

Arthroscopic removal of discrete palmar carpal osteochondral fragments in horses: 25 cases (1999–2013)

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Objective—To characterize discrete palmar carpal osteochondral fragmentation in horses and to document the effect of osteoarthritis and surgical removal of these fragments on functional outcome.

Design—Retrospective case series.

Animals—25 horses.

Procedures—Medical records and radiographic views were reviewed to identify horses that had radiographic evidence of palmar carpal fragmentation, which was subsequently treated by arthroscopic removal. Information collected included cause of fracture, initial and long-term clinical and radiographic findings, and functional outcome.

Results—Palmar carpal fragmentation of 30 carpal bones was identified in 25 unilaterally affected horses. A known traumatic event was reported to cause the fragmentation in 17 of the 25 (68%) horses. Of the 25 horses, 17 (68%) had fragmentation involving the antebrachiocarpal joint, 7 (28%) had fragmentation involving the middle carpal joint, and 1 (4%) had fragmentation involving the carpometacarpal joint. The proximal aspect of the radial carpal bone was the most commonly affected site (12/30 fragments), followed by the accessory carpal bone (6/30). Of the 25 horses, 19 (76%) were not lame (sound) after surgery and returned to their intended use, 4 (16%) were considered pasture sound, and 2 were euthanized (because of severe postoperative osteoarthritis or long bone fracture during recovery from anesthesia). Eight of the 14 horses with preoperative evidence of osteoarthritis returned to function after surgery. Twelve of 17 horses with antebrachiocarpal joint fragments and 6 of 7 horses with middle carpal joint fragments returned to their previous use.

Conclusions and Clinical Relevance—Results indicated that the prognosis for horses after arthroscopic removal of palmar carpal osteochondral fragments is good. Early intervention, before the development of osteoarthritis, is recommended. (*J Am Vet Med Assoc* 2015;246:998–1004)

The carpus is one of the most common locations for osteochondral fragmentation in horses, especially in racehorses.^{1–6} Fragmentation can result from an acute injury or more commonly from chronic pathological changes in the joint margin. These fragments typically develop on the dorsal margin of the joint and result from stresses created during hyperextension.^{2–5} The incidence of fragmentation is slightly higher for the MCJ than for the ABCJ. The distal aspect of the RCB is most commonly affected, followed by the distal aspect of the radius and proximal aspect of the ICB.^{1–5} The arthroscopic approach to the dorsal aspect of the carpus is well documented, and most surgeons consider the surgery routine.^{3,6} For affected racehorses, prognosis for return to racing is good, provided surgery is performed without delay and severe joint damage has not led to development of osteoarthritis.^{1–3}

Discrete PCOFs can also occur; however, such fragmentation is much less common than dorsal chip fracture.^{3–6} The cause of a PCOF is likely to be a single traumatic event, such as a fall or an injury incurred during recovery from anesthesia.^{4,5} Compression between the radius and the affected carpal bone, which can create a nutcracker effect, has been proposed as a possible etiologic mechanism.^{4,5} In a series of 10 horses described by Wilke et al,⁴ the prognosis for return to function was considered poor, with 6 horses being euthanized. Only 3 of the horses returned to work, all of which underwent arthroscopic removal of intra-articular fragments, suggesting that such surgical treatment may improve the prognosis.

ABBREVIATIONS	
ABCJ	Antebrachiocarpal carpal joint
ACB	Accessory carpal bone
CMCJ	Carpometacarpal joint
ICB	Intermediate carpal bone
MCJ	Middle carpal joint
PCOF	Palmar carpal osteochondral fragment
RCB	Radial carpal bone
UCB	Ulnar carpal bone

In a retrospective analysis⁵ of outcomes for 31 racehorses with various types of PCOFs, prognosis for return to racing was considered fair, with 16 of 31 (51.6%) horses returning to racing. Most horses in that study un-

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derwent arthroscopic removal of the PCOFs. Over half of the horses had fragments that were very small (< 3 mm [ie, dust]), numerous (> 2 fragments), and thought to originate from major fracture lines in the dorsal portions of the carpal bones. Horses with these small fragments, which were indicative of a more chronic, diffuse joint disease, had the worst outcomes, with causative mechanisms likely similar to those proposed for disease in the dorsal aspect of the carpus in racehorses.⁵ Horses with large (> 9 mm in diameter), solitary fragments that originated in the palmar aspect of the joint, as described by both Getman et al⁵ and Wilke et al,⁴ made up only 3 cases reported by Getman et al.⁵ These horses had the best outcome after arthroscopic removal.⁵

To our knowledge, there still is little information available on the distribution of large discrete PCOFs and resolution of lameness (return to soundness) following arthroscopic removal of fragments in horses. The purpose of the study reported here was to characterize discrete PCOFs in horses and to document the effect of osteoarthritis in the affected joints and surgical removal of these fragments on the horses' functional outcome.

