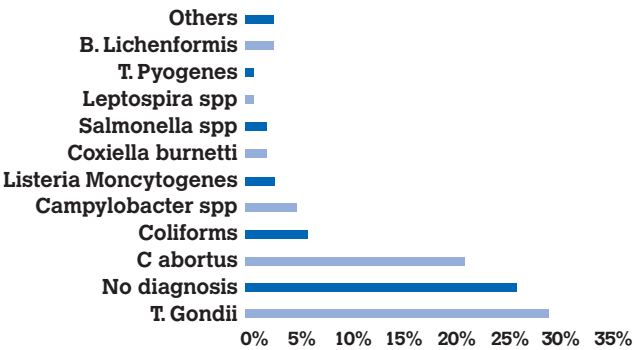
Ovine abortion: an overview

Emmet Kelly MVB, ECAR (European College of Animal Reproduction) resident in farm animal reproduction in University College Dublin (UCD) gives a detailed over view on ovine abortion

Low weaning rates represent one of the major stumbling blocks for flock profitability and nationally this stands at 1.3 for lowland ewes (Creighton, 2015). One of the chief factors driving this are losses due to abortion. Infectious abortive agents play a major role in these losses and a recent descriptive study (Fagan & Sheehan, 2017) of mortality in Irish sheep flocks has shown that the abortion incidence on Irish farms could be even higher than once thought at 7.5% (foetal submission rate of 7.6 foetus per 100 ewes). Undoubtedly, the major infectious agents in Ireland are Toxoplasma gondii and *Chlamydophila abortus*, accounting for 29% and 21% respectively of all abortion submissions in the latest disease surveillance report. These and others are summarised in Table 1 (adapted from Agri-Food and Biosciences Institute [AFBI]/Department of Agriculture, Food and the Marine [DAFM] 2015 Report).

2015 DAFM RVL Abortion Data



A UK study has estimated that nationally *Toxoplasma gondii* and *C abortus* cost the industry £34m/year (Bennet & Ijpelaar 2003) and if this is extrapolated to the Irish flock it would mean that these agents could cost Irish farmers nearly €5.1m/year. Combining this with the fact that a large proportion of these infectious agents carry a large zoonotic potential, the following article aims to outline how to approach cases of abortion on farm and the epidemiology behind these two major pathogens in Ireland.

- Number of ewes?
- Scanning results?
- Expected lambing date?
- Number of abortions?
- Previous abortion history?
- Open/closed flock?
- Indoor/Outdoor lambing?
- Ewe nutrition? Where fed?
- Vaccinations?
- Ewe handling?
- Are aborted ewes sick/dying?
- Ewe groups aborting? Purchased ewes? Hoggets?

Table 2.

INVESTIGATING ABORTIONS AND DEALING WITH 'THE STORM'

HISTORY AND RECORDING LOSSES

While practitioners may be called to investigate abortion on farm during a storm, doing so after the lambing season has ended is almost always a case of closing the stable door after the horse has bolted. However, determining the incidence of abortion and the pathogens involved can really aid in planning and costing future flock decisions and should not be understated. The initial investigation should involve a complete history as outlined in Table 2.

'You cannot manage what you don't measure' and in flock abortion investigations, records are very useful in pinpointing the significance of one pathogen over another and sometimes helping to trace where the causative agent most likely came from (eg. bought-in ewes in case of *C abortus*). Sometimes records may be scant or absent and relying on the farmers memory alone may prove challenging. However, with the advent of smartphones and flock-recording technologies, records on some farms are easily obtained. As well as aiding an investigation, this allows the farmer to monitor the effect that disease-control decisions (eg. vaccinating) have made to farm profitability in subsequent years.

SAMPLE SUBMISSIONS

Preferably, all abortions should be submitted for investigation. However, it is generally accepted that when over 2% of ewes in the flock have aborted or when there has been a concentration of abortions over a short period of time, samples should be submitted for diagnosis. Sending all fresh aborted material including placenta and foetuses gives the best probability of a diagnosis. Repeated submissions during an outbreak are both beneficial in reaching a diagnosis and in identifying whether multiple pathogens are involved, which is not uncommon. In the 2015 All-Island Disease Surveillance Report, diagnostic rates in Ireland were reported to sit at about 74% meaning that one in four samples submitted will not result in a diagnosis. This is an important point to stress to the farmer as a negative result can often be very frustrating and demoralising for them especially in the face of an abortion storm.

Consequently, inconclusive results should not deter repeat submissions of abortions as these are essential until a diagnosis is achieved.

