

Current and Emerging Flock Health Problems (Pasteurellosis, Toxoplasmosis and Caseous Lymphadenitis)

Frank Malone

Disease Surveillance and Investigation Branch, Veterinary Sciences
Division, Department of Agriculture and Rural Development, 43 Beltany
Road, Coneywarren, Omagh, Co. Tyrone BT78 5NF, Northern Ireland

(Text of a paper delivered at a meeting of the Irish Grassland Association, Abbeyleix, Co. Carlow, January 2004)

Introduction

Infectious disease in animals results from an interaction between the affected animal, the environment and the infectious agent. The main principles of control of infectious disease are illustrated in this paper by describing two currently significant diseases (pasteurellosis and toxoplasmosis) and an emerging disease (caseous lymphadenitis).

Pasteurellosis

Pasteurellosis causes two main diseases in sheep, pneumonic pasteurellosis and systemic pasteurellosis (Donachie, 2000). The bacterium *Mannheimia haemolytica* (formerly *Pasteurella haemolytica*) is the most common cause of acute pneumonia in sheep. Systemic pasteurellosis, caused by the bacterium *Pasteurella trehalosi*, predominately occurs in store lambs from September to December. *M. haemolytica*, together with *Mycoplasma ovipneumoniae*, also causes a chronic pneumonia of lambs, which is known as atypical pneumonia. Less common forms of pasteurellosis include mastitis, abomasitis and arthritis.

Pneumonic pasteurellosis

A wide variety of clinical signs, ranging from sudden death to occasional coughing, may occur in sheep affected with pneumonic pasteurellosis.

Acute pneumonia, due to *M. haemolytica*, is a significant cause of mortality, mainly in 3 to 5 month-old lambs in late spring or early summer, but may also occur in other age groups or at other times of the year. Sheep with acute pneumonic pasteurellosis may either be found dead or die after a brief illness. Other affected sheep or lambs in the group will be dull, febrile, breathing heavily and not eating. There may be a greyish-coloured, watery discharge from the nostrils and eyes.

M. haemolytica may be carried in the upper respiratory tract of healthy sheep and a variety of stressors are associated with converting these carriers into clinical cases of pneumonia. These stressors may be: other infections such as parainfluenza type 3 virus (Rodger, 1989); management changes such as dipping, castration, dosing for worms, shearing or housing (Malone and others, 1985); and

either climatic changes at pasture (McIlroy and others, 1989) or microclimatic changes when housed (Linklater and Watson, 1983; Malone, 1991).

M. haemolytica is generally sensitive to a variety of antibiotics including penicillin and oxytetracycline.

Control is mainly by the use of *Pasteurella* vaccines. If lambs receive adequate colostrum from vaccinated ewes within the first 24 hours of birth they will gain only passive immunity to pneumonic pasteurellosis and septicaemia for the first 3-4 weeks of life. Vaccination of the lamb is necessary to build its own active immunity and continued resistance to the disease. The first dose of *Pasteurella* vaccine (Ovipast Plus, Intervet) is administered from 3-6 weeks of age, followed by a booster dose 4-6 weeks later. Full immunity occurs approximately 2 weeks after the booster dose.

Systemic pasteurellosis

Systemic pasteurellosis occurs most commonly in hill, store lambs that are being finished on lowland farms. *P. trehalosi* is present naturally in the tonsils of healthy sheep. However, certain trigger factors may cause the bacterium to invade the bloodstream and cause disease. Systemic pasteurellosis has been associated with recent changes in the plane of nutrition, transport or with cold, wet weather.

The sudden onset of systemic pasteurellosis means that lambs are rarely seen alive. Control is mainly by the use of *Pasteurella* vaccines. The vaccination course should be completed at least two

weeks before the high-risk period. Lambs should be managed so that trigger factors associated with the disease are minimised.

Atypical pneumonia

Atypical pneumonia is a chronic pneumonia of lambs aged from three to twelve months. Normally, the disease has a high morbidity and low mortality, but is frequently severe where housed lambs are purchased from different sources.

Although other agents may modify the disease, *Mycoplasma ovipneumoniae* and *M. haemolytica* are frequently isolated in natural outbreaks (Jones and others, 1979; Malone and others, 1988).

