Standing MRI Lesions Identified in Jumping and Dressage Horses With Lameness Isolated to the Foot

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Lameness diagnosis with the standing magnetic resonance imaging scanner can reveal previously undetectable lesions that contribute to foot pain. Jumping and dressage horses are subject to particular stresses that may result in unique injuries and conditions. This paper reviews the lesions identified in 98 jumping and dressage sport horses over an 18-mo period and provides an indication of response to specific clinical treatment of cases 6 mo after examination. Authors’ address: Fairfield Equine Associates, P.C., 32 Barnabas Road, Newtown, CT 06470; e-mail: Rmitch2074@aol.com. © 2006 AAEP.

1. Introduction

Foot pain is a common source of lameness in jumping and dressage horses. While the principles of perineural and intra-articular anesthesia have long allowed veterinarians to localize the source of foot pain,1 the determination of the specific cause has often proven elusive. Newer imaging techniques of digital radiography, nuclear scintigraphy, and ultrasound have further enhanced the ability of the examiner to identify the cause of lameness. The very nature of the equine foot limits the practical application of many imaging modalities. Magnetic resonance imaging (MRI) has proven to be a valuable tool for identifying specific pathology in the equine foot,2 and many of these lesions have been corroborated with anatomical and histopathological studies.3

As MRI technology has advanced in human clinical medicine, many imaging devices have become available for use in the horse. Closed and open magnets, both of the low-field and high-field type, are now available and affordable for use in equine clinical practice. Most MRI systems require the horse to be anesthetized to fit within the field of the magnet. More recently, a low-field standing MRI has been developed and is now in widespread use in Europe and the United States. Motion can have a significant effect on image quality, and whereas general anesthesia may eliminate motion artifact, adequate sedation techniques and motion correction software are now available. The necessary equipment and specific concerns of general anesthesia and recovery are eliminated by using a standing scanning device.

As the use of MRI is becoming more commonplace, many apparent lesions and abnormalities are being identified in the equine foot. Several excellent reviews of MRI lesions have been published.4 The population of horses in these reviews has been some-
what mixed. A review of the more common lesions specifically seen in jumping and dressage horses as seen with a standing MRI scanner has not been published. The purpose of this paper is to review the more common lesions seen in jumping and dressage horses in the northeastern United States presented for a complaint of foot-related lameness and imaged with a standing low-field MRI scanner. Additionally, an indication of responses to treatment of the identified lesions is provided.

2. Materials and Methods
All horses in this review were examined at Fairfield Equine Associates, P.C. (FEA) in Newtown, CT, between October 2004 and May 2006. The horses in this review were restricted by discipline to sport horses participating in show jumping or dressage. Lameness cases included regular patients of the practice and referrals for specific imaging techniques and case work-up. Cases for MRI were identified by those showing resolution of lameness by palmar (plantar) digital or abaxial sesamoid nerve blocks, thus limiting the lameness to structures distal to the fetlock. Routine lameness evaluation, nerve blocks, ultrasound, and radiographs had failed to elucidate the specific source of the lameness in all cases. A total of 98 horses were included in this review. Thirty horses were also evaluated with nuclear scintigraphy before or after MRI. MR imaging was accomplished using a low-field, fixed, 0.27-T unit for use in the standing horse.

Use of the standing MRI scanner has been described previously. Cases at FEA were sedated by various techniques of bolus sedation and constant intravenous drip using combinations of detomidine and butorphanol. A radiofrequency receiving coil was placed on the foot to be imaged, and the magnet was positioned in a manner that placed the foot centrally within the magnetic field. Pilot scans of short duration were performed to determine proper positioning and for purposes of establishing proper angle for the scanning sequences. Movement of the horse during the scanning sequences resulted in the need for new pilot scans to re-establish proper position. A standard protocol for foot imaging was used that included gradient echo T1-weighted, fast spin echo T2-weighted, and short time inversion recovery (STIR) sequences in sagittal, transverse, and frontal planes. Both feet of the horse were typically scanned, and protocol demanded that lesions were found in more than one plane to be considered valid. Typically, the contra-lateral limb was compared for symmetry.

