Strategies for Managing Septic Arthritis of the Digit in Cattle

Charles Guard, *DVM, PhD*
Ambulatory & Production Medicine Clinic
Veterinary College, Cornell University
Ithaca, NY 14853

Conservative therapy of deep sepsis of the digit is generally unrewarding even with prolonged administration of antibiotics. What we consider prolonged antibiotic administration in bovine practice is clearly different from that employed in other species. In nonruminant species including humans, treatment with antibiotics for septic arthritis typically extends for 2 months or 3 weeks after all clinical signs have resolved. This duration of therapy is clearly not practical in cattle and still might not resolve the types of lesions occurring in the digits. The end result following a common 1 to 2-week course of antibiotics for septic digital arthritis is usually euthanasia or culling after appropriate withholding for drug residues. In the author's opinion, less than 5% of cases of deep digital sepsis respond satisfactorily to such conservative treatment. Why? Possibilities include failure to choose an appropriate antibiotic, inability of the antibiotic to penetrate to the site of infection, or drug resistant strains of bacteria. Most digital infections are caused by a mixed population of bacteria including at least *Arcanobacterium pyogenes* and *Fusobacterium necrophorum*; there may also be various Streptococci, *Staph. aureus*, and other anaerobes involved.[8] The characteristics of the lesions in digital arthritides of cattle are different from those of the other commonly seen arthritides, neonatal polyarthritis. In digital arthritis occurring as a sequel to a primary digital lesion such as foot rot or sole ulcer, there is substantial tissue necrosis surrounding the joint, often including the synovium. In contrast, septic arthritis of the neonate begins with increased production of synovial fluid with decreased viscosity and marked influx of neutrophils. There is often a fibrin clot formed in the joint but the synovia remains intact. It is possible that the septic processes in the digit begin in similar fashion and are just not seen by veterinarians at this early stage. I think not, and with the exception of digital joints made septic following penetration by foreign bodies, most cases of digital sepsis arise by extension of septic, necrotizing processes in the corium of the sole or of the interdigital soft tissues. It is this tissue necrosis that differentiates digital sepsis from neonatal polyarthritis and is the likely reason that antibiotic therapy alone is usually insufficient to resolve the problem.

The main sites of deep digital sepsis include some or all of the following: the distal interphalangeal joint (DIP, coffin), the navicular bone and bursa, the deep flexor tendon, the distal phalange (P3), the intermediate phalange (P2), and the retrobulbar digital cushion. Diagnosis of which anatomical structures are involved with deep sepsis is usually done in the field without special aids such as radiography, but it may be helpful in some cases. The reason for making an anatomical diagnosis is that a particular approach or procedure might be most appropriate for the given condition. Swelling localized to the dorsal and lateral coronary band usually indicates coffin joint involvement. Swelling only in the heel may be due to either a retrobulbar abscess or sepsis of the navicular bone/bursa. Swelling in the heel that extends proximally suggests the deep flexor tendon is involved. If swelling extends above the dewclaws, then tenosynovitis of the deep flexor is very likely. In the author's experience, cows with palmar or plantar swelling above the dewclaws are not good candidates for any corrective or salvage procedure. Often there is a fistulous tract originating at the site of a sole ulcer or interdigitally that can be explored with a finger or a blunt probe to determine the major extent of tissues affected.

Amputation of the digit in the distal portion of the first phalange (P1) using embryotomy wire or disarticulation of the P1-P2 joint is the simplest procedure for resolving deep digital sepsis. The goal is to cut proximal to all infected and necrotic tissue. There are several published descriptions of this procedure with some authors preferring to work on standing and others on recumbent patients.[3,9,13] Anesthesia is either by specific nerve blocks, ring block, or regional intravenous block. I prefer the regional intravenous block with 30 ml of lidocaine injected in the dorsal metatarsal vein. I prefer a 2-foot piece of gum rubber tubing placed below the hock/carpus for the tourniquet.

Alternatives to amputation for septic conditions in the digit include various surgical approaches that permit either debridement of necrotic and infected tissues or placement of tubing for long term irrigation of the site. Clemente[3] suggests either a vertical incision through the heel or one that curves laterally around the heel and extends proximally to whatever extent is required to expose all necrotic tissue. The path of the incision is carried to the posterior midline at the level of the dewclaws. Through this incision the distal sesamoid (navicular bone) can be removed, the coffin joint debrided, and necrotic portions of the flexor tendons excised. Greenough and Ferguson described an alternative approach using a transverse incision through which the navicular bone could be removed and the coffin joint curretted.[6] They have also described techniques for installing plastic tube drains in the coffin joint and bulb of the heel for continuous flushing with saline during a week or so of hospitalization . Most procedures other than amputation describe hospitalization and variable follow-up treatments. Kersjes *et al*[9] illustrate an approach to the navicular bone and coffin joint via a 3 cm circular hole in the hoof at the sole-heel junction through which debridement can be done. They also illustrate fenestrating the joint with a drill to further debride the coffin joint surfaces and allow placement of a through and through drain. Desrochers *et al*[4] described results from facilitated ankylosis in 12 beef breed animals with a septic DIP joint. These cattle did not have navicular disease and were treated by trephining the DIP joint from dorsal and lateral approaches. Saline or povidone iodine was flushed through the joint for about 11 days. An on-farm technique was described that utilized a hoof knife to create a circular hole over the caudal sole and heel 3 to 4 cm in diameter.[2] The sound claw was elevated with a wooden block and some cows required repeat coring to remove obstructing granulation tissue.

