Clinical mastitis of sheep – causes, prevention and treatment

This presentation provides a background on clinical mastitis in Australasian sheep, common causes of the disease and their impact on farm productivity, profitability and animal welfare. Current treatment, control strategies and suggested future directions for control of this disease are discussed. It does not discuss lentivirus or Mycoplasma mastitis as these are considered exotic to Australasia.

Clinical mastitis of sheep is defined as disease that can be diagnosed by the use of clinical examination without further laboratory tests such as milk cell count or bacteriological identification. Causes of mastitis in sheep can vary between production systems based on differences in management. A prime example of this is in dairy sheep production compared to meat or wool production. In most dairy sheep production systems lambs are removed from their dams relatively soon after parturition and they may or may not get further access to their dams for part of the day or night. Any discussion around disease therefore needs to incorporate management on an individual property basis and the impacts this has on the animal and environment.

In dairy sheep production systems and stud sheep production systems mastitis may be diagnosed earlier than in commercial wool and meat sheep production systems due to the frequency of assessing sheep and knowledge of individual animal behaviour. In extensively managed sheep, mastitis is mostly diagnosed by changes in ewe behaviour or appearance such as inappetance, lameness and lethargy. It does however also include less severe clinical forms producing changes in the ewe’s temperature, udder and/or milk but relatively minor changes in ewe behaviour. These latter changes may be picked up earlier on dairy or stud sheep properties than commercial meat and wool properties.

Incidence

The incidence of clinical mastitis varies significantly between different production systems and also between different years on the same property. This variation can be attributed to changes in environment, changes in management such as stocking density and also possible changes in pathogens with introductions of new animals harbouring pathogens onto properties. In general, average rates of mastitis vary across flocks from as low as 1% to higher than 5%, with significant variation in individual flocks reported from year to year. British Breed sheep are reported to have higher incidence of mastitis compared to maternal breeds and Merinos reporting a generally low incidence. There are however incidences of serious disease outbreaks in all of these breeds, with rates of higher than 10 or even 20% of ewes affected by clinical mastitis. These events appear to be more common during climate extremes such as very cold or wet weather or drought leading to stock being under stress or contained within smaller areas.

Causes

The most common causes of acute mastitis in ewes are *Staphylococcus aureus* and *Mannheimia* spp. Infections with these bacteria frequently lead to gangrenous mastitis in meat and wool production systems as the time from infection to severe disease is less than two to three days. Removal of lambs relatively...
early from ewes in dairy production systems tends to result in a higher proportion of Staphylococcal mastitis compared to *Mannheimia*. This is most likely due to the carriage of *Mannheimia* in the nasopharynx of the lamb and subsequent spread during suckling. Where cross suckling is common in flocks this can lead to transfer of disease across a number of ewes. Coagulase negative Staphylococci, Streptococci and enterococci are the next most common infections found with a range of other potential bacteria causing clinical mastitis.

Identification of bacteria and any resistance to antibiotics is important to establish the resident bacteria in the flock, changes in this pattern over time and the likely response to antibiotic therapy along with assistance in the selection of the most appropriate antibiotic for treatment. Cases of mastitis on sheep farms can be isolated and milk samples difficult to collect. Client education and collection packs can result in high quality collections that can be frozen until the end of lactation with acceptable culture percentages, although culturing as soon as possible after collection will result in better outcomes. It may also be useful in designing a prevention plan for sheep mastitis. It is also useful to note other potential risk factors such as environmental extremes (wind, rain, temperature etc) along with disease such as scabby mouth that will increase cases of bacterial mastitis due to reduced teat defence against bacteria.

**Impact on productivity/profitability/welfare**

The overall cost of clinical and sub-clinical mastitis to the Australian sheep industry has recently ranked it as the eighth most financially important sheep disease. Data from the 1960s and early 1970s in New Zealand would suggest that this figure may be similar in New Zealand although no recent published data is available. Clinical mastitis can result in the loss of the ewe and frequently the loss of one or more lambs due to ewes frequently stopping milking on both sides during acute infections resulting in a significant reduction in welfare or death for both ewes and lambs.

**Treatment**

Treatment requires rapid intervention and antibiotic use to save the ewe. Given the speed of clinical disease the most important element to treatment is rapid identification of the disease and treatment. In Australia the only registered treatment is via antibiotic injection as there are no registered intramammary preparations for ewes, although following veterinary advice it is possible to use intramammary preparations off-label with an appropriate increase in withholding period. While data is currently lacking, the use of anti-inflammatory therapy also appears useful on an empirical basis. With relatively low levels of antibiotic use within the sheep industry there is little bacterial resistance to antibiotics. Antibiotic selection will vary on the expected ability to retreat the ewe, resistance status, antibiotic penetration into the udder and bacterial species present.
Control

The critical point for bacterial entry to the mammary gland is the teat junction. If any damage occurs to the teat end or there is an excess of milk production compared to the lamb/s needs this can result in the teat sphincter staying open longer post suckling resulting in increased time for bacterial infection into the udder. Similarly, incorrect pulsation or vacuum pressures or other milking factors in dairy systems leading to teat damage may also increase bacterial entry into the teat canal. While several million bacteria on the outside of the teat do not represent a problem to the sheep, a few hundred colony forming units of bacteria a few millimetres inside the teat are enough to rapidly result in clinical disease with pathogens such as *Mannheimia* spp.

Prevention of clinical mastitis on any given farm will vary depending on the identification of the pathogen and understanding of risk factors leading to previous outbreaks. In situations where it is known that orf or scabby mouth has been present during previous outbreaks vaccination against this may significantly reduce the impact this has on the flock. Scabby mouth can damage the end of the teat and allow subsequent bacterial entry and development of mastitis. Similarly, where properties report high levels of clinical mastitis at certain times, changing lambing time or paddocks to reduce environmental extremes may help to reduce the number of cases.

Prevention of clinical mastitis relies on matching ewe feed requirements to needs, feeding a balanced diet and where necessary removing lambs from the system. In lamb rearing systems where lambs stay on their dams for more than seven to eight weeks this represents a chance to wean at this point if significant mastitis occurs in later lactation. This either requires a relatively short joining and subsequent lambing period or sheep to be ‘drift-lambed’ into age matched flocks post lambing. The removal of ewes with mastitis and their lambs from the flock may also reduce transmission where this is possible.

Future directions

Due to the difficulty in identifying mastitis cases early in the course of disease and the rapid onset of disease there are two primary areas for further research.

The first of these areas is in the development of appropriate vaccines against pathogens that cause clinical mastitis. No current vaccines exist for mastitis in Australia but vaccines do exist worldwide against Staphylococcal mastitis and also against *Mannheimia pneumonia*. Further work investigating potential development of a multivalent mastitis vaccine would provide producers with another tool to use in reducing disease. Use of models such as mammary lymphatic cannulation and RNA sequencing will aid assessment of the potential of these vaccines.

The other area for future research is in genetics and genomics. There are currently no tools available for selecting new sires in this area. Collection of an adequate dataset of several thousand ewe milk cell counts could generate an estimated breeding value for sires. Collecting milk from ewes with known genotypes may also allow for development of genotype tests for rams based on lower risk of passing on genes for mastitis to their daughters. In theory this could then allow culling the lower band of rams for this genotype at a young age where ewe progeny are to be retained.