

Arthroscopic removal of fracture fragments involving a portion of the base of the proximal sesamoid bone in horses: 26 cases (1984–1997)

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Objective—To determine the outcome of horses with basal fractures of the proximal sesamoid bone from which a fracture fragment involving a portion of the base of the bone was removed arthroscopically and to determine whether fragment size was associated with outcome.

Design—Retrospective study.

Animals—26 horses.

Procedure—Dorsopalmar and axial-abaxial lengths of the fracture fragment were measured on the dorsopalmar and mediolateral radiographic views, respectively, and percentage of the base of the sesamoid bone involved was estimated. Fractures were classified as grade 1 ($\leq 25\%$ of the base involved) or grade 2 ($> 25\%$ but $< 100\%$ of the base involved). Outcome was classified as successful if the horse started at least 2 races or unsuccessful if the horse started only 1 race or failed to return to racing.

Results—There were 24 racehorses and 2 nonracehorses. Twelve (50%) of the racehorses returned to racing and started at least 2 races. Eight of 14 horses with grade-1 fractures and 4 of 10 horses with grade-2 fractures had a successful outcome. Ten of 16 horses without associated articular disease had successful outcomes, compared with 2 of 8 horses with associated articular disease. However, fragment size and presence of associated articular disease were not significantly associated with outcome.

Conclusions and Clinical Relevance—Horses with basal fractures of the proximal sesamoid bone from which a fracture fragment involving a portion of the base of the bone is removed arthroscopically have a fair prognosis for return to racing. (*J Am Vet Med Assoc* 2000;217:236–240)

Fractures of the proximal sesamoid bones are common in racehorses and uncommon in other types of horses. Proximal sesamoid bone fractures are classified as apical, basal, midbody, axial, abaxial, and comminuted.¹ Basal fractures have represented 13 and 24% of sesamoid bone fractures in retrospective studies,^{1,2} with Thoroughbred racehorses being affected most commonly. Treatment of basal fractures of the proximal sesamoid bones consists of stall confinement with or without application of a cast,¹⁻³ cancellous bone grafting followed by application of a cast,^{2,4} lag-screw fixation,

⁵ hemicerclage wiring,^{2,6} and surgical removal of the fracture fragment.²

Horses with basal sesamoid bone fractures were reported to have a poor prognosis for return to racing.^{1,7} Parente et al,² however, reported on 57 horses with basal sesamoid bone fractures treated conservatively (ie, stall confinement) or surgically (ie, hemicerclage wiring, cancellous bone grafting, or removal of the fracture fragment via arthrotomy or arthroscopy). In that study, horses were reported to have a favorable prognosis following removal of the fracture fragment, regardless of fragment size. Sixteen of 22 (73%) horses from which the fragment was removed returned to racing, and 14 (63%) raced more than once. However, horses from which the fragment was removed had small fragments, compared with horses from which the fragment was not removed.² Overall, 30 of 51 (59%) horses raced at least once after treatment, and the authors concluded that the prognosis for horses with basal sesamoid bone fractures was not different from the prognosis for horses with other types of sesamoid bone fractures.

In the study by Parente et al,² the long-term prognosis for horses with basal sesamoid bone fractures from which large fragments were removed was reported to be poor. However, there were low numbers of horses. To our knowledge, no studies have investigated the outcome of horses with basal sesamoid bone fractures from which large fracture fragments were removed arthroscopically. The purpose of the study reported here was to determine outcome of horses with basal fractures of the proximal sesamoid bone from which a fracture fragment involving a portion of the base of the proximal sesamoid bone was removed arthroscopically and to determine whether fragment size was associated with outcome. Our hypothesis was that such horses would have an unfavorable prognosis for return to racing overall, but horses from which smaller fragments were removed would be more likely to return to racing than would horses from which larger fragments were removed.

Criteria for Selection of Cases

Medical records of horses admitted to the Colorado State University Veterinary Teaching Hospital or the Equine Medical Center of Cypress, California, between 1984 and 1997 because of basal fractures of the proximal sesamoid bones were reviewed. Only those horses in which the fracture fragment was removed arthroscopically were eligible for inclusion in the study. Horses in which the fracture involved the entire base of the proximal sesamoid bone were excluded. Information obtained from the medical

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records included signalment, type of horse (racehorse vs nonracehorse), affected limb, affected sesamoid bone (medial or lateral), size of the fracture fragment, and whether other musculoskeletal lesions were identified.

