Osseous Trauma in the Fetlock Region of Mature Sports Horses

Sue J. Dyson, VetMB, PhD; and Rachel Murray, VetMB, PhD

Osseous trauma of the fetlock is a potentially important cause of lameness in mature sports horses, and although the diagnosis may be achieved by radiographic examination in some horses, nuclear scintigraphy or magnetic resonance imaging may be required for other horses. Authors' address: Centre for Equine Studies, Animal Health Trust, Lanwades Park, Kentford, Newmarket, Suffolk CB8 7UU, UK; e-mail: sue.dyson@aht.org.uk (Dyson). © 2006 AAEP.

1. Introduction

The concept of stress-related bone injury is well recognized in immature equine athletes; however, there is little published data relating to subchondral bone trauma in mature sports horses. Nuclear scintigraphy has proven efficacious for the early identification of increased osteoblastic activity after bone trauma, and it has been helpful in the characterization of stress-related bone injury in the metacarpophalangeal (MCP) and metatarsophalangeal (MTP) joints (fetlock) of both Thoroughbred\(^1\) and Standardbred\(^2\) racehorses. Osseous cyst-like lesions (OCLLs) in the fetlock region have predominantly been documented in immature horses and debate continues as to whether osteochondrosis or trauma is the most likely cause.\(^3\) Short, incomplete dorsal cortical stress fractures of the proximal aspect of the proximal phalanx have been well described in racehorses\(^4\)–\(^6\) but have been poorly documented in mature sports horses. A “bone bruise” is a well-recognized cause of joint pain in people and is identified using magnetic resonance imaging (MRI).\(^7\) More recently, with the more widespread use of MRI in equine medicine, subchondral bone trauma in the fetlock region of mature horses has been recognized.\(^8\) The aims of this study were to describe how different imaging modalities can lead to a diagnosis of osseous trauma in the equine fetlock region of mature sports horses, to describe the clinical manifestations and the results of diagnostic imaging, and to determine the outcome of treatment.

2. Materials and Methods

Clinical records of horses referred to the Centre for Equine Studies, Animal Health Trust between January 2001 and December 2005 were reviewed. Horses selected for inclusion in the study had to meet the following criteria: a non-racehorse, ≥4 yr of age, history of sudden onset lameness, pain localized to the fetlock region using perineural and/or intra-articular analgesia, and examination using radiography and nuclear scintigraphy. Horses with unequivocal radiographic evidence of a fracture of the third metacarpal (McIII) or third metatarsal (MtIII) bones, the proximal phalanx, or a proximal sesamoid bone (PSB) were excluded along with horses with osteoarthritis or clinical signs referable to the periarticular soft tissues or the digital flexor...
tendon sheath. Selected horses with joint effusion underwent exploratory arthroscopic examination of the fetlock joint. Selected horses with no evidence of joint capsule distension underwent MRI.

Radiographic examination included a minimum of a dorsal 15° proximal-palmarodistal oblique (D15° Pr-PaDiO) view, a flexed lateromedial view, a dorsal-lateral-palmarodistal oblique view, and a dorsomedial-palmarolateral oblique view (or the equivalent views in a hindlimb). In selected horses, additional dorsoproximal-lateral-palmarodistal medial oblique views were obtained to highlight the trabecular bone of the proximolateral-palmarodistal medial oblique views (or the distal aspect of McIII and associated bone trauma). Lameness varied in degree between 1 and 8 (0 = non-weight-bearing; 8 = sound).

Twelve horses (Table 1) were identified with evidence of traumatically induced bone injury of the MetIII or McIII (n = 6), proximal phalanx (n = 5), or a proximal sesamoid bone (n = 1); eight had forelimb lameness, and four had hindlimb lameness. All horses had sudden onset lameness, and in three showjumpers, this occurred immediately after a fall (cases 3, 11, and 12). The duration of lameness at the time of examination at the Animal Health Trust ranged from 2 wk to 8 mo. Effusion of the fetlock joint was only noted in two horses (cases 3, 11, and 12). The duration of lameness at the time of examination at the Animal Health Trust ranged from 2 wk to 8 mo. Effusion of the fetlock joint was only noted in two horses (cases 3, 11, and 12).

