

Case Report

Successful surgical management of radial and ulnar fracture by dynamic compression plating technique in a dog

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ABSTRACT

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Radius and ulna are paired bone. Radius/ ulna or both radius and ulnar fractures are common in small and large animals. Small and toy breeds of dog are more prone to distal radial fractures and have a high rate of complications even after surgical correction. The present case study was conducted for management of right distal radial and ulnar diaphyseal overriding transverse fracture in an eight-month-old, 8.4 kgs bodyweight male intact Samoyed breed of dog. The case was corrected by using a 2.7mm 8-hole dynamic compression plate applied in the cranial aspect of the radius. The patient was evaluated postoperatively at a different interval by clinical and radiographic examination up to 72 days of operation. Clinically, lameness grade was improved gradually and functional limb outcome was excellent on postoperatively day72. Postoperative day1 to day 72, X-ray revealed implant (plate and screw) in position and primary healing of the bone.

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1. INTRODUCTION

Diaphyseal fracture of the radius and ulna are common in dogs and cats. Fractures of the radius and ulna include about 1 in 6 of the fractures perceived in small animal exercise (Harasen, 2003; Muir, 1997). Most of the cases, the fracture occurs through the middle or distal third of the radius and ulna. Frequently, both bones are fractured but infrequently a solitary fracture of whichever the radius or the ulna is encountered (Ness and Armstrong, 1995). The common methods of fixation of radius and ulna fracture are external coaptation using casts or splints (Lappin et al., 1983), bone plating (Gibert et al., 2015; Ramirez and Macías, 2016) and external skeletal fixation (McCartney et al., 2010; Piras et al., 2011). Bone plating is generally accepted which gives consistently good results in the treatment of fractures of the radius and ulna. The plate most frequently used is the dynamic compression plate (DCP) (Permitted and Flo

1997). The method is suggested principally for mature dogs with overriding transverse fractures, oblique or comminuted fractures. This method is also recommended as the primary treatment in the toy and miniature breed of dogs (Denny and Butterworth, 2000). Complications of diaphyseal fractures of radius and ulna are not uncommon. Most common complications are premature closure of the distal ulnar growth plate, delayed union and non-union especially in toy and miniature breeds of dog and malunion especially in distal fractures (Denny and Butterworth, 2000). The distal radius and ulna fractures are recognized as having a frequency of delayed union or nonunion as high as 80% (Muir, 1997; Welch et al, 1997; Lappin et al., 1983) when treated with external coaptation or intramedullary pinning. Plate osteosynthesis with locking compression plates or conventional plates DCP (Gibert et al., 2015; Ramirez and Macías, 2016) achieves good clinical outcomes with a major complication rate of less than 6% (McCartney et

al., 2010; Piras et al., 2011; Gibert et al., 2015; Ramírez and Macías, 2016). The objective of the study is to evaluate the efficacy of dynamic compression plating technique in Samoyed dog at Shahedul Alam Quadery Teaching Veterinary Hospital (SAQTVH).

2. CASE HISTORY AND OBSERVATION

The study was conducted at Surgery Unit, Sahedul Alam Quadery Teaching Veterinary Hospital (SAQTVH) in Chattogram Veterinary and Animal Sciences University (CVASU), Chattogram. An eight-month-old intact male Samoyed dog weighing 8.4kg was carried to SAQTVH for treatment with the history of falling from a height and limping in right forelimb for past 11 days. A local veterinarian has been treated the dog with a soft cotton bandage immediately after fracture (Figure 1). The dog was active and alert but reduced appetite during clinical examination and orthopaedic examination revealed non-weight-bearing (Figure1), pain on palpation, swelling and crepitation. Neurological examination showed positive conscious proprioception and deep pain reflex. The radiographic examination confirmed the closed diaphyseal overriding transverse distal third right radius and ulnar fracture (Figure 2). Based on the fracture patient assessment score (FPAS), the case was decided for open reduction internal fixation (ORIF) by dynamic compression plating.

