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Plate-rod fixation of a comminuted tibial diaphyseal fracture in a Juvenile Dog

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Abstract

A seven-month-old male Golden Retriever weighing 28 kg was presented with non-weight-bearing lameness of the right pelvic limb following a road traffic accident. Radiographs revealed a comminuted tibial diaphyseal fracture with an associated fibular fracture. Surgical stabilisation was achieved using a plate-rod construct comprising a 2.5 mm intramedullary Steinmann pin and a 3.5 mm locking compression plate. Progressive callus formation with stable implants was observed radiographically by postoperative days 9 and 16. The dog regained good weight-bearing without complications. