Regional Limb Perfusion

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Abstract

This session will discuss the use of regional limb perfusion in cattle.

Key words: deep digital sepsis, septic arthritis, lameness, RLP, RIVP, cattle, bovine, distal extremity

Résumé

Cette session discutera de l'utilisation de la perfusion régionale d'un membre chez les bovins.

Introduction

Infections in the distal extremities are a common source of lameness and welfare concern in cattle.[14,20] Preventing lameness is of paramount importance; however, even excellent management systems will have occasional failures that result in some form of infection that extends beyond the protective layers of the foot. These infections of the deeper tissues of the distal extremity are sometimes collectively referred to as deep digital sepsis (DDS). Goals of treatment for DDS include debridement of damaged or devitalized tissues, treatment of infection in remaining tissue and provision of pain management.

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When building your toolbox of skills to combat DDS, 1 technique to remember is the application of regional limb perfusion (RLP). The RLP can be used both for provision of temporarily anesthesia and administration of antibiotic to treat the localized infection. Injection of an antimicrobial directly into the circulation of the distal extremity as an RLP can be an effective method of treating the localized infection in large animals.[7,11,19] This technique involves application of a tourniquet around the distal extremity, proximal to the lesion, and injection of an antibiotic directly into the local venous access. The tourniquet is typically left in place for 30 to 45 min (*variable durations are reported in the literature*) to allow drug diffusion into the tissues of the distal extremity. When using an RLP to provide local anesthesia, this technique is called a Bier block, after German surgeon August Bier. When treating DDS in cattle, the distal extremity is often anesthetized using a Bier block to allow surgical debridement of the lesion, and antibiotics can be injected into the same vessel (following or preceding analgesia) to provide regional antibiosis. It is not recommended to mix the lidocaine and antibiotic directly in the syringe before administration, as many antibiotics precipitate when mixed directly.

The practitioner needs a few basic supplies to perform an RLP. It is necessary to have a safe method of restraint that allows for complete immobilization of the foot, such as a trim chute or recumbent chemical restraint. Supplies to properly clean the site of injection are also necessary. The equipment to perform the RLP itself is simply an effective tourniquet, and a needle and syringe. Different types of tourniquets have been studied in large animals; hydraulic tourniquets outperform manual ones, and flat tourniquets outperform round ones.[2,13] It is much easier to use a butterfly needle to administer the injection because it allows the foot to move a little during injection without losing IV access.

The RLP technique for provision of antibiotics has some advantages over other methods of local or systemic antibiotic administration. Regional perfusion of antibiotic provides high local concentration of drug compared to systemic administration.[9,10,12,15-18] Other options for regional drug administration include intra-articular (IA) or intrarosseous (IO) administration. Challenges with IA injection are possible chemical synovitis and a risk for introducing pathogens, particularly if injecting through an area of cellulitis. Performing IO perfusions in large animals typically requires use of a specialized screw with injection port, and this technique reportedly results in more evidence of discomfort during injection than RLP.

The pharmacokinetics of several antibiotics have been described when used as an RLP in cattle, including: tetracycline, cefazolin, ceftiofur, florfenicol, ampicillin, and marbofloxacin.[3,5,9,10,16,18]

Selection of the right drug for regional perfusion in each case should be based on a number of factors. The intended spectrum of activity is of paramount importance, especially whether or not mycoplasma is expected or known to be present in the case at hand. The most common pathogens associated with cases of deep digital sepsis are *Trueperella pyogenes* and *Fusobacterium necrophorum* in adult cattle, and *Streptococcus* (catalase negative), *Trueperella pyogenes,* Pasteurellaceae, Enterobacteriaceae, and *Mycoplasma bovis* in calves.[4,6,8] A farm history of mycoplasma, or concurrent pneumonia, otitis or mastitis may increase suspicion of mycoplasma. The intended use of the animal and implications of off-label drug use and the associated withdrawal recommendation are also very important to consider before selection of an antibiotic for RLP. No drug is labeled for RLP in cattle (or any other species that the author is aware of) so all RLPs constitute extra label drug use. Drugs that are prohibited from off label use, such as fluoroquinolones,

should not be used as an RLP in livestock. The guidelines of AMDUCA should be followed.[1] The drug selected should be known to be safe if given IV, and preference should be given to drugs with pharmacokinetic data available for RLP use to aid in determining withdrawal intervals.

RLP can be a useful tool as part of the treatment plan for DDS, and the pharmacokinetics of several antibiotics have been investigated for use as RLP in cattle. The provision of high levels of antibiotic directly to the site of infection, in what may be poorly perfused or compromised tissue, is an attractive therapeutic strategy. This technique should be used to complement, not replace, other methods of treatment including appropriate debridement, cleaning, and appropriate nursing care. It should also be noted that there is minimal evidence presented in the peer-reviewed literature critically evaluating outcomes in cases of DDS using RLP or comparing RLP in clinical cases of DDS to other methods of antibiotic treatment such as systemic administration, intrarosseous, or intra-articular administration.

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