

Scientific Report

Surgical repair of distal femoral fracture in a wild gray wolf (*Canis lupus*)

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Summary

A 3-year-old wild gray wolf was referred to the Department of Veterinary Clinical Sciences of Shiraz University with a history of car accident. The radiographic examination showed supracondylar distal femoral fracture in right leg. The wolf was pre-medicated by acepromazine followed by induction of anesthesia using a combination of diazepam and ketamine. Anesthesia was maintained by halothane. The fracture was reduced, the first pin was bent based on anatomical curvature of the femoral shaft and inserted from lateral epicondyle and drove proximally. The second one was inserted from medial epicondyle as a cross pin. For further stabilization, a bone plate was contoured to curve from the shaft onto the condyle and applied on lateral surface of the distal femur. The joint capsule and incision site was closed. Postoperative radiograph showed good pin placement and bone reduction. Cage rest and restricted activity was accomplished for 8 weeks. Postoperative follow up revealed no complication and the wolf was allowed to return to its domain area of wilderness four months after surgery. In conclusion, using a combination of different fixation techniques can result in successful fracture repair in wild animals.

Key words: Femoral fracture, Bone plate, Intramedullary pin, Gray wild wolf

Introduction

Fractures of the distal femoral segment represent about 25 percent of all femoral fractures in small animals (Piermattei *et al.*, 2006). These fractures may be supracondylar, intracondylar or epiphyseal. The first two conditions occur mostly in mature dogs and the latter is seen in young animals. Most of the supracondylar fractures are transverse, although occasionally one may be oblique (Bojrab, 1975). Arthrotomy of the stifle joint is necessary to expose all the distal fractures. The exact approach varies with the extent of the pathology, but the lateral approach is the most common because it is suitable for all non articular fractures. The distal segment is usually displaced caudally and accompanied by a sizable hematoma. The objectives of

treatment should include anatomical reduction and rigid uninterrupted fixation so that the animal is free to move the stifle joint during the healing period. Suggested methods of treatment include rush pins, small transfixation pins in a crossing pattern and IM pin (Piermattei *et al.*, 2006; Johnson, 2007). The present report describes a case of distal femoral fracture in a wolf, and to the authors' knowledge this is the first report of femoral fracture repair in this species.

Case presentation

A 43 kg 3-year-old male wild gray wolf (*Canis lupus*) was referred to the Department of Veterinary Clinical Sciences of Shiraz University with a history of car accident and femoral fracture. Prior to admission, the wolf had received a com-

bination of xylazine-ketamine (unknown doses) by referring veterinarian for sedation during transportation. General physical examination revealed no abnormal vital signs or other lesions except non-weight-bearing on the right hind limb. Radiographs were obtained in anterior-posterior and lateral positions. A supracondylar distal femoral fracture in right leg was evident (Fig. 1). Internal fixation was selected for a perfect osteosynthesis. The wolf was pre-medicated with acepromazine (0.05 mg/kg, IV [Alfasan, Woerden, Holland]) which was followed by induction of anesthesia by a combination of diazepam (0.25 mg/kg, IV [Caspian Tamin Pharmaceutical Co., Rasht, Iran]) and ketamine (5 mg/kg, IV [Alfasan, Woerden, Holland]), mixed together in the same syringe. The animal was intubated by 9-mm cuffed tracheal tube and positioned in left lateral recumbency. Anesthesia was maintained by halothane (0.8 to 1.0%) delivered in oxygen. The wolf received 10 mg morphine sulfate (slow IV [Darou Pakhsh, Iran]) following induction and saline-dextrose solution was administered at $10 \text{ mL.kg}^{-1}.\text{h}^{-1}$ throughout the anesthesia. The total anesthetic time was 127 min, during which time pulse rate and oxyhaemoglobin saturation (SpO_2), respiratory rate and end-tidal CO_2 concentration (capnography) were monitored and remained within clinically acceptable limits (pulse rate=135-160/min, SpO_2 =98-99%, RR=12-16 breaths/min and ETCO_2 =36-43 mmHg). By craniolateral approach following the incision of skin, fascia lata and joint capsule, the fracture site was exposed. The distal part of the fracture was displaced caudally and rotated laterally, and the sharp tip of the proximal part had induced a large hematoma. The fracture was reduced by levering using an osteotome and fragments were aligned by direct force application using bone-holding forceps. The lateral and medial surfaces of the condyles proximal to the gliding surfaces were drilled in order to insert rush pins. The first pin was bent based on anatomical curvature of the femoral shaft using plate bender and inserted from lateral epicondyle, then driven proximally so that an approximately acceptable anatomical fixation was gained. Next, the second pin was inserted from

