Therapy for deep digital sepsis

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Abstract

Therapy for deep digital sepsis (DDS) can be both challenging and rewarding. It can be as routine as digit amputation or as complex as invasive corrective surgery. The precise mode of therapy will be dictated by numerous factors including the structures involved, value of the animal, its intended use and expected longevity, body size, and the experience and facilities available to the veterinarian. This discussion will be limited to techniques applicable to being performed on a tilt table under local/regional anesthesia rather than more advanced techniques involving arthroscopy/tenoscopy that require general anesthesia, expensive equipment, and considerable training to implement. Description of the methods for differentiation of various causes of deep digital sepsis are reviewed in an earlier manuscript in this volume (see Deep digital sepsis in cattle - clinical differentiation). Additionally, techniques for digit salvage via facilitated ankylosis of the distal interphalangeal joint may be mentioned but not fully detailed.

Key words: deep digital sepsis, foot, therapy

Résumé

La thérapie pour la dermatite digitale profonde peut être à la fois difficile et gratifiante. Elle peut être aussi simple que l'amputation du doigt ou aussi complexe que la chirurgie corrective invasive. Le choix particulier de thérapie sera influencé par de multiples facteurs incluant les structures atteintes, la valeur de l'animal, l'utilisation prévue, la longévité attendue, la taille corporelle de même que l'expérience et les installations disponibles pour le vétérinaire. Cette discussion se limitera aux techniques applicables aux plateformes basculantes avec anesthésie locale ou régionale plutôt qu'aux techniques plus avancées comme l'arthroscopie/ténoscopie qui requièrent une anesthésie générale, de l'équipement coûteux et une formation considérable pour être utilisées. Une description des méthodes pour différencier les causes variées de la dermatite digitale profonde est présentée dans un article précédent dans ce volume (voir La dermatite digitale profonde chez le bovin – différenciation clinique). De plus, les techniques pour sauver des doigts par l'ankylose facilitée de l'articulation interphalangienne distale peuvent être mentionnées mais ne feront pas l'objet d'une discussion détaillée.

General Considerations

The basic tenets of treating DDS include effective and sustained antimicrobial therapy, anti-inflammatory adminis-tration, effective and repeated drainage and lavage of infected synovial structures, and debridement of necrotic soft tissue and/or infected bone. Provision of analgesia should also be a major consideration when treating these conditions, but can be one of the more challenging aspects of the treatment regime.

Infections associated with DDS in cattle are often polymicrobial and frequently involve anaerobic bacteria in the genera *Fusobacterium, Bacteriodes, Peptostreptococcus. Truperella pyogenes* is a common tertiary invader and may be the primary pathogen in chronic suppurative cases. Numerous other bacteria have been isolated from DDS lesions including *Eschericia coli*, Staphyococci, and Streptococci spp. Culture and sensitivity testing is indicated in any case of DDS, but is not commonly employed due to previous antimicrobial administration, economic constraints or lack of timely availability of results. Nevertheless, broad-spectrum medications with good efficacy against anaerobes are indicated when choosing empirical therapy. Extralabel use (ELDU) of antimicrobials should be avoided if possible and only be employed within the context of the Animal Medicinal Drug Use Clarification Act, including having a valid veterinary-client-patient relationship and consultation of appropriate sources for appropriate withdrawal times. Regional intravenous perfusion (RIVP) of antimicrobials is sometimes used adjunctively to achieve greater tissue concentrations in poorly perfused regions and empirically seems to improve outcomes. Such use does constitute ELDU and appropriate safeguards should be followed. It should be noted that while ceftiofur is labeled for parenteral treatment of foot rot, extralabel routes of administration are currently banned in the United States. The duration of antimicrobial administration for DDS is longer than for most infectious diseases encountered by food animal practitioners; 2 to 4 weeks duration of therapy may be needed in advanced cases of DDS.