Procedures

Radiographic evaluation—Dorsopalmar and mediolateral radiographic views of the metacarpophalangeal joint were used to determine size of the fracture fragment. Dorsopalmar length of the fragment was measured on the lateral or oblique radiographic views, and axial-abaxial length of the fragment was measured on the dorsopalmar radiographic view. Percentage of the base of the sesamoid bone that was involved was then estimated by use of the following equation:

$$\% \text{ involved} = \frac{\text{dorsopalmar fragment length (mm)} \times \text{axial-abaxial fragment length (mm)}}{\text{dorsopalmar sesamoid length (mm)} \times \text{axial-abaxial sesamoid length (mm)}}$$

Fractures were classified as grade 1 if $\leq 25\%$ of the base was involved or as grade 2 if $> 25\%$ but $< 100\%$ of the base was involved. The degree of fragment comminution and other lesions involving the joint were recorded. Other lesions were diagnosed radiographically and arthroscopically and were classified as associated articular disease involving the palmar aspect of the metacarpophalangeal joint (cartilage wear lines, fibrillation, and erosions on the distopalmar aspect of the third metacarpal or sesamoid bone and osteochondral disease of the distopalmar aspect of the third metacarpal bone) and osteochondral fragmentation of other joints.

Determination of outcome—Outcome was determined by examining racing records^{a,b} and through telephone conversations with owners, trainers, and referring veterinarians. Outcome was classified as successful if the horse returned to racing and started at least 2 races or as unsuccessful if the horse returned to racing but started only 1 race or failed to return to racing. For horses that returned to racing after surgery, information on race class (claiming, allowance, handicap, or stake), number of race starts, money earned, and order of finish was recorded.

Statistical Analyses

Two-tailed Fisher exact tests^c were used to evaluate possible associations between age and fracture grade, between sex and fracture grade, between age and outcome, between sex and outcome, between fracture grade and outcome, and between outcome and whether horses had associated articular disease (yes vs no), fragment comminution (yes vs no), or other orthopedic diseases (yes vs no). Values of $P \leq 0.05$ were considered significant.

Results

Twenty-six horses met the criteria for inclusion in the study. Twenty had been treated at the Equine Medical Center, and 6 had been treated at Colorado

State University. There were 21 Thoroughbreds, 4 Quarter Horses, and 1 Saddlebred. Median age of the horses was 4 years (mean, 4 years; range, 2 to 7 years). There were four 2-year-olds, four 3-year-olds, ten 4-year-olds, three 5-year-olds, and 5 horses that were 6 years old or older. Twelve horses were geldings, 8 were females, and 6 were sexually intact males. Twenty-four horses were Thoroughbred or Quarter Horse racehorses.

The medial sesamoid bone was affected in 17 (65%) horses, and the lateral sesamoid bone was affected in 9 (35%). All fractures involved the forelimbs; the left forelimb was affected in 15 horses (60%), and the right forelimb was affected in 10 (40%). The affected limb was not recorded for 1 horse.

Fifteen (58%) fractures were classified as grade 1 (Fig 1), and 11 (42%) were classified as grade 2 (Fig 2). Thirteen horses had a single fragment; the other 13 had comminution. Twelve horses had other orthopedic diseases, which included associated articular disease involving the palmar aspect of the metacarpophalangeal joint (8) and osteochondral fragmentation of other joints (chip fractures of the carpal bones [2] and chip fracture of the proximal phalanx [4]). One horse with associated articular disease had a fracture of the metacarpal condyle.

Sex was not significantly ($P = 1.0$) associated with fracture grade. Ten (56%) of the 18 male horses had grade-1 fractures and 8 (44%) had grade-2 fractures. Five (63%) of the 8 female horses had grade-1 fractures and 3 (37%) had grade-2 fractures. Similarly, age was not significantly ($P = 0.73$) associated with fracture grade.

For removal of the fracture fragment, horses were placed in dorsal recumbency. The metacarpophalangeal joint was distended with sterile isotonic polyionic fluid, and an 8-mm-long skin incision was made over the proximal aspect of the palmar pouch. The joint was then penetrated, and a conical obturator and arthroscope sleeve were inserted. The conical obturator was replaced with the arthroscope, and the metacarpophalangeal joint was flexed so that the distal aspect of the proximal sesamoid bone could be examined. An instrument portal was established at the level of the base of the sesamoid bone. Fragments were dissected from soft-tissue attachments with a tendon knife followed by a periosteal elevator; Ferris-Smith rongeurs were used to remove the fragments. In 1 horse, a decision was made prior to surgery to remove only the articular component of the fracture fragment. This horse had associated articular disease, and the part of the fragment articulating with the palmar aspect of the third metacarpal bone was removed, avoiding excessive dissection of the distal sesamoidean ligaments. Arthroscope and instrument portals were closed with 2-0 synthetic nonabsorbable suture material in a cruciate pattern, and the limbs were bandaged.