3. Results

Twelve horses (Table 1) were identified with evidence of traumatically induced bone injury of the McIII or MetIII (n = 6), proximal phalanx (n = 5), or a proximal sesamoid bone (n = 1); eight had forelimb lameness, and four had hindlimb lameness. All horses had sudden onset lameness, and in three showjumpers, this occurred immediately after a fall (cases 3, 11, and 12). The duration of lameness at the time of examination at the Animal Health Trust ranged from 2 wk to 8 mo. Effusion of the fetlock joint was only noted in two horses (cases 3, 11, and 12, both of which had full-thickness cartilage defects of the distal aspect of McIII and associated bone trauma. Lameness varied in degree between 1 and 6 on a scale of 0–8 (0 = sound; 2 = mild; 4 = moderate; 6 = severe; 8 = non-weight-bearing).

In five horses (cases 1, 4, 5, 6, and 10), lameness was abolished by perineural analgesia of the digital nerves performed at the junction of the proximal three-quarters and distal one-quarter of the metacarpal (metatarsal) region and the palmar (plantar) metacarpal (meta-
Intermediate signal intensity in T2-weighted images and increased signal intensity in fat-suppressed images. Case 1 had a focal, non-articular lesion in the central proximal aspect of the proximal phalanx that was characterized by low signal intensity on T1- and T2-weighted images and high signal intensity on fat-suppressed images. Case 8 had a focal subchondral defect in the lateral condyle of MtIII with mineralization extending proximally into the subchondral bone that was characterized by low signal intensity on T1- and T2-weighted images and no abnormalities on fat-suppressed images (Fig. 6).

Surgery
Three horses (cases 10, 11, and 12) underwent exploratory arthroscopy, and in two of these horses, a large (2–3 cm) diameter full-thickness cartilage defect was identified on the distal dorsal aspect of McIII; the defect was more dorsal in case 12 (Fig. 3) and more on the weight-bearing surface of McIII in case 11. Both lesions were debrided. In case 12, there was a cavity in the subchondral bone ~1 cm deep that contained fibrous tissue and soft, granular bone that was debrided. Inspection of the palmar pouch of the joint revealed no abnormality in case 12, but in case 11, there were extensive wear lines on the axial aspect of both PSBs. In case 10, the plantar pouch was examined, and no abnormality was seen. However, after an incision in the abaxial aspect of the intersesamoidean ligament adjacent to the lateral PSB, a defect was identified in the cortex of the bone with an underlying area of bone necrosis that was debrided. Case 9, with a non-articular OCLL in the proximal phalanx, was treated by an extra-articular approach. The lesion was debrided through a 5.5-mm drill hole and packed with tricalcium phosphate.

Case 2, with evidence of bone trauma of the lateral plantar condyle of MtIII, underwent arthroscopic exploration after MRI to try to determine if a cartilage defect could be identified, but no abnormality was observed in the areas accessible to inspection. Case 8, with sclerosis of the lateral condyle of MtIII, underwent exploratory arthroscopy at the owner’s request, and as expected, no lesion was identified.

