

New Frontiers in Diagnosing Equine Lameness

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Lameness and Diagnosing Tools

Lameness is one of the most common and expensive health problems seen in horses. It can reduce a horse's performance, require long and costly treatment, and in severe cases, lead to euthanasia.¹ Traditionally, veterinarians diagnosed lameness by visually observing how the horse moves, determining which limb is affected, and identifying abnormalities in the horse's gait. While this approach relies heavily on a veterinarian's experience and skill, it also introduces subjectivity, as two veterinary professionals might not always see the same thing. Further, subtle problems inside the hoof or limb can easily go unnoticed with the naked eye.

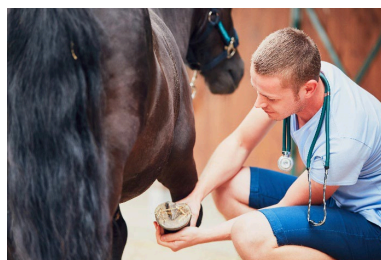
Fortunately, modern technology allows veterinarians to look beneath the surface. Tools such as artificial intelligence (AI), computed tomography (CT), magnetic resonance imaging (MRI), digital radiography (X-rays), nuclear scintigraphy, ultrasound, and positron emission tomography (PET) give clearer, more detailed pictures of what's happening inside the horse's leg. Each technology offers different advantages, from identifying uneven movement to revealing hidden damage within bones, joints, or soft tissues. When combined with veterinary visual evaluation, they help pinpoint the cause of lameness faster and more accurately than ever before.

Artificial Intelligence (AI)

Artificial intelligence is becoming more accepted in equine lameness detection. AI systems can analyze how a horse moves and detects small irregularities that are not easily seen by the human eye. Tools such as Lameness Locator

and Sleip use sensors or smartphone videos to record a horse's gait. They digitally mark points on the horse's body and compare its movement patterns to large databases of normal and abnormal motion.²

This analysis provides an objective, data-based assessment that identifies which limb is affected and how severely. However, AI currently focuses on motion; it can show that something is off, but not necessarily *why*.¹ Even so, as AI continues to learn from thousands of cases, its accuracy improves over time. In the future, AI may not only help veterinarians identify lameness earlier but also suggest likely causes and guide treatment options.¹ For many practitioners, this technology is already becoming an important early screening tool that enhances confidence in diagnosis. AI is still in its infancy and needs time to develop into a usable and trustworthy tool.



Computed Tomography (CT)

Computed tomography, or CT, uses rotating X-rays and computer software to create three-dimensional images, showing the inside of the horse's leg or hoof. This gives veterinarians a highly detailed look at bones and surrounding structures.³ In the past, CT scans required the horse to be placed under general anesthesia and laid down, leading to a stressful and sometimes risky procedure.

Recent advances, however, have made CT scans much more practical. The development of standing cone-beam CT (CBCT) systems now allows imaging while the horse remains standing under light sedation. This safer and faster process can reveal small fractures, early joint degeneration, and subtle changes that might otherwise go unnoticed. While CT doesn't show soft tissues as clearly as MRI, it excels in showing bone detail, joint space narrowing, and areas of bone inflammation. Since 2021, systems like the Hallmarq Vision CT have made these tools more available in equine hospitals, although high equipment costs and space needs still limit how widely they're used.

Magnetic Resonance Imaging (MRI)

Magnetic resonance imaging, or MRI, has revolutionized the diagnosis of soft-tissue and deep structural problems in horses. It uses powerful magnets and radio waves to produce detailed images of both bone and soft tissue.⁴ Two main types of MRI systems are used in equine medicine: high-field and low-field scanners.

High-field MRI produces extremely sharp images, making it the “gold standard” for complex cases, but it usually requires the horse to be fully anesthetized. **Low-field MRI**, on the other hand, can be done while the horse is standing and sedated, which is safer and easier for both horse and handler.⁵ Though the image resolution is slightly lower, studies show that both types of MRI deliver images of diagnostic quality sufficient for accurate clinical decisions. MRI is particularly useful for identifying tendon and ligament injuries, cartilage damage, and bone bruising, conditions that often go undetected on X-rays or CT scans. As MRI technology becomes more affordable and portable, it will continue to improve access to advanced diagnostics in both clinics and field settings.



