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## KEY FACTS

- Most horses with distal tarsal osteoarthritis (OA) will have a mild to moderate hindlimb lameness and a positive response to full-limb flexion.
- Some horses with distal tarsal OA may have a firm, localized thickening (“shelf”) on the medial aspect of the distal tarsus.
- Although radiography of the tarsus can be a useful diagnostic tool for horses with distal tarsal OA, the clinical lameness examination and radiographic findings may not always correlate.

# Diagnosis of Distal Tarsal Osteoarthritis in Horses\*

Colorado State University

Gary M. Baxter, VMD, MS

Oklahoma State University

Julie E. Dechant, DVM, MS<sup>†</sup>

University of Pennsylvania

Louise L. Southwood, BVSc, PhD<sup>†</sup>

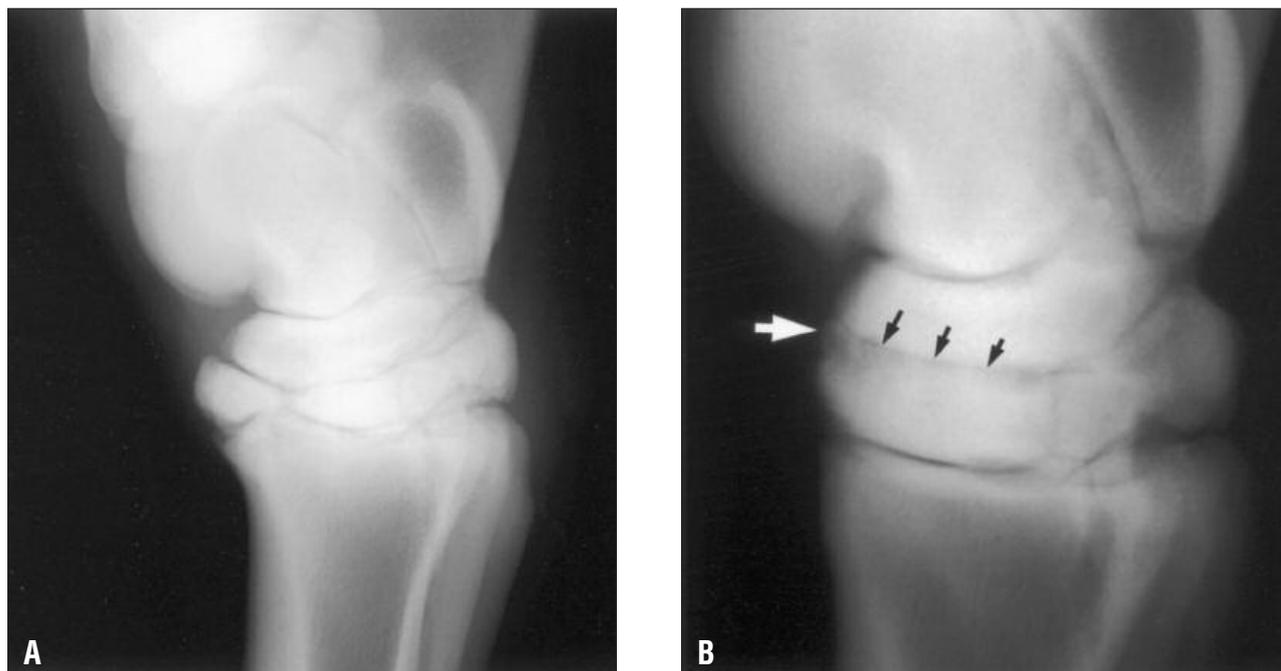
**ABSTRACT:** The distal tarsal joints (i.e., distal intertarsal, tarsometatarsal) in horses are complicated anatomic structures that are thought to absorb the torsional and shear forces applied to the limb during movement. Osteoarthritis (OA) of the distal tarsal joints is a common cause of hindlimb lameness in performance horses and is usually referred to as *bone spavin*. Three clinical syndromes have been associated with distal tarsal OA in horses: (1) tarsitis in standardbreds and other performance horses, (2) juvenile distal tarsal OA, and (3) adult-onset distal tarsal OA. Tarsitis is used to describe lameness attributable to the periarticular soft tissues of the distal tarsus. Juvenile distal tarsal OA is often associated with malformation of the tarsal cuboidal bones. Adult-onset distal tarsal OA usually develops as a result of repetitive joint trauma associated with prolonged use and exercise. Western performance horses and horses that are required to jump or pull a cart are commonly affected. Diagnosis is based on a combination of historical and clinical findings, lameness examination, and radiographic abnormalities within the distal tarsal joints. However, lack of abnormal physical examination findings in the remainder of the limb together with a positive full-limb flexion test often suggests a distal tarsal problem in horses prone to this condition. Radiographic findings consistent with distal tarsal OA include periarticular osteophytes or enthesiophytes, joint space irregularity and/or narrowing, and subchondral bone sclerosis and/or lysis within one or both distal tarsal joints.