Materials and Methods

Criteria for selection of cases—Medical records of horses with forelimb lameness and subsequent radiographic evidence of PCOFs that underwent arthroscopic removal of fragments at Cornell University and affiliates between 1999 and 2013 were reviewed. Horses described in a previous publication⁴ were excluded.

Medical records review—History (cause and time from injury or development of clinical signs to surgery), signalment, affected limb, affected joint (ABCJ, MCJ, or CMCJ), diagnostic imaging findings, arthroscopic approach used for surgery, and arthroscopic findings were obtained from the medical records. The site of lesions in the palmar aspect of the joint was categorized as follows: proximal aspect of the RCB, distal aspect of the RCB, proximal aspect of the UCB, distal aspect of the UCB, ACB, proximal aspect of the ICB, distal aspect of the ICB, proximal aspect of the fourth carpal bone, or proximal aspect of the fourth metacarpal bone. Radiographic views of the affected joint were subjectively evaluated for evidence of osteoarthritis such as joint space narrowing, sclerosis, and osteophytosis; no specific grading of osteoarthritis severity was applied. If radiographic signs of osteoarthritis were present, the joint was deemed to have preoperative osteoarthritis. Postoperative radiographic views or reports in the medical record were assessed for the presence or development of osteoarthritis. Follow-up information (obtained 12 months to 12 years after surgery) regarding postoperative soundness and return to work was obtained by telephone interview with the owners or referring veterinarians and, for racehorses, by analysis of online race records.^{a,b}

Surgical treatment—All horses were anesthetized and underwent arthroscopic examination and removal of the fragments from the affected joint. Each horse was positioned in dorsal recumbency with the forelimb suspended in partial flexion (25° to 30°).^{3,6} For fractures involving the ABCJ, a standard arthroscopic approach to

the dorsal aspect of the carpus was performed initially with a 4-mm-diameter 30° arthroscope (Figure 1).³ This was followed by an appropriate approach to the palmar aspect of the joint as described by Cheetham and Nixon⁶ and Wilke et al.⁴ An arthroscope portal was created in the palmaromedial or palmarolateral outpouching of the joint depending on the location of the palmar fragment. Briefly, the ABCJ palmar pouches were approached medially, 1 to 2 cm palmar to the medial collateral ligament at the level of the distal aspect of the radius, or approached laterally at the palpable distension proximal to the ACB and accessorioulnar ligament, at the level of the physical remnant of the distal aspect of the radius. The MCJ palmar pouch was approached at the medial palpable distension just palmar to the medial collateral ligament, and the MCJ lateral pouch was approached 10 to 15 mm palmar to the lateral collateral ligament and between the accessoriocarpoulnar ligament and the accessorioquartal ligament. A palmaromedial or palmarolateral instrument portal was created approximately 2 cm dorsal and proximal or distal to the arthroscope portal to allow adequate triangulation and manipulation of the fragments with a hook probe and Ferris-Smith rongeurs. A motorized resector was used initially to clear proliferative synovium to create a working space around the fracture. Fragments were freed with an elevator (alternated with a motorized resector for visualization) and finally removed with rongeurs through the instrument portals. The fragment bed was debrided with curettes and biopsy rongeurs, with occasional smoothing of the soft poorly attached bone with a motorized synovial resector. Areas of secondary full-thickness cartilage fibrillation or eburnation were also debrided down to healthy bone when fibrillation was deep or bone was exposed. Joints were thoroughly lavaged with sterile fluids, skin portals were closed in a simple interrupted pattern with 2-0 polypropylene suture, and a full limb bandage was placed for recovery.