Farmers may not always see the value in the time it takes to deliver the aborted material to a regional laboratory during a busy lambing period. This, combined with the future possibility of centralisation of these laboratories, poses a further barrier to submissions. A convenient

alternative to this is the option for a PVP to take samples from the aborted foetus and placenta and post them to the laboratory. The samples that should be collected are outlined below (adapted from Mearns, 2007):

- Segment of placenta, including more than one cotyledon, with large margins of intercotyldonary membranes;
- Pleural fluid collected from the thorax aseptically with needle and syringe into vacutainer;
- Foetal stomach contents collected as in number 2; and
- Fresh foetal spleen and section of liver.

BASIC EMERGENCY PRECAUTIONS

Although the epidemiology varies greatly among the different pathogens that cause abortion in sheep, it is vital to stress to all farmers that all abortions should be treated as if it is a *C abortus* outbreak even if an alternative diagnosis is reached as some abortion storms can involve multiple pathogens. The basic precautions outlined in Table 4 will help to limit the spread of pathogens among pregnant and fresh ewes and their lambs and cannot be understated.

MAJOR PATHOGENS, PATHOGENSIS AND CONTROL

T GONDII

- **Isolate and mark aborted ewes;**
- **Dispose of aborted material promptly and if storing on farm prior to disposal, ensure it is in scavenge-proof containers;**
- **Remove bedding and disinfect pen;**
- **Submit samples for diagnosis;**
- **Do not foster lambs onto aborted ewes;**
- **Treat with antibiotics if ewe ill; and**
- **Make aware of zoonotic risks of direct contact with pregnant women and ensure good hygiene of farmer to prevent indirect contact.**

Table 3.

T gondii is an obligate intracellular protozoan in the same Sarcocystidae family as Neospora. Cats are the definite host, where there sexual phase of reproduction occurs, while sheep and rodents are intermediate hosts where asexual reproduction occurs. Cats are infected by ingesting oocysts from the environment, ingesting infected rodents or transplacentally. They shed oocysts for one to three weeks with 50g of faeces containing up to 10 million oocysts (Williams & O'Donovan 2009). Once infected, cats acquire immunity quite rapidly, so younger naïve cats are of greatest concern if present on farm. However, stress and/or concurrent disease can allow for re-infection and subsequent shedding (Williams & O'Donovan 2009). Once pregnant ewes ingest these oocysts, tachyzoites formed in their gut invade the placenta and cause tissue necrosis and fever, resulting in abortion, stillbirth, mummification, barrenness and even live lambs depending on the stage of gestation and the quantity ingested. The damage manifests grossly as dark cotyledons with white spots in them which can have a gritty texture (Mearns, 2007) due to mineralisation in the areas of necrosis where the tachyzoites multiply (Williams et al, 2009).

The issue of vertical transmission of *T gondii* in sheep is often debated as it is of great significance in the epidemiology of Neosporosis in cattle. Other intermediate hosts such as mice have been found to pass infection vertically to their offspring, which is important in maintaining the source of infection for cats (Mearns, 2007). Research has shown that transplacental transmission does occur in ewes but in low numbers and may vary depending on the genetic resistance of some sheep or on the strain of *T gondii* (Rodger et al 2006).

Diagnosis is confirmed by histopathogical examination of infected tissue, indirect fluorescent antibody testing (IFAT) on foetal fluid or polymerase chain reaction (PCR) on foetal tissues (Noakes et al, 2009). Serum-agglutination testing on ewes that have aborted can be useful in diagnosis after the abortions have occurred as most ewes remain seropositive for at least six months following infection (Williams & O'Donovan, 2009). It is recommended that serum blood samples are taken from at least six aborted or barren ewe if conducting a screen. Interpreting serology, in light of vaccination, proves difficult and therefore, serology is more useful in unvaccinated flocks.

Toxovax (MSD Animal Health) is a live tachyzoite vaccine and it is the only vaccine licensed for use in Ireland against *T gondii*. It offers protection for at least two lambing seasons. It is given intramuscularly and it should be given no less than three weeks before mating (HPRA SPC). An in-feed coccidiostat, decoquinate (Deccox; Zoetis) which practitioners would be more familiar with in the treatment of coccidiosis in lambs and calves, can be fed continuously as a prevention for the last two thirds of pregnancy as a premix added to commercial rations (Mearns, 2007). However, while it is licensed for this indication in the UK it off-label for this purpose in Ireland and its use is further limited by the fact that most farmers will only feed concentrates in the last four to six weeks of pregnancy. Maintaining good hygiene at lambing with appropriate storage and disposal of aborted material to prevent scavenging, rodent control measures, keeping feed bins and hay sheds secure from cats and keeping a healthy neutered group of cats on farm are also key control measures to prevent dissemination of infection (Noakes et al, 2009).