**T**hree clinical syndromes have been associated with distal tarsal osteoarthritis (OA) in horses:

- **Tarsitis** has been used in the past to specifically describe lameness attributed to periarticular soft tissues of the distal tarsus in standardbred racehorses. However, tarsitis can occur in other performance horses, most notably the western performance horse. Horses with tarsitis have pain and lameness originating from the distal tarsus (as determined by physical examination and diagnostic local anesthesia) but have no radiographic abnormalities consistent with distal tarsal OA. Whether horses with tarsitis are predisposed to develop distal tarsal OA with increased work is unknown.

\*A companion article on treatment appears on p. 148.

<sup>†</sup>Drs. Dechant and Southwood were affiliated with Colorado State University when this article was prepared.



**Figure 1**—Lateral radiographs of a yearling quarter horse colt (**A**) and a 2-year-old American paint filly (**B**) with clinical and radiographic evidence of juvenile distal tarsal OA. Collapse or crushing of the third tarsal bone is apparent in **A**. Subchondral bone lysis (*white arrow*) and narrowing of the DIT joint space (*black arrows*) with minimal to no abnormalities within the TMT joint are evident in radiograph **B**.

- **Juvenile distal tarsal OA**, which develops in young horses, is a syndrome that is usually attributed to developmental abnormality of the cuboidal bones, such as with osteochondrosis or incomplete ossification of the cuboidal bones (Figure 1A).<sup>1</sup> However, some horses with juvenile distal tarsal OA may have advanced radiographic evidence of distal tarsal OA (subchondral bone lysis) without detectable cuboidal bone abnormalities (Figure 1B). Most horses with juvenile distal tarsal OA are lame but have not been exercised hard and are too young to have sustained repetitive trauma on the distal tarsal joints associated with most cases of adult-onset distal tarsal OA.
- **Adult-onset distal tarsal OA** is most common and affects a variety of performance horses. Most adult horses that have been worked extensively often have typical “wear and tear” problems associated with the distal tarsal joints. Repetitive trauma is thought to damage the articular (cartilage and subchondral bone) and/or periarticular (joint capsule and ligaments) structures, leading to secondary OA in these joints. The progression of distal tarsal OA in individual horses often depends on the type and amount of work being performed, the conformation of the horse, shoeing practices, and the types of treatment that have been used.

### PREDISPOSING RISK FACTORS

Factors that contribute to excessive compression and rotation of the distal tarsal bones are thought to predispose horses to developing distal tarsal OA. These factors include performance activities, such as jumping, dressage, and western performance; shoeing practices, such as shoes with outside trailers or calks; and conformational defects, such as an excessively straight or angled tarsus.<sup>1</sup> Distal tarsal OA can also result from infectious arthritis of the distal tarsal joints, tarsal bone fractures, and crushed or poorly developed tarsal cuboidal bones.<sup>1</sup>

### ANATOMY

The primary joints of the equine tarsus are the:

- Tarsocrural (TC)
- Proximal intertarsal (PIT)
- Distal intertarsal (DIT)
- Tarsometatarsal (TMT)

Articulations relevant to distal tarsal OA include the DIT and TMT joints, and the PIT joint is occasionally involved. The DIT joint is formed by the articulation of the distal surface of the central tarsal bone (Tc) with

the proximal surfaces of the fused first and second tarsal bones (T1+2) and the third tarsal bone (T3).<sup>2</sup> The fourth tarsal bone (T4) spans the DIT joint, articulating with both the PIT and TMT joints. The TMT joint is formed by the articulation of the distal surfaces of the distal row of tarsal bones (T1+2, T3, and T4) with the proximal aspect of the metatarsal bones (metatarsals II through IV).

