How to Perform Ethyl Alcohol Arthrodesis of the Tarsometatarsal Joint in the Standing Horse

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1. Introduction
Ethyl alcohol arthrodesis of the tarsometatarsal joint in the horse is a new technique developed to alleviate the pain associated with osteoarthritis of the tarsometatarsal and distal intertarsal joints (bone spavin). Ethyl alcohol is administered into the tarsometatarsal joint to facilitate chemical arthrodesis of the joint. The mechanism of action of ethyl alcohol is through non-selective protein denaturation and cell protoplasm precipitation and dehydration. Ethyl alcohol also functions as a neurolytic agent that results in a sensory innervation blockade at the intra-articular level. The neurolytic and non-selective protein-destructive properties contribute to its success at disrupting the cartilaginous matrix, causing necrosis of the chondrocytes, and hastening arthrodesis. Ethyl alcohol is inexpensive and readily available to most practitioners.

Osteoarthritis of the small tarsal joints is one of the leading causes of hindlimb lameness in the performance horse. Several options are available to treat horses with osteoarthritis of the tarsometatarsal and distal intertarsal joints; they include systemic non-steroidal anti-inflammatory drugs and intra-articular corticosteroids. This medical management option is often combined with adjunctive treatments such as systemic or intra-articular hyaluronic acid and oral administration of glucosamine. More recently, avocado and soybean unsaponifiable extracts have been suggested as disease-modifying agents in induced osteoarthritis of the carpus. Other options that allow the horse to return to pain-free function aim to fuse the joints involved. Fusion or arthrodesis can be achieved by chemical destruction of the cartilage or intra-articular drilling of the space to destroy the cartilage surfaces. Laser-assisted arthrodesis has also been suggested as an option to fuse the tarsometatarsal and distal intertarsal joints. Both surgical options require prolonged convalescence, and they increase morbidity and expense. Monoiodoacetate (MIA) is a chemical means of causing articular cartilage destruction by inhibiting chondrocyte metabolism to produce chondrocyte death. The mechanism of action of MIA is through chondrocyte death followed by mechanical breakdown of the articular cartilage over time. After the cartilage is destroyed, arthrodesis occurs through the healing of the adjacent cartilage.
subchondral bone plates. Unfortunately, MIA is a particularly noxious chemical within the joint, and it causes severe discomfort for the horse after treatment, progression of osteoarthritis within the proximal intertarsal joint, severe soft tissue reaction if the chemical is injected into the extra-articular space, and inconsistent outcomes.

Ethyl alcohol fulfills a number of conditions that make it optimal for use as an alternative to the traditional method for arthrodesis of the tarsometatarsal joint. Ethyl alcohol is minimally invasive compared with current accepted treatments, and it results in effective destruction of the articular cartilage and cartilaginous matrix, which leads to arthrodesis in as little as 4 mo. Horses experience minimal to no appreciable discomfort throughout the treatment period, there are no adverse reactions if inadvertently administered extra-articularly, it is affordable, and it has minimal side effects.

2. Materials and Methods

Equipment
The equipment needed includes a 1.5-in, 20- or 19-gauge needle, sterile, injectable radio-opaque contrast material, 70% ethyl alcohol, an intermittent infusion plug (PRN) injection port, and syringe. For radiographs, a standard film or digital processor/reader and portable X-ray generator will be required.

Restraint
Most horses will tolerate injection of the tarsometatarsal joint if adequately sedated. Additional restraint may not be necessary.

Technique: Tarsometatarsal (TMT) Joint
Before injection of alcohol, the horse must undergo a full lameness exam, and the tarsometatarsal joint should be blocked with intra-articular anesthetic to prove that the lameness originates from the tarsometatarsal joint. After localization of the lameness, the plantar-lateral aspect of the tarsus is clipped and aseptically prepared. The head of the lateral splint bone is sterilely palpated, and a 1.5-in, 20- or 19-gauge needle is inserted into the joint distally and dorsomedially over the head of the lateral splint bone until it is seated within the tarsometatarsal joint. The syringe is removed, and a PRN injection port is affixed to the needle and left in the joint. Radiographs are taken immediately after injection of the contrast and application of the injection port. If no communication is identified between the tarsometatarsal and proximal intertarsal or tibiotarsal joints, an empty sterile syringe is attached to the injection port and aspirated to remove excess contrast within the joint. Approximately 3 ml of 70% ethyl alcohol is injected through the injection port into the tarsometatarsal joint. The needle with the injection port is removed from the joint, and the region is covered with sterile bandage applied with an adhesive wrap. The horse is given a single dose of phenylbutazone (2.2 mg/kg, IV or PO). The bandage is removed the following day. A similar technique can be employed for the distal intertarsal joint from the medial approach.

