

# Arthrodesis of the Bovine Distal Interphalangeal Joint

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## Summary

Intractable infection of the distal interphalangeal joint or of structures closely associated with that articulation is a common sequela to several diseases affecting the digital region. Amputation of the affected digit has been the most common line of treatment but is one that cannot always be justified on economic grounds. Arthrodesis of the bovine distal interphalangeal joint is a practical alternative to amputation. This paper discusses the principles involved in considering and facilitating this line of treatment.

## *Etiological Considerations*

**Infections of the deep structures of the bovine extremity such as the distal interphalangeal joint, the deep flexor tendon and the region juxtaposed to the distal sesamoid (navicular bone) are usually very destructive, chronic and unresponsive to treatment.**

In one survey of 152 cases of chronic, non-responsive lameness in cattle (Bargai, 1975), 48% of the cases were attributed to osteoarthritis and about one-third involved the distal phalanges. In another survey (Wriedt, 1976), 43 out of 64 cases of podotrochleitis were associated with sole abscessation. It is suggested (Greenough, 1963) that infection of the navicular bursa and associated abscessation is more frequently encountered than septic pedal arthritis. Several authors (Bagai, 1975; Mogha, 1971; and Pratap, 1975) confirm that *C. pyogenes* is the organism most frequently isolated from purulent digital lesions.

## *Methods of Treatment Available*

1. For animals of minimal economic value or those that will be disposed of within one year, amputation is the procedure of choice. Amputation is relatively inexpensive and provides rapid relief from pain. However, records indicate that animals having only one digit are not retained. Merkens (1977) states that 30 of one group of 32 animals studied were eliminated within one year of surgery. Funk (1977) found that 59% of a series of amputations failed to survive for one year after surgery. It is, therefore, reasonable to conclude that amputation is not the most advantageous method of dealing with destructive infection of the distal joint in the extremities of valuable cattle.

2. Studies of intra-articular therapy have been carried out (Pelt, 1972, '73, '75; Verschooten, 1974; Pratap, 1975; Mogha, 1972) in other than the distal interphalangeal joint. Varying success has been achieved except in instances where *C. pyogenes* has been the organism incriminated. There appears to be no evidence that intra-articular therapy can be successfully applied to the distal interphalangeal joint.

3. Conservative treatment using parenteral antibiotic and curettement of the involved area with the establishment of drainage produced five recoveries out of twelve cases treated by Nesbitt, et al. (1975). Drainage and irrigation were, according to Merkens (1977), sufficiently successful in 17 cases for the animals to be retained for a number of years.

## *The Selection of Cases for Arthrodesis*

1. The animal involved must be of sufficient value to warrant the expense of treatment.

2. **The earlier that the nature of the disease process is identified, the greater will be the chance of a reasonable outcome. Arthrocentesis (Pelt, 1970) is likely to be useful, as is radiography, in reaching an accurate evaluation of the stage of the disease.**

3. The pathogenesis of the disease should be correctly assessed in order to determine the appropriate surgical technique. The technique will differ if the infection is intra-articular or retro-articular.

### *a) Intra-articular Infection*

The primary cause of intra-articular sepsis may be an infected sandcrack or as a sequela to interdigital phlegmon (foot rot). Natural drainage of the joint is usually poor and intra-articular pressure builds up to such an extent that rupture of the plantar pouch occurs and coincidental retro-articular sepsis will develop. Therefore, if septic pedal arthritis is suspected, radiography and arthrocentesis should be employed to confirm the diagnosis. The clinical signs of intra-articular infection will be inflammatory edema and erythema of the coronary band.

### *b) Retro-articular Infection*

Retro-articular infection is usually seen as an accumulation of pus in the region above the digital cushion and caudad to the intermediate phalanx. The clinical signs of this condition are

acute pain and considerable enlargement of the bulb. Retro-articular infection is considerably more commonly encountered than articular infection but in most cases, involvement of the joint is a rapid sequela, making coincidental infection of both regions quite common. Because of the acute nature of generalized sepsis, the primary or initiating lesions may be overlooked. Retro-articular infection usually starts as a sequela to either a white line abscess or a sole ulcer. These lesions progress to cause navicular bursitis and podotrochleitis and may also be associated with necrosis of the deep flexor tendon.

### A Rationale for Arthrodesis

Cost effectiveness is the only credible criteria for successful treatment. Judged by this criteria, some claims for successful recovery are difficult to evaluate. The writer believes that cases of articular or retro-articular sepsis are likely to be successful if treated within 7 days of the onset of acute lameness. In such cases animals should eventually be restored to acceptable locomotory normality and be free from acute pain within 6 weeks. In the event that treatment is delayed, tissue destruction and sclerosis will progressively minimize the chances of a recovery that would be economically justifiable to the owner. It is, therefore, suggested that successful treatment will depend upon the following principles:

#### *Drainage*

Reliable drainage accompanied by irrigation is a primary requirement for the control of infection. The correct location of a drainage tube will assure the continuity of a drainage pathway and control the effects of granulation tissue or the negating effect of the elastic tissues of the bulbar region.