Dense connective tissue and ligaments stabilize the four tarsal joints. The fibrous joint capsules of each joint are attached to the margins of the distal aspect of the tibia, talus, tarsal cuboidal bones, and proximal aspects of the metatarsal bones and fuse with the overlying ligaments. The synovial membranes attach to the margins of each joint and form synovial pouches wherever there is an absence of ligaments overlying the joint capsule.<sup>3</sup> The medial and lateral collateral ligaments consist of a short and long ligament and attach from the malleoli of the tibia to the small metatarsal and adjacent tarsal cuboidal bones.<sup>2,4</sup> Additionally, numerous short intertarsal ligaments between the different tarsal bones are generally regarded as local thickenings of the fibrous joint capsule.<sup>2,4</sup>

### JOINT COMMUNICATIONS AND FUNCTION

Communication between the TC and PIT joints is thought to occur in most horses,<sup>5</sup> but communication between the DIT and TMT joints has been reported to vary between 8.3% and 67%.<sup>5-8</sup> The most consistent findings suggest that these joints communicate in approximately 30% of horses.<sup>5,8</sup> The sites of these communications have been localized to extensions of the synovial membrane within the tarsal canal and between T1+2 and T3.<sup>5,8</sup> It has been proposed that these synovial extensions may become confluent in some horses and that the development of OA may reduce communication between the distal tarsal joints. The variability in communication may also be related to the injection technique (medial versus lateral and low versus high injection pressure).<sup>7</sup> For example, a needle placed at the level of the DIT joint between T1+2 and T3 on the medial aspect of the tarsus may actually be within the TMT joint in some horses.<sup>6</sup> Additionally, the DIT joint has been documented to communicate with the tarsal sheath (14.6%), the cunean bursa (20.8%), tissue planes (16.7%), and the PIT/TC joints (2.1% to 4.1%).<sup>5,8,9</sup>

The majority of motion in the tarsus originates from the TC joint, and little motion, if any, is associated with the most distal tarsus. Based on the orientation of the small, flat articular surfaces, these most distal joints are classified as plane joints. These joints are responsible for translational movement,<sup>2</sup> which, by strict definition,

is defined as the transfer of load with maintenance of the original orientation of the bone. This means that there is no movement of bones relative to each other, which is unlikely to occur in live animals.<sup>2</sup> It is also likely that these joints absorb the torsional and shear forces applied to the limb during movement.

### DIAGNOSIS

#### History and Clinical Signs

Distal tarsal OA is a common condition that affects performance horses of various ages, breeds, and genders. In particular, western performance horses and horses that are required to jump or pull a cart are commonly affected.<sup>1,10</sup> Affected horses generally have a history of chronic, intermittent, low-grade hindlimb lameness that becomes worse with increasing duration and intensity of exercise.<sup>10</sup> The lameness may improve with rest only to recur with recommencement of training.<sup>10</sup> Although lameness associated with distal tarsal OA is usually bilateral, the initial lameness may be unilateral or alternate between the hindlimbs. Owners or trainers may report that the horse is reluctant to take a particular lead, moves differently when pulling a cart, or has developed behavioral problems (e.g., bucking, refusing to jump, or stopping and pivoting abnormally). Western performance horse owners often report an unwillingness to back up, stop abruptly, or turn a particular direction.

#### Physical and Lameness Examination Findings

Physical examination findings may be unremarkable in many horses with distal tarsal OA. Some horses may have a firm, localized thickening ("shelf") on the medial aspect of the distal tarsus. The "shelf" may be identified by digital palpation or visual inspection from a position behind the horse (Figure 2). The medial enlargement is not always radiographically evident, suggesting that the thickening in some horses is most likely fibrous tissue.<sup>11</sup> Gluteal muscle atrophy and pain may occur but is rare in horses with distal tarsal OA.<sup>1</sup> An increase in heel length and wearing of the toe as a result of dragging the limb may be evident with protracted lameness. Effusion of the TC joint is not a common feature of horses with distal tarsal OA unless the PIT joint is also affected.<sup>1</sup>