Postoperative management—Sutures were removed in aseptic fashion 2 weeks after surgery, and a full limb bandage was maintained for 3 weeks after surgery. All horses underwent a routine postoperative rehabilitation program. This involved strict stall rest until suture removal followed by gradual increases in handwalking (5- to 10-minute increases in exercise duration/wk) for 6 weeks, followed by small pen rest for 1 month, and then light riding pending recheck clinical and radiographic examinations until resuming full work at 3 to 6 months after surgery if the horse was free of signs of discomfort. Systemic (IV, IM, or PO) or intra-articularly administered chondroprotectives such as hyaluronic acid and polysulfated glycosaminoglycan were recommended.^{3,4} To help maintain joint mobility, the horses' caregivers were advised to perform passive range of motion exercises, including flexion and extension of the carpus to the greatest degree that the horse would tolerate, twice daily for the first 2 months after suture removal.

Follow-up analysis—Outcome information was obtained by telephone interview with the owner, trainer, or referring veterinarian, and from online race records for racehorses. For racehorses, race records were obtained from computerized databases.^{a,b} When avail-

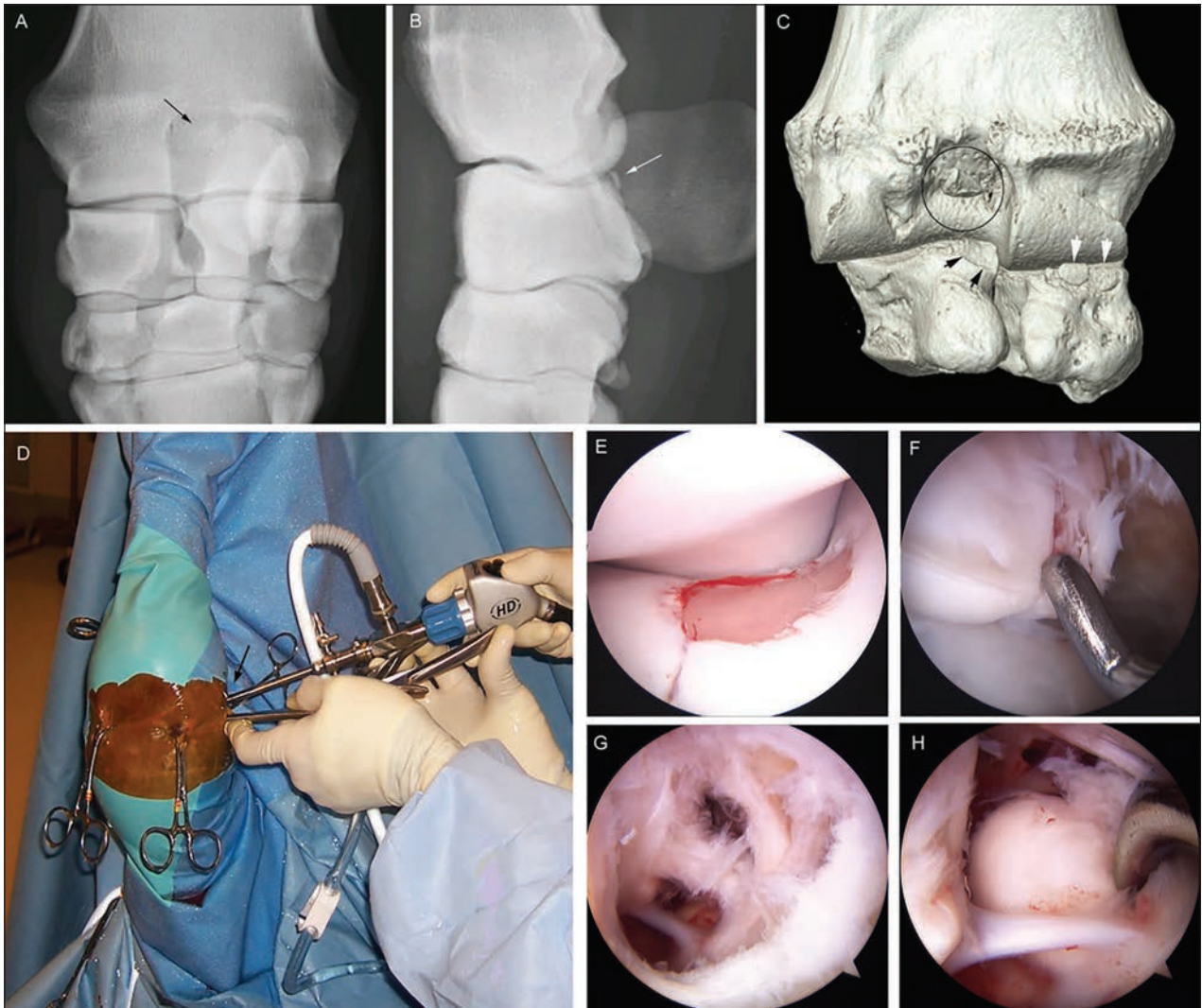


Figure 1—Representative radiographic (A and B), CT (C), intraoperative photographic (D), and arthroscopic (E through H) images of the left carpus in a horse that had radiographic evidence of multiple PCOFs, which were resolved by arthroscopic removal. A—Preoperative dorsopalmar radiographic view. Notice a single large proximal PCOF (arrow) associated with the ICB. B—Lateromedial radiographic view. An additional PCOF (arrow) associated with the proximal aspect of the RCB in the ABCJ is visible. C—Three-dimensional reconstructed CT image (palmar view) of the left carpus. The proximally displaced ICB fragment (circle), the fracture bed on the ICB (black arrows), and proximal RCB fragments (white arrows) are visible. D—Intraoperative photograph obtained during the arthroscopic procedure for PCOF removal in this horse. The image illustrates the approach to the palmar, medial aspect of the ABCJ (black arrow) with towel clamps in the routine dorsal approach. E—Arthroscopic image of the dorsal aspect of the ABCJ. Notice the cartilage erosion on the distal aspect of the radius. F—Arthroscopic image of the palmar medial aspect of the ABCJ. The probe is placed on one of the RCB fragments. G—Arthroscopic image of the palmar central aspect of the ABCJ. Prior to synovial resection, synovial webbing is present in the proximal, palmar radial fossa. H—Arthroscopic image of the palmar central aspect of the ABCJ following development of a working space; the probe is placed on the ICB fragment.