Radiographic Evaluation of Contrast Arthrography
The radiographs should be examined to ensure that there is no communication of the tarsometatarsal joint with the distal intertarsal, proximal intertarsal, or tibiotarsal joints. The radiographic series needs to include a straight lateral to medial view and dorsal to plantar view. In an acceptable arthrogram of the tarsometatarsal joint, a contrast line will be evident within only the tarsometatarsal joint space (Fig. 1). If the contrast line extends into and fills part of the proximal intertarsal or tibiotarsal joints (Fig. 2), alcohol injection must be aborted, and this horse is not a candidate for alcohol fusion of the tarsometatarsal joint. If communication exists between the tarsometatarsal and distal intertarsal joint, it is prudent to complete a contrast arthrogram of the distal intertarsal joint to ensure com-
3. Results
Sixteen horses are currently enrolled in a prospective study examining the efficacy of ethyl alcohol. In all treated horses, the tarsometatarsal joint was successfully injected. To date, the technique has successfully resolved lameness in all 16 horses evaluated at the radiographic recheck exam 6–12 mo after alcohol injection. All horses that have returned for follow-up evaluation have had radiographic evidence of tarsometatarsal joint ankylosis at 4–6 mo and are pain free. Four horses that have completed the study beyond 12 mo are sound and returned to intended use. There have been no detrimental extra-articular reactions in any of the horses evaluated. One horse developed mild soft tissue swelling around the head of the fourth metatarsal bone that resolved within 24 h. Four horses have required general anesthesia to perform contrast arthrogram and alcohol injection after unsuccessful attempts to perform the procedure standing. In these horses, the distal intertarsal joint was also evaluated with contrast arthrography and injected with alcohol if no communication with the proximal joint was appreciated.

4. Discussion
The technique for ethyl alcohol arthrodesis of the tarsometatarsal joint can be completed with relative ease and little time provided radiographic equipment and processing is readily available. Digital radiography makes this technique applicable to in-hospital and field application. Because the technique is no more challenging than tarsometatarsal joint injection, the general equine practitioner should have little difficulty integrating this method into regular use for selected cases. Case selection should be limited to those horses that are refractory to traditional treatment such as corticosteroids, and selection should also be limited to horses with advanced osteoarthritis of the small tarsal joints. Young horses with osteoarthritis should be approached by traditional modalities initially before implementing the use of ethyl alcohol-facilitated ankylosis. Horses tolerate the technique well with sedation. In the horses treated in this manner that have clinical osteoarthritis of the tarsometatarsal joint, there have been few complications. The most common complication has been ensuring accurate access to the tarsometatarsal joint in horses with advanced osteoarthritis. Typically, needle placement into the joint has been confirmed by presence of synovial fluid within the hub of the needle and/or radiographic examination. If this confirmation was not available, ease of contrast delivery into the needle has been used to assess proper placement within the joint.

The other most common difficulty encountered is assessment of the contrast arthrogram. There are several confounding factors with assessment of the contrast arthrogram of the tarsometatarsal joint. In multiple cases, contrast can be seen within the greater tarsometatarsal or peroneal artery and/or vein on the arthrogram. This should be carefully evaluated but not interpreted as communication between the tarsometatarsal joint and the proximal joints. Another confounding factor is extra-articular injection of contrast. This will appear as a diffuse opacity of contrast over the plantar-lateral aspect of the tarsus at the head of the lateral four metatarsal bone. This should not be interpreted as communication between the tarsometatarsal joint and the proximal joints. The final difficulty in assessing arthrograms is obliquity of the radiograph. Straight, level views are required to properly and confidently confirm contrast medium within the articular space of the tarsometatarsal joint. These difficulties are easily overcome with thorough attention to proper technique and a moderate level of radiographic interpretation skills. Practitioners will find that they quickly become comfortable with radiographic evaluation after only a few horses.
Studies are currently underway to characterize the efficacy and use of ethyl alcohol in horses with naturally occurring osteoarthritis of the tarsometatarsal joint. Current data from a prospective clinical trial has shown that 16 of 16 horses with naturally occurring osteoarthritis of the tarsometatarsal joint have decreased lameness and are sound at 6–12 mo.

References and Footnotes


*Intermittent infusion plug, Kendall Argyle, Tyco Healthcare Group, Mansfield, MA 02424.*


*Carmalt JL. Personal communication, 2009.*