The Churchill test involves deep palpation of the medial aspect of the distal tarsus in the region of the cunean tendon and bursa and the head of the second metatarsal bone. The test may be conducted with the limb weight bearing, but more commonly, the limb is held up with one hand while palpating with the opposite hand. A positive (painful) response to palpation (the horse pulls its leg away or lifts it if weight bearing) may be suggestive of distal tarsal OA. Although some



**Figure 2**—Large swelling (“shelf”) on the medial aspect of the tarsus that is sometimes seen in horses with distal tarsal OA. Most swellings are smaller than the one shown and can be a useful clinical finding to help diagnose distal tarsal OA. However, a similar swelling can also develop subsequent to cunean tenectomy and intraarticular drilling and laser-facilitated arthrodesis procedures.

clinicians believe that this is a reliable test, experience is required for appropriate interpretation because it is somewhat subjective. The Churchill test should be repeated several times to confirm a positive or negative response.

Lameness examination at a walk may reveal a decrease in the cranial phase of the stride on the affected limb and reduced extension of the fetlock during the weight-bearing phase.<sup>1,10</sup> The horse may also appear reluctant to flex the tarsus, resulting in a lower foot flight arc, and may adduct the limb during the swing phase of the stride when trotting. The severity of the lameness is variable but usually ranges from mild to moderate (grades 2 to 4/5) based on the American Association of Equine Practitioners lameness grading scheme.<sup>12</sup> When a horse is circled, the lameness is usually exacerbated when the affected limb is toward the

inside; bilateral lameness may become evident when a horse is circled in each direction.

Tarsal flexion tests (i.e., spavin, full-limb flexion) usually increase the severity of lameness associated with distal tarsal OA when the horse is trotted in a straight line. Lack of abnormal physical examination findings in the remainder of the limb together with a positive full-limb flexion test often indicates a distal tarsal problem. Although an increase in lameness after full-limb flexion is not specific to the distal tarsus, it should be suspected in most horses because of the high prevalence of distal tarsal OA in performance horses. Bilateral hindlimb flexion tests should always be performed because the disease is often bilateral and comparisons between the left and right limbs are clinically useful.

### Diagnostic Local Anesthesia

Distal tarsal OA can be tentatively diagnosed in many horses based on the history, physical findings, characteristic lameness, and response to flexion tests. However, local anesthesia may be required to further isolate the source of lameness.

Despite the low percentage of overt communication between the DIT and TMT joints *in vitro*, most clinicians feel that TMT joint anesthesia alone is adequate to diagnose distal tarsal OA.<sup>8,9,11</sup> One study reported that 93% of horses with distal tarsal OA improved or went sound following TMT joint injection alone.<sup>8</sup> This suggests that diffusion of local anesthetic must occur clinically between the TMT and DIT joints because distal tarsal OA rarely affects the TMT joint alone. In support of this clinical assumption, Gough et al<sup>13</sup> reported that diffusion of mepivacaine between the TMT and DIT joints occurs in over 80% of fresh cadaver limbs.

It has also been suggested that joint communication varies with the arthrocentesis approach and injection pressure.<sup>7</sup> One study demonstrated communication in 7.3% versus 18.5% with low and high injection pressures, respectively,<sup>6</sup> whereas another study showed no effect of injection pressure on communication between the two joints.<sup>5</sup>

Additionally, periarticular anesthetic secondary to TMT injections reportedly alleviates pain associated with the DIT joint, insertion of the fibularis tertius, insertion of the cranial tibial muscle, and tarsal sheath.<sup>11-14</sup> It may also cause perineural analgesia of the dorsal and plantar metatarsal nerves.<sup>15</sup>

Results of diagnostic local anesthesia should be interpreted together with the history and physical and lameness examination findings.

