

Case Study

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Surgical Management of Proximal Tibial Physeal Fracture in a Dog

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ABSTRACT

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A 6 month old male intact French mastiff was presented for left pelvic limb lameness 2 days after the dog had been hit by a motor vehicle. Medio-lateral and cranio-caudal radiographs of the left stifle revealed a Salter-Harris type 2 fracture of the proximal tibial physis with segmental fracture of fibula. A medial surgical approach allowed reduction and stabilisation of proximal tibial physeal fracture with two 1.4 mm crossed kirschner wires, a 3.5-mm lag screw and a 6 holed 3.5mm T-plate. Modified Robert Jones bandaging was done to reduce stifle motion. Satisfactory fracture reduction was confirmed in immediate post-operative radiographs. Radiographic re-evaluation revealed periosteal reaction at fracture site at two weeks and healed tibial physis and fibular fracture with remodelling of periosteal reaction and stable implant at 3 months postoperatively. The owner reported the dog had resumed normal activities and regained full limb usage without showing any sign of lameness. Physeal fracture was reduced using a combination of pin and plate, suggesting that surgical treatment of these challenging and uncommon fractures may be more appropriately achieved by this technique.

Introduction

Fractures of the proximal tibial physis are relatively uncommon and account for only 3.7 per cent of all physeal fractures in small animals (Marretta and Schrader 1983). There are two centres of ossification in the proximal tibia of dogs namely the proximal tibial epiphysis and the tibial tuberosity apophysis. The proximal tibial physis closes at an average age of 10.7 months and the physis of the tibial tuberosity closes at an average of 8.3 months (Manley *et al.*, 1990). It is hypothesised that contraction of the quadriceps muscle group

against stifle flexion results in a proximal distractive force on the tibial tuberosity which leads to this type of fracture (Pratt, 2001). Fibular fractures are occasionally associated with separation of the proximal tibial physis and avulsion of tibial tuberosity. Various conservative and internal method of stabilisation of these types of fractures have been documented (Clements *et al.*, 2003). It has been suggested that if the avulsion of the tibial tuberosity has a displacement of less than 3 mm, it can be treated conservatively (Withrow *et al.*, 1976). However, it is recommended that all avulsions of the

tuberosity combined with a proximal tibialphyseal separation should be reduced to prevent any change in the tibial plateau inclination angle.

Case description

A six-month-old male French mastiff was presented with a non-weight-bearing on left hind limb after being hit by a motor vehicle. Medio-lateral and cranio-caudal radiograph of affected limb revealed Salter Harris type 2 fracture of the left proximal tibialphysis, with a large lateral oblique metaphyseal component and segmental fracture of fibula (Fig. 1). Marked medial displacement of the tibial diaphysis was noted. There was moderate swelling and pain over left stifle region.

Treatment

Dog was premedicated with a combination of Inj. Butorphanol @ 0.2 mg/kg b.wt., Inj. Acepromazine @ 0.05 mg/kg b.wt. and Inj. Glycopyrrolate @ 0.01 mg/kg b.wt. intramuscularly. Anaesthesia was induced with Inj. Propofol @ 4 mg/kg b.wt. I.V. and then maintained on 1-2% Isoflurane in oxygen through cuffed endotracheal tube connected to the circle system of small animal anaesthetic machine. Normal saline solution (NSS) was administered intravenously as continuous infusion throughout the operative period till the recovery from anaesthesia. The site was aseptically prepared. A medial surgical approach to the right proximal tibia (Piermattei, 1993) facilitated exposure, but not reduction of the proximal tibial physis. Transection of the distal soft tissue attachments of the tibial tuberosity to the proximal tibia allowed reduction of the proximal tibial epiphysis, which was stabilised by cross pinning with two 1.4-mm Kirschner (K) wires, a lag screw and 6-hole 3.5-mm T-plate. Proximal fragment was

first stabilised with 1.4 mm kirschner wire which was inserted from cranio-medial side between collateral ligament and tibial tuberosity and second wire inserted from cranio-lateral approach (Fig. 5). A lag screw was also placed to stabilise the proximal epiphyseal fracture fragment, then a 6 hole T-plate was placed medially by giving small incision over medial side (Fig. 6). The muscles, subcutaneous and skin were sutured in routine manner.

Results and Discussion

Immediate post-operative radiograph revealed satisfactory fracture reduction and kirschner wire, lag screw and T-plate placement (Fig. 2). Modified Robert Jones bandaging was done till the date of suture removal to provide external support and to reduce stifle motion. Re-evaluation two weeks post-operatively revealed the dog to be moderately weight bearing on operated limb. Radiographs revealed new bone formation at fracture site and stable implants (Fig. 3). Complete bone union and closure of tibial physis were noted on 3 month post-operative radiographs. Radiography at 3 months post-operatively revealed healed tibial physis and fibular fracture with remodelling of periosteal reaction and stable implant (Fig. 4). Dog was excellently weight bearing on operated limb (Fig. 8) and no visible difference between pelvic limb was noted (Fig. 7). Telephonic follow-up at 5 months post-operatively, the owner reported that the dog had resumed normal activities without any sign of lameness.

