Review of Equine Distal Hock Inflammation and Arthritis

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1. Introduction
The tarsus is a common etiology of hindlimb lameness in the horse. The distal intertarsal and tarsometatarsal joints are considered the wear and tear joints of the hindlimbs and are a common source of reduced performance. Conformation, such as a sickle hock, may increase the stress across the distal hocks, but occupation and athleticism are the chief culprits involved with increasing the shear and rotational forces through these joints. Horses with distal hock pain can often be managed conservatively and maintain their athletic career. Occasionally, more aggressive methods of management are indicated and necessary.

2. Anatomy
The hock is composed of 10 bones and 4 joints. The proximal tibiotarsal or tarsocrural joint is the high-motion joint of the tarsus, and it is comprised of the tibia, talus, and calcaneus bones. The three lower joints are the proximal intertarsal, distal intertarsal, and tarsometatarsal joints in a proximal to distal direction. The distal intertarsal joint is bordered by the central tarsal bone proximally and the third and fused first and second tarsal bones distally (Fig. 1). The fourth tarsal bone spans the distal intertarsal joint laterally and articulates with both the proximal intertarsal and tarsometatarsal joints. The tarsometatarsal joint lies between the distal row of tarsal bones and the proximal aspect of the metatarsal bones (Fig. 2). Each of these joints has minimal flexion-extension motion, and most of the stress applied through them is rotational and shear.

The proximal intertarsal joint communicates with the tibiotarsal joint, and therefore, disease of the proximal intertarsal joint can be considered possible disease of a high-motion weight-bearing joint.1 For the most part, the distal intertarsal and tarsometatarsal joints do not communicate with either the proximal intertarsal or tibiotarsal joints. There have been varying reports of communication of 8.3–67% between the distal intertarsal and tarsometatarsal joints, but, in general, they are thought to communicate ~30% of the time.1–5 The communication seems to occur between the third and the combined first and second tarsal bones and/or the tarsal canal.1,4

3. Lameness Diagnosis
The degree of lameness related to pain emanating from the distal intertarsal and tarsometatarsal joints can vary from mild and performance hindering to relatively severe. As with all horses pre-
presented for lameness, the examination should commence with a thorough and accurate history as well as a comprehensive visualization and palpation of the musculoskeletal system. An accurate history from the owner or trainer is invaluable, especially in cases of reduced performance. Any time that the chief complaint is reduced performance, such as a prolonged time in speed events, reduced stopping and turning capabilities, rails knocked down or jump refusals, trouble picking up or holding leads, or development of other performance or behavioral changes, inflammation and/or osteoarthritis of the distal tarsal joints should be a primary rule out.

Physical examination should include palpation of the back, forelimbs, and hindlimbs. Particular attention should be focused on pain associated with the forelimb suspensory ligaments as well as the lumbar and gluteal muscles. Often, horses with distal hock pain will place more pressure through the forelimbs, and proximal suspensory pain may be present. Any joint effusion should be noted, although effusion of the distal tarsal joints is not capable of being palpated. Occasionally, a firm swelling will be present on the distal medial aspect of one or both hocks and may indicate more advanced osteoarthritis (Fig. 3). Pain related to palpation of the plantar medial hock in the region of the cunean tendon and bursa and the head of the second metatarsal bone may be present but is unreliable. Any conformational flaws such as sickle hock or hindlimb base narrow should be noted, because these issues may increase stress applied through the distal hock joints.

Motion examination should occur at a walk and trot in a straight line and circle as well as a canter in a circle. There needs to be no tension on the horse’s head during the examination to allow for accurate evaluation of movement. It is also frequently helpful to examine the horse when ridden, although not necessary in the majority of cases. A characteristic gait related to lameness from the distal hock joints has been described as an adduction of the hindlimb with an abrupt abduction occurring just before the limb contacting the ground and has been referred to as a “stabbing” gait. Although this is frequently evident, it is not pathognomonic. Horses can exhibit this gait with lameness originating from other causes, and distal hock pain may also present with a different gait. It is also common for the most evi-
dent gait problem to be a caudal shortening of the stride when circling if the affected limb is the outside limb. Flexion tests of the distal and upper hindlimbs can help differentiate the likely source of lameness. Lameness related to the distal tarsal joints usually causes an exacerbation of the gait deficit seen on the initial straight trot. Severe responses to upper hindlimb flexion are rare with distal hock pain, and other sources of lameness should be explored.