C ABORTUS

C abortus is a Gram-negative obligate-intracellular bacteria that is spread from sheep to sheep by the oral-nasal route. Aborting ewes shed vast quantities of bacteria in the placenta and foetal fluids and ingestion or inhalation by other ewes or lambs results in infection. These infective particles (elementary bodies) can persist in the environment for weeks at low temperatures (Williamset al, 2009). Regardless of timing of infection, it is not until 90 days of gestation that the bacteria invades the placenta to cause a severe suppurative necrotising placentitis that appears grossly as a placenta with a brownish colour and thickened-intercotyledonary areas (Mearns, 2007). The location of

this dormancy is believed to be in the tonsil or pharyngeal lymphoid tissue and the process of re-activation is poorly understood (Noakes et al, 2009).

Unless the ewe is exposed and infected at least six weeks before she is due to lamb, abortion rarely occurs in the same season. More commonly ewes infected in a particular season will go on to abort at the subsequent lambing (O'Donovan et al, 2008). Abortions occur classically in the last three weeks of gestation and commonly produce live, weak lambs alongside dead lambs. Eighty per cent of outbreaks in clean flocks are due to the purchase of infected ewes of any age (Greig,1996). The classic pattern observed is that abortion is seen in a small number ewes in a particular season but the abortion storm does not happen until the subsequent season as those naïve ewes exposed the previous season abort. Abortion storms where over 30% of the ewes are affected can be commonly seen (Greig, 1996).

Diagnosis is confirmed by histopathological examination of the placenta, modified Ziehl-Neelsen staining of the placenta. If the placenta is not available, PCR of the foetal tissues (kidney, liver) is becoming quite commonplace. Serological testing by complement-fixation of serum antibodies or enzyme-linked immunosorbent assays (ELISAs), can be done after the fact but both have their limitations. False positives occur due to cross reactivity with other *Chylamydophilia spp* and positive titres are not present until the ewe aborts so latently infected ewes are impossible to detect (Noakes, 2009). In addition, it is impossible to differentiate between vaccinated and naturally infected ewes (Gerber et al, 2007).

Much of the generic control strategies for containing *C abortus* during an outbreak are outlined in Table 4. A classic feature of *C abortus* infection is that ewes that abort due to it do not abort again in subsequent seasons in spite of evidence that the infection persists in the endometrium. It has been deduced that the maternal immune system limits the numbers of *C abortus* reaching the susceptible trophoblast (Sammin et al, 2005) thus preventing abortion. Even though the likelihood is that these ewes will not abort again due to *C abortus* their retention within the flock is not advised as they can shed the bacteria at subsequent lambings or even during oestrus (Winter et al, 2002) and remain a potential source of infection to the flock.

Whole-flock treatment with long-acting oxytetracyclines at a dose of 20mg/kg has been traditionally used in an attempt to increase the number of viable lambs by limiting bacterial growth and placental damage but good recent scientific evidence is lacking (Williams et al, 2009). It can be used with effect during an outbreak or beginning six weeks before lambing if *C abortus* was diagnosed the previous year. However, the antibiotic treatment must be repeated every 10-14 days until lambing in order to suppress bacterial growth and it does nothing to stop shedding in the foetal fluids (Aitken et al, 1990).

Enzovax (MSD Animal Health) is a live, attenuated vaccine and is the only *C abortus* vaccine licenced for use in Ireland. It offers protection for at least three years post-vaccination. It is can be administered either intramuscularly or subcutaneously and should be administered at least four weeks before mating. It is worth noting that vaccinating latently-infected ewes will reduce the incidence of abortion, however a small proportion of them can still go on to abort from *C abortus (*HPRA SPC).

SUMMARY

Even though there is little that can be done to stop an abortion storm, veterinary intervention is key in advising the farmer and achieving a rapid and reliable diagnosis. In the short term, veterinary expertise is critical as it facilitates immediate implementation of control measures to help limit the spread of infection and achieving a rapid diagnosis in some instances allows for appropriate targeted treatments. While in the long-term, flock-health plans with vaccination and biosecurity measures that can limit future abortions will improve future farm profitability through an increased weaning rate.

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