Of the 2 nonracehorses, 1 had a grade-1 fracture and did not return to its intended use for reasons unrelated to the fracture. The other had a grade-2 fracture and was used successfully for show jumping.

Of the 24 racehorses, 12 returned to racing and started at least 2 races, 9 returned to racing but started only 1 race, and 3 did not return to racing. Percentage



Figure 1—Dorsopalmar (left) and dorsomedial palmarolateral oblique (right) radiographic views of the metacarpophalangeal joint in a horse with a grade-1 basal fracture of the proximal sesamoid bone (ie, $\leq 25\%$ of the base involved).

of horses with grade-1 fractures that had successful outcomes (8/14; 57%) was not significantly ($P = 0.44$) different from percentage of horses with grade-2 fractures that had successful outcomes (4/10; 40%). Median convalescence time (ie, time from surgery to first race start) for the 21 horses returning to racing and starting at least 1 race was 8 months (mean, 10 months; range, 7 to 18 months), and fragment size was not significantly ($P = 0.9$) associated with convalescence time. Median convalescence time for horses with grade-1 fractures was 10 months (range, 7 to 18 months); median convalescence time for horses with grade-2 fractures was 9.5 months (range, 7 to 14 months).

Of the 8 horses with grade-1 fractures that returned to racing, 6 raced in the same class, and 2 raced in a lower class. Median number of race starts was 4 (range, 3 to 18), and 6 of the 8 horses finished first, second, or third, with earnings ranging from \$420 to \$40,000 dollars. In 1 horse, the suspensory apparatus failed after the fourth race start. Of the 6 racehorses with grade-1 fractures that had unsuccessful outcomes, 3 had associated articular disease or a small condylar fracture and were retired for breeding, 2 were persistently lame, and 1 developed superficial digital flexor tendonitis during training. Four horses with grade-1 fractures had associated articular disease, and 3 of these horses did not return to racing. Therefore, 3 of the 6 horses with grade-1 fractures that did not return to racing had associated articular disease.

Of the 4 horses with grade-2 fractures that returned to racing, 2 raced in the same class, and 2 raced in a lower class. Median number of race starts was 3.5 (range, 2 to 5), and 3 of the 4 horses finished first, second, or third, with earnings ranging from \$9,240 to \$16,000. In 1 horse, the suspensory apparatus failed after the fifth race start. Of the 6 racehorses with grade-2 fractures that had unsuccessful outcomes, 1 was persistently lame, 1 developed superficial digital flexor tendonitis during training, 2 had associated articular disease and were retired, and 2 had not raced prior to surgery and were lost to follow-up. Four horses with grade-2 fractures had associated articular disease, and 3 of these horses did not return to racing. Therefore, three of the 6 horses with grade-2 fractures that did not return to racing had associated articular disease.

Overall, percentage of racehorses with associated articular disease that had a successful outcome (2/8; 25%) was not significantly ($P = 0.08$) different from percentage of racehorses without associated articular disease that had a successful outcome (10/16; 63%). Six of the 9 horses with grade-1 fractures that did not have associated articular disease had a successful outcome, as did 4 of the 7 horses with grade-2 fractures that did not have associated articular disease.

Outcome was not significantly associated with whether horses had other orthopedic disease, whether the fracture was comminuted, age, or sex. Percentage of horses with other orthopedic diseases that had a successful outcome (4/4; 100%) was not significantly ($P = 0.25$) different from percentage without other orthopedic diseases that had a successful outcome (8/20; 40%). Percentage of horses with a comminuted fracture that



Figure 2—Dorsopalmar (left) and mediolateral (right) radiographic views of the metacarpophalangeal joint in a horse with a grade-2 basal fracture of the proximal sesamoid bone (ie, > 25% but < 100% of the base involved).

had a successful outcome (6/12; 50%) was not significantly ($P = 1.0$) different from percentage without comminution that had a successful outcome (6/12; 50%). Percentage of female horses with a successful outcome (5/7; 71%) was not significantly ($P = 0.19$) different from percentage of male horses with a successful outcome (7/17; 41%).

Discussion

Results of the present study suggest that horses with basal fractures of the proximal sesamoid bone from which a fracture fragment involving a portion of the base of the bone is removed arthroscopically have a fair (50%) prognosis for return to racing. Earlier studies^{1,7} reported that horses with basal sesamoid bone fractures had a poor (8%) prognosis for return to racing; however, Parente et al² reported an overall success rate of 59% (30/51) following treatment of basal sesamoid bone fractures. In that study, 12 of 17 (71%) horses with small or medium fracture fragments returned to racing and raced more than once following fragment removal via arthroscopy or arthrotomy,² which was similar to the percentage of horses with grade-1 fractures without associated articular disease that raced more than once (6/9). In the study by Parente et al,² fragment size was determined on the basis of dorsopalmar length of the fragment, with small fragments affecting < 33%, medium fragments affecting 33 to 66%, and large fragments affecting > 66% of the dorsopalmar length of the bone.