3. PATIENT PREPARATION, ANAESTHESIA AND OPERATIVE TECHNIQUE

Under physical restraining, clipping and shaving were done on affected limb proximally above the elbow joint and distally below the carpal joint and surgical areas were made aseptic by using 7% povidone-iodine and 70% alcohol (Figure 3). The dog was sedated by using xylazine hydrochloride (Xylaxin®, Indian Immunological Ltd.) @ 1.0 mg/kg body weight intramuscularly and induction was performed by ketamine

hydrochloride (G-Ketamine®, Gonoshasthaya Pharmaceutical Ltd.) @ 5.0 mg/kg body weight intravenously and anaesthesia was maintained by monitoring the patient approximate half of the induction dose. The patient was positioned in lateral recumbency and the affected limb downward (Figure 3). Through the craniomedial approach, a linear incision was done (Figure 4), exposed both proximal and distal end of the fractured bone (Figure 5) and removed all soft tissue attachment of the fractured end. The fracture was anatomically reduced by manual and toggling technique and stabilized by applying 2.7mm 8 holes DCP with cortical screws in the cranial aspect of bone (Figure 6). The surgical wound was closed like a standard surgical procedure (Figure 7) and applied Modified Robert Jones Bandage (Figure 8).



Figure 1. Non weight bearing after 1 week of MRJ bandage applied (left) and X-ray revealed fractured fragments were not in alignment (right).



Figure 2. Lateral and craniocaudal radiograph of affected and contralateral limb- Overriding diaphyseal radius and ulnar fracture in right forelimb.



Figure 3. Aseptic preparation of surgical site by using sterile drapes.



Figure 4. Craniomedial approach- a linear incision was done.



Figure 5. Exposed the proximal and distal end of fractured bone.



Figure 6. Fixation of fractured bone by using 2.7mm 8-hole dynamic compression plate.



Figure 7. Closure of surgical wound by using silk.



Figure 8. Applied MRJ bandage, immediate after surgery.

4. POSTOPERATIVE CARE AND ADVICE

Postoperatively, antibiotics- Ceftriaxone (Renacef vet®, Renata Ltd.) used for five days intramuscularly @ 50 mg/kg body weight, pain killer- Meloxicam (Melvet®, Acme Ltd.) used for three days subcutaneously @ 0.2mg/kg body weight and antihistaminic- Pheniramine maleate (Alerin®, SK+F Ltd.) used for five days intramuscularly @ 0.5mg/kg body weight. Advice was given to apply cold application in the affected area for three days and restricted movement for one week, keep the surgical area dry, neat and clean until wound healing and follow up checkup especially for radiographic evaluation of bone healing. To evaluate the surgical outcome of the dog, the following parameters were analyzed at regular interval- lameness grade, functional limb outcome, fracture healing by radiographic examination.

5. RESULTS AND DISCUSSIONS

Postoperatively, the results were evaluated by clinical and radiographic examination. Immediate after surgery, an X-ray was taken which revealed implant (plate and screws) in position (Figure 9). On a postoperative day 7, mild weight-bearing was observed on the affected limb (Figure 10) and wound healing was also noticed on the same day and stitches were

removed. Radiographic examination was performed on the same day which revealed implant in position and there was a gap in fracture fragments (Figure 10). On a postoperative day 15 and day 28, clinically and radiographically, improved weight-bearing (Figure 11) and primary healing progress (Figure 12) was observed respectively.

Postoperatively 72 days, clinically functional limb outcome was excellent (Figure 13) and radiographic examination confirmed the implant (plate and screws) in position and fracture gap was reduced and primary healing (Figure 14) was observed. Postoperatively from day 1 to day 72, there were no complications in the wound, plate and screws but mild reduced carpal joint mobility was recorded during the flexion of the joint.



Figure 9. Lateral and craniocaudal radiograph- immediate after surgery- implant in position.



Figure 10. Mild weight bearing at 7th postoperative day (left) and implant in position (right).



Figure 11. Improved weight bearing at 15th post-operative day.



Figure 12. Lateral radiograph- post operative day 28- primary healing progressed.



Figure 13. Normal weight bearing in posture at post-operative day 72.



Figure 14. Lateral and craniocaudal radiograph-implant in position and primary healing noticed at PO day 72.

The present case study was reported on successful surgical management of diaphyseal radius and ulnar fracture in a Samoyed dog by using dynamic compression plating technique. The dog was intact male, 8 months and 8.4kgs body weight and the aetiology of fracture was falling from a height.

Diaphyseal distal third radius and ulnar fractures are very common in small breed of dogs and mostly the nature of fracture is an either transverse or short oblique fracture which was reported by (Lappin et al., 1983; Eger 1990; Muir, 1997; Larsen et al., 1999; Hamilton et al., 2005; McCartney et al., 2010; Piraset al., 2011; Gibertet al., 2015) as injuries resulting from falls (Harsen, 2003). The occurrence of radius and ulnar fracture varies in different studies - 30% of all appendicular bone (Haaland et al., 2009), 10.6% (Cardoso et al., 2016), 36% (Roush, 2014), 5.1% (Eyarefe and Oyetayo, 2016), 5.8% (181/3110) (Keosengthong, 2019). Similar information like location and nature of the fracture, small breed, causes of fracture also found in the present case study.