A presumptive diagnosis of lameness related to the distal tarsal joints may be made with a supportive history and clinical examination (i.e., the primary complaint is reduced performance, and the clinical examination reveals only a mild gait deficit that is slightly to moderately exacerbated with upper hindlimb flexion). However, if any suspicion exists of another source of lameness, the examination should continue with the use of perineural and intrasynovial anesthesia. Intra-articular anesthesia of the distal intertarsal and tarsometatarsal joints can be performed to help localize the lameness. One has to be cautious in interpreting the results, because diffusion of mepivacaine occurs between joints as well as surrounding soft tissues. Although arthrographic studies have shown that the distal intertarsal and tarsometatarsal joints communicate ~30% of the time,1–5 mepivacaine has been found to diffuse readily (nearly 90%) between both the distal intertarsal and tarsometatarsal joints and the tibiotalar joint.7 Additionally, the tarsometatarsal joint also has plantar outpouchings along the proximal aspect of the proximal metatarsus just axial to the splint bones. Diffusion of local anesthesia from these pouches may also desensitize the proximal suspensory ligament, and similarly, diffusion of local anesthetic at the origin of the suspensory ligament may desensitize the tarsal joints. Attempting to localize the source of lameness may require several examinations with the performance of different blocks at different times.

Radiographs of the tarsus should be performed if the lameness has been localized to the region or if any inflammation or abnormality of the tarsus is suspected. Quality radiographs require an adequate number of views, proper positioning, and good technique. A minimum of four views should be obtained including a lateral, dorsoplantar, dorsolateral-plantar medial oblique, and dorsomedial-plantar lateral oblique, because abnormalities may only be present on one view. Occasionally, special views such as a flexed lateral and plantar-skyline view may be indicated and helpful. Often, a small, subtle lesion will be present on one view only. Assessment of joint surfaces requires proper positioning with the limb square under the horse with equal weight bearing. The increasing availability of digital and computerized radiography has improved the detail, which allows for more subtle lesions to be identified. In many cases, inflammation can be present within the distal tarsal joints without radiographic evidence of disease. If changes are present, they frequently consist of small osteophytes, joint-space narrowing, bone sclerosis, or small areas of lysis.8–10 In more severe cases, there can be extensive bone exostosis, aggressive lysis, and severe narrowing of the joint space or even ankylosis (Fig. 4).

Ultrasoundography of the inflamed or arthritic distal tarsus is usually of limited diagnostic value. The narrow width of the joints limits evaluation of the joint capsule, articular cartilage, and intertarsal ligaments. The medial and lateral collateral ligaments have both a long and short component and can be evaluated. Bony proliferation can usually be diagnosed with quality radiographs; however, ultrasound examination of the plantar tissues and proximal suspensory ligament can be invaluable in determining pathology in closely related regions. As magnetic resonance imaging and computerized tomography become more available, the type and degree of pathology of the distal tarsal joints may be further defined.

Nuclear scintigraphy is occasionally used to aid with the diagnosis of distal tarsal inflammation. It is rarely needed in the typical case, but it can be very helpful in horses not amenable to intra-articular anesthesia or to rule out other sources of lameness. Normal horses exhibit a greater radiopharmaceutical uptake in the dorsal and lateral aspects of the joint.11 Compared with horses with diagnosed distal tarsal pain, there was a significant increase in radiopharmaceutical uptake in painful.

Fig. 3. Large firm swelling present on the distal medial aspect of the left tarsus. This may indicate more advanced osteoarthritis of the distal tarsal joints.
limbs, especially if osteoarthritis was radiographically apparent.\textsuperscript{12}

At times, it may be difficult to completely determine the precise source of lameness. The physical exam may be suggestive of distal tarsal inflammation or arthritis but not completely confirmed with the use of anesthetics or imaging. In those situations, a presumptive diagnosis can be made and later confirmed if a positive response to intra-articular medication occurs.

4. Non-Surgical Treatment

As most clinical conditions related to the distal tarsal joints are primarily performance-limiting problems, owners generally prefer maintaining the horse in their occupation if there is not a risk of future damage. Treatment is directed at reducing inflammation in the affected region and keeping the horse in performance training.

