strangulation was possibly a consequence of intestinal hypermotility due to the enteritis.

A Meckel’s diverticulum is a vestigial remnant of the vitelline duct (also referred to as the yolk stalk or omphalomesenteric duct) which can be found in the lower small bowel. In animals, it is an uncommon anomaly mostly observed in pigs and horses. It is usually an incidental finding but can be involved in intussusceptions and impactions.

CLOSTRIDIAL ENTEROTOXAEMIA
A two-month-old lamb was submitted to Limerick RVL having been found dead. Necropsy revealed a number of small pericardial fibrinous clots. No abnormalities were seen in the other organs. Upon examination of the faeces, a positive result for epsilon toxin ($\varepsilon$-toxin) confirmed a diagnosis of Clostridial enterotoxaemia or pulpy kidney disease.

Table 3: Causes of mortality in sheep submitted to DAFM RVLs, broken down by organ system, excluding foetuses.

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alimentary tract disease</td>
<td>20%</td>
</tr>
<tr>
<td>Respiratory disease</td>
<td>10%</td>
</tr>
<tr>
<td>No diagnosis</td>
<td>5%</td>
</tr>
<tr>
<td>Systemic disease</td>
<td>20%</td>
</tr>
<tr>
<td>Musculoskeletal/Integument disease</td>
<td>5%</td>
</tr>
<tr>
<td>Metabolic disease</td>
<td>10%</td>
</tr>
<tr>
<td>Hereditary/Developmental disease</td>
<td>5%</td>
</tr>
<tr>
<td>Urogenital disease</td>
<td>10%</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>5%</td>
</tr>
<tr>
<td>Hepatic disease</td>
<td>5%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>10%</td>
</tr>
<tr>
<td>Clostridial disease</td>
<td>10%</td>
</tr>
<tr>
<td>Neurological disease</td>
<td>0%</td>
</tr>
</tbody>
</table>

Figure 4: Persistent Meckel’s diverticulum. Photo: Rebecca Froehlich-Kelly.

Figure 5: Pericardial effusion containing a fibrin clot common in Clostridial enterotoxaemia. Photo: Colm Ó Muireagáin.

Figure 6: Intestinal mucosa containing protozoal-life stages in a case of coccidiosis. Photo: Aideen Kennedy.
Sligo detected epsilon toxin of *Clostridium perfringens* in the watery intestinal contents of two separate neonatal lambs that hadn’t received sufficient colostrum. There was a typical pericardial effusion with gelatinous fibrin clots (see Figure 5).

**COCCIDIOSIS**

A 42-day-old Hampshire Down ram lamb was presented to Kilkenny RVL; the animal had been noted as dull and had died despite treatment with oral rehydration solution and antibiotics. This was the second case on the farm with similar symptoms that week. Severe dehydration was noticed on necropsy. The small and large intestines contained fluid-intestinal contents, green in colour. No other significant abnormalities were noted. Faecal examination revealed a moderate burden of coccidial oocysts. Histological examination of the intestines showed disruption of intestinal mucosa, with mucosal epithelial cells distended with micro- and macro-gametes (see Figure 6) as seen in coccidiosis. A review of coccidiosis-control measures on the farm was advised.

**LISTERIOSIS**

Two four-day-old lambs were presented to Cork RVL with a history of death following ill-thrift. Five similar cases were reported in the flock of 300 ewes and their lambs. On examination, both lambs had fibrinous fluid in the peritoneal cavity. Both had multifocal white spots on the liver (see Figure 7). *Listeria monocytogenes* was cultured from the livers of both lambs.

