Segmental ostectomy of the second and fourth metacarpal and metatarsal bones in horses: 17 cases (1993–2002)

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Objective—To determine clinical findings in and outcome of horses with fractures of the second or fourth metacarpal or metatarsal bone that underwent segmental ostectomy, leaving the proximal and distal portions of the bone undisturbed.

Design—Retrospective case series.

Animals—17 horses.

Procedures—Medical records were reviewed, and information on signalment, affected bone, lesion type, surgical procedure, amount of bone removed, and surgical and postsurgical complications was obtained. Follow-up information was obtained through telephone conversations with owners, trainers, and referring veterinarians.

Results—One horse had a fracture involving the distal third of the second metacarpal bone; 13 had fractures involving the middle third of the second metacarpal bone (n = 4), fourth metacarpal bone (5), or fourth metatarsal bone (4); and 3 had fractures involving the proximal third of the second (2) or fourth (1) metacarpal bone. Affected portions of the bones were surgically resected, leaving the proximal and distal portions undisturbed. All horses returned to previous performance levels without evidence of lameness. Cosmetic results were good to excellent.

Conclusions and Clinical Relevance—Results suggest that horses with a complicated injury of the proximal, middle, or distal portion of the second or fourth metacarpal or metatarsal bone may be successfully treated by means of segmental ostectomy of the abnormal portion of the bone. (*J Am Vet Med Assoc* 2004;224:271–274)

Injuries to the second and fourth metacarpal and metatarsal bones (splint bones) can occur in horses of any age. Treatment of such injuries has traditionally included rest, internal fixation, or resection, with the most appropriate treatment dependent on the location and severity of the lesion. For instance, closed, nondisplaced fractures and exostoses are usually treated with stall rest and nonsteroidal anti-inflammatory drug administration.[1-3] Closed, displaced fractures involving the distal aspect of the splint bones may also be amenable to this treatment,[4] but open fractures and displaced fractures involving the proximal or middle third of the bone often require surgical management. Fractures involving the proximal aspects of the splint bones have typically been treated by means of internal fixation or complete resection of the affected bone,[5-7] and open midshaft fractures have been treated by means of ostectomy of the affected portion of the bone and its entire distal aspect.[8,9] It has been suggested that fractures of the proximal aspects of the splint bones may require internal fixation for fracture repair and articular stability.[5,6,8-10]

Resection of bone fragments and amputation of the splint bone distal to the fracture site have resulted in successful healing and resolution of associated lameness, yet this requires extensive incision and dissection of the tissues.[5,6,9-11] Segmental resection of the diseased or injured sections of the splint bones has been suggested as a possible alternative in the literature.[12-14] However, to our knowledge, outcome of horses with splint bone lesions that were treated with segmental ostectomy has not been reported. Therefore, the purpose of the study reported here was to determine outcome of horses that underwent segmental ostectomy of the splint bones. The authors hypothesized that segmental ostectomy would reduce surgical invasiveness, result in minimal complications, and be associated with a good prognosis for return to preinjury performance.

Criteria for Selection of Cases

Medical records of all horses that underwent segmental ostectomy of a splint bone at the Kansas State University Veterinary Medical Teaching Hospital between 1993 and 2002 were eligible for inclusion in the study.

Procedures

Medical record review—Information obtained from the medical records included signalment, affected splint bone, lesion type, surgical procedure, amount of bone removed, surgical and postsurgical complications, and outcome. Radiographs were reviewed to characterize the splint bone lesions.

Surgical procedure—On the day of surgery, potassium penicillin (22,000 U/kg [10,000 U/lb], IV, q 6 h), gentamicin sulfate (6.6 mg/kg [3 mg/lb], IV, q 24 h), ampicillin (20 mg/kg [9 mg/lb], IV, q 8 h) or trimethoprim-sulfamethoxazole (15 mg/kg [6.8 mg/lb], PO, q 12 h), and phenylbutazone (2.2 to 4.4 mg/kg [1 to 2 mg/lb], IV, q 12 h) were administered. Dimethylsulfoxide (1 g/kg [0.45 g/lb], IV, as a 10% solution, q 24 h) was also admin-

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istered before surgery in horses with acute trauma and associated edema.

Horses were anesthetized and placed in lateral recumbency with the affected splint bone uppermost or were sedated and allowed to remain standing. A linear skin incision was made immediately over the affected portion of the splint bone; the incision did not extend to the distal end of the splint bone. The periosteum, if intact, was incised and elevated. Contaminated and necrotic tissues were débrided, and bone fragments, osseous callus, and sequestra were removed. The remaining proximal and distal portions of the splint bone were obliquely ostectomized with an osteotome or motorized burr. If the periosteum could be preserved, it was closed. Subcutaneous tissues and skin were closed in 2 layers or left open to heal by second intention if soft tissues could not be closed.

