



PLATE-ROD TECHNIQUE FOR THE REPAIR OF COMMUNUTED DIAPHYSEAL FEMORAL FRACTURES IN YOUNG DOGS

Sherin B. Sarangom, *Kiranjeet Singh, Aswathy Gopinathan, K. Mohammed Arif Basha, D.S. Surendra, C. Sowbharenaya, Pallvi Sharma and Christina John

Division of Surgery, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, U. P., India - 243 122

*Corresponding author e-mail: ksuppli@yahoo.co.in, Ph: +91 8410757265

ABSTRACT

Comminuted diaphyseal fractures of femur in eight young dogs of age ranging from 5 months to 14 months and weighing above 10kgs, repaired with plate-rod construct (PRC) using locking plates, were clinically evaluated for its efficacy. The diameter of the intramedullary rod (IMR) used was 40% of the diameter of medullary cavity. In all the cases, 2.7mm (6-8 holes) locking plates along with locking screws were used without engaging the epiphyseal growth plates. At least two bicortical screws were placed in each fracture fragment. Size and length of the bone plate and screws was determined based on preoperative orthogonal radiographs and body weight of the dog. All the dogs started bearing weight on the affected limb the immediate postoperative day which improved gradually. There was satisfactory visible callus formation radiographically during the 4th postoperative week. Among the eight cases that underwent repair, one case developed major complication of pin migration. Minor complications like seroma formation and soft tissue irritation was seen in three cases. The results suggested that PRCs yield excellent results in diaphyseal femur fractures in young dogs with a range of severity if bone plates are placed away from the epiphyseal growth plates.

KEYWORDS: plate-rod construct, locking plates, femur, young dogs.

INTRODUCTION

Femur fracture is the most common long bone fractures in dogs accounting 37% (Kallianpur *et al.*, 2018). The surgical treatment of long bone diaphyseal fractures in puppies has to take into account the particulars of growing bone. In addition to anatomical alignment and apposition of bone fragments, added care is a prerequisite to prevent iatrogenic damage to the growth plates and periosteum. Meticulous handling of implants, particularly screws is imperative since the compact bone is less developed and cortices are thin in puppies (Sarrau *et al.*, 2007). Clinical use of plate-rod combination (PRC) has been associated with a high (98%) success rate (Reems *et al.*, 2003). The PRC has a greater versatility in fracture repair especially its ability in providing adequate strength despite some plate holes are left empty without adversely affecting the potential for fracture healing (Reems *et al.*, 2003). Also, the intramedullary rod (IMR) in PRCs serves to replace any transcortical defect in the bony column and act in concert with the eccentrically positioned plate to resist bending (Hulse *et al.*, 1997). The objective of this study was to evaluate the clinical outcome of PRCs in comminuted diaphyseal fractures of femur in young dogs.

MATERIALS & METHODS

Eight young dogs, aged between 5 months to 14 months weighing above 10kgs, presented with non-weight bearing lameness of hind limbs and diagnosed to have comminuted diaphyseal fractures were selected for the study. All the dogs had the history of automobile accident. The configuration and type of fracture along with the size and dimension of the implants used for the repair were

determined by orthogonal radiographs. For application of PRCs, the 2.7mm 6-8 hole locking plates (Nebula surgicals, Ahmedabad, Gujarat, India) were used in all the cases along with an IMR of 40% of diameter of medullary cavity. Preoperatively, food was withheld for 12 hours and water for 6 hours in all the dogs. Atropine sulphate at the rate of 0.04mg/kg BW SC followed by diazepam at the rate of 0.2mg/kg BW IV and butorphanol at the rate of 0.2mg/kg BW IV after 15 minutes were administered for premedication. Anaesthesia was induced using propofol at the rate of 4-6mg/kg BW IV and was maintained under 2% isoflurane in oxygen. A standard cranio-lateral approach to femur was made through an incision along the skin followed by subcutaneous tissue and *fascia lata*. The *biceps femoris* muscle was caudally retracted and the *vastus lateralis* muscle was cranially retracted to expose the fractured bone. Axial realignment and length of the fractured bone was re-established with a Steinmann pin that was inserted in a normograde manner through the inter-trochanteric fossa. Ancillary cerclage wiring was done if required to proximate any widely displaced bone fragments. The fractures was fixed using locking plates placed on the cranio-lateral surface without engaging the epiphyseal growth plates in all cases after contouring the plate according to shape of the bone. Every effort was made to preserve the periosteal attachments and fracture hematoma by minimizing handling of fracture fragments. At least two bicortical screws were placed in each fracture fragment and at least four cortices were engaged without damaging the epiphyseal growth plates. Once the plate was fixed, the *fascia lata* and the subcutaneous tissue were apposed separately using no 1-0 polyglycolic acid sutures

followed by the skin using polyamide in simple interrupted pattern.