Muller et al. (1970) reported the principles and developed techniques for fracture fixation. The original principles of the Arbeitsgemeinschaft für Osteosynthesefragen (AO) philosophy included open precise reduction and rigid fixation of all fracture fragments. The common methods of fixation of radius and ulna fracture are external coaptation using casts or splints (Lappin et al., 1983), bone plating (Gibert et al., 2015; Ramírez and Macías, 2016) and external skeletal fixation (McCartney et al., 2010; Piras et al., 2011). Piermattei and Flo, 1997 stated that bone plating is widely accepted method which gives consistently good results in the treatment of fractures of the radius and ulna. Among different plates, the dynamic compression plate (DCP) is most frequently used because it has the built-in potential of compression at the fracture site. Denny and Butterworth 2000 recommended that this method is suitable particularly for mature dogs with overriding transverse fractures, oblique or comminuted fractures. This method is also suggested as the primary treatment in the toy and miniature breed of dogs. In the present case study, 2.7mm 8-hole dynamic compression plate was used for the correction of radius and ulnar fracture in a male dog which was supported by the above findings.

Wallace et al. (1992) reported the plate application either cranial or medial aspect of radial fracture correction. The plate is usually applied to the cranial aspect of the radius and is the most widely used method for all diaphyseal fractures because it is easily accessible and provides a broad and only slightly curved surface. This surface helps well for fractures of the proximal and middle regions of the radius focus in the distal zone, the plate is the source of some morbidity. Therefore, the plate can be applied to the medial aspect in some cases particular distal radius fracture. Lappin et al., 1983 mentioned the ulnar fracture correction in small and large breeds of dog. Usually, the ulnar fracture requires no fixation because the radius is the main weight-bearing bone in the forearm. It acts as a splint for the ulna because of the interosseous attachments between the two bones. But this rule is not applicable in large and giant breeds of dog in which plate fixation of both the radius and ulna is suggested. Piermattei and Flo (1997) described the difficulty of closing the surgical site and plate application in the medial or cranial aspect of the radial bone. Partition and raise of the extensor tendons from their synovial sheaths in the middle groove of the distal radius and the succeeding gliding of these tendons over the plate surface produce a variable gradation of functional problem. In calculation to that difficulties are sometimes met in closing the scant soft tissues over a distal plate. However, the majority of the problems can be eliminated by medial plate placement for distal fractures. Technically one problem in the medial plate application is that the medial surface is narrower and the medial plate should be smaller (2.7 versus 3.5mm) than the cranial plate. In the present case study, the 2.7 mm DCP was applied in the cranial aspect of radius bone only which suggests the above findings. Complications of diaphyseal fractures of radius and ulna are very common. Denny and Butterworth, 2000 stated that the most common complications are premature closure of the distal ulnar growth plate, delayed union and non-union especially in the toy and miniature breeds of dog and malunion especially in distal fractures. Muir (1997); Welch et al. (1997) and Lappin et al. (1983) found that the distal radius and ulna fractures are the most common site where delayed union or nonunion as high as 80% when treated with external coaptation or intramedullary pinning. There are three main reasons for the higher rate of complications: high

interfragmentary strain, challenges in achieving stability with external coaptation, variations in blood supply. The biggest single reason why small breed dogs have problems with the healing of fractures in the distal third of the radius or ulna is decreased density of the intrasosseous blood supply in this region in small compared with larger dogs (Welch et al., 1997). Extraneous blood supply is also limited due to minimal overlying soft tissues (Denny and Butterworth, 2000). Gibert et al. (2015); Ramírez and Macías (2016) stated that plate osteosynthesis achieves good clinical outcomes with a major complication rate of less than 6% (McCartney et al., 2010; Piraset al., 2011; Gibert et al., 2015; Ramírez and Macías, 2016). Postoperative swelling and pain are reduced by the use of a Robert-Jones bandage for 3 to 5 days. In the present case study, there was no complication in soft tissues and bone healing except mild reduces the carpal joint mobility during the flexion of the joint.

6. CONCLUSIONS

Radial fractures are most common in the distal one-third of the diaphysis of small and large breeds of dog and have a greater risk for development of delayed union or nonunion. The method selected for the repair of radial fractures influences the course of healing. In the present case study, distal diaphyseal overriding transverse radial fracture was corrected by using a 2.7mm 8-hole dynamic compression plate. This study concluded that the DCP technique can be successfully applied in field condition for distal radial fracture management in small breed of dog.

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