Although joint lameness in most horses with distal tarsal OA improves following local anesthesia of the

## Landmarks for Injections

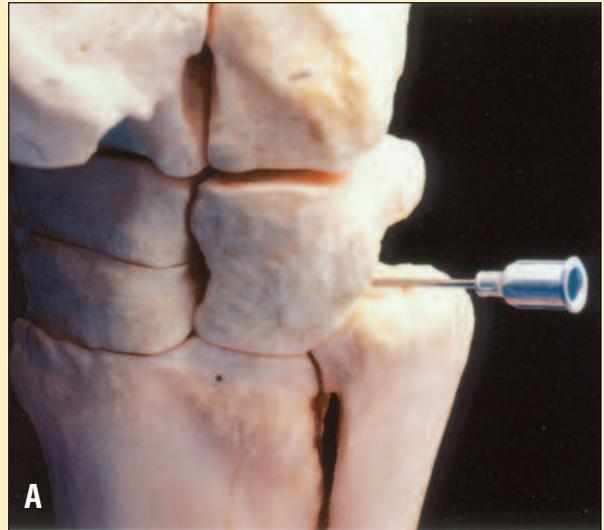
### TMT Joint

For diagnostic local anesthesia, the TMT joint is approached from the plantarolateral aspect of the tarsus,<sup>5,6,8,9,20</sup> with the limb in a weight-bearing position. The landmarks are the lateral edge of the superficial digital flexor tendon and the proximal head of the fourth metatarsal bone. A needle (20 gauge; 1 to 1.5 inches [0.9 × 25 to 40 mm]) is inserted in the palpable depression between the head of the fourth metatarsal bone and T4, approximately 0.6 cm proximal to the head of the fourth metatarsal and 1.3 cm lateral to the edge of the superficial digital flexor tendon (A).<sup>5,20</sup> The needle should be directed at a 45° angle dorsodistomedially.<sup>5,20</sup>

An alternate injection site for the TMT joint is on the medial aspect of the hock and is much more difficult compared with the plantarolateral approach. The technique is similar to that for the DIT joint, but the needle insertion site is located about 1.3 to 1.6 cm distal to that for the DIT joint.<sup>6,20</sup> The advantage of this technique is that only one area on the limb must be aseptically prepared for injection of both distal tarsal joints.

### DIT Joint

Injection of the DIT joint is performed on the medial aspect of the distal tarsus, with the limb in a weight-bearing position. The landmarks are midway between the plantar and dorsal aspect of the distal tarsus, just below the palpable distal border of the cunean tendon in a notch between T1+2, T3, and Tc (B).<sup>5,6,20</sup> The puncture site is slightly proximal and directly plantar to the eminence on T3, and the needle should be directed slightly plantar to follow the interosseous space.<sup>5</sup> The needle (22 or 25 gauge; ¾ to 1 inch [0.7 × 25 mm]) passes through the cunean bursa to a depth of approximately 1.3 to 2.5 cm. If the notch is difficult to palpate, the injection site may be identified by the intersection of a line connecting the palpable distal tuberosity of the medial talus and the space between T1+2 and T3 along the distal border of the cunean tendon.<sup>6</sup> The notch is also approximately 2 cm caudal to a vertical line extending distally from the medial malleolus of the tibia.<sup>1</sup>



**A**  
Injection site for the TMT joint on the lateral aspect of the tarsus.



**B**  
Injection site for the DIT joint on the medial aspect of the tarsus.

TMT joint, lack of improvement does not completely eliminate the possibility of distal tarsal OA in some horses. It is not uncommon for distal tarsal OA to be localized to only the DIT joint, and horses with this condition may not respond to anesthesia of the TMT joint alone if there is no joint communication (Figure 1B). Local anesthesia of the DIT joint either alone or combined with the TMT joint may be necessary for an accurate diagnosis. Intraarticular anesthesia of the DIT

joint is not commonly performed in many horses with distal tarsal OA because it is more technically difficult than injection of the TMT joint and most horses improve following anesthesia of the TMT joint because both distal tarsal joints are usually affected. If there is doubt whether both distal tarsal joints are involved, however, separate intraarticular anesthesia may further localize the source of pain and facilitate the design of a long-term treatment plan.<sup>16</sup>



**Figure 3A**—Left tarsus evidence of OA primarily in the DIT joint.



**Figure 3B**—Right tarsus evidence of OA primarily involving the TMT joint.

**Figure 3**—Dorsolateral-plantaromedial radiographs of the left (A) and right (B) tarsi of a 12-year-old quarter horse gelding.

