

Condylar buttress plate fixation of femoral fracture in a colt

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A 1-year-old Pony of America was admitted to the George D. Widener Hospital for Large Animals for evaluation and repair of suspected fracture of the distal portion of the femur. The colt had been exercising in routine manner in a field when it was found to have non-weightbearing lameness of the right hind limb. Immediate examination by the referring veterinarian/owner revealed associated swelling of the stifle region of the right hind limb. Radiography revealed fracture of the distal epiphyseal and metaphyseal region of the right femur, with medial displacement of the distal aspect of the fractured proximal bone segment. The fracture was characterized as Salter-Harris type II (Fig 1).

Surgical repair, involving lateral plating in conjunction with interfragmentary compression, was planned. Preoperative stabilization included volume loading with a balanced crystalloid solution^a and administration of phenylbutazone^b (4.0 mg/kg of body weight, IV, q 12 h) and antimicrobial drugs consisting of cefazolin sodium^c (25 mg/

kg, IV, q 6 h) and gentamicin sulfate^d (2.2 mg/kg, IV, q 8 h).

Xylazine hydrochloride^e (300 mg/kg, IV), followed by glyceryl guaiacolate^f (50 mg/kg, IV) and thiopental sodium^g (22 mg/kg, IV), was administered for induction of general anesthesia. General anesthesia was maintained by isoflurane^h and oxygen in a semiclosed circle system. The colt was positioned in left lateral decubitus, and after aseptic preparation, a lateral parapatellar curvilinear incision was made in the affected limb, to provide access to the dorsolateral aspect of the distal portion of the femur. The incision extended from the distal portion of the femoral diaphysis to the distal trochlea of the femoropatellar joint.

Internal fixation was achieved by placement of a 7-hole condylar buttress plateⁱ along the lateral distal aspect of the femur. Two 4.5-mm cortical screws were inserted, independently of the condylar buttress plate, in lag fashion across the fracture line for interfragmentary compression of the fracture fragments. The plate was then luted^j prior to final screw tightening. During surgery, the site was

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^aNormosol-R, Abbott Laboratories, North Chicago, Ill.

^bButazolidin USP, The Upjohn Co, Kalamazoo, Mich.

^cAcef, SmithKline Beckman Laboratories, Philadelphia, Pa.

^dGentocin, Schering Corp, Kenilworth, NJ.

^eRompun, Mobay Corp, Shawnee, Kan.

^fGlyceryl guaiacolate, Lee Laboratories Inc, Petersburg, Va.

^gPentothal, Ceva Laboratories Inc, Overland Park, Kan.

^hForane, Anaquest, Madison, Wis.

ⁱCondylar buttress plate, Synthes Ltd, Wayne, Pa.

^jMethyl-Methacrylate, Howmedica Inc, Rutherford, NJ.



Figure 1—Caudocranial [left] and lateromedial [right] radiographic views of the distal femoral region of the affected horse, taken at admission. Notice displacement of the metaphyseal portion of the femur.

liberally lavaged with a prophylactic solution consisting of bacitracin^k (50,000 U), polymyxin B sulfate^l (500,000 U), and neomycin^m (1.0 g). The joint capsule was closed with No. 0 polyglactin 910,ⁿ in a simple interrupted pattern. A closed suction drainage system with a Jackson-Pratt drain^o was placed distal to the skin wound after tunneling in the subcutaneous tissue. The remaining tissue planes were closed, using the following materials and suture patterns: subcutaneous tissues, 2-0 polyglactin 910 and simple continuous; subcuticular tissue, 2-0 polyglactin 910 and simple interrupted; and skin, 2-0 nylon^p and simple vertical mattress. A long-leg Robert Jones bandage was placed on the surgically treated limb.

Recovery from general anesthesia took place in a padded recovery stall. Radial nerve paresis, characterized by an inability to extend the left front limb on standing, with corresponding dropped elbow, was diagnosed. Radial palsy was treated by administration of 0.9 g (1 ml/kg) of a 90% solution of dimethylsulfoxide^q in 500 ml of 0.9% NaCl. Preoperative medication—phenylbutazone, cefazolin, and gentamicin—was continued. At 24 hours after surgery, cefazolin was replaced with potassium penicillin^r (22,000 U/kg, IV, q 6 h). The closed suction drain was reset every 2 hours for the first 72 hours after surgery, and at 6-hour intervals thereafter for another 24 hours before removal. Antimicrobial drug administration was maintained for 24 hours after removal of the closed suction system, for a total treatment period of 5 days.

Postoperative radiography of the limb indicated that the fracture had been repaired by placement of the bone plate along the distal and lateral aspects of the femur, with multiple bone screws passing into the opposite portion of the bone. Additionally, radiography revealed a long-bone screw placed through the distal aspect of the femur proximally into the metaphyseal and diaphyseal regions (Fig 2). Alignment of the femoral fragments, as seen on the radiographs, was judged to be good. The colt was discharged from the hospital 20 days after surgery, with instructions to the owner to confine it to a box stall for 8 to 12 weeks. Phenylbutazone was to be administered orally, as needed.

Five months after surgery, the colt was admitted for re-evaluation. Radiography indicated complete healing of the distal Salter-Harris type-II fracture (Fig 3). The condylar buttress plate and multiple screws were intact, unchanged in appearance from that on the immediate postoperative radiographs. A decision to leave the plate and screws

in place was based on closure of the distal femoral growth plate and excellent ambulation by the colt.