*Listeria monocytogenes* causes septicaemia, abortion and encephalitis in both man and other animals. In sheep, encephalitis is the dominant form of listeriosis. Keratitis and mastitis are also recognised. Clinical signs of listerial encephalitis include circling, head tilt and facial paralysis. The condition can be recognised in any age of animal. Listerial abortion can occur at any stage of pregnancy. Septicaemia predominantly affects lambs under three months. There can be fever and dullness but often, death can occur suddenly. It is unusual for all forms to occur at one time in a flock, but abortions can be followed at a later date by encephalitis in other sheep. Poor weather, intercurrent disease and silage feeding are all considered risk factors. Listeriosis can occasionally be encountered in young lambs that have had no access to silage. *L. monocytogenes* is common in the environment and can be found in the faecal and nasal secretions of healthy animals. The route of infection for lambs with septicaemia is presumed to be either orally or via the nasal. Lesions of listerial septicaemia are most often found in the liver as multifocal areas of coagulative necrosis giving an appearance grossly of pinpoint white foci throughout. The prognosis for clinical cases of encephalitis is poor. Cases of septicaemia may respond to antibiotics if treated early. To prevent occurrence of the disease, it is beneficial to use good-quality silage with effective sealing. Avoid large amounts of soil or faeces contaminating the silage.

**RESPIRATORY TRACT**

**ASPIRATION PNEUMONIA**

A four-day-old lamb was submitted to Cork RVL. The lamb had been stomach tubed after birth. On necropsy, severe dehydration and marked depletion of body fat was noted. The right lung was markedly larger and heavier than the left lung and when palpated. On dissection, the bronchi and bronchioles were filled with a white liquid. These findings in conjunction with the history are indicative of aspiration pneumonia.

**URINARY/REPRODUCTIVE TRACT**

**ABORTION**

*Chlamydophila abortus* and *Toxoplasma gondii* were the most commonly diagnosed cause of abortions in sheep in March in Sligo. There were isolated storms due to *L. monocytogenes* and *Salmonella* spp. *Salmonella serovar Montevideo* was one example of isolated *Salmonella* serovars. There were a few cases were *Trueperella pyogenes* was the only agent isolated.

*Salmonella serovar Montevideo* is an uncommon cause of abortions in ewes in Sligo. In this case, the abortions were in the last trimester and the ewes showed no signs of ill health. A neighbouring farm had had a similar occurrence the previous year. Although the exact means of transmission of the agent to sheep has not been established, scavenging birds including gulls are frequently implicated. Feeding outdoor sheep in a different part of the field each day may reduce the risk of contamination from these sources.

**CARDIOVASCULAR SYSTEM**

**FIBRINOUS PERICARDITIS**

A four-year old ewe was submitted to Limerick RVL with a history of weight loss. Necropsy revealed a marked volume of fibrinopurulent exudate in the pericardial space. Both lungs were congested and had cranioventral consolidation and pleural adhesions (pleuroneumonia). Within the abdomen, there was a large volume of fluid. Bacterial culture of the pericardial material revealed sterile conditions. The cause of the pericarditis could not be elucidated.
REGIONAL VETERINARY LABORATORIES REPORT

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Veterinary Ireland Journal I Volume 8 Number 6

Sligo investigated three separate incidents of poisonous-containing plants. Laurels are cyanide-containing plants. Grayanotoxins also known as andromedotoxin are the active toxic principles in Pieris species. Their effect mediated through binding to sodium channels in excitable cells, thereby exerting their main effect on cardiac and skeletal musculature and the nervous system. Laurels are cyanide-containing plants.

Sligo investigated three separate incidents of poisonous-plant ingestion causing multiple deaths in sheep in March. Sligo also had a single incident of poisoning in four 10-month-old lambs that was attributed to the ingestion of urea.

POISONINGS/MISCELLANEOUS

PIERIS POISONING

Four ewes were submitted to Athlone RVL with a history of sudden death after having broken into a garden on the previous day. There were two other ewes sick and poisoning was suspected. The state of carcase preservation was moderate to poor. Garden-shrub leaves were found in the rumens of all four ewes. There were Pieris japonicus variegata leaves and laurel leaves. There was some pulmonary congestion but no other significant gross findings. Grayanotoxins also known as andromedotoxin are the active toxic principles in Pieris species. Their effect mediated through binding to sodium channels in excitable cells, thereby exerting their main effect on cardiac and skeletal musculature and the nervous system. Laurels are cyanide-containing plants.