Alternatively, a caudal tibial and deep peroneal nerve block may be performed to diagnose distal tarsal OA. However, the entire tarsus and structures distal to the tarsus are anesthetized with this block, and, in most cases, this nerve block is more difficult to perform than intraarticular anesthesia of the TMT or DIT joints. Regardless of the diagnostic anesthesia technique used, it is recommended to evaluate the change in lameness several times over a 30-minute period. If more than 30 minutes elapses before evaluating the effect of intraarticular anesthesia, there is a risk of diffusion of the local



**Figure 4**—Dorsolateral-plantaromedial radiograph of the tarsus of a horse that presented for forelimb lameness. There was no known lameness in the rear limb, but the distal tarsus was enlarged with a firm swelling on the medial aspect. Complete loss of the TMT and DIT joint spaces was evident, suggesting that natural ankylosis of the joints had occurred.

anesthetic and inappropriate interpretation of the results. A minimum of 60% to 70% improvement in lameness is considered to be a positive response, and most horses do not become completely sound.<sup>14</sup>

### Radiographic Findings

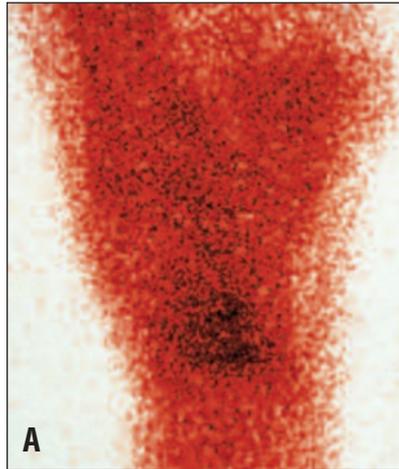
Radiographic findings consistent with distal tarsal OA include periarticular osteophytes or enthesiophytes, periarticular bone proliferation, joint space irregularity and/or narrowing, and subchondral bone sclerosis and/or lysis<sup>16-18</sup> (Figure 3). Radiography is useful for confirming a tentative diagnosis of distal tarsal OA based on historical and clinical findings. A definitive diagnosis of distal tarsal OA should not be based solely on radiographic abnormalities because there is not a good correlation between the clinical lameness examination and radiographic findings of the tarsi.<sup>17</sup> Additionally, horses with early stages of distal tarsal OA may have minimal radiographic abnormalities, and complete ankylosis of the distal tarsal joints can be seen as an incidental finding on tarsal radiographs (Figure 4). This may be due in part to the particular tarsal structures that are affected (periarticular versus articular cartilage versus subchondral bone) and demineralization of bone that must be advanced before radiographic changes can be observed.<sup>18</sup> However, in the first author's clinical experience, most horses with distal tarsal OA that have moderate to severe lameness (grades 3 to 4/5) also have

moderate to severe radiographic abnormalities within the distal tarsal joints (Figure 3).

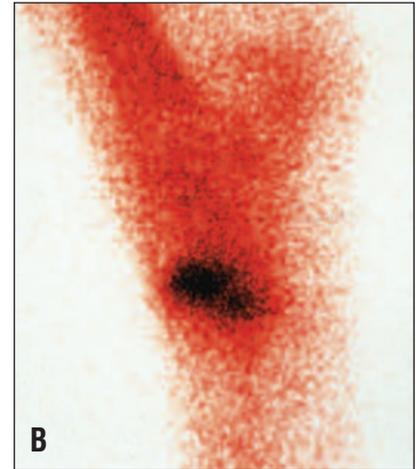
Radiographic lesions are most commonly seen on the dorsomedial aspect of the TMT and DIT joints and extend dorsally.<sup>16-18</sup> Some authors have suggested that the presence of osteophytes on the margins of the distal tarsal joints may have little clinical significance because their presence may not necessarily indicate intraarticular damage.<sup>18</sup> However, localized demineralization of the TMT or DIT joints is considered pathologic<sup>17</sup> (Figure 3A). The articular margin may initially appear roughened (margin irregularity), which can progress to demineralization of the joint margin (marginal radiolucency), and then to destruction of the joint space (Figures 1B and 3A). Subchondral bone lysis with cyst-like radiolucent areas within the tarsal bones are thought to develop in severe cases of distal tarsal OA.<sup>17</sup> Distal tarsal joint space narrowing or irregularity can sometimes be best observed on a dorsoplantar



**Figure 5**—Dorsoplantar radiograph of a horse with distal tarsal OA primarily affecting the DIT joint. A defined DIT joint space cannot be seen on the radiograph (*black arrows*), but the TMT and PIT joint spaces are easily identified. Comparison of the distal tarsal joint spaces on a dorsoplantar radiograph is often helpful to determine joint space narrowing.