able, postoperative radiographic views (obtained 3 and 6 months after surgery) were examined for the presence or progression of osteoarthritis, compared with preoperative radiographic views. Outcome data were assessed to determine survival time, final degree of lameness (ie, noticeably lame [unsound], pasture sound, or sound for work), return to function (ie, level of the horses' previous activity [at previous level, at a reduced level, or unable to function]), and degree of osteoarthritis on postoperative radiographic views.

Statistical analysis—The effect of horse age, joint involved, carpal bone fracture site, interval from initial clinical signs to surgery, cause of the fracture (if

known), and presence of preoperative osteoarthritis in the affected joint on outcome were assessed for significance by Wilcoxon rank sum tests. Values of $P \leq 0.05$ were considered significant.

Results

Clinical data—Twenty-five horses with forelimb lameness and subsequent radiographic evidence of PCOFs that underwent arthroscopic removal of fragments were identified during the medical records review; all 25 horses were included in the study. There were 6 females, 16 geldings, and 3 stallions. The horses' ages ranged from 1 to 15 years (mean age, 7.36 years).

Breeds included Thoroughbred (n = 11), warmblood (9), Quarter Horse (3), Standardbred (1), and Lusitano (1). Each horse was lame in only the 1 affected forelimb (14 left and 11 right forelimbs). The PCOFs were presumed to have been generated by a fracture resulting from a known traumatic injury or fall in 9 (36%) horses, and as a complication of recovery from anesthesia (not hand recovered) in 8 (32%) horses. The cause of the fragmentation in the remaining 8 (32%) horses was unknown. The horses with an unknown cause of PCOFs generally had a more insidious onset of lameness, whereas the horses with an apparent traumatic cause had obvious swelling of the carpal region and lameness associated with the traumatic event. The time from initial clinical signs to surgery was known for 21 cases (data were not available for 4 horses that had PCOFs in the MCJ) and ranged from 1 week to 18 months (median, 2 months), illustrating that diagnosis and subsequent treatment were often delayed despite onset of lameness.

