

Fractures of the palmar aspect of the carpal bones in horses: 10 cases (1984–2000)

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Objective—To determine clinical and radiographic findings, treatment, and outcome of horses with fractures of the palmar aspect of the radial carpal bone, with or without concurrent fractures of the palmar surfaces of the other carpal bones.

Design—Retrospective study.

Animals—10 horses.

Procedure—Medical records were reviewed to obtain information on history, signalment, clinical and radiographic findings, treatment, and outcome. Follow-up information was gathered from owners and referring veterinarians.

Results—7 horses became lame after recovery from general anesthesia for treatment of an unrelated problem. The remaining 3 horses developed a forelimb lameness after falling (1 horse) or being turned out in a pasture (2 horses). Fractures involved the palmar surface of the radial carpal bone in all 10 horses; in addition, the ulnar carpal bone was affected in 2 horses, the intermediate carpal bone in 2 horses, and the distal aspect of the radius in 4 horses. None of the 4 horses treated nonsurgically returned to work, and 3 were euthanatized because of recalcitrant lameness. In the other 6 horses, fragments were removed surgically. Two were euthanatized because of continued lameness, 1 was euthanatized for other reasons, 2 were sound enough for light work, and 1 returned to athletic work.

Conclusions and Clinical Relevance—Results suggest that fractures of the palmar aspect of the carpal bones are uncommon in horses. The prognosis appears to be poor for affected horses but may be better for horses that undergo arthroscopic removal of intra-articular fragments. (*J Am Vet Med Assoc* 2001;219:801–804)

Fractures of the carpal bones have been extensively documented in racehorses and predominantly involve osteochondral chip and slab fractures of the dorsal surfaces of these bones. Fractures of the distal aspect of the radius and of the radial, intermediate, and third carpal bones are the most common and are thought to be related to chronic cyclic loading and superimposed acute compressive forces.¹⁻⁴ Progressive subchondral bone sclerosis induced by repetitive trauma predisposes to fracture of these bones. The inflammatory response that follows results in synovitis and capsulitis and, if left untreated, osteoarthritis

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and recalcitrant lameness. Comminuted or crush fractures of the carpal bones, with subsequent severe lameness and instability of the carpal joint, have also been documented.⁵ Fracture of the accessory carpal bone is an uncommon, although well-recognized, fracture that is reported to occur predominantly as a result of a fall during racing over fences.⁶⁻⁸ Both hyperextension (bowstring effect) and compression between the radius and third carpal bone (nutcracker effect) have been proposed as possible etiologic mechanisms.

Fractures of the palmar surfaces of the carpal bones, however, are rarely described in the literature.⁹ A single case report¹⁰ describes fragment removal in a horse with a fracture of the palmar aspect of the intermediate carpal bone, and little other information is available on the pathogenesis of these fractures or on the clinical and radiographic signs in and outcome of affected horses. The purpose of the study reported here, therefore, was to determine clinical and radiographic findings, treatment, and outcome of horses with fractures of the palmar aspect of the radial carpal bone, with or without concurrent fractures of the palmar surfaces of the other carpal bones.

Criteria for Selection of Cases

Medical records of horses with forelimb lameness and subsequent radiographic evidence of a fracture of the palmar aspect of the carpal bones examined between 1984 and 2000 at the Cornell University Veterinary Medical Teaching Hospital, the Edisto Equine Clinic, or the Rochester Equine Veterinary Clinic were reviewed. Horses that had radiographic evidence of crushed carpal bones and carpal collapse were excluded.

Procedures

Medical record analysis—Signalment, history, clinical findings, results of diagnostic testing (including lameness examination, diagnostic intra-articular anesthesia, and radiography), surgical and necropsy findings, treatment, and outcome were obtained from medical records. Follow-up information was gathered from referring veterinarians and owners by means of a detailed questionnaire and telephone interviews.

