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Diagnostic Evaluation of the Tarsus

Katherine S. Garrett, DVM

Author’s address: Rood and Riddle Equine Hospital, PO Box 12070, Lexington, KY 40580-2010; e-mail: kgarrett@roodandriddle.com.

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In horses with obvious visible abnormalities of the tarsal region, identification of the tarsus as the source of lameness may be simple. In other patients, a complete lameness examination including diagnostic analgesia must be performed in order to localize the lameness to the tarsal region. Regardless of the method used to identify the tarsus as the site of interest, results of diagnostic imaging should always be evaluated in light of the clinical presentation of the patient.

During the physical examination, effusion of the tarsocrural joint is simple to recognize, but effusion of the tarsometatarsal and distal intertarsal joints can be difficult or impossible to appreciate on physical examination alone. The tarsal sheath, gastrocnemius bursa, and calcaneal bursa should also be assessed for the presence of effusion. Differentiation of these structures from one another can be challenging, especially if severe effusion or edema are present. The tarsal region should be palpated for any areas of tenderness and the horse’s response to flexion and manipulation should be recorded.

Lameness can be localized to the tarsal region by a positive response to perineural anesthesia of the tibial and peroneal nerves after a negative response to anesthesia of the metacarpal region and distal limb. Alternatively, intra-synovial anesthesia of the tarsometatarsal, distal intertarsal, and/or tarsocrural joints can be performed. If the tarsal sheath or other synovial compartment is suspected as the source of the lameness, these areas can also be selectively anesthetized. In some horses, distal tarsal pain can be eliminated or improved after anesthesia of the proximal metatarsal region due to inadvertent entry into the tarsometatarsal joint. Conversely, anesthesia of the distal tarsal joints can reduce lameness associated with the proximal suspensory ligament. Additionally, mepivacaine may diffuse between synovial structures in the tarsus. These confounding factors should be borne in mind when interpreting results of intra-synovial or regional anesthesia.

Once the source of the lameness has been isolated to the tarsal region, diagnostic imaging can be used to formulate a more specific diagnosis. Radiography and ultrasonography are usually chosen for an initial assessment of the area, as they are widely available, relatively inexpensive, and do not require general anesthesia or specialized equipment.

Radiography provides an excellent overview of the status of the bony structures. However, radiography is not particularly useful to evaluate soft tissue structures and can be insensitive to bony inflammation initially. Standard views include a dorsoplantar, dorsolateral-plantaromedial...
oblique, dorsomedial-plantarolateral oblique, and lateral-medial. Additional views may be obtained to highlight specific areas of the joint. A flexed lateral-medial highlights the plantar aspect of the trochlear ridges. A dorsolateral view obtained 10 degrees from the dorsal plane towards the lateral plane allows for improved assessment of the medial malleolus. A skyline view of the tuber calcaneus enables assessment of the sustentaculum tali and the plantar aspect of the tuber calcanei.

Radiographs are often sufficient to diagnose many conditions of the tarsus, including osteoarthritis, osteochondrosis, and fractures of the talus, lateral malleolus of the tibia, and cuboidal bones. In foals, radiographic signs of physitis and osteomyelitis may not be apparent at the time of onset of lameness, but serial radiography may reveal these lesions.

If radiography is unsuccessful at identifying the specific problem or a soft tissue injury is suspected, ultrasonography is often employed. Although ultrasonography of the complex tarsal region is challenging, ultrasonography allows evaluation of soft tissue structures as well as external bony contours. Excellent reviews of ultrasonographic anatomy and technique have been published. Briefly, a complete examination involves assessment of the synovial structures, bone surfaces, and supporting soft tissue structures.

The amount and character of the synovial fluid and synovial membrane should be assessed in the tarsal joints, the tarsal sheath, and the cunean, calcaneal, and gastrocnemius bursae. However, ultrasonographic evaluation does not replace synoviocentesis and fluid analysis for investigation of a possibly septic synovial structure. When effusion and/or edema are present in the plantar portion of the tarsus, identification of the exact synovial structure involved can be made easier with ultrasonography, as the plantar pouches of the tarsocrural joint, the tarsal sheath, and the gastrocnemius and calcaneal bursae are in close proximity to one another.

