Lameness and poor performance are common problems afflicting equine athletes. After the clinical lameness examination has localized the site of lameness, imaging is often the next step in the diagnostic plan. The fetlock and palmar/plantar metacarpal/tarsal regions are common sites of lameness in sport horses. Specific injuries may include desmopathy of the suspensory ligament, distal accessory ligament, or distal sesamoidean ligaments, superficial or deep digital flexor tendinopathies, osteoarthritis, and osteochondral chip fractures or major fractures. Investigation of a problem may require only a single imaging modality, or may require a multimodal approach.

Radiography is often the first technique used when investigating lameness problems isolated to the distal limb. Computed and direct digital radiography have become more prevalent over the past decade and are now widely available on an ambulatory basis. These technologies can enhance the diagnostic value of radiographs, but do not compensate for poor positioning or inappropriate technique.

In the fetlock region, four views (dorsal-palmar/plantar with 20-30 degrees of elevation, lateralmedial, dorsolateral-palmaro/plantaromedial oblique with 10-15 degrees of elevation, and dorsomedial-palmaro/plantarolateral oblique with 10-15 degrees of elevation) may be sufficient. These images may reveal signs of osteoarthritis, including osteophyte formation or joint space narrowing (Fig. 1). Enthesiophytes may suggest the presence of ligamentous disease. Fractures can range from small osteochondral chip fractures to comminuted phalangeal or metacarpal/tarsal bone fractures. Subtle variations in the angulation of the projection may be necessary to identify nondisplaced fracture lines. Additional views may be necessary to investigate specific locations within the joint.1 For example, flexed lateral-medial and flexed dorsal-palmar/plantar views can highlight pathology on the distal or palmar/plantar condyles of the third metacarpal/tarsal bone.2

Radiography can also be valuable in assessing pathology associated with the soft tissue structures of the palmar/plantar metacarpus/tarsus. Four standard views (dorsal-palmar/plantar, lateral-medial, dorsolateral-palmaro/plantaromedial oblique, and dorsomedial-palmaro/plantarolateral oblique) are generally obtained. Horses with suspensory ligament desmitis may have irregularity of the palmar/plantar or endosteal surface of the proximal third metacarpal/tarsal bone or avulsion fragments at the origin of the suspensory ligament.3 The second and fourth metacarpal/tarsal bones can be assessed for fractures or exostoses that may impinge upon the suspensory ligament.4

Ultrasonography is an excellent choice to assess both soft tissue structures and bony contours. A linear transducer operating between 8-12 megahertz is typically used for the fetlock and palmar/plantar metacarpal/tarsal regions. A microconvex transducer may allow more thorough assessment of some
structures, such as the proximal suspensory ligament. A standoff pad can improve image quality for superficial structures and contours to the horse's leg. Comparison to the opposite limb is encouraged, as ultrasonographic changes can be subtle. Some soft tissue structures (e.g., the distal sesamoidean ligaments and the suspensory ligament) may normally have some heterogenicity, so comparison to the normal limb can help reduce errors in interpretation. Subtle irregularities of the bony margins are often better appreciated ultrasonographically than radiographically.5

Ultrasonography is often the first diagnostic modality used when pathology of the suspensory ligament is suspected. Findings may include enlargement, irregularity of the fiber pattern, and decreases in echogenicity (Fig. 2).6 Large core lesions are less common in the sport horse than is a more chronic desmitis characterized by a more subtle decrease in echogenicity and enlargement of the ligament. Irregularity or avulsion fractures of the proximal palmar/plantar aspect of the third metacarpal/tarsal bone can be identified using ultrasonography as well.

Figure 1. Radiographic image (elevated dorso-lateralpalmaromedial oblique) demonstrating osteophyte formation on dorsomedial PI with proliferative and lytic changes of distal MC III consistent with severe degenerative joint disease.
Figure 2. Ultrasonographic images of suspensory branches. Top image shows a normal suspensory branch with homogeneous echogenicity and fiber pattern. Bottom image shows an abnormal suspensory branch with an area of moderate-severe hypoechogenicity with disruption of the normal fiber pattern. The subcutaneous tissues are also thickened. In each image, the transverse view is on the left side of the image and the longitudinal view is on the right side of the image. Proximal and dorsal are on the right of the image.