Palmar osteochondral fragmentation was identified in 30 carpal bones in the 25 horses (Table 1). Of the 25 horses with PCOFs, 17 (68%) had an affected ABCJ, 7 (28%) had an affected MCJ, and 1 (4%) had an affected CMCJ (fracture location at the proximal aspect of the fourth metacarpal bone). Fracture locations in the 17 ABCJs included the proximal aspect of the RCB (n = 8; Figure 2), ACB (4), proximal aspect of the RCB

and UCB (1), proximal aspect of the RCB and ICB (2; Figure 1), and proximal aspect of the UCB and ACB (2). Fracture locations in the 7 MCJs included the distal aspect of the RCB (n = 2), distal aspect of the UCB (3), distal aspect of the ICB (1), and proximal aspect of the fourth carpal bone (1). The most commonly fractured sites were the proximal aspect of the RCB (11/30 [37%] fragments), followed by the ACB (6/30 [20%] fragments). Radiographic changes consistent with osteoarthritis were evident prior to surgery in 14 of 25 (56%) cases. Evidence of osteoarthritis was more prevalent ($P = 0.02$) in the ABCJ (12/17 horses), compared with the MCJ (1/7 horses).

All 25 horses underwent arthroscopic removal of PCOFs via a palmar approach to the joint.⁴⁻⁶ A dorsal approach to the ABCJ was used initially³ for fractures involving the proximal palmar perimeter of the RCB or ICB. For these fractures, cartilage erosions on the distal aspect of the radius were common (Figure 1) and were considered to result from impact and torsional trauma at the time of the original injury. Microfracture was used in 7 horses and stem cell implantation in 1 horse to enhance cartilage repair after debridement of the radius. All joints had synovial membrane hypertrophy and fibrosis regardless of fracture location. Palmar approaches required needle insertion to develop the instrument portal for synovial resection and to establish a working space for palmar fragment visualization and

Table 1—Summary of various characteristics of 25 horses that had radiographic evidence of PCOFs, which were resolved by arthroscopic removal.

Variable	ABCJ (n = 17)	MCJ (n = 7)	CMCJ (n = 1)	P value
Fracture site				—
Proximal aspect of RCB	8	0	0	
ACB	4	0	0	
Proximal aspect of RCB and ICB	2	0	0	
Proximal aspect of UCB and ACB	2	0	0	
Proximal aspect of RCB and UCB	1	0	0	
Distal aspect of the RCB	0	2	0	
Distal aspect of the ICB	0	1	0	
Distal aspect of the UCB	0	3	0	
Proximal aspect of fourth carpal bone	0	1	0	
Proximal aspect of fourth metacarpal bone	0	0	1	
Cause				—
Complication of recovery from anesthesia	7	1	0	
Known injury or fall	8	0	1	
Unknown	2	6	0	
Interval from initial clinical signs to surgery* (mo)	0.25–6	1–12†	18	0.09
Preoperative osteoarthritis‡				0.02
Yes	12	1	1	
No	5	6	0	
Outcomes§				0.008
Not lame (sound) and returned to previous use	12	6	1	
Pasture sound	3	1	0	
Euthanized	2	0	0	

Values are number of horses, with the exception of the data for the interval from initial clinical signs to surgery. One joint in each horse was affected; there were 30 fragments detected in the 25 horses.

*Interval between time of initial clinical signs and surgery influenced outcome, albeit not significantly ($P = 0.09$); generally, a longer interval between injury and surgery had a negative impact. †Interval from time of initial clinical signs to surgery was unknown for 4 horses that had PCOFs in the MCJ. ‡Evidence of preoperative osteoarthritis was significantly ($P = 0.02$) more prevalent in the ABCJ (12/17 horses) than in the MCJ (1/7 horses). §Presence of osteoarthritis significantly ($P = 0.008$) reduced extent of return to function after fragment removal.

— = Not reported.