Postoperatively, ceftriaxone at the rate of 20mg/kg BW was administered IV for 7 days along with meloxicam at the rate of 0.2mg/kg BW orally and tramadol at the rate of 4mg/kg BW orally for two weeks. Regular bandage dressing was done and the skin sutures were removed on the 10th postoperative day. Movement restriction was advised for four weeks followed by leash walking. Postoperative grading was performed for lameness while standing and walking, weight bearing while running, functional outcome and radiographic outcome up to 12th week. In all the cases, the IMR was removed on the 6th postoperative week.

RESULTS & DISCUSSION

The radiographic evaluation during the 4th, 6th, 8th and 12th postoperative week showed adequate alignment of fracture

fragments, good implant stability and satisfactory bone healing (Fig. 1). Periosteal and endosteal callus was observed during the 4th postoperative week. Extensive inter-osteal bridging callus was observed during the 4th to 5th weeks. Also, the photographic and video-graphic gait analysis and grades of weight bearing on these days showed satisfactory results. All the dogs showed weight bearing on the immediate postoperative day and complete weight bearing by 5th postoperative week. Out of the eight cases that underwent repair, one case developed pin migration. Minor complications such as seroma formation and soft tissue irritation due to the impingement of proximal end of pin were seen in three cases. Similar postoperative complications with PRCs were previously observed by Sarangom *et al.* (2018).

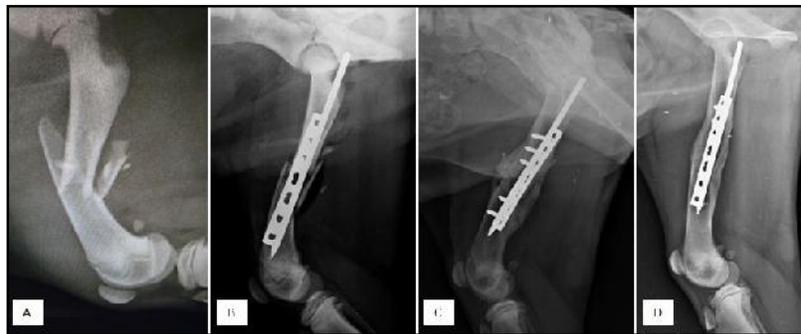


FIGURE 1: Plate-rod technique employed for the repair of diaphyseal femoral fracture in a pup. A: Day 1; B: Immediate postoperative; C: 6th week and D: 10th week

Plate rod technique has been used for the repair of diaphyseal fractures in dogs (Reems *et al.*, 2003 and Shiju *et al.*, 2010). In puppies, the simple femoral and tibial fractures usually undergo repair by the principle of elastic plate osteosynthesis (Casbassu, 2001 and Sarrau *et al.*, 2007). The elasticity was achieved by using longer thin plates fixed by two screws each in proximal and distal fragment. This was thought to induce micromotion of fracture fragments and in turn early callus formation. But in comminuted fractures where adequate implant-bone stability is imperative, the strength of the repair can be improved by the use of an IMR along with the plate. The eccentrically placed bone plates prevent the axial collapse and rotation of fracture fragments and the addition of IMR along with the plate improve the bending strength. Also, the IMR counteracts the susceptibility of plate to fail by bending at the level of empty screw holes. Another advantage of using PRC for the repair compared to plate alone is the ability to create an intermittent stress on the fracture site by removal of rod for stimulating fracture healing once the callus forms (O'Sullivan, 1989). Normograde placement of IMR was performed since retrograde pinning of femur was more likely to induce sciatic nerve injury (Palmer *et al.*, 1988).

Functional and radiographic outcome of seven dogs was excellent and one dog was good. The results suggests that PRCs can be used for the repair of diaphyseal femoral fractures of young dogs with wide range of severity by

placing bone plates away from the epiphyseal growth plates.

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