Clinical signs are mild, namely coughing, nasal and ocular discharges and pyrexia; deaths occurring infrequently. The main effect of atypical pneumonia is on production – affected lambs require more feed and take longer to reach finishing weight (Jones and others, 1982).

Oxytetracycline is commonly used in the treatment of clinical cases, as it is effective against both *Mycoplasma* and *Mannheimia* species. Attention should be paid to stocking density and ventilation. Batches of bought-in store lambs should not be housed until the stresses of transportation and change of diet have been overcome. As foot bathing close to the time of housing was associated with an increase of atypical pneumonia lesions at slaughter (Malone, 1991), this should be carried out well before housing. Vaccination is not effective in preventing atypical pneumonia (Jones and others, 1986).

Toxoplasmosis

Abortion in sheep is a major constraint to flock profit margins, as it causes approximately one third of all lamb losses on lowland farms. The consequences of sheep abortion in Northern Ireland have become more dramatic in recent years due to the introduction and spread of enzootic abortion of ewes (EAE). Control of infection is of vital economic importance for the farmer. It also reduces environmental contamination with infectious agents, such as *Chlamydomphila abortus* (the cause of EAE) and *Toxoplasma gondii* (the cause of toxoplasma abortion), which have the potential to cause serious illness in humans. Toxoplasmosis, due to the protozoon organism, *Toxoplasma gondii*, is a major cause of sheep abortion in Ireland (Table 1).

Table 1. Laboratory identification of toxoplasmosis and enzootic abortion of ewes at the Regional Veterinary Laboratory Service (Republic of Ireland; ROI) and the Veterinary Sciences Division (Northern Ireland; NI)

	ROI (%)	NI (%)
Toxoplasmosis	54.0	34.0
Enzootic abortion	4.6	46.2

Signs of toxoplasmosis

Sheep are normally infected by eating feedstuffs that have been contaminated by cat faeces containing toxoplasma oocysts (eggs). Sheep-to-sheep spread of toxoplasma infection is not significant. Clinical disease occurs when sheep become infected for the first time during pregnancy; the

outcome depending on the age of the foetus when first infected.

In early pregnancy (less than 50 days gestation) infection may result in death of the embryo and resorption. This presents as either a return to service or in barren ewes, if the ram has been removed. Infection with toxoplasma in mid-pregnancy (about 70-100 days gestation) will present as losses due to abortion, stillbirths or mummified foetuses. Mummified foetuses are small chocolate-brown miniature lambs and are commonly seen in toxoplasma infections. Infection in late pregnancy (over 120 days gestation) will result in the birth of normal, but infected immune lambs. Ewes that have aborted due to toxoplasmosis are immune to re-infection.

Spread of toxoplasmosis

The central role in toxoplasma spread is played by a young hunting cat acquiring infection for the first time from its prey (Buxton, 1989). Rodents and small birds are the main source of toxoplasma infection for cats. The infected cat subsequently passes large numbers of toxoplasma oocysts in its faeces for up to two weeks. Toxoplasma oocysts are very resistant and may persist in the environment for up to a year. Therefore, although cats will only shed the infection for a short time, any place where they have fouled during this period (such as in a grain store) will be contaminated with toxoplasma oocysts. A single infected cat may produce tens of millions of oocysts; by contrast about 200 oocysts may infect a susceptible ewe, so there is great potential for an abortion storm.

Control of toxoplasma abortion

Because the infection is caused by faecal contamination of feedstuffs by cats, it is important to keep stored feedstuffs covered and to control the cat population by neutering. After infection, the ewe will develop a strong natural immunity. Medication of the concentrates with decoquinatate (Buxton and others, 1996) will control toxoplasma abortion, but this should be undertaken only on the advice of a veterinary surgeon and after a definitive laboratory diagnosis. Vaccination against toxoplasma abortions will give a life long immunity. The vaccine (Toxovax™, Intervet) is administered three to twelve weeks before tupping. As toxoplasmosis occurs more commonly in younger breeding ewes, it is more cost effective to vaccinate first breeding ewes.

The toxoplasmosis vaccine currently available is a live vaccine and may therefore also infect humans, so the manufacturer's instructions for use should be carefully followed.