After diagnosis, a portion of the horses were treated at FEA, whereas some returned to the referring veterinarian for therapy. Therapy included corrective shoeing, rest, injection of the distal interphalangeal (DIP) joint, injection of the navicular bursa, intravenous tiludronate, and short-term phenylbutazone (2.0 mg/kg/day) depending on the individual diagnosis and duration of lameness. Pentoxifylline (8.0 mg/kg, q 12 h) or isoxsuprine (1.0 mg/kg, q 12 h) was prescribed in a limited number of cases. Focused extracorporeal shockwave therapy was used on selected DDF tendon core lesions. Tiludronate was administered for apparent navicular bone inflammation at a dose of 1.0 mg/kg diluted in 1 l of saline and given as a slow infusion over 90 min. The navicular bursa was injected under fluoroscopic guidance with a combination of triamcinolone (6 mg) and sodium hyaluronate (22 mg); a total volume of 3 ml was used. The same combination of medications was used for treatment of DIP joint synovitis in relatively acute cases. Other cases of DIP synovitis deemed to be more chronic were treated with IRAP per manufacturer's instructions. Owner preference and economic considerations affected choice of therapeutics in some cases.

Those horses ≥6 mo from time of examination were assessed for soundness by veterinary examination or owner/trainer reports. Information was collected on the age and use of all horses examined, predominantly affected lame limb, combinations of lesions, duration of lameness before MRI examination, and percentage of horses that returned to soundness.

3. Results
A total of 98 sport horses were examined with the standing MRI scanner between October 2004 and May 2006. Nuclear scintigraphy was performed on 30 horses of this group. Breed distributions were as follows: Warmblood, 70; Quarter Horse and Quarter Horse cross, 9; Thoroughbred, 6; Thoroughbred cross, 7; various other breeds, 6. There were 69 geldings, 26 mares, and 3 stallions. The mean age of all horses examined was 10.7 yr (range, 4–24 yr). The mean duration of lameness before MRI scan was 33 wk (range, 1 wk to 4 yr). Seventy-seven horses were training in jumping disciplines, and 21 horses were training in dressage.

Fifty-seven (58%) of the horses had a primary complaint of right front limb lameness; 39 horses (40%) were primarily lame in the left front limb, with 2 horses (2%) having complaints of hind foot lameness. More specifically, the trend toward right fore lameness was even greater in jumpers with 46 right fore (RF) (60%) and 29 left fore (LF) (38%) as opposed to dressage horses that showed a much more balanced distribution of 11 RF (52%) and 10 LF (48%).

Abnormal findings in the navicular bone were the most common lesions identified, appearing in 75 horses (77%). Navicular bone lesions included fluid signal within the body of the navicular bone, sclerosis, contour defects, cyst-like defects, and fragmentation (Figs. 1 and 2). DIP joint effusion (Fig. 3) was observed in 67 horses (68%). Deep digital flexor (DDF) tendon lesions of various locations and dimensions were diagnosed in 64 horses (64%). Lesions of DDF tendons included evidence of tendon...
thickening and distortion of shape, fluid signal, margin changes such as fibrillation, core lesions, and other evidence of significant fiber pattern disruption (Fig 4). Navicular bursitis was noted in 48 horses (49%). Bursitis was identified as increased fluid signals from the region of the bursa and evidence of synovial proliferation (Fig. 5). In contrast to a previous presentation regarding Warmblood horses with foot lameness,\textsuperscript{8} desmitis of the medial and lateral collateral ligaments of the distal interphalan-geal joint was only identified in 21 horses (21%). Other abnormalities identified included desmitis of the navicular collateral ligament (n = 13), impar
ligament injury (n = 4), pedal bone fracture (n = 2), and subchondral cyst of P2 (n = 2).

Fluid signal of the navicular bone was often seen concurrently with other lesions. Of those with fluid signal (or cyst-like lesion) from the navicular bone (75 horses), 61 horses (81%) had DDF tendon lesions, 48 horses (64%) had navicular bursitis, and 40 horses (53%) had DIP joint effusion. Twenty-five horses (26% of the total population) had concurrent DDF tendon lesions and DIP joint effusion.

Of the 30 horses examined with nuclear scintigraphy, 26 showed increased uptake of radioisotope in the region of the navicular bone, which corresponded with abnormalities indicated on MRI. Eight horses also showed increased uptake of radioisotope at the insertion of the DDF tendon and subsequently had indication of tendonitis on MRI.

Sixty-six horses were ≥6 months after examination at the time of review. Soundness was assessed as a successful return to function in the same or related activity before injury. Forty-four of 66 horses (67%) were sound in work, 17 (26%) were still lame, 3 (4%) had undergone palmar digital neurectomy and were functioning as before, and 2 horses (3%) were lost to follow-up. Twenty-nine of 46 horses (63%) affected with navicular bone lesions were sound and in work. Twenty-five of 48 horses (52%) affected with DDF tendon lesions were sound and had returned to work. Sixteen of 24 horses (67%) with evidence of navicular bursitis were reported sound. Of 10 horses diagnosed with desmitis of the DIP collateral ligaments, 8 (80%) were sound after 6 months or more.