The bony surfaces are evaluated for the presence of any irregularity that may indicate the presence of osteochondrosis, fracture, insertional desmopathy, osteomyelitis, or physitis. In many cases, subtle bony or physeal margin irregularities as seen in cases of osteomyelitis or physitis can be appreciated using ultrasonography sooner than they can be identified using radiography. The sonographer should evaluate the echogenicity, fiber pattern, and size of the tendons and ligaments of the tarsus, including the collateral ligaments, the long plantar ligament, the peroneus tertius, the cranial tibial tendons, the common calcaneal tendon, the superficial digital flexor tendon, the deep digital flexor tendon, and the long and common digital extensor tendons. Comparison to the opposite limb is extremely useful to differentiate a subtle lesion from a variation of normal.

Nuclear scintigraphy may be used once the lameness has been localized to the tarsus or as a more generalized screening tool to pinpoint potential regions of interest. Scintigraphy allows identification of areas of increased bony turnover and is particularly useful to diagnose occult fractures, stress remodeling, or injuries at ligament-bone interfaces. In the tarsal region, this may include areas of osteoarthritis, collateral ligament desmitis, and fracture of any of the tarsal bones. Additionally, it should be borne in mind that areas of increased radiopharmaceutical
uptake do not necessarily correspond to areas of lameness, and if scintigraphy is performed too soon after an injury occurs, false negative results may occur. In many cases, radiography and ultrasonography are sufficient to formulate a diagnosis of lameness originating from the tarsus. Due to the complexity of this anatomic region, the availability and increased usage of three-dimensional imaging techniques are affording us new insights into the sources of tarsal lameness. The use of computed tomography (CT) and magnetic resonance imaging (MRI) has added greatly to our diagnostic abilities in the tarsal region. For example, the small intertarsal ligaments are inaccessible to ultrasonographic evaluation. Subtle abnormalities of soft tissue structures may not be apparent when assessed ultrasonographically. Superimposition of the bony structures can make radiographic identification of small lesions difficult, and early stages of bony lysis, sclerosis, or inflammation may not be apparent even with digital radiography.

General anesthesia is almost always required for CT and MRI examinations of the tarsus. All high-field magnets, many low-field magnets, and nearly all CT scanners require the patient to be recumbent in the bore of the machine. Although standing MRI is available for the equine, slight motion often occurs in the more proximal regions of the limb, decreasing image quality, so general anesthesia is often used for this magnet design as well. Due to the cost of the examination and the requirement for general anesthesia, specific localization of lameness to the tarsal region is extremely important. This is especially true for MRI, as the length of the examination is longer. When performing a CT or MRI scan of the tarsal region, imaging of the proximal portion of the suspensory ligament is recommended, and the converse is true as well. Horses with a blocking pattern suggestive of proximal desmitis have been diagnosed with tarsal disease and horses that were suspected to have distal tarsal pain were ultimately diagnosed with suspensory ligament desmitis based upon the results of the CT and MRI scans.

Computed tomography can provide the highest degree of bony detail due to its excellent spatial resolution. Tendon and ligament injury can also be identified, and the use of contrast-enhanced protocols may increase the diagnostic ability of CT to find these types of lesions. Although CT allows acquisition in only one plane, the data can be post-processed to provide reconstruction in any plane or in three dimensions. These types of reconstructions are extremely helpful in pre-operative planning, especially for difficult fractures. Scan times are typically short, making immediate pre-operative imaging feasible. Portable CT scanners have recently been introduced into the equine veterinary market and these permit intra-operative imaging as well.