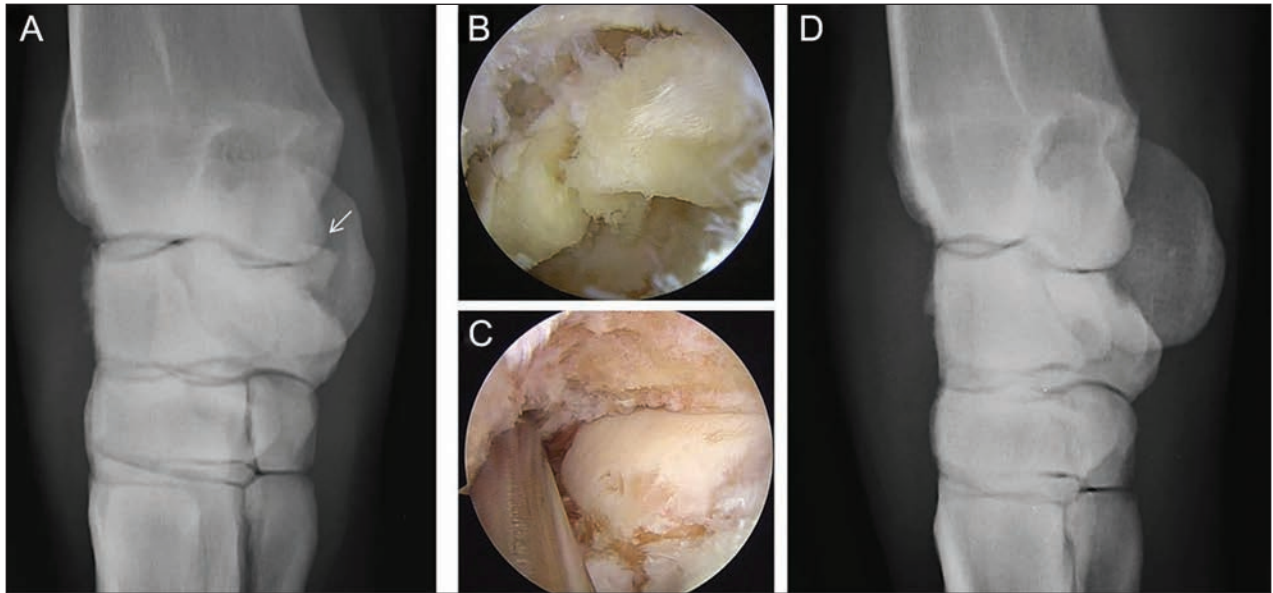


Figure 2—Representative radiographic (A and D) and arthroscopic (B and C) images of the right carpus in another horse that had radiographic evidence of a PCOF involving the proximomedial aspect of the RCB, which was resolved by arthroscopic removal. A—Preoperative dorsomedial-palmarolateral oblique radiographic view. Notice the changes consistent with osteoarthritis in the ABCJ and a single large PCOF (arrow) associated with the proximal aspect of the RCB. B—Arthroscopic image of the RCB fragment in the ABCJ following debridement with a shaver and fragmentation with a small osteotome. C—Arthroscopic image of the ABCJ illustrating the successful removal of the RCB fragment. D—Postoperative dorsomedial-palmarolateral oblique radiographic view of the ABCJ illustrating the successful removal of the RCB fragment.

removal.⁶ Three large RCB fragments required division for removal (Figure 2). All fragments were successfully removed arthroscopically.

Outcome—Follow-up information was available for all 25 horses (Table 1). Nineteen of the 25 (76%) horses were considered sound and returned to intended use (riding, jumping, or racing). Among the other 6 of the 25 (24%) horses, 4 (16%) were considered pasture sound, 1 (4%) was euthanized at 1 year after surgery because of severe osteoarthritis (proximal aspect of the RCB [preoperative osteoarthritis had been present]), and 1 (4%) was euthanized as a result of a fractured humerus during recovery from anesthesia for PCOF removal. The interval from initial clinical signs to surgery (recorded for 17/25 horses) influenced outcome; a longer interval from injury to surgery had a negative, albeit not significant ($P = 0.09$), impact. Presence of osteoarthritis prior to surgery significantly ($P = 0.008$) reduced the return to function after fragment removal. All of the horses without osteoarthritis at the time of surgery returned to their previous work function, whereas only 8 of 14 horses with osteoarthritis returned to their previous use. The joint affected ($P = 0.47$) and fracture location ($P = 0.48$) had no significant influence on outcome, with many horses returning to previous function regardless of fracture site. Twelve of 17 horses with fragments in the ABCJ, 6 of 7 horses with fragments in the MCJ, and the 1 horse with proximal fourth metacarpal bone fragmentation in the CMCJ returned to work. Of the horses with involvement of the proximal aspect of the RCB (most common site), only 7 of 11 returned to work. One horse with an ICB PCOF developed an RCB palmar fracture during the rehabilitation period, leading to a poorer outcome; during surgery, this horse

was noted to have soft, crumbling bone. All 8 horses that had an unknown cause of the PCOFs, 7 of 9 horses that had an injury or fall, and 4 of 8 horses that had a traumatic event during recovery from anesthesia returned to work function.