Systemic anti-inflammatory medication is accomplished with the use of non-steroidal anti-inflammatories (NSAIDs). Both phenylbutazone and flunixin meglumine are commonly used and can be effective; however, because the inflammation and trauma to the region is related to occupational strain, NSAIDs are transiently effective and of limited use for long-term therapy if the horse continues to perform. Supplementation with IM polysulfated glycosaminoglycans, oral glucosamine/chondroitin, or IV hyaluronan may also be beneficial and is more commonly used as maintenance therapy. Additionally, the topical application of diclofenac liposomal cream over the distal tarsus can benefit some horses, but the response is inconsistent.\textsuperscript{13}

The most effective way to treat distal tarsal inflammation while the patient is performing is with local injection of the distal joints with corticosteroids. Often, intra-articular hyaluronan is added, because it has anti-inflammatory properties and to reestablish the joint environment. The most common corticosteroid used is methylprednisolone acetate. Other corticosteroids used include triamcinolone acetonide and less frequently, betamethasone. Controversy exists as to whether both the distal intertarsal and tarsometatarsal joints need to be injected. A recent study showed that injection of methylprednisolone into the tarsometatarsal joint achieved diffusion of methylprednisolone into the distal intertarsal joint in therapeutic concentrations; however, these concentrations were \textasciitilde50 times lower than the concentration within the tarsometatarsal joint.\textsuperscript{14} The author still prefers to inject both joints individually, because clinically, there have been horses with a superior clinical result versus injection of the tarsometatarsal joint alone. In general, the majority of horses can be managed with periodic injection of the distal joints throughout their athletic career. Although corticosteroids have been shown to have negative effects regarding cartilage metabolism,\textsuperscript{15,16} their repeated use does not clinically seem to enhance the progression of degeneration within the joint. Likely, the ability to keep the horses in work and the repetitive strain on the joints is what causes further progression of the arthritis in a limited number of cases.

Recently, tiludronate has been used in the treatment of distal tarsal inflammation. It has been used more frequently in Europe and the United Kingdom, and the author has limited experience with the medication. Tiludronate is a bisphosphonate compound that theoretically has antiresorptive properties by inhibiting osteoclastic activity. There are few controlled studies with this medication, and in a small double-blind clinical study, only one of eight horses improved with the administration of tiludronate for distal tarsal inflammation or arthritis.\textsuperscript{17} Further studies are needed to effectively evaluate this treatment.

Extracorporeal shockwave treatment (ESWT) has also been used in the treatment of distal tarsitis. It has been used more frequently in Europe and the United Kingdom, and the author has limited experience with the medication. Tiludronate is a bisphosphonate compound that theoretically has antiresorptive properties by inhibiting osteoclastic activity. There are few controlled studies with this medication, and in a small double-blind clinical study, only one of eight horses improved with the administration of tiludronate for distal tarsal inflammation or arthritis.\textsuperscript{17} Further studies are needed to effectively evaluate this treatment.

Fig. 4. Dorsolateral-plantarmedial oblique radiograph of the tarsus with severe narrowing and lysis of the distal intertarsal joint.
were treated with a focused unit under general anesthesia. There were 139 joints treated in the 74 horses, and 80% of the horses had improvement in their lameness of at least one lameness grade; however, only 18% of the horses became clinically sound. The author occasionally uses standing focused shockwave therapy with some benefit in horses that have become refractory to routine intra-articular medication (Fig. 5).

Chemical arthrodesis of the distal intertarsal and tarsometatarsal joints has been performed with the use of sodium monoiodoacetate (MIA). MIA is a very irritating chemical that induces an inhibition of chondrocyte glycolysis and death. This technique can only be performed if the joints can physically be injected, and care must be taken to ensure that the correct joints are injected. Contrast arthrography is necessary to ensure accurate needle placement as well as confirm if any communication with proximal joints is present. Generally, 100 mg of MIA diluted into 2 ml of sterile saline solution is injected into each affected joint. After injection, pain control is necessary with the use of analgesics and anti-inflammatories, because severe pain is often present for 4–18 h post-injection. Perineural analgesia with bupivacaine of the peroneal and tibial nerves will also help alleviate the pain. Several studies have shown that 75–85% of horses have been free of lameness with radiographic evidence of joint fusion at ~6 mo after treatment. However, because horses were followed for several years after treatment, the success rate decreased, and a significant number of horses developed arthritis of the proximal intertarsal and tibiotarsal joints. Other reported complications include persistent swelling, septic arthritis, skin sloughing, and increased lameness. This technique has fallen out of favor because of the initial severe pain and significant possible complications.