Non-steroidal anti-inflammatory therapy is indicated in most cases of DDS. When synovial cavities are infected, the suppression of inflammatory mediators within the synovium is considered a central component of therapy. Additionally, NSAIDs provide analgesia for what are often severely painful conditions. Flunixin meglumine is most commonly used and, while quite effective, should only be given via approved routes (IV and transdermal). The pour-on formulation is labeled for the control of pain associated with foot rot in certain classes of cattle. Reduction of weight bearing on the affected digit by application of a treatment block/shoe is paramount for reducing pain for most cases of DDS, but does not alleviate pain sufficiently for the aggressive debridement required for some cases. Multimodal analgesia utilizing additional albeit

extra-label analgesics are often indicated for alleviation of pain associated with DDS. Lavage and debridement guidelines will be outlined below for specific categories of DDS. In this author's opinion, it is important to cleanse the entire foot including both hooves, the dewclaws and all skin below the fetlock prior to deep surgical debridement. Maintaining a sterile bandage is probably a fallacy unless changed daily, but keeping it as clean as possible is essential and manure-soaked skin on the opposite side of the bandage will quickly wick organisms to the surgical site once blood, serum or exudate saturates the bandage. A protective outer layer of the bandage is readily fashioned from a modified treatment boot, which markedly improves the ability to maintain cleanliness within a foot bandage. These boots are available in 1 size fits all (not!) for cattle, but variable-sized equine boots can be modified to work on large bull feet.

Digital Septic Arthritis

The core treatment principles for therapy of acute cases of septic arthritis include joint lavage, antimicrobial administration, and anti-inflammatory medications. The DIP joint is relatively small but can be accessed via needle puncture, most readily via a dorsal approach adjacent to the extensor process of P3. Ideally a second needle is inserted in the palmar/plantar aspect of the joint for through-and-through lavage. Placement of the second/egress needle is facilitated by distending the joint capsule with sterile isotonic fluid (15 to 30 mL). If a second needle is not achievable due to lack of distensibility or overlying cellulitis, distension irrigation via 1 needle may provide adequate lavage in early cases. Joint lavage is quite painful, and analgesia is most effectively provided by RIVP using lidocaine. If RIVP is not feasible, distension of the joint with a local anesthetic will provide significant, albeit inferior analgesia. Joint lavage is performed with 0.5 to 1 liter of polyionic crystalloid fluid and generally repeated at 1 to 2 day intervals with most cases requiring 2 to 4 lavages to combat the infection. Ideally, synovial fluid is collected and evaluated at each lavage, and the decline in total protein and the proportion of neutrophils used to determine when lavages can be stopped.

Most often, bovine practitioners are presented with subacute to chronic cases of DIP joint sepsis. With subacute joint sepsis, fibrin deposition can markedly interfere with the ability to provide effective lavage and drainage of the joint, allowing for the persistence of organisms and inflammatory mediators in the synovial space. In such instances, arthrotomy should be considered and may be effective when coupled with repeated high-volume lavage and ancillary therapies. Arthrotomy for the DIP joint is performed via trephination through the abaxial hoof wall centered over the most distal portion of the joint. Sharp excision of the corium within the resultant hoof wall defect allows limited but oftentimes adequate exposure to the joint for removing fibrin and achieving effective lavage. Once subchondral bone destruction has oc-

curred following chronic septic arthritis, lavage in any fashion is unlikely to be effective at achieving a clinical cure. More aggressive therapy in the form of digit amputation or digit-sparing surgery via facilitated ankylosis (FA) are indicated, depending on the value and functional needs of the animal. In the absence of radiographic evaluation, the presence of draining tracts above the coronary band that originate from the DIP joint are sufficient evidence of the need for more aggressive therapy. Digit amputation is adequately familiar to most bovine veterinarians and will not be discussed further. Numerous approaches for facilitated ankylosis have been described and are reviewed elsewhere. The choice of a given technique depends largely on which extra-articular structures are involved, as well as the experience and preference of the attending veterinarian. A recently described modified abaxial approach for facilitated ankylosis shows promise as it is less disruptive to the supporting structures within the hoof capsule, and may be a preferred technique for DIP joint sepsis without involvement of the digital flexor tendons or sheath.