X-ray Imaging

Credit: Karl Hoopes, DVM

Radiographic Imaging (X-ray)

X-rays remain one of the most essential and accessible tools in equine medicine. X-rays are a type of ionizing radiation made of high-energy electromagnetic waves that pass through the body to create pictures of bones and internal organs. They are quick, cost-effective, and can be performed in almost any setting, from a hospital to a stable.⁶ Modern digital radiography provides sharper images and allows instant viewing and sharing, making it easier for veterinarians and farriers to collaborate.

Radiographs help evaluate bone structure, hoof balance, and alignment. They are especially valuable for diagnosing fractures, laminitis, and joint changes. While X-rays can't show soft-tissue problems like tendon injuries, they remain the best starting point for most lameness evaluations. In

many cases, digital X-rays provide enough information for treatment decisions or corrective shoeing, without the need for more advanced imaging. These images can help the farrier with hoof balance to achieve correct angles, sole depth, and hoof symmetry.

Nuclear Scintigraphy

Nuclear scintigraphy is a diagnostic imaging technique that uses small amounts of radioactive tracers to identify areas of increased bone or soft-tissue activity. After the tracer is injected, it collects in regions of injury or disease and emits gamma rays that are detected by a gamma camera.⁷ Although the resulting images are less detailed than those produced by CT or MRI, scintigraphy is highly effective at locating hidden sources of pain that may not be visible with other imaging methods. One of its greatest advantages is its ability to evaluate areas surrounded by large amounts of muscle, such as the pelvis, where the other imaging systems may be limited.

Ultrasound

Ultrasound is one of the most widely used imaging tools for diagnosing equine lameness because it is affordable, portable, and readily available. It excels at evaluating soft-tissue structures such as tendons, ligaments, and muscles, making it especially useful for detecting injuries to the deep digital flexor tendon.⁸ Unlike CT or MRI, however, ultrasound cannot image bone or some deeper structures, meaning certain injuries may be missed. Even with these limitations, ultrasound remains an important first-line diagnostic tool and is often used alongside more advanced imaging techniques to obtain additional detail.

PET Scan

Positron emission tomography (PET) is an advanced form of nuclear imaging that produces detailed three-dimensional images of areas with increased metabolic activity.⁷ In 2016, the University of California, Davis became the first veterinary facility to use PET scanning for horses, marking an important advancement in equine diagnostic imaging.⁹ Because the technology is still relatively new, researchers are continuing to study its full diagnostic potential. Modern PET scanners are becoming smaller and more portable, and veterinary professionals can combine PET images with CT, X-ray, or MRI to provide a more complete understanding of a horse's injury and guide treatment planning.

Conclusion

Diagnosing equine lameness has advanced dramatically in recent years, combining traditional clinical experience with cutting-edge technology. Each imaging tool plays a unique role:

- **AI** helps identify movement irregularities with remarkable accuracy, often before a veterinarian can see them.
- **CT** provides detailed three-dimensional views of bones and joints, revealing microfractures or early arthritis.
- **MRI** shows soft-tissue structures in exceptional detail, uncovering tendon, ligament, or cartilage damage that may not appear on X-rays.
- **Radiography** remains the most practical and widely available tool, giving quick insights into bone and hoof health.
- **Nuclear scintigraphy** identifies areas of increased metabolic activity and can detect sources of pain in regions that are difficult to image with other modalities.
- **Ultrasound** provides an affordable and portable option for evaluating soft-tissue injuries.
- **PET scan** provides detailed three-dimensional images of metabolic activity; however, because the technology is still relatively new and limited in availability, additional research and broader adoption are needed.

Beyond improving accuracy, these advancements also enhance horse welfare. Early and precise detection reduces pain, shortens recovery times, and helps prevent small problems from becoming career-ending injuries. For performance horses, that means more consistent training and longer athletic careers. For all horses, it means better comfort, improved quality of life, and a more compassionate approach to care.

Looking ahead, integrating AI with imaging systems could soon enable near real-time diagnosis. As these technologies become more affordable and portable, they will not only transform how lameness is diagnosed but also how equine health is managed worldwide. What was once guesswork is rapidly becoming precision science, making life better for both horses and the people who care for them.

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The authors of this content used ChatPGPT to edit the original paper. Authors reviewed and edited the content

provided by the AI tool, and they take full responsibility for the content.

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