5. Surgical Treatment

Many different techniques have been reported for the treatment of distal tarsal arthritis. These include cunean tenectomy, subchondral forage, neurectomy, and several different techniques of surgical arthrodesis. The reason so many techniques exist is that there has not been one single technique shown to be vastly superior to the others. Additionally, there is likely tremendous individual variation in the clinical patient both in disease process and definition of successful outcome.

Cunean tenectomy has been described for several decades as a treatment for distal tarsitis. Theories of its use have been to reduce the pressure over the medial aspect of the distal tarsus and cunean bursa; additionally, it might reduce the rotational and shear stress over these joints during contraction of the tibialis cranialis muscle. The procedure is generally performed in the standing sedated horse with local anesthesia. A linear vertical incision is made over the palpable cunean tendon on the medial aspect of the hock. Curved hemostats or forceps are used to identify the tendon, and a 1.5- to 2.0-cm section of cunean tendon is excised. Routine skin closure is performed. Reports of successful outcome in racehorses has been variable, but an owner-survey study reported an 83% good or excellent outcome in 285 horses, although 30% of the horses required further medical treatment. The author has generally used a cunean tenectomy in those cases with radiographic evidence of medial bone proliferation. Periodic intra-articular medications have usually been necessary post-operatively.

Subchondral forage or fenestration involves the drilling of tracts across the joints and into the bones in an effort to reduce subchondral bone pressure. Bones adjacent to osteoarthritic joints often become sclerotic with a resulting increase in intraosseous pressure. Fenestration has been performed through stab incisions on the medial aspect of the tarsal region in a distal to proximal direction; it begins in the proximal third metatarsal bone and extends proximally and obliquely through the tarsometatarsal joint, third tarsal bone, and distal intertarsal joint and into the medullary cavity of the central tarsal bone. Radiographic or fluoroscopic guidance is recommended to avoid penetration of the proximal intertarsal joint. Conversely, the drilling can commence in the central tarsal bone and extend distally to the third metatarsal bone. Additionally, a more subtle fenestration can occur at the time of arthrodesis using intra-articular drilling. Studies to evaluate subchondral fenestration are limited, but in one study, 66% of horses treated returned to their intended use. The clinical significance of sub-
chondral bone pressure in distal-tarsal osteoarthriti-
is currently unknown.

A technically difficult procedure of transection of a portion of the tibial nerve and its branches, the deep peroneal nerve, and the plantar nerves has been described. The procedure is performed under general anesthesia with the use of a tourniquet. This study reported a success rate of eliminating lameness in 83% of horses at 2 mo, but only 61% remained sound for 12–36 mo. Presumably, regrowth of the nerves occurs over time, reducing the long-term effectiveness. The author has no personal experience with this technique and is reluctant to pursue its use related to the non-selective desensitization that occurs.

The most common surgical technique used in the treatment of distal tarsal osteoarthropathy is facilitation of fusion of the affected joints. A natural ankylosis of the joints is preferred, and further intervention is only indicated if the patient cannot continue in performance work despite medical therapy or if the lameness is severe. Fusion of the joint results in stabilization and subsequent pain alleviation. A true arthrodesis is the removal of joint cartilage and mechanical stabilization. Most described tarsal arthrodesis techniques are more to facilitate ankylosis, because these joints have minimal natural motion and are inherently stable. Before considering a surgical arthrodesis, the lameness needs to be carefully localized to the distal tarsal joints. Quality radiographic images are necessary to determine if any proximal-tarsal osteoarthropathy exists, because this would affect the prognosis.