medial epicondyle and forced forward in metaphyseal region. The hook ends of the pins were left in situ. For further stabilization, a bone plate was contoured to curve from the shaft onto the condyle and applied on lateral surface of the distal femur, two screws were inserted on each side of the fracture (Fig. 2). The joint capsule, fascia lata and subcutaneous tissue were sutured using simple continuous pattern and the skin was closed using a subcuticular suture pattern. Postoperative radiograph was obtained to evaluate fracture reduction and implant location ensuring a successful outcome (Fig. 2). Anesthetic recovery was uneventful. Post operative analgesia was provided by Tramadol (1.2 mg.kg^{-1} , IM [Exir Pharmaceutical Co., Borooger, Iran]) and antibiotic therapy (Cefazoline; 22 mg/kg, daily, IM) continued for 7 days. Cage rest and restricted activity was accomplished for eight weeks. Five-month postoperative follow-up revealed no complication. The wolf was allowed to return to its domain area of wilderness.

Discussion

Using a combination of rush pin, cross



Fig. 1: Lateral radiographic view of distal femoral fracture before surgery



Fig. 2: Postoperative lateral radiographic view of the fixed femoral fracture

pin and bone plate provided a successful fracture repair in this case. Fracture repair in wild animals can be a frustrating issue because of their natural free mobilization and inability to restrict them. Using rush pins, crossed pins and IM pin as a sole technique is a routine method in simple distal femoral fractures in dogs. But in animals with large body weight and excessive movement (i.e. wild animals) a combination of these techniques could lead to a rigid fixation and successful outcome. In this case a combination of rush pin, cross pin and bone plate gained these objectives.

There are very limited reports of successful fracture repair in wild animals. The supra-condylar fractures of femur have been treated by double rush pins achieving three point fixation, double cross pins or bent pin technique (Bojrab, 1975). Use of

intramedullary pin was the most satisfactory method (Leonard, 1971). The simple distal femoral fracture is usually reduced and maintained by single or double pins or other methods of fixation (Whittick, 1990). Femoral fracture repair has been reported in bear using a locking plate (Zimmerman *et al.*, 2010). Poole *et al.* (1998) reported using compression plate in a transverse fracture of a lynx (Poole *et al.*, 1998). In the present case following driving first rush pin, it necessitated the second pin but due to the pin's thickness using another rush pin could have induced bone crack and fracture in the shaft. A decision was therefore made to use the second pin as a cross pin to reduce the chance of fracturing. Because the wolf was skeletally matured, the hook end of the pins was left in situ to prevent the pins tendency to become loose or migrate distally. It is recommended in young animals to cut off the hook ends following pin installment to prevent premature closure of the growth plate (Piermattei *et al.*, 2006). By applying a bone plate on the lateral surface of the femur, more rigid fixation was gained in this case that could not be influenced by animal movement. Although fixation of distal femoral fractures is discussed in different sources, to the authors' knowledge, this is the first reported case of distal femoral fracture repair in wolf. Using a combination of different internal fixation techniques can achieve a successful fracture repair despite large body weight and inability to restrict postoperative activity in a wild species.

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