MANAGEMENT OF DIAPHYSEAL HUMERAL FRACTURE USING PLATE ROD TECHNIQUE IN A DOG

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ABSTRACT
A two year old non-descript male dog was presented to the Small Animal Orthopaedic Unit of Madras Veterinary College Teaching Hospital with the history of non-weight bearing lameness of right forelimb. Palpation of the right shoulder indicated pain, swelling and crepitus. Confirmative diagnosis of an unstable humeral diaphyseal fracture was made by radiographic evaluation of lateral and craniocaudal views. Haematological parameters were within the normal range. ORIF was carried out. A pre-operative plan was prepared using a small animal preoperative planning guide developed by the AO/ASIF (Small animal group) using plain radiographs. Open reduction and internal fixation was accomplished using a 3.5mm dynamic compression plate. The plate was applied on the tension surface of the bone based on ASIF technique. Additional stability was provided by insertion of 3mm of intramedullary steinmann pin. Normal weight bearing was noticed on immediate post operative day.

Key words- Plate rod, humeral fracture, biological osteosynthesis, dog

INTRODUCTION
Humeral fractures are the least common long bone fractures in dogs. The low incidence of these fractures combined with the complex humeral anatomy and surrounding neurovascular bundles makes repair of humeral fractures challenging. They represent 34 percent of the forelimb fractures and 10 percent of all the fractures. Approximately 20 percent of humeral fractures were physeal, 50 percent were diaphyseal and 20 percent were condylar fractures (Simpson, 2009). Humeral fractures were generally not amenable to conservative repair and internal fixation is required (Beale, 2004). External co-aptation and inadequate implants led to fracture diseases. The primary goal of fracture treatment is to achieve a healed fracture with normal bone alignment and promote immediate function of the affected limb (Johnson et al., 1998). Open reduction and internal fixation using appropriate implants with minimal disruption to vascularity and soft tissue components is the goal of biological osteosynthesis. Plate rod fixation is a technique based on biological osteosynthesis and is a combination of intramedullary pin and dynamic compression plate (Stiffler and Kevin, 2004).
**CASE HISTORY AND OBSERVATION**

A two year old non-descript male dog was presented to the Small Animal Orthopaedic Unit of the Madras Veterinary College Teaching Hospital with the history of non-weight bearing lameness of right forelimb. Palpation of the right shoulder region indicated pain, swelling and crepitus. Confirmative diagnosis of an unstable humeral diaphyseal fracture was made by radiographic evaluation of lateral (Fig. 1) and craniocaudal views. Haematological parameters were within the normal range. Open reduction and internal fixation was decided for this case.

**TREATMENT AND DISCUSSION**

After a routine pre-operative fasting the dog was premedicated with Atropine sulphate at the dose rate of 0.04 mg/kg b.wt intramuscularly followed by Xylazine hydrochloride at a dose rate of 1 mg/kg b.wt intramuscularly. General anaesthesia was induced using Ketamine hydrochloride at a dose rate of 10 mg/kg b.wt intramuscularly and Diazepam at a dose rate of 0.2 mg/kg b.wt intravenously and maintained with (2%-3%) of sevoflurane using a Boyles anaesthetic machine. Pre-operative Cefotoxime and Meloxicam were administered at a dose rate of 20 mg/kg b.wt and 0.5 mg/kg b.wt intravenously.

A pre-operative plan was prepared using a small animal preoperative planning guide developed by the AO/ASIF (Small animal group) using plain radiographs. Lateral view was used to determine the length of the plate and craniocaudal view was used to determine the length and size of the screws. A craniolateral skin incision was made from the greater tubercle to lateral condyle (Piermattei and Greely, 1993). Cephalic vein was ligated and transected. Minimal separations of attached soft tissues were performed. The bone was approached after separation of brachiocephalicus, triceps and brachialis. Free floating bone fragments were removed. Open reduction and internal fixation was accomplished using a 3.5mm (8 holes) dynamic compression plate. The plate was applied on the tension surface of the bone based on ASIF technique. Seven cortices were engaged with the screws (proximal fragment 4 screws and distal fragment 3). The forth cortical screw was applied as a compression manner using an eccentric drill guide. Additional stability was provided by insertion of 3mm of intramedullary steinmann pin in retrograde manner. Muscle was apposed using no.1 PGA in continuous pattern and skin was apposed using silk as a cruciate pattern.

The standard craniolateral approach of the humerus advocated by Piermattei and Greely, (1993) provided adequate exposure with minimal soft tissue and vascular trauma to the fracture site. Smooth trocar pointed steinmann pins occupying approximately 40 per cent of the medullary cavity provided ancillary stability. The retrograde procedure was technically easy to perform. The intramedullary pin embedded in the distal cortex, had a three point fixation and resisted bending forces (Buchloz et al., 1987). No complications were observed in the present case.

A 3.5 mm dynamic compression plate and 3.5 mm cortical screws were used bicortically. Selection of plates was based on the weight of the animal and length of the bone. The technique of application depended on the configuration of the fracture and was based on AO/ASIF principles. When screws were inserted on either side of the fracture gap, and when one proximal screw was applied through an eccentric hole the bone and plate moved longitudinally relative to one another, the plate came under tension, the bone came under compression and the fracture gap was narrowed. Eccentric drill guide provided displacement of plate relative to bone. As the screw was tightened,
adjoining bone fragments created inter fragmentary strain. Free floating fragments with no tissue attachment were removed as they do function as a source of osteoblasts and have no role in the fracture healing process. The selection of plates and the technique of application were in accordance with the recommendation of Brinker et al. (1984).

The Lameness grading was carried out in accordance with the protocol developed by Brinker et al. (1984). Weight bearing was observed on immediate post operative day. The case was followed for six months and the outcome was excellent. Normal weight bears on all limbs at rest and when walking was graded as 1 (excellent) and was due to adequate fracture reduction with Plate Rod implant, load sharing between implants and bone and due to minimal disruption of the soft tissue hence facilitating biological osteosynthesis. Dynamic compression plate counteracted the fracture forces adequately but its ability to counter bending forces was probably insufficient. Addition of an intramedullary pin increased bending strength twice and fatigue life of the plate hundred fold (Vannini, 2004) which was observed in the

Fig. 1
Radiograph showing unstable Diaphyseal humeral fracture

Fig. 2 Plate rod - Immediate Post Operate day showing excellent alignment
presented case. Radiological study indicated excellent alignment of fractured fragments with stable implants and functional outcome was categorized as excellent (Fig. 2).

The plate rod technique is a recently developed technique based on AO/ASIF principles advocated for stabilizing unstable diaphyseal fractures of long bones and promoting biological osteosynthesis with excellent functional outcome.

ACKNOWLEDGEMENT

The authors acknowledge their gratitude to the Dean and Director of Clinics, Madras Veterinary College, for providing necessary facilities.

REFERENCES