Intra-articular drilling across the distal intertar-
sal and tarsometatarsal joints is the most frequently used procedure for distal tarsal arthrodesis. Initial techniques described a more aggressive procedure with 60% of the articular cartilage removed. Significant post-operative pain was associated with this procedure, and a more conservative approach is currently used and recommended. The approach is on the medial aspect of the limb either through a linear incision and cunean tenectomy or with the use of stab incisions. Needles are placed into the joints, and their positioning is confirmed with radiographs. Three diverging drill tracts are made with a 3.2-, 4.0-, or 4.5-mm-diameter drill bit to an approximate depth of 3 cm in each joint. Radiographic or fluoroscopic guidance during drilling is recommended, and care must be taken to avoid breaking a drill bit. As previously mentioned, subchondral fenestration may also be performed at the same time. Post-operatively, a controlled exercise program is followed with the horses returning to exercise after the lameness significantly improves (generally 2–4 mo). A return to full athletic performance usually takes 10–12 mo. A recent retrospective study evaluating this technique reported 59% of horses successfully returning to their previous level of performance and a further 11% improved. The client should be notified before performing this procedure that complete ablation of the joint space is unlikely and that the goal is to create functional bone bridging to eliminate joint motion and pain.

Both a neodymium:yttrium aluminum garnet (Nd: YAG) and 980-nm diode laser have also been used to facilitate arthrodesis of the distal tarsal joints. The technique involves placing a laser fiber through a stainless-steel cannula placed into the dorsomedial aspect of the joints. A second needle is also placed at a distant location to serve as an egress for the smoke plume generated by the laser. Approximately 800–1200 J of energy are then delivered through the laser in an effort to boil the synovial fluid until it vaporizes. The heat generated causes chondrocyte death and a collagen shift in the joint capsule and intertarsal ligaments. Several studies have shown that horses treated with laser-facilitated arthrodesis are more comfortable after the procedure than when surgical drilling or MIA is used. It has been theorized that the superheating occurring with the laser may cause thermal damage to nerve endings and diminish the perception of pain. Also, several recent studies comparing the laser-facilitated method with other techniques have shown that less bone formation and bridging occurs with the laser-facilitated procedure; however, these studies have been performed in normal horses. Longer studies and especially studies in clinically affected horses are needed to determine if this technique is ultimately successful in generating joint fusion.

In an effort to improve success rates and benefit from features of multiple techniques, it has recently been described to combine the intra-articular drilling with diode-laser treatment. It is recommended to perform the laser-facilitated procedure first followed by the surgical drilling. The drilling should stimulate more bone production and fusion, whereas the laser might reduce the post-operative pain. This combination of procedures has been reported to have been performed without complications thus far.

Surgical stabilization in addition to intra-articular drilling of the distal tarsal joints has been proposed to have a superior clinical result versus intra-articular drilling alone. Lag screws or a screw and plate combination have been used. That study reported a success rate of 89% of horses returning to soundness compared with 60% with drilling alone. However, only a small number of cases were reported. Further studies are needed to determine if surgical stabilization should be recommended as a means to improve clinical outcome.

Post-operative care includes the use of NSAIDs, bandaging, and initial stall confinement. Except in those cases where surgical implants are used, hand walking commences after bandages are removed in 2–3 wk. During the second month, the patient is allowed turnout into a small paddock. If responding favorably after 60 days, the horse is allowed to return to a gradual exercise program. In many
cases, the horse will be significantly improved in 90–120 days and may return to competition; however, it usually takes ~1 yr for fusion to occur. In those cases where the distal intertarsal disease was significantly more advanced than the tarsometatarsal joint, periodic corticosteroid injections of the tarsometatarsal joint may be beneficial post-operatively for a period of time.

6. Conclusions
Distal tarsal inflammation and osteoarthritis are very common conditions in the athletic horse. The severity of signs are variable but frequently are related to a reduction in athletic performance. Often, a tentative diagnosis can be made with a corresponding history and supportive clinical signs. The diagnosis can be confirmed with an appropriate response to intra-articular anesthesia and radiographic findings. Many horses can be managed throughout their athletic career with periodic injections of corticosteroid, usually in combination with hyaluronan. If the clinical response to injections is less than optimal, then further therapy such as extracorporeal shockwave or surgical intervention may be necessary. The need for more aggressive therapy decreases the prognosis for athletic function, although the majority still have a positive outcome.

References