Nonsurgical treatment—Treatment for horses that did not undergo surgical removal of fracture fragments consisted of stall rest and, in some instances, application of a cast or bandage to the injured limb. Some horses also received injections of hyaluronan into the antebrachio-carpal joint or IM injections of **polysulfated glycosaminoglycan (PSGAG)**. Physiotherapy, consisting of passive flexion of the carpal joint, was also performed in some horses.

Surgical treatment—In some horses, fracture fragments were removed by means of arthroscopy, performed with a 4-mm-diameter 30-degree angled arthroscope. A standard dorsolateral approach to the antebrachiocarpal joint⁹ with a dorsomedial instrument portal was used to explore the dorsal aspect of the joint. For access to the palmar aspect of the joint, an arthroscope portal was created in the caudomedial outpouching of the antebrachiocarpal joint. This outpouching was identified during arthroscopic examination of the dorsal aspect of the joint by inserting an obturator through the dorsomedial instrument portal and under the medial collateral ligament (Fig 1). Alternatively, the joint was distended with saline (0.9% NaCl) solution, and the caudomedial outpouching of the joint was identified by palpation. A caudomedial instrument portal was created about 2 cm proximal or distal to the arthroscope portal to allow adequate triangulation and manipulation of the fragments with a hook probe and Ferris-Smith rongeurs. Fragments were removed with rongeurs through the instrument portals. The fracture bed was débrided with straight and angled spoon and loop curettes. Areas of secondary cartilage fibrillation or eburnation were also débrided.

Results

Ten horses met the criteria for inclusion in the study. Seven horses had undergone general anesthesia for unrelated reasons between 1 day and 10 weeks prior to radiographic diagnosis of the carpal fracture.

For all 7, recovery from general anesthesia had been unassisted, and horses had been monitored routinely by a veterinary technician. Circumstances of the recovery had been recorded for only 2 horses; the recovery was described as rough for 1 horse and smooth for the other. Swelling of the carpus was evident soon after injury in all horses, and median time from general anesthesia to detection of carpal swelling was 5 days (range, 1 to 35 days). However, a diagnosis was not made until up to 70 days after general anesthesia (median, 14 days; range, 1 to 70 days). The remaining 3 horses developed a forelimb lameness after falling (1 horse) or being turned out in a pasture (2).

Horses included in the study consisted of 6 Thoroughbreds, 2 Arabians, 1 Quarter Horse, and 1 Warmblood. Horses ranged from 2 to 19 years old. There were 5 geldings, 4 mares, and 1 stallion.

Clinical findings at the time of initial examination included diffuse carpal swelling in horses that were examined within 2 weeks after the presumed injury. Effusion of the antebrachiocarpal joint was palpable in all horses; none of the horses had palpable effusion of the intercarpal joint. All horses had marked signs of pain on flexion of the carpal joint. In 1 horse, substantial improvement in the severity of the lameness was achieved by local anesthesia of the antebrachiocarpal joint; in the other horses, intra-articular anesthesia was considered unnecessary to make the diagnosis. Lameness was reported to range from mild to moderately severe at the time of initial examination; lameness grades were not assigned.

