

Case Study

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Surgical Management of Salter-Harris Type IV Fracture With Partial Dislocation of Right Humerus in a Nondiscript Female Dog

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ABSTRACT

A nondiscript female dog was presented at MSVH, Kudappanakunnu with limbing and swelling of right forelimb with a history of fall from first floor. Anterior-posterior view on x ray revealed Salter Harris-IV fracture of distal condyle of right humerus with dislocation of the main bone. Taking all the aseptic precautions under general anaesthesia, surgical intervention was given and fracture was corrected. Surgical wound was sutured in standard routine manner. Uneventful recovery marked successful surgical intervention.

Introduction

Fracture is an incomplete/complete break in the continuity of bone or cartilage (Venugopal, 2019). Causes may involve trauma which may again involve direct and indirect trauma and the other one is the various pathological conditions like bone neoplasms, infections etc.

Physeal fractures is a type of fracture that happens at or across the physal line in an immature animal it may be subdivided into Salter-Harris(S-H) classification. Salter-Harris type IV is a fracture that crosses the physis, with one end of the fracture line exiting at the metaphysis and the other exiting at the epiphysis (McKee *et al.*, 2005). Articular fractures involve the joint surface. Physeal fractures involve the growth plates in immature animals. Epiphyseal

fractures and metaphyseal fractures occur in the trabecular bone at the proximal or distal end of the humerus.

Fractures of the distal humeral condyle are common and include fractures of lateral or medial portions of the condyle or both, known as a T-fracture or Y-fracture of the condyle (Fossum *et al.*, 2018).

The fracture line passes between the lateral and medial portions of the condyle, crosses the physis and exits through the metaphysis. Because the physis is involved, the fracture is classified as Salter-Harris IV fracture. Adult animal also sustain lateral condylar fractures through this mechanism.

In small breeds, particularly Spaniels, incomplete ossification between the medial and lateral portions

of the condyle predisposes to condylar fracture and may cause forelimb lameness (Fossum *et al.*, 2018).

Materials and Methods

A 6 month old non descript female dog was presented at Multi Speciality Veterinary Hospital, Kudappanakunnu with limping and swelling of right forelimb with a history of falling.

Signalment

A 6 month old nondescript female dog, weighing 7.5 kg was presented at MSVH kudappanakunnu with above said complaints.

Anamnesis

The animal was presented with a history of falling. The animal was unable to bear weight on the right forelimb and was keeping the right forelimb raised from the floor on presentation. Animal was alert and active on presentation and temperature was found to be within the normal range. No external wounds were observed.

Physical examination

Physical examination of right forelimb was done and crepitation was noticed on the elbow joint. Rectal temperature was within the normal range (102 F). Mucus membrane was pale roseatte. Lymph nodes were palpable.

Radiographic examination

On radiographic examination partial avulsion of the distal condyle of right humerus with dislocation of rest of the bone was observed. The fracture was graded as Salter-Harris type IV.

Diagnosis and treatment

Simple Salter-Harris type IV fracture of the right humerus was diagnosed. Intramedullary pinning using Steinmann's pin (2mm) and Cross Pinning was

suggested as the treatment option. On complete blood count slight lymphocytosis and anemia could be observed. Serum calcium, phosphorus and magnesium levels were estimated of which phosphorus levels were higher than normal. On biochemical analysis LFT, RFT values were normal.

Surgical procedure

Surgical anatomy

Depending on the severity of injury, the normal anatomy and surgical landmarks of this region may be distorted by soft tissue bruising and swelling. Proximally, the greater tubercle and acromion of the scapula are readily palpable, distally the medial and lateral epicondyles are easy to identify.

The cephalic vein courses with the subcutaneous tissue along the cranio-lateral surface of the limb. The radial nerve lies beneath the lateral head of the triceps near the distal third of the humerus. This nerve must be identified as it courses superficial to the brachialis muscle before the brachialis muscle is reflected from the humeral diaphysis. The tissue plane between the brachiocephalicus and triceps muscles must be carefully dissected to prevent injury to the nerve.

Preoperative preparations

The animal was fasted for 12 hr prior to surgery. The surgical site was clipped, shaved and prepared aseptically. The animal was placed in lateral recumbency.

Premedication and anaesthesia

Preanaesthetic medication was given with inj atropine sulphate at 0.045mg/kg and inj dexamethasone at 0.5mg/kg, administered intramuscularly, after 20 minutes induction was done with inj xylazine hydrochloride at 1 mg/kg and inj ketamine at 5 mg/kg intramuscularly. The animal was maintained with inj. ketamine and inj. diazepam (v/v) intravenously.

Positioning of the animal

The patient was placed on left lateral recumbency. Surgical site was sterilized and draped with sterile drape, exposing the fracture site.

Site

A linear incision was made on the craniolateral aspect of the arm (from distal condyle to the mid arm region).

Procedure

The distal humeral condyle was exposed by making a skin incision over the distal third of the humerus, extending 4 to 5 cm distal to the elbow joint. The deep fascia was incised to expose the extensor muscle. Incision was done on intermuscular septum between the extensor carpi radialis and common digital extensor muscles.

