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Caseous lymphadenitis: Present and near forgotten from persistent vaccination?

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ABSTRACT

Ovine caseous lymphadenitis (CLA) is a serious disease of the global sheep industry, mainly causing losses from abattoir condemnations and in some countries, compromised productivity. However in Australia, CLA is now of minimal concern on-farm with cases reported rarely, although the disease remains an important food quality issue for abattoirs. There is evidence from longitudinal abattoir surveillance that CLA prevalence has been declining, from estimates of 26% in 1995–5.2% in 2009. Change management factors relevant to reduced prevalence and producer concerns for CLA in Australia were examined, including drivers and motivation for change, resistance to change, knowledge management, farming systems dimensions and leadership. Although extension programs addressing disease risk factors, such associations of CLA with dipping for external parasite control and frequency of close confinement, may be of relevance to improved disease risk management by producers, improved CLA control on many Australian sheep farms is considered largely attributable to the introduction of vaccination programs for CLA in 1983, with inclusion of CLA antigen within clostridial vaccines ('6 in 1′ vaccine). This innovation enabled routine annual CLA vaccination to occur in an increasing proportion of the national flock, despite several surveys that have shown that producer knowledge of CLA is low. However, promoting the persistent use of 'combination' vaccination to continue suppression of CLA infection and improved biosecurity to reduce re-introduction of disease, plus targeting properties that are not using vaccination, remains a challenge for animal health authorities. As CLA in Australia is now primarily an issue for the sheep meat processing sector, efforts to improve feedback to producers suffering carcass condemnations at slaughter should be encouraged. Persistent vaccination for CLA improves the health and welfare of sheep and this strategy deserve wider recognition in all sheep and goat production countries where vaccine usage is sporadic.

1. Introduction

Caseous lymphadenitis (CLA or cheesy gland), caused by *Corynebacterium pseudotuberculosis* (CPTB), is a chronic systemic bacterial disease involving inflammatory lesions of the lymphoid system particularly of sheep and goats, although the disease has been reported in humans and particularly those that work with sheep (Windsor, 2014, 2011; Baird and Fontaine, 2007). A separate biotype of CPTB that is the cause of ulcerative lymphangitis in horses is not present in Australia (Peel et al., 1997). CLA of small ruminants is of near global distribution and importance and the presence in flocks and herds of animals with subclinical disease is important in maintaining infections (Windsor, 2014). However, the use of persistent vaccination that invokes CLA suppression is increasingly considered a critical factor in the accumulating evidence for slowly improving control of the disease in Australia and the near elimination of readily observable clinical cases on-farm (Windsor, 2014; Bush et al., 2012).

In CLA, CPTB enters the live animal via skin wounds with release of the exotoxin phospholipase D (PLD) and a mycolic acid surface lipid (although other virulence factors have been proposed), leading to dermal necrosis with inflammation and increased vascular permeability. This promotes the invasiveness of the organism with transport to the regional lymph nodes through phagocytes, causing soft caseous lesions of lymphadenitis that have been described as abscesses but are more correctly described as pyogranulomas (Windsor, 2014). The inflammatory response may prevent infection from progressing beyond the cutaneous lesion. However, usually local lymphadenitis occurs followed by destruction of the lymph node and unless these lesions fistulate externally, they usually progress to chronic pyogranulomatous lymphadenitis,

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forming so-called 'cheesy gland' lesions. CLA may then disseminate to the abdominal and thoracic viscera where similar granulomatous lesions may occur, with the mediastinal lymph nodes responsible for dissemination of the infection following fistulation into the bronchi, forming an aerosol that readily transmits to other sheep, especially in close confinement and when skin lesions occur, as in shearing (Windsor, 2014, 2011; Baird and Fontaine, 2007).

2. History and estimated prevalence of CLA in Australia

Although the Australian sheep population has declined in recent years it was estimated there were 74.7million sheep on 43,760 properties in mid-2011 (Anon, 2013). CLA was probably introduced to Australia over 100 years ago and eventually became a disease of economic importance, with estimated losses in 1991–92 at $A30-40million per annum, largely from the cost of carcass condemnations to prevent unsightly lesions from appearing in sheep meat products (Windsor, 2014). A commercially available vaccine was developed for CLA (Glanvac™) and then became incorporated with clostridial vaccines in a combination product (eg '6 in 1') for producer use in Australia in 1984 (Windsor, 2014). Inclusion of CLA antigens in a clostridial vaccination combination has proven to be convenient to use regularly and is relatively cheap, safe and easy to deliver. However, optimal protection requires multiple doses for lambs, usually delivered at marking and weaning, with an annual booster of administered to adult ewes preferably prior to shearing, although this is more frequently administered prior to lambing to boost protective maternal colostral antibody ().