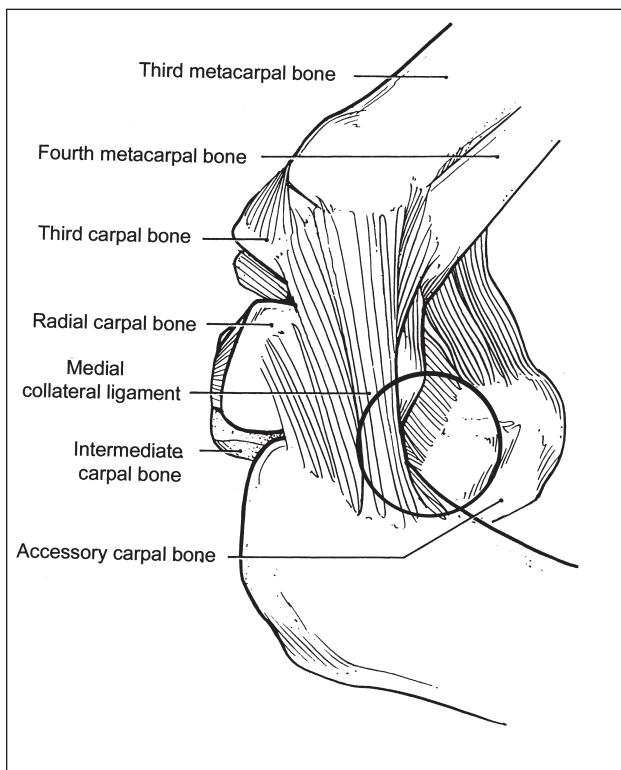


Figure 1—Diagram (left) of the anatomy of the medial aspect of the antebrachiocarpal joint in horses, depicted with the horse in dorsal recumbency and the distal aspect of the limb uppermost (adapted from Kainer RA. Functional anatomy of the equine locomotor organs. In: Stashak TS, ed. *Adams' lameness in horses*. 4th ed. Philadelphia: Lea & Febiger, 1987;24.). Area of the caudomedial joint pouch is circled. Photograph (right) showing the placement of arthroscopic and instrument portals in the caudomedial joint pouch of the antebrachiocarpal joint. Distal aspect of the limb is uppermost.



Figure 2—Dorsomedial-palmarolateral oblique radiographic projection of the carpal joint of a horse. The osteochondral chip fracture is located on the palmar aspect of the radial carpal bone (arrow).

In all horses, the fracture was evident on radiographs of the carpus. Osteochondral chips of various sizes could be seen at the palmar aspect of the radial carpal bone on the lateromedial and dorsomedial-palmarolateral oblique projections (Fig 2). In 8 horses, concurrent fractures of other bones were also recognized, including fractures of the caudodistal aspect of the radius (4 horses), the ulnar carpal bone (2), and the intermediate carpal bone (2). In some horses, fragments were difficult to demonstrate radiographically, and involvement of > 1 carpal bone was recognized on follow-up radiographs.

Four horses were treated without surgery. Treatment consisted of rest with or without IM administration of PSGAG and with or without application of a bandage or cast. One horse was retired from work and became a broodmare. The owner reported 4 years after the injury that the horse was comfortable at a walk but lame at a trot and had a reduced range of motion of the carpal joint. A second horse still had signs of pain during flexion of the carpal joint 6 months after the initial injury, along with radiographic evidence of osteoarthritis of the antebrachio-carpal joint, and was euthanized. The remaining two horses were found to be severely lame during follow-up examinations 6 and 14 months after the injury and were euthanized.

The remaining 6 horses all underwent surgical removal of the fracture fragments. Surgery was per-

formed between 14 and 210 days after the initial injury (median, 42 days; SD, 77 days) and consisted of arthroscopic removal of intra-articular osteochondral fragments via a palmaromedial approach (3 horses) or removal via a palmaromedial arthrotomy (3). Three horses returned to function as riding horses; mean time to return of function was 12 months (range, 6 to 18 months). Two horses were euthanized because of severe osteoarthritis 2 and 9 months after surgery, and 1 horse was euthanized after recovery from arthroscopic surgery because of triceps myositis. Mean time between injury and surgery was 6 weeks for the 3 horses that returned to function and 2 and 10 weeks for the 2 horses that were euthanized because of advanced osteoarthritis. Postoperative treatment consisted of administration of phenylbutazone for 2 to 4 weeks, intra-articular administration of hyaluronan, and IM administration of PSGAG. A bandage was applied after surgery in 1 horse, and a splint was applied after surgery in a second horse.

Discussion

Fractures of the palmar surface of the carpal bones are infrequently documented in the literature, and the mechanism for the fracture has not been described.^{9,10} In 7 horses in this study, fractures apparently occurred during recovery from general anesthesia, suggesting that trauma during recovery may be an important predisposing factor. Conversely, the variation in age, breed, sex, and occupation of the affected horses suggests that these are not predisposing factors. Characteristics of the recovery were reported for only 2 horses, and although the recovery was reportedly rough for 1 of these horses, it was reportedly smooth for the other. Given this, it seems unlikely that prevention is possible during routine unassisted recovery. However, development of a forelimb lameness in a horse in association with carpal swelling after recovery from general anesthesia warrants radiographic assessment. Most importantly, results for the horses described in the present report would seem to suggest that surgical removal of the fragments may improve an otherwise poor prognosis for return of function.