After surgery, a padded bandage was applied for protection during recovery from anesthesia. Firm pressure bandages were maintained for 2 weeks or until incisional wounds had healed. Bandages were changed at 1- to 3-day intervals as needed. Phenylbutazone (2.2 mg/kg, PO) was administered every 12 hours for 3 to 5 days after surgery, then every 24 hours for an additional 3 to 5 days. Dimethylsulfoxide (1 g/kg, IV, as a 10% solution, q 24 h) was also administered for 3 days in horses with substantial swelling and edema.

The initial antimicrobial regimen was continued for 10 to 14 days after surgery or changed in accordance with results of bacterial culture and susceptibility testing. Horses that underwent segmental ostectomy involving the distal two-thirds of the splint bone were rested in a stall for 2 weeks, whereas horses that underwent segmental ostectomy involving the proximal third of the splint bone were rested in a stall for 8 weeks because of possible articular instability. Follow-up radiography to evaluate healing was recommended before a return to exercise was allowed.

Follow-up evaluation—Outcome information was obtained via telephone interviews with owners, trainers, or referring veterinarians or from medical records of horses reevaluated at the veterinary teaching hospital. Treatment was considered successful if the horse returned to its previous level of performance and did not have subsequent lameness associated with the surgical site or remaining portions of the splint bone.

Results

Seventeen horses with 17 splint bone lesions managed by means of segmental ostectomy were included in the study. There were 8 Quarter Horses, 4 Thoroughbreds, 1 Hanoverian, 1 Trakehner, 1 Warmblood, 1 Appaloosa, and 1 Paint. Nine were mares, 7 were geldings, and 1 was a stallion. Age ranged from 1 to 10 years (mean, 4.3 years).

All 17 lesions consisted of splint bone fractures. In addition, 13 horses had sequestered bone fragments, 2 had extensive osteitis, 5 had exuberant periosteal proliferation, and 2 had chronic exostosis formation. The **second metacarpal bone (MC II)** was affected in 7 of the 17 horses, including 3 with right forelimb involvement and 4 with left forelimb involvement. The **fourth metacarpal bone (MC IV)** was involved in 6 horses, including 4 with right forelimb involvement and 2 with left forelimb involvement (**Fig 1**). The **fourth metatarsal bone (MT IV)** was affected in 4 horses, including 1 with right hind limb involvement and 3 with left hind limb involvement.

Six horses with open fractures were evaluated within 2 weeks of the injury. Nine horses had sequestered bone fragments associated with a chronic draining tract at the initial examination. Two horses had closed, nonhealing fractures with exostosis formation. One of these horses had mild mineralization of the suspensory ligament in the region of the fracture.

Fracture location was categorized as the proximal, middle, or distal third of the splint bone. One horse had a fracture involving the distal third of MC II that was associated with a degloving injury. The horse was treated by means of application of a half limb cast and bandages for 3 weeks prior to segmental ostectomy of the affected splint bone. A 5-cm-long segment of MC II was removed, as well as a 5-mm-thick sequestrum from the third metacarpal bone. Approximately 2 cm of the distal end of MC II remained intact. The wound was left to heal by second intention.

Thirteen horses had fractures involving the middle third of a splint bone. Four of these fractures were simple, 8 were comminuted, and 1 was segmental. Seven

Figure 1—Dorsolateral-palmaromedial oblique radiographic view of the fourth metacarpal bone in a horse with a nonhealing segmental fracture.

of the 13 horses had sequestered bone fragments at the fracture site. In addition, 7 had exostosis formation associated with the fracture site. The length of the portion of the splint bone resected from horses with fractures involving the middle third of a splint bone ranged from 1 to 13 cm (**Fig 2**). Periosteum of the splint bone could be preserved in 3 horses. Subcutaneous tissue and skin were closed in all 13 horses.

The remaining 3 horses had fractures involving the proximal third of MC II or MC IV. One horse had a fracture of MC IV that was associated with sequestered bone fragments, exuberant periosteal proliferation, and a chronic, draining tract 3 cm distal to the carpometacarpal joint. Ten centimeters of the affected splint bone was resected, along with the periosteum, leaving a 3-cm-long proximal fragment. The other 2 horses had fractures of MC II; in 1, the fracture was 3 cm, and in the other, the fracture was 4 cm from the carpometacarpal joint. Both horses were examined 3 to 4 weeks after the original injury. One had an open, comminuted fracture; the other had an open, simple fracture. Both horses had associated sequestra. These horses were treated with resection of 3- and 4-cm segments of the affected splint bone and periosteum. This left a 3-cm-long proximal fragment in 1 and a 2-cm-long fragment in the other. Surgical sites were closed in 2 layers.