Caseous lymphadenitis

Caseous lymphadenitis (CLA) is caused by the bacterium *Corynebacterium pseudotuberculosis*. Although it can affect a number of domestic species and man, it is as a disease of sheep and goats that CLA is most important (Baird, 2000). *C. pseudotuberculosis* causes chronic abscessation in lymph nodes and internal organs. When superficial

lymph nodes are affected these abscesses are visible as swellings beneath the skin, which may rupture and discharge pus. CLA is present in many countries throughout the world and was first recorded in sheep in Northern Ireland in 1999, when the source of the infection was traced to imported Scottish sheep. CLA is a notifiable disease in both the Republic of Ireland and Northern Ireland, but DEFRA has removed restrictions in Great Britain.

Implications for sheep farming

Economic losses occur mainly by the culling of affected animals, carcass condemnations and restrictions on trade. Production losses may occur when internal abscesses are present. Although uncommon, human cases of *C. pseudotuberculosis* infection have been reported.

Diagnosis

CLA may be detected clinically if superficial lymph nodes are affected. These lymph nodes lie under the skin in the head, neck, shoulder, groin and leg regions. CLA abscesses may also be present in internal lymph nodes (such as those in the chest and abdomen) and in internal organs such as the lungs. The abscesses may be present in single or multiple sites (Table 2). *C. pseudotuberculosis* must be cultured from the abscesses to obtain a definitive diagnosis and rule out other possibilities such as actinobacillosis, *Arcanobacterium pyogenes* infection and staphylococcal dermatitis.

Table 2. Distribution of culture-confirmed caseous lymphadenitis lesions in 76 sheep from 3 flocks in Northern Ireland

Site	Number of sheep with CLA lesions	Site	Number of sheep with CLA lesions
Lungs	35	Liver	5
Mediastinal lymph node	24	Submandibular lymph node	4
Prescapular lymph node	24	Mesenteric lymph node	4
Parotid lymph node	17	Supermammary lymph node	4
Retropharyngeal lymph node	7	Bronchial lymph node	3
Prefemoral lymph node	6		

A preliminary study of 3 CLA-affected flocks in Northern Ireland (Malone and others, 2002) showed that CLA lesions were solely present in the viscera (lungs and internal lymph nodes) in approximately 24% of cases confirmed at post-mortem examination. Consequently clinical examination alone would not detect all affected sheep in a flock.

Dercksen and others (2000) evaluated a double antibody sandwich ELISA test for the detection of CLA in healthy sheep from CLA-free flocks and in sheep with culture-confirmed CLA. They found that the ELISA test had a sensitivity of 79±5% and a specificity of 99±1%. However, within 3 affected flocks this blood test had a sensitivity of 96% and a specificity of 36% (Malone and others, 2002). This disparity may be explained by sheep becoming infected with *C. pseudotuberculosis*

and developing antibodies, but either not developing CLA abscesses or eliminating the infection.

This blood test has been used as the basis of a test and cull policy in six infected flocks located in Scotland, England and Northern Ireland (Baird and others, 2003). In four of the six flocks considerable reductions in disease prevalence and incidence were achieved over the course of three years. Seroprevalence of CLA as measured by the ELISA was reduced to zero in each flock by the end of the trial and no new clinical cases of CLA were reported during the last six months of the trial. A fifth flock was tested twice before being withdrawn from the trial. However, in the sixth flock where little effort was made by the owner to remove antibody positive animals, disease prevalence increased considerably.

Control

There are a number of factors that make the control of CLA difficult. CLA may only be detected clinically in superficial lymph nodes, whereas in a number of sheep CLA abscesses may be only present in internal lymph nodes or organs such as the lungs. CLA has a relatively long incubation period, of 2-4 months, before it may be detected clinically. *C. pseudotuberculosis* may survive for long periods in the environment, thus providing a source of infection in the absence of clinical cases. In addition, antibiotic treatment is ineffective.

A closed flock policy (including rams) should be maintained, where possible. Sheep should only be purchased from flocks known to be free from CLA. Newly introduced sheep should be quarantined and examined regularly for lymph node enlargement. It is important to note that internal lesions cannot be detected clinically.

Once CLA is detected in a flock, affected animals should be separated, thus forming clean and dirty flocks. However, it should be remembered that "clean" flocks might contain subclinically infected animals. Affected stock should ideally be culled, although it is accepted that widespread culling is usually not financially viable, especially in pedigree flocks.