**Figure 6A**—Normal tarsus



**Figure 6B**—Distal tarsal OA

Nuclear scintigrams of a horse with a normal tarsus (A) and one that has distal tarsal OA (B) indicated by localized uptake of radiopharmaceutical in the area of the distal tarsal joints. Nuclear scintigraphy can be helpful for documenting distal tarsal OA in difficult cases.

radiograph (Figure 5). Joint space thickness among the three distal tarsal joints can be compared to help determine whether articular loss is present (Figure 5). Subtle narrowing of the distal tarsal joint spaces, without other radiographic abnormalities, is considered a good indicator of distal tarsal OA by some clinicians.<sup>a</sup> Correct positioning for the dorsoplantar radiograph is critical to accurately evaluate these joints. The distal tarsal joints are seen most clearly if the metatarsus is placed in a vertical, fully weight-bearing position. The x-ray beam is centered either in a horizontal plane at the level of the lateral malleolus or at the PIT joint and angled ventrally, approximately 10°.<sup>17</sup> Any proximodistal obliquity may result in overinterpretation of joint space narrowing on the radiographs.

### Nuclear Scintigraphy

Nuclear scintigraphy is not usually performed on horses with distal tarsal OA and is rarely necessary to obtain a definitive diagnosis. However, nuclear scintigraphy may be useful in fractious horses that cannot be evaluated thoroughly or in horses in which the history, physical and lameness examinations, and radiographic findings are atypical or nondefinitive and another source of lameness is suspected<sup>16</sup> (Figure 6). To our knowledge, no studies have evaluated the specificity, sensitivity, and overall accuracy of nuclear scintigraphy in diagnosing distal tarsal OA. However, scintigraphy has been shown to accurately predict distal tarsal inflammation in horses with occult distal tarsal bone trauma.<sup>19</sup> It is the first author's opinion that nuclear

<sup>a</sup>Trotter G: Personal communication, Colorado State University, Fort Collins, 2000.

scintigraphy is a reliable indicator of distal tarsal joint disease in horses presented to our hospital (Figure 6).

## CONCLUSION

Distal tarsal OA is most common in adult horses that are used for western performance, jumping, dressage, or pulling a cart. Visual inspection and palpation of the medial aspect of the distal tarsus is important to detect soft tissue thickening or pain in this region. The diagnosis can often be made based on historical and clinical findings together with radiographic signs of OA within the DIT or TMT joints. Despite the low percentage of overt communication between the DIT and TMT joints in vitro, most clinicians feel that TMT joint anesthesia alone is adequate to diagnose distal tarsal OA because both distal tarsal joints are affected in most cases. However, intraarticular anesthesia of the TMT or DIT joints either alone or in combination may be necessary in select cases because of the variability of joint communication and the differences in severity of OA between the two joints.

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## ARTICLE #6 CE TEST

The article you have read qualifies for 1.5 contact hours of Continuing Education Credit from the Auburn University College of Veterinary Medicine. Choose the best answer to each of the following questions; then mark your answers on the postage-paid envelope inserted in *Compendium*.

- Bone spavin in horses is the lay term used to describe
  - effusion of the TC joint.
  - inflammation of the cunean bursa.
  - OA of the DIT and TMT joints.
  - OA of the PIT joint.
  - osteochondritis dissecans within the TC joint.
- The site used for injecting the TMT joint in horses is located on the
  - medial aspect of the distal tarsus just proximal to the palpable border of the cunean tendon.
  - lateral aspect of the distal tarsus just proximal to the head of the fourth metatarsus.
  - lateral aspect of the distal tarsus just proximal to the fourth tarsal bone.
  - medial aspect of the distal tarsus just proximal to the head of the second metatarsal bone.
  - dorsomedial aspect of the tarsus just distal and axial to the medial malleolus of the tibia.