Survival and productivity following any of these treatments is of concern for the ultimate economic value of the procedure to the producer. Forty one cases of claw amputation done in 2 university hospitals (USA) over about 20 years were reviewed for outcomes.[12] The rear lateral digit was most commonly amputated with survival and function about evenly divided between good, fair, and poor. Removal of any other claw had a more favorable outcome with the hind medial claw the best. Overall there appeared to be an inverse correlation between success and body weight. The post-operative survival in cattle with amputation performed at the clinic in Bern, Switzerland averaged 16.5 mo with half of those culled at the time of the study removed from the herds because of lameness.[7] Of 114 cows with amputation at the clinic in Munich, survival was similar to the Swiss data but only about 27% of those culled were for lameness.[5] Eighteen cases of claw amputation of adult Holstein cows done in our practice during a year were evaluated for outcome. Survival time was less than 3 wk for 4, indicating a failure to return to adequate performance and/or a failure of the procedure to relieve the pain of the septic process. The remaining 14 cows had a median survival of 19 mo. About half were culled for breakdown in the remaining claw and the other half for reasons unrelated to the amputation. Parity- and stage of lactation-matched controls for the 18 cows had a median survival of 16 months.

Survival for 200 cows with resection of the distal part of the deep flexor tendon or the tendon and the navicular bone (~50%) done at the clinic in Munich was reported.[10] The mean survival time was 15 mo and 67% were considered fully recovered. Removal of both the navicular and tendon increased survival as did housing in long platform stalls. All of the 12 Kansas beef cattle with facilitated ankylosis had a good outcome with survival in excess of 27 mo.[4] Some lameness was detectable by owners for about 4 mo after hospital discharge. From the surgery clinic in Utrecht 49 cows were assigned to drilling into the ventral part of the coffin joint, amputation below the coronary band, or amputation through P2.[11] The recovery period was long for the drilled cows (6-10 wk), but more than half remained in production for greater than 1 year. Survival was short for those amputated below the coronet and recovery intermediate between drainage and P2 amputations. Recovery was 2-3 wk for the P2 amputations and 38% survived more than 1 year. The on-farm procedure of establishing ventral drainage with a hoof knife resulted in a satisfactory outcome in 55 of 64 cases.[2]

Given all the various options for treating deep sepsis of the digit, what factors are important in selection of an approach? A range of factors were discussed by Baxter *et al*.[1] All studies agree that the convalescent period for procedures other than amputation are significantly longer than for amputation. Since amputation is simple, fairly quick, and able to be performed in almost all conceivable circumstances why consider anything else? If a claw other than the hind lateral is involved, the long term prognosis may be similar regardless of technique. If the hind lateral claw is diseased, as is most often the case in adult dairy cows, then other treatment options bear consideration. The longer convalescent period for non-amputation procedures suggest that younger or intrinsically more valuable animals might justify the extra cost. Typical commercial cows in 3rd or greater lactation should probably have septic digits amputated.

Most dairies will not be able to provide hospital like conditions or the aftercare provided to most of the cows in the published reports of non-amputation procedures. Practitioners need techniques that are quick, easy, doable in either a treatment stanchion, chute, or

tilt table. For these reasons amputation will likely remain the favored treatment option for most cows.

My personal experience with the sole and heel coring technique has been disappointing. Most cases did not respond even with repeated removal of the obstructing granulation tissue. Drilling through the coffin joint from the sole surface provides a method for installing a drain that will permit discharge of pus and exudate from the coffin joint and navicular bone/bursa. The drilling also destroys part of the articular surfaces of P2 and P3, leading to eventual ankylosis. A block is first placed on the sound claw and intravenous anesthesia administered. I recommend using a 0.5 inch (12 mm) or larger drill. The path of the drill is from the typical ulcer site dorsally to exit about 1 cm above the coronary band and lateral to the central axis of the claw. I use braided nylon rope for the drain and secure the 2 ends in a knot forming a loop through the joint and around the lateral surface of the claw. If the navicular bone is necrotic, the first step might be to core out the sole to remove the navicular bone followed by drilling through the joint. This is similar to the procedure of Kersjes *et al*[9] but without fastening the diseased claw to the healthy one or bandaging the foot. Occasionally there is hemorrhage after removal of the tourniquet and a temporary bandage around the drill holes is required. It should be removed the next day. Parenteral antibiotics are given for about 1 wk and the drain removed in about 2 wk. Cows are returned to the home pen or stall or to the hospital string until antibiotics are cleared. The outcome for cows with only septic arthritis of the coffin joint has been excellent. Several cows have finished 3 more lactations since the procedure. The greater the degree of navicular and flexor tendon involvement the poorer the outcome. Claw amputation can always be done after a claw-sparing procedure if it fails.

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