The results of blood testing young sheep for antibodies to CLA have indicated that few lambs contract the infection while suckling their mothers. This suggests that early weaning and subsequent isolation of the lamb crop from the adult

sheep population could form the basis of a CLA management and control strategy

C. pseudotuberculosis can persist in purulent discharges for up to several months under optimal environmental conditions. Contaminated buildings should be thoroughly cleaned to remove all organic material using hot water and/or steam. The building should then be disinfected using proprietary disinfectants. There is no data available to allow estimates for survival times on grass under British or Irish conditions, but it is probably reasonable to assume that most pastures will be safe 6 months after grazing with affected sheep.

Shearing or tail docking (because of contaminated equipment) and dipping (because the organism penetrates wet skin) are high-risk transmission factors. Appropriate hygienic precautions, including thorough equipment disinfection, should be undertaken at shearing/docking and dipping, and sheep should not be housed together for longer than necessary when handling for routine procedures.

CLA is controlled in Australia and the USA by vaccination. However, commercial CLA vaccines are not licensed in the United Kingdom or Ireland.

References

Baird, G.J. (2000). Caseous lymphadenitis in the United Kingdom. *Proceedings of the Sheep Veterinary Society*, **24**, 209-211.

Baird, G.J., Malone, F.E. and Kamp E.M. (2003). The use of serological testing to control and eradicate

caseous lymphadenitis (CLA) within sheep flocks. *Proceedings of the Sheep Veterinary Society*, (In Press).

Buxton, D (1989). Toxoplasmosis in sheep and other farm animals. *In Practice*, January, 9-12.

Buxton, D., Brebner, J., Wright, S., Maley, S.W., Thomson, K.M. and Millard, K. (1996). Decoquinat and the control of experimental ovine toxoplasmosis. *Veterinary Record*, **138**, 434-6.

Dercksen, D.P., Brinkhof, J.M.A., Dekker-Norren, T., van Maanen, K, Bode, C.F., Baird, G. and Kamp, E.M. (2000). A comparison of four serological tests for the diagnosis of caseous lymphadenitis in sheep and goats. *Veterinary Microbiology*, 167-175.

Donachie, W. (2000) Pasteurellosis. In: Diseases of sheep (eds W.B. Martin and I.D. Aitken) Blackwell Scientific, Oxford. pp: 191-197.

Jones, G. E., Buxton, D. and Harker, D. B. (1979). Respiratory infections in housed sheep, with particular reference to mycoplasmas. *Veterinary Microbiology*, **4**, 47-59.

Jones, G. E., Donachie, W., Gilmour, J. S. and Rae, A. G. (1986). Attempt to prevent the effects of experimental chronic pneumonia in sheep by vaccination against *Pasteurella haemolytica*. *British Veterinary Journal*, **142**, 189-194.

Jones, G. E., Field, A. C., Gilmour, J. S., and Rae, A.G. (1982) Effects of experimental chronic pneumonia on bodyweight, feed intake and carcass composition of lambs. *Veterinary Record*, **110**, 168-173.

Linklater, K. A. and Watson, G.A.L. (1983). Sheep housing and health. *Veterinary Record*, **113**, 560-564.

McIlroy, S.G., Goodall, E.A., McCracken, R.M. and Stewart, D.A. (1989). Rain and windchill as factors in the occurrence of pneumonia in sheep. *Veterinary Record*, **125**, 79-82.

Malone, F.E. (1991). A study of respiratory disease in housed fattening lambs. *FRCVS Thesis*, Royal College of Veterinary Surgeons, London.

Malone, F.E., Fee S.A., Kamp, E.M., King D.C., Baird G.J. and. Murdock F.E.A (2002). Post-mortem and serological examinations of sheep in three flocks affected with caseous lymphadenitis. *Proceedings of the Sheep Veterinary Society*, **26**, 55-57.

Malone, F. E., McCullough, S. J., McLoughlin, M. F., Ball, H. J., O'Hagan, J. and Neill, S. D. (1988). Infectious agents in respiratory disease of housed fattening lambs in Northern Ireland. *Veterinary Record*, **122**, 203-207.

Malone, F. E., McParland, P.J. and O'Hagan, J. (1985). Causes of mortality in an intensive lamb fattening unit. *Irish Veterinary Journal*, **39**, 86-90.

Rodger, J. L. (1989) Parainfluenza 3 vaccination of sheep. *Veterinary Record*, **125**, 453-456.