Corrective shoeing was recommended in all cases of foot lameness. Corrective shoeing primarily consisted of improving hoof-pastern axis (normally correcting a broken back axis) and medial to lateral balance. Egg bar shoes were used most often for DDF tendon injuries. Rest involved stall rest initially for 30–60 days and then confinement to a small “medical paddock” that discouraged vigorous activity for at least another 2 mo. Sixteen horses were treated with a brief course of phenylbutazone, corrective shoeing, and rest. Eight horses (50%) so managed were reported sound at 6 mo. Ten horses that showed navicular lesions were treated with tiludronate, corrective shoeing, and rest; of these, 8 (80%) were reported sound at 6 mo. The navicular bursas were injected in 10 horses (in addition to shoeing recommendations) as therapy for navicular bone inflammation, navicular bursitis, and tendon inflammation in the region adjacent to the navicular bone. Of those treated, seven horses (70%) were reported sound after 6 mo. Sixteen of 20 horses (80%) treated concurrently with intravenous tiludronate and injections of the navicular bursa were reported sound in the same time period. Two horses were treated with injection of the DIP joint for synovitis: one with triamcinolone and sodium hyaluronate and one with IRAP. These two cases of synovitis were reported to be sound after 6 mo. Three horses were treated for core lesions of the DDF tendon with focused shockwave therapy (in an effort to reduce lesion size), corrective shoeing, and rest. These three horses were all reported sound at 6 mo.

4. Discussion

Foot pain is a major source of lameness in the jumping and dressage horse and may be related to the nature of the repetitive work performed in jumping and extended gaits. New diagnostic techniques have allowed veterinarians to more precisely locate the source of pain, yet the physical structure of the equine foot limits imaging techniques for precise identification of causative lesions. MRI has been shown to solve many of the physical problems encountered with ultrasound, radiography, and scintigraphy. The standing MRI scanner provides considerable insight for the diagnosis of foot pain in the sport horse. While the low-field magnet may have less resolution compared with a high-field magnet, images have proven very satisfactory while avoiding some of the issues associated with general anesthesia. General anesthesia can be very labor intensive, may pose some risk for the horse, and increases the expense for some examinations. Because the horse is fully load bearing, the standing scanner provides anatomical correctness that may be distorted by general anesthesia and recumbency. The quality of images from the standing scanner is

Fig. 5. STIR FSE TRA showing effusion (arrow) localized to the medial aspect of the navicular bursa.
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most seriously affected by incorrect positioning of the horse and movement during imaging.

Lesions of the navicular bone are common in jumping and dressage sport horses exhibiting distal limb pain. The incidence of navicular bone lesions in our review was far greater than has been previously reported in other groups. While evaluator bias may have affected some results, the population of horses may have been pre-selected by referring veterinarians to likely include such cases. MRI was performed on many of these horses to confirm suspicions of navicular bone involvement. Nuclear scintigraphy had indicated increased radioisotope uptake in the navicular bones of 26 of 30 horses examined (87%). The authors speculate that mild fluid signal from the navicular bone in jumping and dressage horses may be a feature of stress remodeling and not necessarily a sign of profound pathology.11 Because of the frequent presence of other lesions, the navicular bone abnormalities seen may not have been the root cause of the lameness noted, yet could not be ignored in a diagnostic review. DDF tendon lesions are very common in those horses diagnosed with foot pain and often accompany navicular bone abnormalities. Navicular bone inflammation is often seen concurrently with navicular bursitis and DIP joint effusion. DIP joint effusion less commonly accompanies DDF lesions. The DIP effusion apparent in some images may be a function of weight bearing and might not be as evident in a scan performed under general anesthesia. It is very apparent from this study that palmar foot pain is a syndrome involving multiple lesions in the majority of cases.

The results of this review suggests that DDF tendon lesions respond positively to rest, corrective shoeing, and medical therapies directed specifically at the pathology identified on MRI. The percentage of horses that returned to soundness in this group was greater than previously reported for horses with similar lesions.4 This may be related to duration of lameness before examination, the severity of the injuries most frequently encountered by jumping and dressage sport horses, and the select population of horses included in this review.

The limited number of horses treated with either tiludronate or injection of the navicular bursa indicates an encouraging outcome for treatment of navicular bone inflammation and navicular bursitis, respectively. Our results suggest that combining the two techniques may prove useful in more serious cases involving significant inflammation in the two structures.

Foot pain in jumping and dressage sport horses originates from a variety of sources. After localization of the pain to the foot, standing MRI can precisely define the anatomical structures with pathology and assist the attending veterinarian with developing more specific therapy for the horse.

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References and Footnotes


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