Discussion

Results of the present study indicated that fractures originating from the palmar aspect of the carpus in horses appear to occur more frequently than previously recognized and have an impact on return to previous function. In the present study, the palmar proximal aspect of the RCB was most frequently fractured. The outcome data indicated that prognosis for affected horses to return to work following arthroscopic removal of the PCOFs was fair to good. The interval from injury to surgery and the existence of preoperative osteoarthritis were critical in determining the extent of the horses' return to function.

A majority of the horses (17/25 [68%]) in the present study had a known traumatic event that most likely resulted in formation of the PCOFs. These horses generally had worse outcomes than those where the cause of fragmentation was unknown. Additionally, horses without a known cause of PCOF typically had a more insidious onset of lameness, compared with horses with a traumatic cause, wherein notable swelling and lameness was evident soon after the event, suggesting a difference in the severity or effect of the fracture. Of the horses that had a traumatic initiating event, those that developed PCOFs as a complication of recovery from anesthesia had worse outcomes (only 4/8 horses returned to intended use), compared to those that developed PCOFs as a result of a known traumatic injury

or fall (with 7/9 horses returned to intended use). This finding could be attributable to the nature of the injury, with a poorly controlled fall in the disoriented anesthetic recovery phase resulting in axial impact and rotational forces in excess of simple hyperflexion. Alternatively, it may simply reflect a lack of early detection and treatment of the fracture because the clinicians were focused on the original problem requiring the anesthesia (often colic).^{4,5} Horses with witnessed falls onto a flexed carpus in the present study most commonly had PCOFs of the RCB, which supported carpal hyperflexion and a nutcracker effect on the RCB as the causative mechanism.^{4,5} The formation of PCOFs in the MCJ may occur via a slightly different mechanism because of the joint's hinged mechanics of motion and consistently smaller fracture dimension. Small fractures in the MCJs would affect less weight bearing area and likely contributed to the better outcomes for horses with PCOFs in the MCJ.

To help decrease the risk of PCOF formation, hand-assisted recovery should be considered for horses that undergo prolonged periods of anesthesia or that are anticipated to be weak or in pain during recovery from anesthesia. Additionally, wrapping the forelimbs (specifically around the carpi) with thick bandaging may help prevent hyperflexion to the extent required for the development of PCOFs. Following recovery from anesthesia, a swollen and evidently painful carpus in a horse should not be overlooked and radiography should be performed as soon as possible to rule out a PCOF. Additionally, a PCOF can easily be overlooked unless the palmar aspects of the carpal bones are carefully scrutinized and multiple radiographic views are used to delineate all the palmar surfaces. Even then, CT may reveal additional fractures and should be considered immediately prior to repair for fractures involving the ABCJ.

The proximal aspect of the RCB followed by the ACB were the most commonly affected sites for PCOF. An event that causes a horse to fall and hyperflex the carpus creates a nutcracker effect primarily on the RCB and the ACB between the radius and third carpal bone.^{4,5} This is likely a result of the rotary action of the ABCJ and the substantial shear stress from the radius on the palmar articular table of the RCB.⁴ Horses with ABCJ fragments and specifically proximal RCB involvement had worse outcomes and rapid progression of osteoarthritis, which was likely attributable to a more important articular weight-bearing role of the RCB. These lesions were also associated with cartilage erosion of the distal aspect of the radius. Both factors likely contributed to instability and the rapid onset of osteoarthritis as well as the poor outcomes for horses with PCOFs of the RCB. Concurrent soft tissue injury, such as collateral and intercarpal ligament rupture, which could contribute to joint instability and development of osteoarthritis and a worse prognosis,^{5,7-10} was evident in only 1 horse in the present study (which returned to work) and was presumed to not be a factor in outcome. Bone quality should be assessed during surgery; in more chronic cases, horses with osteoarthritis may have more fragile bone that, despite debridement, could refragment after surgery.³ One horse with an ICB PCOF developed a PCOF of the RCB during the rehabilitation period, leading to a poorer outcome; during surgery, this horse was noted to have soft, crumbling bone.

The outcomes in the present study were better than those previously reported for horses with PCOFs.^{4,5} Clinicians are becoming more aware of this type of fragmentation and initiating treatment earlier. All the horses in the present study had arthroscopic removal of the fragments, rather than conservative management or an arthrotomy. In a study⁴ of 10 horses, all horses that underwent conservative management had poor outcomes; only 3 horses (all of which had arthroscopic surgery) returned to some level of work. In another study,⁵ horses with small, multiple palmar fragments frequently had more generalized and severe dorsal carpal injury, with small comminuted fragments that translocated palmarly, compared with the solitary palmar origin fragmentation evident in the present study population. As one might expect, the outcome for horses with comminuted carpal injury was poorer (16/31 [52%] returned to racing),⁵ compared with the reported return to function after discrete palmar fracture⁵ and compared with outcome in the present series (19/25 [76%] horses returned to work).