Follow-up
Nine horses have returned to full athletic function (cases 1, 2, 3, 4, 5, 6, 9, 10, and 12); however, in cases 2, 9, 10, and 12, it took between 5 and 9 mo for...
<table>
<thead>
<tr>
<th>Case</th>
<th>Imaging &amp; Response</th>
<th>Treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NAD</td>
<td>Moderate focal IRU distal lateral palmar aspect McIII</td>
<td>NP</td>
</tr>
<tr>
<td>2</td>
<td>NAD</td>
<td>Moderate focal IRU plantarolateral aspect MtIII</td>
<td>Decreased signal intensity in planter aspect of lateral condyle of MtIII in T1- and T2-weighted images with increased signal intensity in fat suppressed images</td>
</tr>
<tr>
<td>3</td>
<td>NAD</td>
<td>Intense IRU distal McIII laterally&gt;medially</td>
<td>Decreased signal intensity in T1-weighted images and increased signal intensity in fat suppressed images in lateral and medial condyles McIII; areas of increased signal intensity in fat suppressed images close to origin of lateral collateral ligament</td>
</tr>
<tr>
<td>4</td>
<td>Subtle sclerosis proximal aspect of proximal phalanx axially</td>
<td>Moderate focal IRU proximodorsal aspect of proximal phalanx axially</td>
<td>NP</td>
</tr>
<tr>
<td>5</td>
<td>Subtle short radiolucent line axial proximal aspect of proximal phalanx</td>
<td>Moderate focal IRU proximal dorsal aspect of proximal phalanx axially</td>
<td>Incomplete short dorsal cortical sagittal fracture proximal aspect of proximal phalanx</td>
</tr>
<tr>
<td>6</td>
<td>Mild thickening of subchondral bone plate of proximomedial aspect of the proximal phalanx</td>
<td>Moderate focal IRU proximal axial aspect of proximal phalanx extending from dorsal to palmar</td>
<td>Decreased signal intensity in T1- and T2-weighted images in proximal aspect of proximal phalanx medial&gt;lateral and also distal McIII; increased signal intensity in fat suppressed images</td>
</tr>
<tr>
<td>7</td>
<td>NAD</td>
<td>Moderate focal IRU distal dorsal lateral aspect MtIII</td>
<td>Focal area of increased signal intensity in proximal aspect of proximal phalanx axially, mid-dorsal to plantar in fat suppressed images with decreased signal intensity in T1- and T2-weighted images</td>
</tr>
<tr>
<td>8</td>
<td>NAD</td>
<td>Subtle IRU distal lateral aspect MtIII</td>
<td>Focal mineralization of lateral condyle of MtIII, with normal signal in fat suppressed images</td>
</tr>
<tr>
<td>9</td>
<td>OCLL axial proximal aspect of proximal phalanx</td>
<td>Focal intense IRU proximal axial aspect of proximal phalanx</td>
<td>NP</td>
</tr>
<tr>
<td>10</td>
<td>NAD at first examination; 4 wk later radiolucent defect in axial proximal aspect of lateral PSB</td>
<td>Focal intense IRU lateral PSB LH</td>
<td>NP</td>
</tr>
<tr>
<td>11</td>
<td>NAD</td>
<td>Focal intense IRU distal medial aspect McIII, dorsal&gt;palmar</td>
<td>NP</td>
</tr>
<tr>
<td>12</td>
<td>Small ill-defined radiolucent zone abaxial aspect of medial condyle McIII; 4 wk later enlarged and better defined, although lameness improved substantially</td>
<td>Focal intense IRU distal medial dorsal aspect McIII</td>
<td>NP</td>
</tr>
</tbody>
</table>

* NAD, no abnormality detected; OCLL, osseous cyst-like lesion; PSB, proximal sesamoid bone; McIII, third metacarpal bone.  
† IRU, increased radiopharmaceutical uptake; MtIII, third metatarsal bone.  
‡ NP, not performed.  
§ S, sound; R, retired; HD, humane destruction because of persistent lameness.
lameness to resolve. Clinical improvement was much more rapid in cases 1, 4, 5, and 6. Cases 1, 3, and 5 were reexamined radiographically and scintigraphically 6 wk (cases 1 and 5) and 3 mo (case 3) after initial examination. No radiographic abnormality was seen, and IRU was normal. Case 4 underwent radiographic follow-up examination, and the previously identified sclerosis was no longer detectable. Although it was less well-defined, the cyst-like lesion in case 12 was still apparent radiographically after 3 mo. Case 11 improved clinically and is used as a broodmare. Cases 7 and 8 were euthanized because of persistent lameness. Case 7, with a non-articular osseous cyst-like lesion seen on MR images in the proximal axial aspect of the proximal phalanx, underwent post-mortem examination, which verified the presence of a cyst.

4. Discussion
Bone trauma of the fetlock region is not common, and only 12 horses fulfilled the inclusion criteria for this study over a 5-yr period. During that time, ~2500 horses were examined by the author for lameness or poor performance. Nonetheless, recognition of primary osseous trauma of the fetlock as a cause of lameness in mature equine athletes is considered important. Mares were over-represented, comprising 50% of the horses in this study compared with 28% of the normal clinic population.

