Third carpal bone palmar avulsion fracture in a Thoroughbred racehorse

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History and Physical Examination

A 5-year-old Thoroughbred gelding was presented for acute onset right forelimb lameness, following track work. Relevant history included carpal and forelimb fetlock pain bilaterally, that spanned approximately a year and was being treated with intra-articular triamcinolone acetonide (Kenacort A-10, Aspen Australia) and hyaluronic acid (Equinate injection, Randlab). Both intermediate carpal joints and metacarpo-phalangeal joints were treated bilaterally a total of seven times, with the last treatment 12 days prior to the onset of lameness. Radiographs of both carpi taken 4 months prior to presentation did not show any abnormalities.

On clinical examination, the horse was lame in the right foreleg at the walk and grade 3/5 lame at the trot. There was obvious heat over the dorsal aspect of the carpus, pain on palpation of the palmar carpus medial to the accessory carpal bone and carpal flexion induced a grade 5/5 lameness.

Diagnostic Analgesia and Radiographs

A low 4 point nerve block did not resolve the lameness. However, a high 1-point block (lateral branch of the palmar nerve) completely resolved the lameness, eliminating pain on palpation of the palmar carpus and after carpal flexion.

Due to localisation of the pain to the carpal region and the suspicion of a carpal fracture, a full series of carpal radiographs were taken. These identified a transverse radiolucent line midway through the third carpal bone on the dorso-palmar view (Figure 1). A lateral to medial radiograph showed a minimally displaced fracture on the distal palmar aspect of the third carpal bone (Figure 2).

Synoviocentesis analysis of the intermediate carpal joint indicated no evidence of sepsis.

Ultrasound examination of the palmar carpus was conducted but was inconclusive.

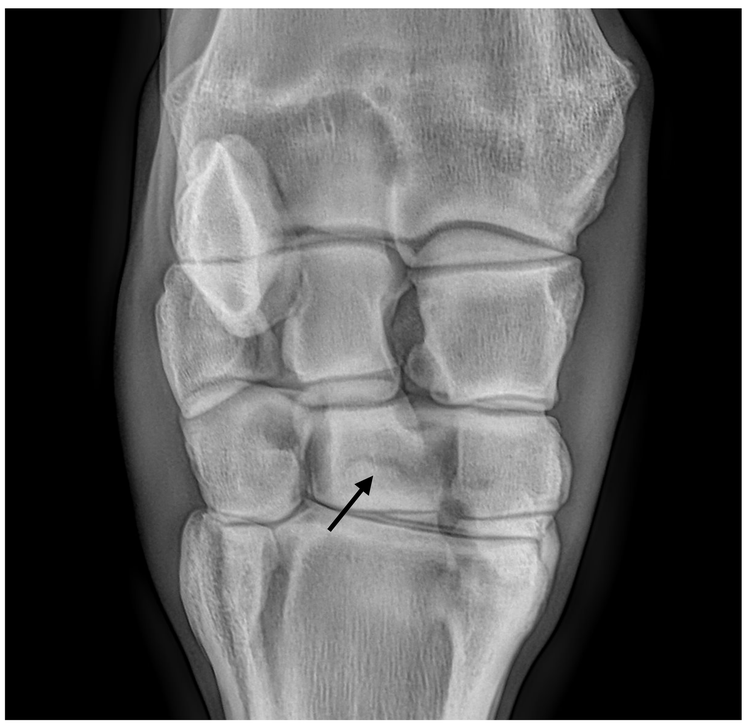

Fig. 1. Dorso-palmar radiograph of the right carpus. Black arrow highlights transverse radiolucent line in the third carpal bone.

