ADVANCED IMAGING - DO YOU REALLY NEED IT?
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Key points
- Advanced imaging represents a significant practice expense and should be chosen with the overall practice function in mind.
- Significant training of the veterinary and lay staff is necessary to take full advantage of the technologic advances presently available.
- Advanced imaging has provided substantial insight into the types and incidence of orthopedic disorders of the digit.
- Advances in imaging technology and reduction in cost have allowed sophisticated imaging techniques to be utilized in the operating room, leading to improved patient outcomes.

The purpose of this presentation is to discuss the utilization of advanced imaging techniques in the management of soft tissue, musculoskeletal, respiratory and neurological disorders in the horse. The emphasis will be on the application of these techniques to optimize diagnosis and management to improve patient outcomes. The majority of the presentation will focus on the use of advanced imaging techniques in the management of clinical cases.

Recent (last 10 years) Advances in Imaging

Wired and Wireless Digital Radiography
Direct digital radiography (DR) has become commonplace in equine practices of all types, but has additional advantages in surgical practice. Radiographic images are immediately available to the surgeon without a time lag for processing, leading to increased efficiency. In many cases, direct digital radiography can replace a fluoroscope in the operating room, reducing radiation exposure and eliminating an additional equipment expense while maintaining precise control over surgical technique.

Recently (within the past two years), wireless DR panels have entered clinical practice. The wireless panels have several distinct advantages over wired DR due to their design and mechanism of action. Wireless panels are easier to use and are presumably more durable due to the lack of a cord. The cesium iodide-based wireless DR panel allows for a reduced radiation dose and improved image quality as compared to the amorphous silicon-based wired DR. From a clinical perspective, while image quality is enhanced, this advantage is marginal for extremities and may not justify replacement of a well-functioning wired DR panel.

Laryngeal Ultrasonography
While use of ultrasound is commonplace for soft tissue disorders, it has recently been used for the diagnosis of laryngeal pathology. Advantages include its non-invasive and inexpensive nature. Additional diagnostic information can be obtained in cases of recurrent laryngeal neuropathy, arytenoid chondritis, and laryngeal malformation, enhancing the clinician’s ability to make the correct diagnosis and recommend appropriate treatment.
Laryngeal ultrasonography is particularly valuable in cases that are not straightforward or when dynamic upper airway endoscopy is not pursued.

**Figure 1:** Dorsal plane ultrasound images of the left (A) and right (B) sides of the larynx of a horse with left recurrent laryngeal neuropathy. Rostral is to the left of the images. The left cricoarytenoideus lateralis and vocalis muscles (arrows) are hyperechogenic as compared to the same muscles on the right side.

**Magnetic Resonance Imaging**

The dramatic increase in availability of magnetic resonance imaging (MRI) over the last ten years means that it is an available imaging technology for most horse owners in the United States. Magnetic resonance imaging has opened the veterinary surgeon’s eyes to a variety of conditions that were either misdiagnosed or not described previously, especially with regard to the equine digit. It is most valuable in cases of refractory lameness when other imaging techniques have not led to a specific diagnosis. A key component of appropriate use of MRI in musculoskeletal disorders of the horse is careful pre-imaging lameness evaluation, including regional anesthesia to localize the lameness as specifically as possible. The combination of careful lameness examination and this advanced imaging modality has enhanced MRI’s usefulness in clinical practice.
Figure 2: MRI images of a 5 YR STD G with severe lameness and resolved septic arthritis of its fetlock. Medial is to the right of the images.

A: Dorsal plane T1W VIBE pre-contrast image at the level of the proximal sesamoid bones. There is focally increased signal on the axial border of the medial proximal sesamoid bone.

B: Transverse plane STIR image at the level of the proximal sesamoid bones. There is focally markedly increased signal on the axial border of the medial proximal sesamoid bone in the same location as the increased signal in image A with more diffusely moderately increased signal in the remainder of the bone.

C and D: Digital subtraction image in the dorsal plane (C) at the same site as in image A and in the transverse plane (D) at the same site as in image B after administration of intravenous gadolinium-based contrast agent. Note the marked enhancement of the medial proximal sesamoid bone diffusely with a focal region of absent enhancement axially at the same site of the increased signal on the pre-contrast image.

Based on the results of the MRI, the axial border of the medial proximal sesamoid bone was subsequently debrided arthroscopically and the horse returned to race training.

Computed Tomography

Computed tomography (CT) is less widely available than MRI for the horse population, but has superior spatial resolution and three dimensional reconstruction capabilities, rendering it extremely useful in cases of bony pathology. Preoperative CT is considered the standard in human orthopedic surgery, allowing the surgeon to more complete understand fracture configuration and to identify additional pathology.

Portable CT units have recently become available, permitting intraoperative CT in the horse. Intraoperative CT provides three dimensional control of implant placement that is superior to intraoperative radiography, allowing optimization of fracture reduction and fixation. Limitations in bore size have generally relegated the use of portable CT to the distal limb. The vast majority of larger bore units are not portable and require dedicated facilities for their use. Currently, large bore portable CT units are becoming commercially available and price reductions in the future may make them more practical for routine use in horses.
**Figure 3:** Digital radiographs (A and B) and three dimensional CT reconstruction (C and D) of a comminuted fracture of the second phalanx of a 6 year old QH. The anatomic detail provided by the CT allowed the surgeon to more precisely plan and complete the subsequent pastern arthrodesis.