Results following nonsurgical treatment of 4 horses in the present study were generally poor, and many factors likely contributed to the lack of improvement in these horses. One important factor may have been the lack of knowledge of the prognosis for horses with these types of fractures. Several previous reports^{3,11,12} of horses with carpal bone chip fractures do not mention any horses with fractures of the palmar aspects of the bones, and without any literature to support the need for surgical treatment, the prevailing opinion may be that these fractures are not as clinically important as fractures of the dorsal aspects of the carpal bones.

Three of the 6 horses in this study that underwent surgery did improve and returned to function as riding horses. Arthroscopic débridement of the antebrachio-carpal joints revealed concurrent articular cartilage damage in several of these horses, and this may have contributed to the poor outcome in 3 horses. A delay in diagnosis and initiation of definitive treatment also was a common finding. Median times from injury to

diagnosis and injury to surgical treatment were 14 and 42 days, respectively. This suggests that the affected joint should be explored as soon after the injury as possible and that the prognosis may depend on the severity of concurrent damage to articular surfaces and the degree of preexisting osteoarthritis.

In our opinions, arthroscopy provided a better assessment of the articular surfaces than did arthrotomy in these horses. However, arthroscopic approaches to the palmar surfaces of the carpal bones have not been described in any detail previously,^{9,13} and arthroscopic approaches to the palmar articular surfaces of the ulna and the intermediate carpal bone are still not well defined. The limited access for arthroscopic and instrument portals posed a problem, but with planning, we were able to create arthroscopic and instrument portals in the caudomedial pouch of the antebrachio-carpal joint. Owners should be forewarned about the possible need for arthrotomy for removal of large fragments.

The cause of the fractures in these horses is conjectural. Potentially, these fractures could be a result of a nutcracker effect, with crushing of the palmar perimeter of the radial carpal bone against the caudal aspect of the radius, when horses fall with the carpal joints flexed. A similar mechanism has been proposed for fractures of the accessory carpal bone.^{7,14} Horses certainly have an opportunity to fall with their carpal joints flexed during recovery from anesthesia, and the horse that developed this fracture during a fall was seen to have fallen onto its carpus during race training. The rotary action of the antebrachio-carpal joint provides a mechanical endpoint to flexion, where the palmar articular surface of the radial carpal bone would be exposed to substantial shear stress because of the concave architecture of the palmar articular table of this bone and the relative mass of the radial facet of the radius, compared with the smaller articulations of the radius with the intermediate and ulnar carpal bones.¹⁵ Most fractures involved the most medial portion of the palmar surface of the radial carpal bone, but there were no apparent anatomic reasons for this.

Inflammatory mediators initiated and maintained by the fracture fragments and any concurrent cartilage injury most likely led to the generalized osteoarthritis seen during surgery and follow-up examinations of many of these horses.¹⁶ Medical treatment to control these degenerative changes, including intra-articular administration of hyaluronan and IM administration of PSGAG, was apparently ineffective in horses in which fracture fragments were not removed. Outcomes were

slightly better for horses that underwent fracture fragment removal, but the initial cartilage injury and the delay in surgery probably allowed for development of irreversible osteoarthritis.

Nonsurgical treatment of horses with vertical fractures of the accessory carpal bone or avulsion fractures of the palmar fibrocartilage of the carpus has been recommended.^{7,9} Additional case numbers would be required to evaluate the benefits of early detection and fragment removal in horses with fractures of the palmar aspect of the carpal bones, but results for horses in this study suggest that fractures of the palmar aspect of the radial carpal bone are far from innocuous and that fracture fragments should be removed surgically as soon after the diagnosis is made as possible.

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