#### *Curettage*

Depending on the stage of tissue destruction, necrosis of the deep flexor tendon, podotrochleitis and osteoporosis of the distal phalanx may occur. A radiographic evaluation of the region is of value in making an assessment. Curettage of the distal phalanx or the joint is usually required while removal of necrotic tendon or portions of navicular bone is essential if sequestration is to be avoided.

#### *Immobilization*

Movement of the distal extremity in which pus is imprisoned will have two effects. Firstly, the movement will "pump" infection from one location to another. Secondly, attempts by the body reaction process to ankylose the joint will be frustrated by movement until enormous bony depositions have occurred.

### Technique

#### *Drainage*

The site for entry to the joint should be the most distal level of the joint; that is to say, at a level ap-

proximately two-thirds the distance from the coronet to the bearing wall at a point about two-thirds of the distance from the toe to the plantar aspect of the bulb.

A one-half inch drill may be used to enter the abaxial wall at this point, then be directed dorsally across the distal extremity of the distal phalanx to exit between the claws close to the skin line at the dorsal aspect of the interdigital space. The destruction of horn-producing tissue wall is quite minimal.

If, however, the lesion is located retro-articular, the opening in the wall should be a little higher and more caudad. A probe or trocar may then be directed into the abscess and directed proximally to the axial aspect of the bulb. In this case the probe or point of the trocar may be palpated through the skin which may be excised to expose the instrument beneath. With the abscesses in the caudad region, an opening large enough to admit a finger is usually desirable in order to evaluate the integrity of the navicular bone and deep flexor tendon.

In the cases of joint involvement, curettage of the joint is necessary to ensure rapid ankylosis. Curettage is only required in retro-articular infections if potential sequestra can be palpated.

The most suitable drainage tube would be composed of flexible tubing stiff enough to resist compression but flexible enough to conform to the irregularities of the artificially-produced drainage track. Ideally, the drainage tube should be occluded at its distal extremity and bear openings at a point within the foot to permit the escape of irrigation fluids.

Irrigation should take place for a period of not less than five days, although continuing therapy beyond seven days does not appear advantageous. Continuous drip irrigation can be started using a five-gallon reservoir. Alternatively, irrigation may be carried out three or four times per day. Sterile saline should be the vehicle to carry soluble antibiotics such as crystalline penicillin which would be used at the rate of about 10 grams per 20-litre reservoir. If intermittent irrigation is preferred, the lesion may be first flushed with saline and then infused with a concentrated antibiotic solution.

#### *Immobilization*

Mechanical immobilization of the distal interphalangeal joint improves the rate of ankylosis, reduces the amount of bony deposition necessary to eliminate movement and reduces the extent by which infection will spread.

**The two claws must be immobilized either in a symmetrical manner or with the affected digit flexed in relation to the horn. This latter alternative relieves tension on the deep flexor tendon and the associated anticoncussive devices of the bulb.**

The two toes should first be wired together. Two holes (4 mm) are drilled 3 cm apart immediately medial to the white line in the abaxial region of the

toe. A loop of baling wire is passed through the holes from the solear surface to be turned over the abaxial wall to the holes on the abaxial wall of the contralateral claw. After passing through these holes, the wire is twisted tight and spare ends removed.

Next, a bridge of "Technovit" should be formed around the toes to incorporate the wire. This bridge should be substantial and extended all around both toes. The operator will use his discretion regarding the application of a wooden block to the sound claw; this is, however, an addition likely to be advantageous in many instances.

The toe "bridge" would be applied after surgery has been completed and no further immobilization should be attempted until the irrigation procedure has been completed. However, once the lesion shows signs of settling, a plaster cast may be applied to enclose the distal extremity as far as the fetlock. A suitable window(s) should be left in the cast in order that the progress of the condition may be observed. A plaster cast will deteriorate quite rapidly unless it is protected from moisture, therefore, there is considerable advantage in applying a plastic bag over the entire cast and then covering it with a layer of elastoplast. The cast should be kept in place for six weeks and if during this period it shows signs of deterioration, it may need to be replaced on one or more occasions.

#### Discussion

The writer's experience in treating cases of articular or periarticular infection has been encouraging. The technique varied to some extent throughout the

series treated, but the most rapid resolution has been observed in instances in which drainage tracks were laid directly through the focus of infection. It should be noted that surgical interference in cases where natural resolution is already occurring is likely to initiate an acute reaction.

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