Outcome—All 17 horses returned to normal activities or training within 8 weeks after surgery, and all returned to previous levels of athletic performance. None of the horses had any complications related to the proximal and distal portions of the affected splint bones, and cosmetic results were reported as good or excellent in all horses.

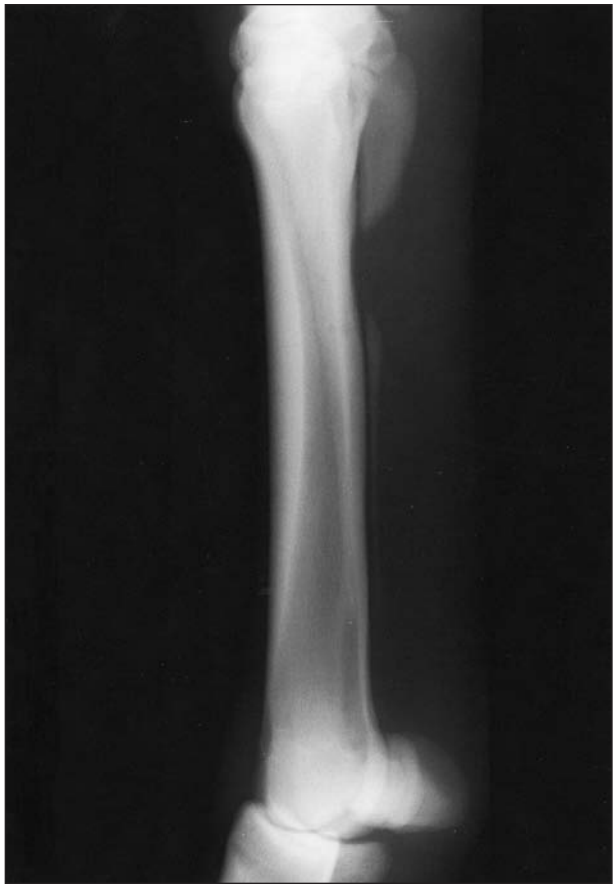

Figure 2—Dorsolateral-palmaromedial oblique radiographic view of the fourth metacarpal bone in the horse in Figure 1 obtained after segmental ostectomy.

One horse was reevaluated because of an acute onset of lameness 3 years after segmental ostectomy of 7 cm of the middle portion of a splint bone. The splint bone radiographically resembled a normal splint bone, but the middle portion had sustained a simple nondisplaced fracture, which was successfully managed with stall rest and systemic nonsteroidal anti-inflammatory drug administration.

Discussion

Results of the present study suggest that segmental ostectomy may be a viable alternative for treatment of horses with splint bone fractures. Infected soft tissue and bone and excessive proliferative exostoses associated with fractures were successfully managed by removing only the affected portion of the splint bone, and subjectively, segmental ostectomy appeared to be less invasive than amputation of the entire distal aspect of a fractured splint bone.

Potential complications that were considered prior to instituting segmental ostectomy at our hospital included the possibility of joint instability if the proximal fragment became displaced and displacement or sequestration of the distal fragment. Concerns regarding carpal joint instability have led several authors to recommend rigid fixation of proximal splint bone fragments to the third metacarpal bone when > 50% of MC II is removed.[5,11,14] Internal fixation was considered for horses in the present study if instability or lameness resulted after segmental ostectomy and resolution of sepsis. However, the remaining portions of the splint bones remained stable, and subsequent internal fixation was not necessary, presumably because of preexisting soft tissue attachments and fibrous scar tissue formation.

The distal fragment of the affected splint bone was left undisturbed in horses in the present study, and no complications were observed. In particular, sequestration did not occur, regardless of the dimensions of the distal fragment. Periosteal and soft tissue vasculature were likely responsible for maintaining perfusion and integrity of the distal fragment.

Excessive exostosis formation after segmental ostectomy of the splint bone was also considered as a potential complication. Preservation of the periosteum and application of bone wax may reduce or contain new bone formation. However, exostosis formation after segmental ostectomy was not observed in any of the horses in the present study, even when periosteal loss was evident. Excessive swelling was not observed after surgery, and cosmetic results were considered good or excellent for all horses. It appears that local debridement and resection of nonviable and infected tissues can result in good functional and cosmetic outcomes.

One horse in the present study did have a second fracture of the original splint bone 3 years after undergoing segmental ostectomy and returning to athletic

function. A relationship between the original and second fractures could not be determined.

Our results suggest that horses with a complicated injury of the proximal, middle, or distal portion of a splint bone may be successfully treated by means of segmental ostectomy of the abnormal portion of the bone. Segmental ostectomy requires less soft tissue disruption than the traditional procedure of resecting the entire splint bone distal to the injury. The prognosis for a return to athletic function for horses that underwent this procedure appeared to be excellent.

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