Magnetic resonance imaging allows assessment of both bony and soft tissue structures with a high degree of detail. It does not have the degree of spatial resolution that CT has, but MRI has much higher contrast resolution, so the differentiation of normal from abnormal tissue is made easier. MRI scans are acquired in multiple geometric planes and multiple sequence types are included for a complete examination. Some sequences produce images with a high degree of anatomic detail while others produce images that are weighted to highlight pathology. Other sequences are useful to assess specific types of tissue, including articular cartilage. Bony pathology found with MRI includes signs of osteoarthritis, including sclerosis, cartilage damage, and subchondral cyst-like lesions, bone bruising, and fracture. Tendon and ligament lesions ranging from collateral ligament desmitis to intertarsal ligament desmitis have been diagnosed.
Recent work suggests that lesion appearance in different sequence types may allow lesion staging in tendon and ligament pathology. MRI, especially contrast-enhanced scanning, has also been useful in cases of septic synovitis involving the tarsus, especially those which are not responding well to typical therapy. We have been able to not only assess the synovial structure involved, but also the underlying bones and physes to determine the extent of the infection and formulate a more accurate prognosis. MRI should be considered in foals with severe lameness in which radiography and ultrasonography have failed to lead to a diagnosis.

Some typical situations in which a multi-modality approach may be indicated are performance horses with lameness associated with the distal tarsal joints, horses with severe tarsocrural joint effusion, and horses with a suspected septic process of the tarsal region.

In athletic horses with mild to moderate lameness, the goal is often to return these horses to soundness so they can resume their prior level of performance. A specific diagnosis will allow more targeted treatment and (hopefully) a quicker return to function. In horses with lameness localized to the distal tarsal joints, signs of osteoarthritis may be recognized on radiographs. These horses may also have increased radiopharmaceutical uptake in these joints as well if nuclear scintigraphy is performed. MRI often demonstrates sclerosis, inflammation, and cartilage damage of the bones of the distal tarsus. Similar changes are seen on CT examination. In horses who improve with intra-articular anesthesia of the distal tarsal joints but with equivocal radiographic changes and have a poor response to treatment, imaging of the proximal metatarsal region may reveal additional abnormalities.

Several conditions of the tarsocrural joint present with marked effusion of the joint and varying degrees of lameness. In young horses, osteochondrosis is common. Signs of osteochondrosis may be apparent on radiographs, but ultrasonography or diagnostic arthroscopy may be required for a diagnosis in select cases. Collateral ligament desmitis and fractures involving the tarsocrural or intertarsal joint also cause severe effusion, and are typically accompanied by a more severe lameness. Desmitis can be recognized using ultrasonography, but MRI can provide a more detailed examination in these cases.

Septic synovitis of the tarsocrural joint, the tarsal sheath, calcaneal bursa, or gastrocnemius bursa typically presents with obvious effusion of the synovial structure, but effusion of the distal intertarsal and/or tarsometatarsal joints can be more difficult to recognize on physical examination. Ultrasonographic evaluation can assist with characterizing the degree of effusion and synovial proliferation. On radiographs, radiolucent areas suggestive of osteomyelitis or septic physitis may be appreciated, although the conspicuity of these lesions may not be high at the onset of infection. If the septic process involves the surface of the bone or physis, ultrasonography may be a more sensitive tool with which to monitor the progression of the infection. In cases that are not responding to treatment as expected, CT or MRI may be employed to further define the extent of the problem. Inclusion of fluid-sensitive sequences in an MRI examination is particularly important to identify additional areas of osteomyelitis, abscessation, and synovitis. By using intravenous contrast agents, areas of increased blood flow associated with infection can be located.
Although radiography and ultrasonography have been and will remain the most commonly used tools to determine the causes of tarsal lameness, the increasing availability and usage of CT and MRI in these cases is contributing to our understanding of the clinical presentation and pathologic changes in these diseases. As we are able to make more specific diagnoses and refine our prognoses, hopefully we will be able to treat these horses more effectively and at an earlier stage of disease, allowing us to return them to soundness more efficiently.

References