Septic Pedal Osteitis

Septic pedal osteitis (SPO) of the third phalanx (P3) may be encountered singularly as a result of subacute extension of infection from a sole perforation, hoof wall trauma or white line abscess. Focal SPO if recognized early can be effectively managed by focal curettage coupled with medical therapy and appropriate wound care with satisfactory results. Preoperative radiographic imaging is ideal and can significantly guide operative decision-making. Surgical analgesia is provided by RIVP with lidocaine. Following aseptic preparation, the infected corium overlying the bone defect is excised with a scalpel. Curettage can be performed manually with a curette, or alternatively with a sterilized burr attached to a handheld rotary tool. Debridement of P3 should progress until healthy and hence dense and bleeding bone is encountered along the entirety of the surgical field. Bleeding of the corium and bone is limited by the tourniquet associated with the RIVP, but pinpoint minute hemorrhages can be visualized emerging from the canaliculi of the healthy bone once exposed. Repeated lavage of the surgical site is performed to remove bone debri, necrotic soft tissue, and ambient contamination. Significant postoperative hemorrhage can occur depending on the extent of the debridement, so a hemostatic compression bandage is applied postoperatively. Calcium alginate dressing is a preferred first layer in the author's hands for the initial 1 of 2 bandages. The initial bandage is changed in 24 to 48 hours. Further bandage changes and cleansing of the operative site occur at 2 to 3 day intervals until granulation tissue covers the void created in the bone, typically in 7 to 10 days. If granulation tissue fails to form over the osseous defect, persistent infection of the bone is likely and repeated curettage may be indicated. The author sometimes uses polymethylmethacrylate beads loaded with antimicrobials placed into the wound to provide elution of antimicrobials

to the site of infection over time. Once the granulation tissue is several millimeters thick and the edges of the corium defect are starting to keratinize, bandaging intervals can be extended or the wound left open, assuming the treatment block remains on the sound digit and environmental conditions are appropriate.

Complicated Sole Ulcer

In the author's experience, complicated sole ulcers that progress to the development of a draining tract deep to the level of the deep digital flexor tendon typically involve infection of several deeper structures including P3, the navicular bone/bursa, the DIP joint or flexor tendon sheath. Such cases are typically not amenable to focal debridement, and more often require either digit amputation or facilitated ankyloses. An exception occurs when the tract of infection bypasses the above-mentioned vital structures and forms a solitary retroarticular abscess which may be drained by excision through the heel. Healing can be uncomplicated if adjacent bone and synovial structures are not involved initially and can be avoided during debridement.

Septic Flexor Tenosynovitis

Infection of the sheath enveloping the superficial and deep digital flexor tendons should be therapeutically approached similarly to a septic joint, with the additional caveat that weight bearing across the diseased flexor tendons must be eliminated until healing is advanced. Fortunately, the digital flexor tendon sheath for the 3rd and 4th digits do not communicate, so that most cases are unilateral unless the original insult invades both sheaths. In more chronic and severe cases involving ascending septic tendonitis, the infection can invade across to the other side resulting in a much poorer prognosis.

Acute cases associated with focal wounds or punctures with minimal overlying necrosis or infection can be managed with through and through lavage via needles as for any septic joint. Lavage should be performed aseptically, with large-bore ingress and egress needles placed above and below the dewclaws. A multifenestrated drain can be implanted through the sheath to improve drainage and facilitate periodic lavage and sometimes local antimicrobial administration. As for septic joints, if the disease process is subacute larger incisions into the sheath may be required to allow for continual drainage and removal of fibrin accumulation. The palmar/plantar annular ligaments can compress the tendon sheath, limiting the effectiveness of lavage. A tendon bistoury can be used to cut these ligaments and hence improve lavage effectiveness. Severe and refractory cases may respond to aggressive debridement following removal of the dewclaw and splitting the sheath along the majority of its length while maintaining the integrity of the tendons. Once infection is resolved, half-limb casting with changes at 2 and 6 weeks prevents exuberant granulation tissue formation and protects the tendons from elongation associated with weight bearing while healing. In such cases, severe tendon laxity is a long-term postoperative sequela that requires repeated visits for application and modulation of heel extension shoes for several weeks after the infection has resolved.

Conclusions

Therapy for DDS is time consuming, expensive, and requires diligent care and monitoring. If therapy is initiated early in the course of the disease, the inputs can be moderate and are within the capabilities of practicing veterinarians with adequate haul-in facilities and modest equipment availability. Most animals with these conditions will be managed by salvage or digit amputation, but more valuable breeding stock and pet livestock can provide challenge and reward to those of us inclined to offer such services.