3. Which statement regarding communication of the tarsal joints in horses is correct?
  - a. The TC joint always communicates with the DIT joint.
  - b. The TMT and DIT joints almost always communicate with each other.
  - c. The PIT and TC joints almost always communicate with each other.
  - d. The PIT joint communicates with the TMT and DIT joints in most horses.
  - e. The TC joint communicates with the PIT, DIT, and TMT joints in most horses.
4. Which radiographic abnormality is not usually identified in horses with distal tarsal OA?
  - a. periarticular osteophytes and enthesiophytes
  - b. subchondral bone lysis along the DIT or TMT joints
  - c. irregularity or narrowing of DIT or TMT joint spaces
  - d. subchondral bone sclerosis of distal tarsal cuboidal bones
  - e. osteochondral fragmentation of distal tarsal cuboidal bones
5. Which clinical finding is not characteristic of most horses with distal tarsal OA?
  - a. acute-onset, unilateral rear-limb lameness
  - b. firm soft tissue or bony enlargement on the medial aspect of the distal tarsus
  - c. positive response to a full-limb flexion test
  - d. painful response to direct digital pressure over the cunean bursa and/or the medial aspect of the distal tarsus
  - e. a minimum of 60% to 70% improvement in lameness following injection of anesthetic into the distal tarsal joints
6. Juvenile distal tarsal OA refers to the development of distal tarsal OA
  - a. associated with severe tarsal valgus in foals.
  - b. resulting from malformation of the tarsal cuboidal bones in young horses.
  - c. with no radiographic abnormalities.
  - d. in young horses that have experienced spontaneous joint ankylosis.
  - e. associated with hard work and repetitive trauma to the distal tarsal joints.
7. The site used for injecting the DIT joint is located on the
  - a. medial aspect of the distal tarsus just proximal to the palpable border of the cunean tendon.
  - b. lateral aspect of the distal tarsus just proximal to the head of the fourth metatarsus.
  - c. medial aspect of the distal tarsus just proximal to the central tarsal bone and distal to the third tarsal bone.
  - d. medial aspect of the distal tarsus just proximal to the head of the second metatarsal bone.
  - e. medial aspect of the distal tarsus below the palpable distal border of the cunean tendon in a notch between T1+2, T3, and Tc.
8. Adult-onset distal tarsal OA
  - a. occurs secondary to malformation of the tarsal cuboidal bones.
  - b. occurs secondary to exercise-induced wear and tear of the TMT and DIT joints over time.
  - c. refers to the development of subchondral bone lysis and sclerosis within the DIT joint.
  - d. refers to the development of tarsal pain and lameness attributable to periarticular soft tissue damage within the tarsus.
  - e. progresses gradually and is indicated by a change from mild to severe radiographic abnormalities.
9. Which statement regarding the anatomy of the tarsus in horses is correct?
  - a. The fused third and fourth tarsal bones form the caudal aspects of both the DIT and TMT joints.
  - b. The fourth tarsal bone is located above the head of the fourth metatarsus and spans the DIT joint space, forming its lateral border.
  - c. The large central and third tarsal bones lie directly beneath the talus and contribute to the joint surface of the PIT joint.
  - d. The cunean tendon is a branch of the long digital extensor tendon that inserts on the medial aspect of the distal tarsus.
  - e. The head of the second metatarsus is much larger than that of the fourth metatarsus and is used as a landmark for injecting the TMT joint.
10. Which statement regarding communication between the DIT and TMT joints in horses is correct?
  - a. The DIT and TMT joints communicate freely in most horses.
  - b. Communication between the DIT and TMT joints is thought to occur in approximately one third of all horses.
  - c. Injection volume and pressure used to inject do not appear to affect the frequency of communication between the DIT and TMT joints in horses.
  - d. The DIT and TMT joints do not communicate and should be anesthetized independently in all horses with distal tarsal OA.
  - e. The DIT and the TMT joints communicate with the TC joint and contribute to joint effusion in horses with distal tarsal OA.