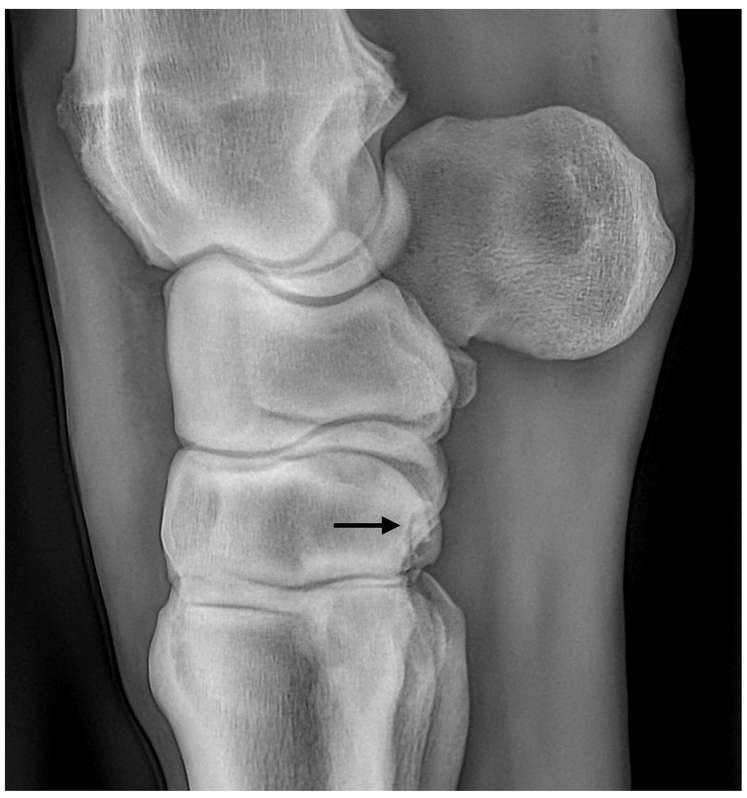

Fig. 2. Lateral to medial radiograph of the right carpus. Black arrow shows a fracture of the palmar distal aspect of the third carpal bone.

Low Field Standing MRI

In order to fully understand the nature and extent of the injury, magnetic resonance imaging of the right carpus was performed. A focal, standing low field magnetic resonance imaging (MRI) study of the right carpus (distal radius to proximal third metacarpus) was completed using a 0.27T, open standing magnet. Multiple sequences were acquired including T1 W GRE, T2*W GRE, STIR FSE and T2W FSE in sagittal, frontal and transverse planes.

The MRI showed a number of abnormalities within the carpus:

- An osseous fragment (measuring 4mm proximal to distal, 1.5cm medial to lateral and 4mm dorsal to palmar) that had fractured off the distal aspect of the palmar eminence of the third carpal bone (C3) (Figure 3).
- The fragment was associated with the soft tissues palmar to C3 including the palmar carpal ligament and the origin of the accessory ligament of the deep digital flexor tendon (AL-DDFT).
- Poorly defined region of moderate hyper-intensity within the palmar, medial aspect of the AL-DDFT.
- Marked, diffuse STIR hyper-intensity at the palmar aspect of the third carpal bone (Figure 4).
- Small region of demineralisation of the palmar, medial aspect of C3 in the region of the attachment of the palmar intercarpal ligament between the second carpal bone (C2) and C3. This area was also surrounded by mild sclerosis.
- Mild to moderate sclerosis of the trabecular bone of the dorsal, lateral aspect of the third carpal bone