Arthroscopic techniques for treatment of disease in the palmar pouches of the carpus have improved over time. Cheetham and Nixon⁶ described arthroscopic approaches to the palmar pouches of the carpal joints that can be used for the examination and removal of PCOFs. A routine dorsal approach to the ABCJ should be used initially in horses with PCOF of the RCB and ICB to assess the overall health of the joint and to address any lesions that extend dorsally. Examination of the dorsal regions of the MCJ in cases with PCOF of the UCB, fourth carpal bone, or distal aspect of the RCB is generally not necessary. The approach to the palmar pouches varies depending on the location of the PCOF. There are 5 described approaches to the palmar aspect of the carpal joints, lateral and medial approaches to both the ABCJ and MCJ, and a lateral approach to the CMCJ.^{6,11}

In the present study, all horses underwent a rehabilitation program after surgery. A period of rehabilitation should allow sufficient time for the bone to remodel, the cartilage to repair, and any soft tissue injuries to heal. However, it is important to begin light handwalking and range of motion exercises after suture removal to help prevent joint capsule fibrosis and loss of mobility. There is some evidence that intra-articular or systemic administration of chondroprotectives minimizes the progression and development of osteoarthritis,^{3,4} and such treatment was recommended in the management of all of the horses of the present study. Horses with severe cartilage erosion, which was typically seen on the distal aspect of the radius associated with a PCOF of the RCB, may benefit from regenerative efforts such as microfracture³ (used in 7 horses) or use of stem cells.¹²

Potential shortcomings of the present study included the small number of cases with fractures at each location, which made further statistical comparisons with sufficient power impossible. Yet, some useful generalizations could be made. The radiographic extent of osteoarthritis and integrity of the joint surface at the time of surgery were not graded but simply classified as present or absent, so the degree of change relative to outcome could not be specifically evaluated. The horses in the present

study were often evaluated by the referring veterinarian after surgery, providing more objective lameness data and radiographic assessment of osteoarthritis. However, the horses performed at different athletic levels and in different disciplines (less than half were racehorses); this made an objective analysis of performance outcome very difficult, which is an inherent shortcoming of many retrospective studies. Nevertheless, results of the present study indicated that the prognosis for return to function for horses following arthroscopic removal of PCOFs is good. Early intervention, before the development of osteoarthritis, is essential.

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From this month's AJVR

Effect of long-term oral administration of a low dosage of clenbuterol on body fat percentage in working and nonworking adult horses

Rose D. Nolen-Walston et al

Objective—To determine the anabolic and lipolytic effects of a low dosage of clenbuterol administered orally in working and nonworking equids.

Animals—8 nonworking horses and 47 polo ponies in active training.

Procedures—Each polo pony continued training and received either clenbuterol (0.8 mg/kg) or an equal volume of corn syrup (placebo) orally twice daily for 21 days, and then was evaluated for another 21-day period. Nonworking horses received clenbuterol or placebo at the same dosage for 21 days in a crossover trial (2 treatments/horse). For working and nonworking horses, percentage body fat (PBF) was estimated before treatment and then 2 and 3 times/wk, respectively. Body weight was measured at intervals.

Results—Full data sets were not available for 8 working horses. For working horses, a significant treatment effect of clenbuterol was detected by day 3 and continued through the last day of treatment; at day 21, the mean change in PBF from baseline following clenbuterol or placebo treatment was -0.80% (representing a 12% decrease in PBF) and -0.32% , respectively. By day 32 through 42 (without treatment), PBF change did not differ between groups. When treated with clenbuterol, the nonworking horses had a similar mean change in PBF from baseline from day 6 onward, which peaked at -0.75% on day 18 (an 8% decrease in PBF). Time and treatment had no significant effect on body weight in either experiment.

Conclusions and Clinical Relevance—Among the study equids, long-term low-dose clenbuterol administration resulted in significant decreases in body fat with no loss in body weight. (*Am J Vet Res* 2015;76:460–466)



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