The incision was continued proximally through the origin of the extensor carpi radialis muscle. The muscle was retracted cranially to expose the joint capsule and underlying humeral condyle. Dislocation of the humerus was corrected together with correction of Salter-Harris IV fracture by intramedullary pinning, cross pinning and screwing.

The muscle layers was sutured with PDS(1-0) in simple continuous pattern and the skin was sutured with Nylon(2-0) by simple interrupted pattern (cross mattress). The limb was then immobilized with modified RJ bandage.

Preoperatively, Inj ceftriaxonetazobactam at 20 mg/kg intravenously was given along with Inj pantoprazole at 1 mg/kg, Inj chloril 5mg total dose intramuscularly, Inj meloxicam at .3 mg/kg subcutaneously and advised to continue antibiotic along with Inj pantoprazole, Inj chloril and Inj meloxicam for 6 more days. Advised syrup osteopet to be given 5ml twice a day per orally. Skin sutures were removed on 14th postoperative day and animal made an uneventful recovery from the surgery.

Results and Discussion

The above case occurred in a 6 month old female non-descript dog. The animal was presented with non-weight bearing of right forelimb. Diagnosis was made based on clinical signs, physical examination which revealed crepitation of the right forelimb in the elbow region.

Definitive diagnosis was made from radiograph which revealed partial avulsion of distal condyle of the right humerus with partial dislocation of the main bone. Anaesthesia was induced using ketamine and xylazine premedication with atropine, dexamethasone and maintained ketamine and diazepam.

Intramedullary pinning using 2mm steinmann's pin and cross pinning and screwing was done. Post-operative therapy with antibiotics (ceftriaxone) and analgesics (carprofen) were given with regular follow-up to check whether healing was taking place or not. The animal recovered well and no abnormalities with the function of limbs were observed after 1 month.

Articular fractures involve the joint surface. Physeal fractures involve the growth plates in immature animals. Epiphyseal and metaphyseal fractures occur in the trabecular bone at the proximal or distal end of the humerus. Fractures of the proximal humeral metaphysis and epiphysis are uncommon but occasionally occur through the proximal humeral physis in young animals. Fractures through the physis may result from minimal external force and exhibit only slight displacement. Fractures of the distal humeral condyle are common and include fractures of the lateral or medial portions of the condyle both, known as a T or Y fracture of the condyle. These fractures can also occur with comminuted supracondylar fractures. Lateral condylar fractures predominate over medial condylar fractures for two reasons. First, the radial head articulates with the lateral portion of the condyle, transmitting weight-bearing forces primarily through the lateral portion of the condyle.

Fig.1 Pre-operative radiograph.



Fig.2 Surgical site.



Fig.3 Skin incision



Fig.4 Exposing the fracture fragments



Fig.5 Salter-Harris IV



Fig.6 Fracture site after correction of dislocation



Fig.7 Cross Pinning.



Fig.8 Intramedullary pinning (Retrograde)



Fig.9 Fracture after correction.



Fig.10 Muscle after apposition



Fig.11 Skin after apposition.



Fig.12 Post-operative radiograph Lateral view



Fig.13 Postoperative radiograph Craniocaudal view



Fig.14 Robert Jones bandaging



Fig.15 Patient after 1 month.



Second, the anatomic position of the lateral portion of the condyle is eccentric to the bony column, causing weight-bearing forces to be transmitted through the radial head lateral condylar axis, resulting in separation of the lateral portion of the condyle. The fracture line passes between the lateral and medial portions of the condyle, crosses the physis and exits through the metaphysis. Because the physis is involved, the fracture is classified as Salter IV fracture (Fossum *et al.*, 2018).

Careful evaluation of the craniocaudal radiograph is essential because minimal displacement of the intercondylar fracture can occur. Adult animals also sustain lateral condylar fracture through the

mechanism already described. Isolated medial condylar fractures are not common but do occur in both immature and mature patients. T-and Y-fractures of the elbow are more common and represent an intercondylar fracture combined with a transverse (T) or oblique (Y) fracture combined through both medial and lateral epicondyle ridges (Fossum *et al.*, 2018).

Salter-Harris type IV fractures of the distal humerus (lateral condyle) is one of the most common physeal fractures encountered in practice. This is an articular fracture so anatomic reduction is essential to minimize the subsequent development of Degenerative Joint Disease. Although some

surgeons approach to this fracture is via transolecranon osteotomy, this approach and the pin and tension band repair necessitates are quite morbid and unnecessary. These fractures are well visualized and reduced using a caudolateral approach to the elbow. Repair is performed with a transcondylar lag screw and anti-rotational K-wire placed into the lateral humeral epicondyle. In small patients, two K-wires can be placed across the condyles or so called "Magic Pins" (self-compressing threaded k-wires) can be used. Most of these patients have an excellent post-op result despite the theoretically guarded prognosis typically associated with Salter-Harris type IV fractures (Venugopal, 2019).

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