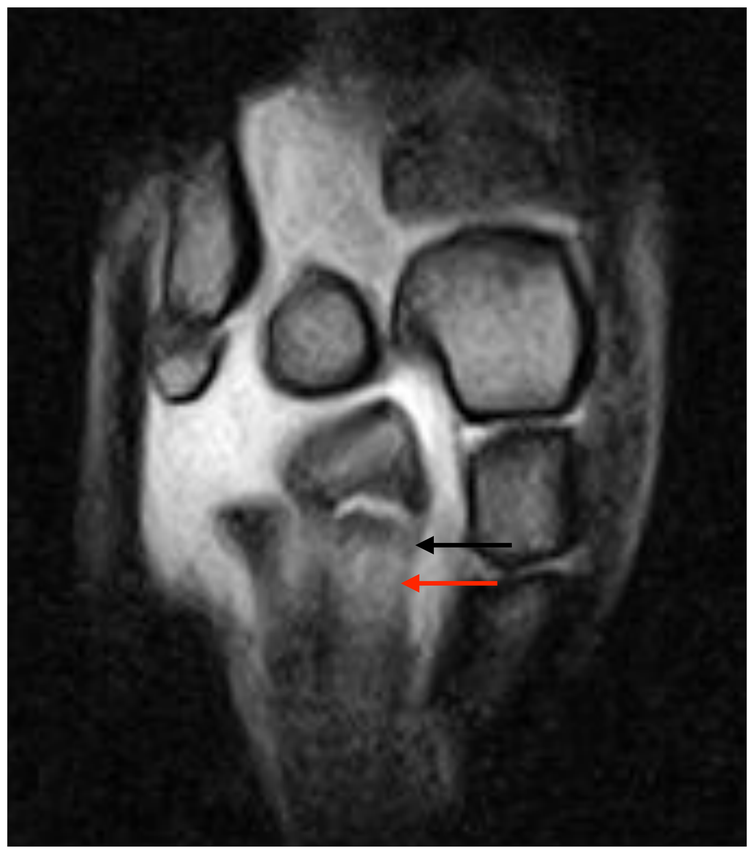

Fig. 3. Frontal T2*W GRE image obtained from the palmar aspect of the right carpus. Black arrow indicates osseous fragment. Red arrow indicates hyper intensity within the AL-DDFT.

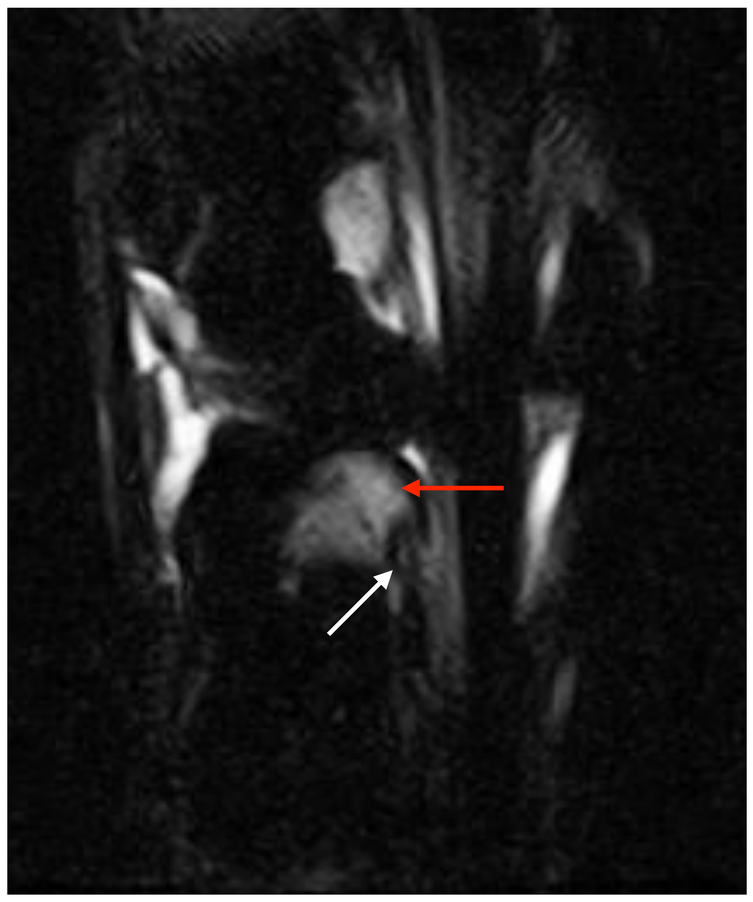

Fig. 4. Sagittal STIR image of the right carpus. Red arrow shows marked hyper intensity within the palmar portion of C3. White arrow indicates osseous fragment.