Fractures of the femur of horses are common, but reports of successful surgical repair are limited.²⁻⁴ Suggested methods for repair include intramedullary pinning,⁵ Kuntscher nailing, bone plating using Venable plates,⁴ and Association for the Study of Internal Fixation compression plating.² The prognosis after use of most methods is fair to poor, because of complications that include shortening of the limb, angulation, rotation problems, muscular atrophy, osteomyelitis, and infection.^{2,6,7}

Femoral fractures of the distal growth plate are particularly difficult to treat. Epiphyseal fractures have been repaired by cruciate placement of Steinmann or Rush pins.⁸ Cancellous bone screws placed subchondrally in the lateral and medial ridges of the trochlea and infratrochlear groove were used successfully to treat a Salter type-IV articular fracture of the distal portion of the femur in a yearling.⁹ Fractures of the proximal femoral growth plate (slipped capital epiphysis) have been repaired successfully by direct pinning of a non-displaced fracture of the femoral head with Knowles

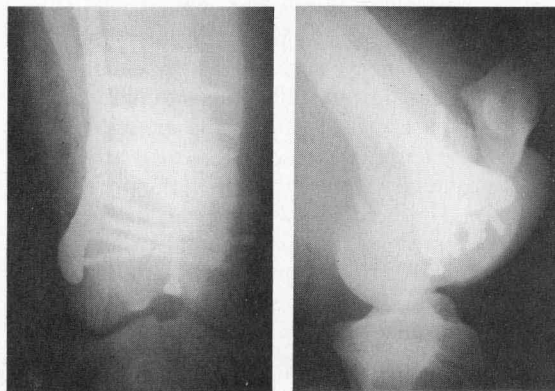


Figure 2—Caudocranial [left] and lateromedial [right] radiographic views immediately after surgery. The condylar buttress plate was placed laterally. Notice a long cortical screw placed through the distal portion of the femur and directed proximally into the metaphyseal and diaphyseal regions.

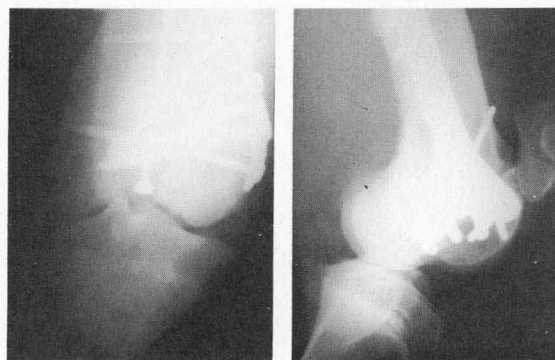


Figure 3—Caudal [left] and lateromedial [right] radiographic views 20 weeks after surgery. Primary bone healing has been achieved.

^kBacitracin USP, The Upjohn Co, Kalamazoo, Mich.

^lPolymyxin B Sulfate, The Upjohn Co, Kalamazoo, Mich.

^mNeomycin, VEDCO, Inc, St Joseph, Mo.

ⁿVicryl, Ethicon Inc, Somerville, NJ.

^oJackson-Pratt, Hubless silicone drain, American V. Mueller, Chicago, Ill.

^pEthilon, Ethicon Inc, Somerville, NJ.

^qDOMOSO, Syntex Animal Health, Palo Alto, Calif.

^rPenicillin G, E.R. Squibb and Sons Inc, Princeton, NJ.

pins and radiographic monitoring during surgery, although such monitoring is difficult with the patient positioned in lateral recumbency.⁸ The prognosis for femoral fracture repair is largely dependent on age of the horse, location and type of fracture, and the horse's intended use. In general, fractures of the proximal and distal femoral growth plates have guarded prognosis for return to normal function.

A Salter-Harris type-II fracture involving the distal portion of the femoral physis differs slightly with regard to general principles of treatment. The proximity of a joint creates problems in obtaining adequate purchase for epiphyseal implants. Because the physis is the site of active bone formation, these fractures heal more rapidly than diaphyseal and metaphyseal fractures of long bone, reportedly in 3 to 4 weeks.⁶ Closure of the growth plate is almost assured after physeal fractures in horses, because of the effects of trauma on the actively dividing cartilage cells. Usually, the distal femoral epiphysis fuses with the femoral diaphysis in horses by the age of 2 to 2.5 years. This particular horse was 1 year old and had matured to the point at which maximal long-bone growth had already taken place.

The condylar buttress plate was chosen to repair this fracture, because the extension of the plate shaft into the metaphyseal and diaphyseal portions of the femur allowed sufficient purchase in the distal epiphysis. Used in this manner, the plate protects the cortex from collapsing and provides a bridge of sufficient strength to span the physis. Additional 4.5-mm screws were placed in the intercondylar fossa into the distal metaphyseal portion of the femur for axial alignment and stabilization of the fracture.

The condylar buttress plate fixation technique provided stability and early ambulation without development of the usual complications of internal fixation (eg, joint stiffness, osteoporosis, muscular atrophy, and delayed healing).² Furthermore, this method minimized flexor laxity and angular limb

deformity acquired in the opposite limb during healing. At re-evaluation, radiographic evidence of osteoporosis was not observed around the plate. The radiographs taken 3 and 20 weeks after surgery also did not reveal periosteal callus formation, indicating that primary bone healing took place in this horse.

The usefulness of suction drainage when hemostasis is difficult to achieve has been documented.² With the large amount of soft tissue dissection required for plate fixation, a considerable amount of capillary fluid oozed from these tissues. The Jackson-Pratt system was used to reduce the accumulation of fluid and air that might otherwise compromise wound healing by reduction in blood supply to the soft tissue covering. Additionally, the collection of fluid in the wound provided a substrate for bacterial growth and repelled the migration of phagocytic cells. However, the benefits of drainage must be weighed against the potential complications of introducing a foreign body into the wound, thereby compromising host resistance to infection.

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