Pathology of the deep and superficial digital flexor tendons may range from a mild decrease in echogenicity typical of tendonitis to large anechoic core lesions in either the metacarpal/tarsal or fetlock regions. Similar changes may be seen in the distal sesamoidean ligaments and the distal accessory ligament. Fetlock joint collateral ligament desmitis and intersesamoidean ligament desmitis are uncommon, but can be diagnosed ultrasonographically.

While radiography and ultrasonography can be performed on an ambulatory basis, nuclear scintigraphy, computed tomography, and magnetic resonance imaging require specialized equipment and are performed in a hospital environment.

Nuclear scintigraphy identifies areas of increased bone metabolism. In some cases of poor performance, scintigraphy may be used as a screening tool to identify areas with abnormal increased radiopharmaceutical uptake suggestive of pathology. It is an excellent tool to identify subchondral bone damage in the fetlock joint or occult fractures. Abnormal increased radiopharmaceutical uptake may also occur in desmopathies at sites of ligamentous attachment, such as at the origin of the suspensory ligament (Fig. 3). Nuclear scintigraphy is often followed by additional imaging of regions with increased radiopharmaceutical uptake in order to more completely define the location and severity of the lesion.
Cross-sectional imaging techniques provide excellent definition of both bony and soft tissue structures. Both computed tomography (CT) and magnetic resonance imaging (MRI) examinations result in images that represent thin, cross-sectional slices of tissue, allowing precise delineation and localization of pathology. In some instances, CT or MRI can provide a specific diagnosis when results of radiography or ultrasonography have been negative. In other cases, although a preliminary diagnosis has been formulated, MRI or CT examination provides important additional information leading to a refinement of the diagnosis and prognosis.

Computed tomography has excellent spatial resolution, providing crisp detail of bony structures in particular (Fig. 4). For example, CT has been used to identify a bony component of suspensory ligament desmitis at the origin of the ligament.12 The three dimensional reconstruction abilities of CT are very useful in defining the nature of complex fractures on a pre-operative basis. Additionally, desmopathies and tendonopathies can be diagnosed, and lesion conspicuity can be improved by using contrast media.13 Due to the short acquisition time, it is possible to complete peri-operative CT scans during the same anesthetic episode as fracture repair.
Magnetic resonance imaging provides an extremely thorough investigation of the bony and soft tissue structures of the distal limb. Magnetic resonance imaging may detect changes in soft tissue or bone before they become apparent during radiographic or ultrasonographic examination. MRI has also been reported to be superior to CT in the diagnosis of bone bruising and in injuries that involve both the bone and soft tissues. A variety of imaging planes and sequences are used, so examination of a region using MRI takes longer than using CT. While MRI of the fetlock or metacarpus/tarsus can be performed in the standing, sedated horse, motion artifacts can lead to missed lesions and difficult interpretation.

Soft tissue pathology is diagnosed based on the presence of abnormal signal intensity, irregular margins, or enlargement of the structure. Differences in the degree of abnormal signal intensity between different types of sequences may provide an estimate of the stage of the lesion. Lesion detection in soft tissue structures has been reported to be superior using MRI than using either CT or
ultrasonography, especially in the suspensory ligament and oblique distal sesamoidean ligaments (Fig. 5).14-16 MRI is also useful for detection of abnormalities of bone and cartilage.17-19 Areas of bone irregularity, edema, and sclerosis can be identified at an early stage. Cartilage damage or loss is best appreciated using a high-field magnet, although cartilage lesions have been shown to be underestimated using MRI.19,20

In conclusion, it is important to recognize that diagnostic imaging is only one component of a thorough assessment of the lame horse. It is vital that the results of the diagnostic imaging examination be interpreted in light of the history as well as the findings of the lameness examination. Many horses have abnormalities or evidence of previous injury that are not clinically significant. Comparison to the contralateral limb is helpful in establishing if a finding is a variation of normal or a true abnormality. Conversely, if an exhaustive imaging assessment of the anatomic region of interest has been completed with negative results, the anatomic localization of the lameness may require reassessment.

![Figure 5. Proton density weighted fat saturated transverse MR image of the proximal metatarsal region. An image of the non-lame, normal limb is seen in A. Enlargement, abnormal contour, and markedly abnormal signal intensity of the suspensory ligament is shown in B. Dorsal is at the top of the images and lateral is on the left side of the images.](image-url)
References


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