Treatment

The location and size of the fragment precluded surgical fixation or removal, therefore conservative therapy was advised. This consisted of the following:

- Peri-ligamentous injection of platelet-rich plasma (PRP) around the palmar third carpal bone and proximal AL-DDFT, 4 and 8 weeks post injury.
- Extracorporeal Shockwave Therapy (ESWT) of the affected area at 8 weeks post injury- 3 treatments, 2 weeks apart
- 8 weeks of strict box rest followed by another 8 weeks of small yard turnout.
- Repeat radiographs at 16 weeks.

Clinical Outcome

The horse is still in rehabilitation, however, examination 6 weeks post injury showed the lameness to have improved to grade 1/5 lame at the trot. The horse was mildly positive to carpal flexion and had no heat or pain on palpation of the palmar carpus.

Discussion

Even though the avulsion fracture was clearly identified on radiographs, the soft tissue structures within the carpus could not be accurately assessed by ultrasonography and required the use of standing MRI. The difficulty in diagnosing palmar carpal injuries has been established, especially in relation to the limitations of ultrasonography[1]. While endosteal irregularity on MRI at the palmar aspect of the third metacarpal bone in the region of the origin of the AL-DDFT have been reported, to the authors' knowledge, a case of palmar third carpal bone avulsion fracture has not been described[2].

This suggests that the injury is somewhat unique. Causes for both proximal AL-DDFT tearing and avulsion fracture of the origin of the suspensory ligament have been described and relate to hyperextension of the carpus[3]. AL-DDFT tearing is thought to occur when on impact, while the fetlock is in full extension, the carpus suddenly snaps into complete extension[3]. This results in a sudden increase in tensile forces. Presumably this fracture has occurred in a similar fashion however, the weakest point must have been within the palmar aspect of C3 instead of within the AL-DDFT. This is unusual as the majority of injuries to C3 occur in the dorsal, weight bearing portion of the bone and poses the question whether the endosteal irregularity is a preemptive marker for this injury.

The significance of intercarpal ligament injuries and their role in causing lameness is controversial. In this particular case there were irregularities associated with the insertion of the medial palmar intercarpal ligament (MPICL) onto C3, that correlate with ligament damage. Such findings could explain the long history of carpal pain that the horse had been experiencing and give support to the role of palmar intercarpal ligament injury in causing lameness.

The unusual nature of this injury means the precise cause, application of efficacious therapy and long term prognosis is difficult to determine. Platelet-rich Plasma (PRP) is widely used in the treatment of soft tissue injuries in the equine patient. Although unproven in the horse, human and laboratory studies have shown PRP to accelerate the histological union of fractures and increase bone strength[4]. ESWT is another treatment modality that is used for a range of musculoskeletal injuries. Although the direct mechanisms are unclear, it is known to stimulate osteogenic cells and promote neovascularisation at bone-tendon junctions[5].

The collective use of these treatment therapies, in conjunction with the extended rest period, aim to return this horse to full athletic capabilities.

Reference

1. Nagy A, Dyson S. The challenge of diagnosing soft tissue injuries in the palmar aspect of the carpus. Equine Veterinary Education 2014;26:353-356.
2. Nagy A, Dyson S. Magnetic resonance anatomy of the carpus of the horse described from images acquired from low-field and high-field magnets. Veterinary Radiology & Ultrasound 2011;52:273-283.
3. Rooney JR. Pathogenesis of three lesions causing lameness of the foreleg in horses. Journal of Equine Veterinary Science 1986;6:330-332.
4. Guzel Y, Karalezli N, Bilge O et al. The biomechanical and histological effects of platelet-rich plasma on fracture healing. Knee Surgery, Sports Traumatology, Arthroscopy 2015;23:1378-1383.
5. Wang CJ, Huang HY, Pai CH. Shock wave-enhanced neovascularization at the tendon-bone junction: An experiment in dogs. The Journal of Foot and Ankle Surgery 2002;41:16-22.