Bovine mastitis – current control methods in the face of AMR concerns

Dr James Breen BVSc PhD, DCHP, MRCVS, associate professor of veterinary medicine and science at the University of Nottingham, presented at the 2018 London Vet Show on the topic of bovine mastitis. The specifics of his lecture, which looked at various approaches to mastitis therapeutics and control in the context of antimicrobial resistance concerns are featured in the following article

In response to the Government objective of 'identifying sector-specific targets for the reduction, refinement or replacement of antibiotics in food-producing animals', last year saw the publication of the Targets Task Force Report facilitated by the Responsible Use of Medicines in Agriculture (RUMA) Alliance (http://www.ruma.org.uk/wp-content/uploads/2017/10/RUMA-Targets-Task-Force-Report-2017-FINAL.pdf). Of the six targets for the dairy sector, four are directly linked to mastitis control, and the remaining two (Highest Priority Critically Important Antibiotics [HP-CIA] injectable usage and Total mg Usage) are heavily influenced by mastitis treatment choices as well as mastitis control. Of the four targets that relate directly to bovine mastitis control, two concern the use of intra-mammary antibiotic dry cow therapy (where a 20% reduction is proposed by 2020) and intra-mammary antibiotic lactating cow therapy (where a 10% reduction is proposed by 2020), while a third aims for a 50% reduction in the use of HP-CIA intra-mammary antibiotic, whether at drying-off or in lactation. As these targets can only be achieved if producers and veterinary surgeons review the approaches to mastitis therapeutics and control, this paper summarises current thoughts in the former and approaches to the latter.

ANTIBIOTIC USE IN THE DAIRY SECTOR – WHAT DO WE KNOW?

Recent research published by the University of Nottingham on antimicrobial use in more than 350 UK dairy herds has shown that the average total usage is around 16mg per population corrected unit (PCU) (Hyde et al 2017), well below a proposed target of 21mg/PCU for the year 2020. However, there is considerable variation between herds, with the worse performing 25% of herds in the study contributing 50% of the overall mg of antibiotic used. Key drivers of high mg usage herds include the use of antibiotic footbaths, the use of oral antibiotics in calves and importantly the use of parenteral antibiotic treatment. It is interesting to note that, as measured by mg use, intra-mammary antibiotic dry cow therapy and intra-mammary lactating cow therapy account for proportionally very little in the overall herd mg use, but do count towards the Daily Course Dose (DCDvet) and the Defined Daily Dose (DDDvet) metrics that are used.

HOW DOES MASTITIS THERAPEUTICS AFFECT HERD ANTIBIOTIC USE?

The treatment of clinical mastitis (and to a certain extent increased somatic cell count) in lactating dairy cows continues to be the subject of much debate, fuelled in part by the focus in veterinary education on the need to diagnose and treat individual animals, in part by the huge choice of products available to treat mastitis in dairy herds, and often in part in a response to apparently disappointing cure rates and client feedback despite intensive antimicrobial therapy. This has led to treatment protocols and regimes based on anecdotal evidence of their effectiveness, and in particular the use of parenteral antibiotic therapy to treat mastitis infections, both in lactation and at drying-off. The evidence for an improved chance of cure with the use of systemic antibiotic treatment in combination with intra-mammary therapy in the treatment of mild and moderate cases of clinical mastitis as well as infected cows at drying-off is poor, as well as inappropriate use of antibiotic. For example, a recent UK study failed to find any additional benefit of an extended treatment using a combination of intra-mammary and systemic antibiotic therapy versus an extended treatment using intra-mammary

therapy alone (Swinkels and others, 2013). Current advice to the industry is that clinical mastitis cases do not require systemic antibiotic treatment unless the affected cow is systemically unwell (https://dairy.ahdb.org.uk/technical-information/animal-health-welfare/amu-calculator/clinical-mastitis/).

Confusion and concern also exist around the perception that mastitis infections are often resistant to antibiotic treatment, and it is often recommended that antimicrobial sensitivity testing be carried out with a consequence that the use of HP-CIA antibiotics may be required. Whilst there is good evidence that screening Staphylococcus aureus isolates for phenotypic sensitivity to penicillin will inform likely prognosis, the use of sensitivity testing for other mastitis pathogens is often less clear, particularly for coliform bacteria where the sensitivity profiles for several isolates are unlikely to be the same for the next coliform infection that is acquired from the environment. Infection with the environmental Gram-positive pathogen Streptococcus uberis (the most prevalent organism from clinical and subclinical mastitis samples in the last large scale randomised UK study; Bradley et al 2007) is a classic example of mastitis therapeutics: the pathogen is highly susceptible to penicillin but of course in vitro sensitivity does not mean a 100% chance of cure. Indeed the chance of cure for clinical mastitis in lactation is of the order of 40-50%, with rapid cow-side detection and rapid treatment, as well as cow factors such as parity and cell count history shown to be very important rather than the treatment chosen per se. Ultimately, bacteriological cure rates during the dry period with antibiotic dry cow therapy in the modern dairy herd are very high for nearly all mastitis pathogens, and typically in excess of 90% (Bradley et al 2010).

WHAT OPPORTUNITIES EXIST FOR THE PRACTITIONER TO ENGAGE WITH MASTITIS CONTROL?

It is now widely recognised that it is vital for all parts of the dairy sector to reduce antimicrobial use through improved mastitis control, rather than rather than simply changing class of antimicrobial used or even leaving infections untreated. Ultimately, any reliance on antibiotic sales to dairy herds in the absence of more fee-paying consultancy and a move towards actively reducing the mastitis rate and therefore the need to use antibiotic is not sustainable.

While there is interest around the use of on-farm culture in clinical mastitis therapeutics decision making, the reality is that leaving some mild cases untreated either on the assumption that they are caused by E. coli or that rapid culture plates suggest that the causative pathogen is likely to be E. coli, practitioners should realise that a) not treated cases caused by Gram-positive pathogens or Gram-negative pathogens other than E. coli is likely to lead to more use of antibiotic, and on farm culture is unlikely to be cost-beneficial for the majority of UK dairy herds.

Where there remains great scope for the UK practitioner to engage with mastitis control is working with clients to avoid the need to treat in the first place. This requires a herd diagnosis from the herd's veterinarian, and a prediction of the likely role of the dry period or the lactating period in the acquisition of new intra-mammary infections. Whilst the predominance of environmental pathogens or contagious pathogens remains another important categorisation, it is the epidemiology of herd infections and the timing in the lactation cycle which allows the practitioner to successfully target areas of management and reduce the rate of new mastitis.

A national scheme, the AHDB Dairy Mastitis Control Plan (DMCP, www.mastitiscontrolplan.co.uk) continues to provide a structured approach tested in a Randomised Clinical Trial that is available to UK practitioners. Recently, QMMS Ltd. and the University of Nottingham, the team responsible for the continued development of the DMCP, have produced a Mastitis Pattern Analysis Tool, designed to aid the busy practitioner in rapidly obtaining a herd diagnosis (Breen et al 2017). Using readily available milk recording and clinical mastitis data, this Pattern Analysis Tool is able to identify the most likely area for targeted intervention, for example an 'Environmental-Dry Period' infection pattern will mean any focus on parlour routine or cubicle management will be a waste of effort and resources.

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