Lameness Characteristics and Response to Local Analgesia
The degree of lameness ranged from 1 to 6, but, in general, the horses had moderate to severe lameness that was exacerbated by distal limb flexion in most. Joint effusion was only present in those horses with major cartilage pathology.

Five horses (cases 1, 4, 5, 6, and 10) had lameness that was abolished by perineural analgesia of the digital nerves at the level of the base of the PSBs within 10 min of injection. It is important to recognize that this nerve block has the potential to
Fig. 2. (A) Dorsal 15° proximal-palmarodistal oblique radiographic view of the left MCP joint of case 5. Medial is to the left. There is a short axial radiolucent line in the proximal aspect of the proximal phalanx that could not be reproduced in other similar radiographic projections. (B) Lateral scintigraphic image of case 5. There is focal moderate IRU in the dorsoproximal aspect of the proximal phalanx. (C) Dorsal SPGR image of the left metacarpophalangeal joint of case 5. There is a short high signal-intensity line going through the proximal cortex of the proximal phalanx with generalized hypointense signal throughout the proximal aspect of the proximal phalanx and the distal aspect of the McIII. This verified the presence of an incomplete dorsal cortical fracture of the proximal aspect of the proximal phalanx. (D) Transverse SPGR image of the proximal aspect of the proximal phalanx of case 5. There is generalized hypointense signal in the dorsal third of the bone.
abolish fetlock region pain, including lesions of the McIII (MtIII), proximal phalanx, and PSBs. One horse (case 1) was sound after intra-articular analgesia; another five horses (cases 2, 3, 8, 11, and 12) with lesions of the distal McIII or MtIII showed >50% improvement in lameness. Case 1, rendered sound, and two of the horses with improvement in lameness (cases 2 and 8) were presumed to have intact articular cartilage. The mechanism by which primary subchondral bone pain is improved by intra-articular analgesia remains unclear. One horse (case 10) with a lesion of the axial aspect of the lateral PSB and an intact intersesamoidean ligament showed no change in lameness after intra-articular analgesia, which has been previously reported in other horses with axial lesions of the PSBs.11

Location of Lesions
The axial aspect of the proximal phalanx seemed to be a predilection site for injury. The dorsoproximal aspect of the proximal phalanx is a well-recognized
Fig. 4. (A) Lateral pool-phase, (B) lateral bone-phase, and (C) dorsal bone-phase images of the MCP joints of case 1. In the dorsal image, the right forelimb is to the left. There is moderate IRU in the palmar lateral aspect of the right McIII in both the pool-phase and bone-phase images. Lameness had been sudden in onset after the horse leaped into the air in a wash box and landed heavily. It was concluded that the horse had stress-related bone injury of the lateral palmar condyle of McIII. Lameness resolved, and IRU was normal 8 wk later.
Fig. 5. (A) Dorsal and (B) lateral scintigraphic images of the MCP joints of case 6. In the dorsal image, the left forelimb is to the right. There is moderate IRU in the proximomedial aspect of the left proximal phalanx, extending from dorsal to palmar in the lateral image (compare with Figs. 1 and 2). (C) Dorsal SPGR, (D) T2* GRE, (E) STIR, and (F) transverse SPGR images of the left MCP joint of case 6. There is diffuse decreased signal intensity in the proximal medial aspect of the proximal phalanx (black arrows) in both T1- and T2-weighted images (A, B, and D) involving only the cancellous bone with more focal decreased signal intensity in the opposing aspect of the McIII (white arrow). There was mild increased signal intensity in STIR images in the same region (C) consistent with both mineralization and fluid. The horse returned to full athletic function.
Lesions of the Subchondral Bone of McIII, MtIII, and the Proximal Phalanx

Lesions of the subchondral bone of the McIII, MtIII, or the proximal phalanx occurred with or without lesions of the articular cartilage. Variable signal intensity was observed in association with subchondral bone pathology and loss of trabecular architecture on MR images. In two horses (cases 2 and 3), there was focal increased signal intensity in the subchondral bone plate in T2-weighted and fat-suppressed images surrounded by a much larger area of reduced signal intensity extending into the cancellous bone. The nature of the tissue associated with the focal high signal intensity remains open to speculation; it may represent proteinaceous fluid, granulation tissue, or necrotic bone. In case 8, there was a generalized area of low signal intensity in the lateral condyle of MtIII in both T1- and T2-weighted images consistent with mineralization. This may possibly be the end result of long-term repetitive overload.