In the present study, fragment size was not signifi-

cantly ($P = 0.68$) associated with outcome; however, the authors believe that the lack of statistical significance may be because of the low power of the study (power = 0.12). In excess of 100 horses would be required to detect statistical significance. Intuitively, one would suspect that horses from which large fragments are removed would have a poorer prognosis, because larger fragments affect a larger portion of the attachment of the distal sesamoidean ligament, which is an integral part of the suspensory apparatus.⁸ However, results of the present study suggest that horses with large fragments can successfully return to racing. On the other hand, 2 horses with basal sesamoid bone fractures involving the entire base of the bone were excluded from the present study. The fragments were removed from both of these horses, and neither had a successful outcome. One had failure of the suspensory apparatus during its first race start; the other was lost to follow-up. Because of the poor outcome for these 2 horses, we do not recommend arthroscopic removal of the fracture fragment from horses with basal sesamoid bone fractures if the fragment involves the entire base of the bone.

It has been suggested that severity of distal sesamoidean desmitis is associated with outcome.⁸ Although size of the fracture fragment is thought to be proportional to severity of distal sesamoidean desmitis,⁸ severity of distal sesamoidean desmitis was not evaluated in the present study. Therefore, what effect, if any, this factor had on outcome was not evaluated.

In the present study, whether horses had associat-

ed articular disease was not significantly ($P = 0.08$) associated with outcome; however, the authors believe that this may be an important factor affecting outcome and may have contributed to the low success rate in our study. A lack of statistical significance may have been associated with the low power of the study (power = 0.42). Parente et al² did not find an association between radiographic evidence of osteoarthritis and outcome; however, cartilage damage without loss of adjacent bone may not be detected radiographically. One author⁷ has suggested that horses with basal sesamoid bone fractures have a poor prognosis for racing, because the fracture is secondary to osteochondral disease of the distopalmar aspect of the third metacarpal bone, which results in persistent lameness and inflammation. In the present study, we were not able to determine whether the fracture or the osteochondral disease developed first; however, there were horses in the present study and an earlier study² that did not have osteochondral disease of the distopalmar aspect of the third metacarpal bone, suggesting that not all basal sesamoid fractures are secondary to this disease. Because of the low numbers of horses in this study, we did not separate horses with articular cartilage damage (cartilage wear lines, fibrillation, erosions) from those with osteochondral disease of the distopalmar aspect of the third metacarpal bone; however, both groups of horses appeared to have a poor prognosis for success. Similarly, among horses with various fractures involving the articular surfaces of the metacarpophalangeal joint, those with preexisting osteoarthritis had a poorer prognosis.^{9,10}

Whether the fracture was comminuted was not associated with outcome in the present study, and we did not measure the amount of fragment displacement. Another study² found that fracture comminution and fragment displacement were associated with outcome following treatment; however, these factors may be more important for horses treated conservatively or with bone grafting or internal fixation. Horses with other orthopedic diseases other than associated articular disease did not have a less-favorable prognosis, compared with horses without other orthopedic diseases. One horse with a small condylar fracture did not return to racing; however, this was attributed to associated articular disease and not the condylar fracture.

Although another study suggested that horses with basal sesamoid bone fractures do not have a less-favorable prognosis, compared with horses with other types of sesamoid bone fractures,² we have previously found that approximately 71% of horses with abaxial sesamoid bone fractures have a successful outcome,¹¹ and in an unpublished review of 60 horses with apical fractures, we found that 67% had a successful outcome. We suggest that the apparently poorer prognosis for horses with basal fractures may be a result of

greater disruption of the distal sesamoidean ligaments, which are an important component of the suspensory apparatus. In addition, there may be more trauma and, subsequently, more soft-tissue damage and associated articular disease with basal sesamoid bone fractures. The lower percentage of horses with basal fractures that return to racing may also be attributable to the older age of horses with these types of fractures, compared with horses with other types of sesamoid bone fractures,¹¹ and consequently the greater likelihood that they will be retired.

The major limitation of the present study was the small numbers of horses, which made statistical analysis of the data problematic. The inability to detect significant associations among various factors may have been a result of the low numbers, resulting in low power. In addition, only horses that were treated surgically were included in the study, which may have caused a case selection bias based on decisions of the owners and trainers.

^aAmerican Quarter Horse Association, Amarillo, Tex.

^bEquineline, The Jockey Club Information Systems Inc, Lexington, Ky.

^cSAS PROC FREQ, SAS Institute Inc, Cary, NC.

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