Sligo investigated three separate incidents of poisonous-plant ingestion causing multiple deaths in sheep in March. Two cases were attributed to varieties of Pieris japonica and the third to a garden variety of Rhododendron. All these plants contain high levels of lethal grayano/andromedotoxin. Sligo also had a single incident of poisoning in four 10-month-old lambs that was attributed to the ingestion of urea.

OTHER SPECIES

PIGS

LAMENESS

Pathology Division in CVRL Backweston investigated an outbreak of lameness affecting grower and fattener pigs in a commercial unit. The clinical signs were described as an insidious onset of lameness affecting multiple joints which had started in grower pigs, but recently had become more pronounced in fattener animals. Animals varied in the severity of their clinical signs but some had become recumbent and were euthanised. Palpable soft swellings had been noted over the hock and carpal joints.

The necropsy of pigs described as acutely affected from the unit revealed a fibrinous polyarthritis involving the carpal, tarsus, stifle, and in one pig included the hip joints. There was oedema, necrosis and haemorrhage involving tendons, tendon sheaths and musculature surrounding affected joints. There was chronic ulceration of the skin over pressure points of affected joints indicating that although the animals were described as acutely affected by the farmer and were in good body condition there had been increased pressure on this skin for some time, which suggested a longer course of infection than previously thought. Joints taken from animals with more severe chronic lesions that had been treated with antibiotics had severe purulent polyarthritis. It was not clear from the clinical history if the more acute cases had received antibiotic treatment at earlier stages of production as there had been lameness present for some time in the herd. Laboratory diagnostic tests included comprehensive bacterial culture and PCR tests for likely differentials including Mycoplasma spp, Haemophilus parasuis, Erysipelothrix rhusiopathiae, Streptococcus spp and many others which were negative in the acute cases but T pyogenes was isolated from some joint swabs in the chronic cases. Histopathology revealed a chronic severe fibrinosuppurative necrotising polyarthritis and tenosynovitis of varying severity in all pigs. It was concluded that a chronic bacterial aetiology was likely and was consistent with the history and necropsy findings but may have been related to an infection earlier in the pig’s life than had been previously thought. Negative bacteriology results did not rule out a previous infection. Initial presentation and age at onset suggested Mycoplasma hyosynoviae or hyorhinis as likely differentials which could not be proven by histopathology or PCR testing. It was considered possible that the observed worsening of clinical signs in older age groups may actually have been related to unresolved bacterial infections in weaner groups and that treatment of batches earlier in production may have obscured bacterial culture in these cases however it was not possible to explore this theory further with the material provided. The isolation of T pyogenes from some of the more chronically treated animals could not be adequately explained but this organism is frequently a secondary pathogen and can be responsible for lameness in individual pigs but was considered unlikely to have caused an outbreak especially as it was not detected in less chronically affected pigs. Further acutely affected pigs were requested from the outbreak to ensure findings were representative and the investigation is continuing. This case highlights some of the difficulties involved in investigating a clinical syndrome on intensive pig farms where thorough clinical history is often not possible or misleading due to the batch nature of the systems where it is not possible to account for the cumulative effect of disease as pigs move through production stages, when faced with the immediate presenting clinical signs. Necropsy in this case characterised the aetiology as bacterial and provided information on the chronicity that had not previously been available to the veterinary practitioner investigating the case. Although the results were negative and did not completely rule out Mycoplasma spp involvement, it provided information on where to target controls and further investigations. Further lameness outbreaks on this farm will be investigated until the aetiology is adequately explained.

Figure 8: Pieris japonica as recovered from a rumen of a poisoned sheep. Photo: Denise Murphy.

POISONINGS/MISCELLANEOUS

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