Lesions of the Articular Cartilage

Joint effusion was present in the two horses (cases 11 and 12) that had major cartilage defects confirmed arthroscopically. Focal cartilage defects were suspected based on the MR images of cases 2 and 3, and we would have expected associated joint effusion if the cartilage surface had been broached. Case 2 was subsequently evaluated arthroscopically and no lesion was seen; however, the postulated site of a lesion was inaccessible to view. MRI permits identification of changes of signal intensity, which reflect chemical changes within a tissue without necessarily being gross structural change. The curved articular surfaces of the fetlock joint make the articular cartilage particularly susceptible to partial-volume averaging artifacts, and there-
Fig. 7. (A) Lateral scintigraphic image of the right hindlimb of case 2. There is moderate IRU in the plantar aspect of the MtIII. (B) Lateral parasagittal SPGR, (C) T2*GRE, (D) dorsal SPGR, (E) transverse SPGR, and (F) transverse STIR MR images of the right MTP joint of case 2. There is diffuse decreased signal intensity in the lateral plantar condyle of MtIII in T1- and T2-weighted images (white arrows), which is consistent with mineralization and fluid. There is also focal increased signal intensity in the cortex extending into the cancellous bone (black arrow), which is consistent with proteinaceous fluid. In the STIR image, there is a diffuse mild increase in signal intensity throughout the plantar two-thirds of the condyle (arrow heads) consistent with loss of fat signal. Subsequent arthroscopic evaluation through the plantar pouch of the MTP detected no cartilage surface abnormality. The horse has returned to competition after a prolonged rest period.
Fig. 8. (A) Lateral parasagittal SPGR, (B) dorsal SPGR, (C) dorsal T2*GRE, (D) lateral parasagittal STIR, and (E) transverse STIR images of the left MCP joint of case 3. In (A), there is diffuse decreased signal intensity extending from the dorsal to plantar aspects of the lateral condyle of McIII (white arrows). In (B) and (C), there is decreased signal intensity in the lateral and medial condyles of McIII and the proximomedial aspect of the proximal phalanx (white arrows), which is consistent with mineralization. There is also focal increased signal intensity laterally in the subchondral bone (arrowhead), which is consistent with proteinaceous fluid and altered signal intensity in the overlying cartilage. In (D), there is mild increased signal intensity on the dorsal aspect of McIII (arrows), and in (E), there is intense increased signal intensity laterally adjacent to the origin of the lateral collateral ligament of the MCP joint. No abnormality of the ligament was detected.
fore, the accurate identification of lesions is not easy. In this study in both horses (cases 4 and 5) with an incomplete dorsal cortical stress fracture of the proximal aspect of the proximal phalanx, IRU was localized to the dorsal aspect of the bone in lateral scintigraphic images. In Case 6, which had abnormalities on MR images extending from the dorsal to palmar aspects of the bone, IRU also was present from the dorsal to palmar aspects.

MRI allowed the characterization of osseous lesions and had the capacity to identify subchondral bone lesions that would not be detectable arthroscopically because of the intact overlying cartilage; this has previously been documented in the carpus. Prognosis

Many of the horses had acute-onset, severe lameness that took many months to improve. Nonetheless, 75% of horses returned to their former level of activity, including international-level competition. Lameness associated with an incomplete dorsal cortical fracture of the proximal phalanx resolved most quickly.

5. Conclusions

In conclusion, osseous trauma of the fetlock region can cause moderate to severe lameness, but with appropriate diagnostic imaging, an accurate diagnosis can usually be achieved. With suitable treatment, a favorable outcome is possible for many horses; however, in some cases, the convalescent period is long.

We thank Michael Schramme, Richard Payne, and Timothy Greet for performing surgery.

References and Footnotes


"Domosedan, Pfizer Ltd., Sandwich, Kent CT13 9NJ, UK.

"Hermes, Nuclear Diagnostics, Unit E1, Springhead Enterprise Park, Northfleet, Gravesend, Kent DA11 8HH, UK.

"General Electric, Milwaukee, WI 53201.