Since the introduction of combination vaccination that includes CLA, the disease has gradually faded as a concern for most Australian sheep producers, with clinical cases reported rarely. However, surveys in 1995 identified that the disease was extremely widespread and present on 97% of farms in New South Wales (NSW), 91% in Victoria, and 88% in Western Australia (WA), although the average estimated prevalence of CLA in the adult sheep population has been in decline and was then estimated at 26% (Windsor, 2014; Paton et al., 2003). Routine abattoir surveillance introduced in 2006 to monitor the prevalence of ovine Johne's Disease (OJD or paratuberculosis), found 17% of 3608 consignments of sheep to NSW abattoirs in that year having sheep with CLA, but only 1.3% of all sheep identified with CLA lesions. CLA prevalence in the national flock appears to have declined from the 1995 estimate of 26% to approximately 5.2% in 2009 (Windsor, 2014), yet accompanied by low producer awareness of the disease (Bush et al., 2012; Paton et al., 2003). Estimates of CLA prevalence derived at slaughter of 1,604,659 sheep in 2009 were 12.9% in Victoria, 12.8% in Tasmania, 9.5% in South Australia, 5.3% in NSW, 4.8% in Queensland and 1.0% in Western Australia (Bush et al., 2012). Further, prolonged pathological surveillance over 10 years of the 'tail of the mob' (sheep with low exercise tolerance that fall behind when the mob is moved and are well below the flock average condition score) on a CLA-infected farm that had been vaccinating diligently for over a decade, found that sheep with chronic pyogranulomatous bronchial lymphadenitis due to CLA (so-called 'shedders') occurred at between 0.5 and 1.5% of 'tail' sheep at necropsy (Windsor, 2014).

3. CLA as a concern for the processor sector

However, these apparent positive changes in prevalence and current low producer awareness of CLA, appear not to be reflected as a diminution of CLA concern for the Australian sheep meat processing sector. Currently, sheep export abattoirs generally consider CLA as their most severe disease issue, particularly as subcutaneous lesions 'explode' on machine-operated skin removal at slaughter, creating extensive contamination of the carcass with caseous exudates that often extends to surrounding carcasses on the slaughter chain. This leads to high levels of carcass disposal and thus discounting of carcasses in certain lines of sheep. These observations from abattoirs indicate that on many farms, CLA vaccination is still not routinely practised according to recommended vaccination protocols, if at all, despite the convenience of a widely available combination vaccination strategy for CLA for several decades.

Changing the attitudes of farmers to improve animal health and welfare practices on-farm is challenging, particularly in encouraging the uptake and adoption of sustainable interventions that improve the management of disease risks (Windsor, 2014). 'Change management' refers to the understanding of how change is leveraged through strategy, structure and operational mechanisms as well as informal processes, including power, politics and conflict, culture and leadership (Evans-Kocinski, 1992). This paper examines the effectiveness of vaccination and disease control extension programs and strategies used on-farms, as promoted by animal health stakeholders. Change management considerations are used to provide a framework for reflection on the factors involved in CLA control practices, including: drivers and motivation for change; resistance to change; knowledge management; farming systems dimensions; and change management leadership.

4. Vaccination for CLA

Following demonstration that the PLD exotoxin of CPTB could be used as a protective antigen, an effective toxoid vaccine for CLA was provided to the Commonwealth Serum Laboratories (CSL Australia) in 1978 and an optimal antigen dose led to release of a CLA vaccine in 1984 (Windsor, 2014). A highly purified recombinant derivative of PLD was then shown to provide similar protection to that produced by the bacterin vaccine, with superiority in preventing the spread of infection beyond the site of inoculation plus efficacy in a combination of PLD antigen with 5 clostridial antigens used in Australia. This led to the marketing of and now relatively widespread use of the combination vaccine Glanvac 6 ® (Zoetis Australia), commonly called '6 in 1′ vaccine for sheep throughout Australia. Field trials have shown variable rates of protection, from 25% to 90% following the vaccination of a previously unvaccinated infected flock with high challenge. Although vaccinating a flock will not prevent infection, it does reduce the number of sheep that develop lung lesions and as older sheep are culled over time, the infectious challenge reduces, meaning fewer sheep will be infected. However, the vaccination program preferably consists of the administration of two doses at least 1 month apart and an annual booster a month before lambing or shearing. In commercial self-replacing wool flocks, it is most practical to administer the initial vaccine to lambs 6–8 weeks after start of the lambing season at 'lamb marking', with the second dose administered 4–5 weeks later at 'weaning' (Windsor, 2014).

5. Extension programs for CLA

Control of CLA depends on vaccination in most countries, although the disease persists even after prolonged vaccination, consistent with the suppressive nature of CLA vaccination control of a facultative intracellular pathogen that can be inhibited but not prevented from infection by the enhanced immune response of vaccination (Windsor, 2014). A 1990's study in Australia concluded that only 10–15% of sheep producers were using the recommended CLA vaccination program, so persistence of the infection on-farm is not surprising (Windsor, 2014; Paton et al., 2003). More recently, with abattoir surveillance data from 2009 suggesting that CLA prevalence had declined, an examination of current vaccination practices on-farm in NSW was undertaken (Bush et al., 2012). The