Fractures of the proximal tibialphysis are not very common in dogs (Marretta and Schrader 1983). Minimally displaced fractures that can be reduced in a closed fashion can be successfully managed conservatively with coaptation (Clements *et al.*, 2003). Mildly or moderately displaced fractures can be reduced

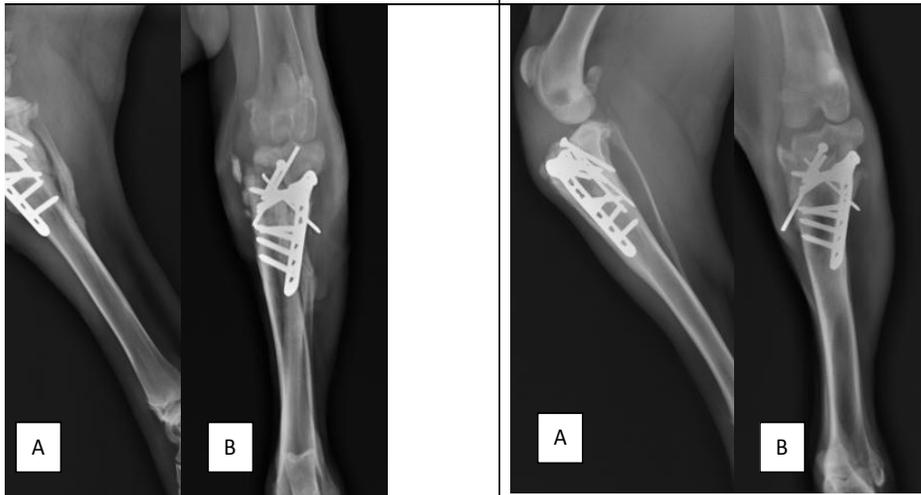
by means of open reduction, are typically stabilised with divergent interfragmentary Kirschner wires (Clements *et al.*, 2009). This case was managed using Arbeitsgemeinschaft für Osteosynthesefragen/ Association for the Study of Internal Fixation (AO/ASIF)

principles, namely, rigid internal fixation, accurate anatomical reduction, the preservation of blood supply and early post-operative mobilisation. Intra-operatively it was difficult to position the T-plate for stabilising proximal tibial epiphysis.



anterior (A) and mediolateral (B) radiographs showing a type 2 fracture of the proximal tibial epiphysis with displacement of the proximal tibial epiphysis and segment of the fibula.

Fig. 2. Immediate post-operative craniocaudal (A) and mediolateral (B) radiographs showing anatomically reduced fracture with Kirschner wire, lag screw and T-plate.



Post-operative mediolateral (A) and craniocaudal (B) radiographs showing callus formation at fracture site and complete union at two weeks after surgery.

Fig. 4. Post-operative mediolateral (A) and craniocaudal (B) radiographs showing obliteration of fracture line, remodeling of periosteal reaction and complete union 3 months after surgery.



Fig. 5. Photograph showing primary stabilisation of the tibial epiphysis by kirschner wire.

Fig.6. Photograph showing intra-operative stabilisation of tibial physeal fracture with T-plate.



Fig. 7. Photograph taken 90 days following surgery. No visible difference is noted between pelvic limbs.

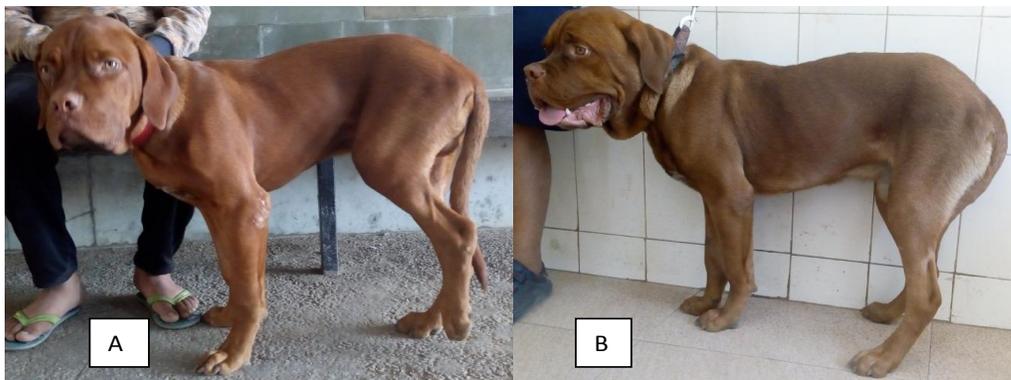


Fig. 8: Pre-operative (A) and Post-operative (B) images of dog. In image B complete weight bearing on operated left hind limb 3 months post operatively.

This depicts the challenging alignment of the fracture and the difficulties in positioning adequate internal fixation in the proximal tibial epiphysis. The difficulty encountered in reduction of this fracture was due to mild overriding of the fracture segments. Intra-operative application of kirschner wire as well as lag screw simplified the placement of T-plate. This technique facilitated rapid reduction and rigid stability intra as well as post-operatively. For open reduction this technique could prove advantageous in stabilising proximal tibial physeal fracture. In

conclusion, the laterally displaced proximal tibial physeal fractures can be managed successfully with kirschner wire, lag screw and T plate.

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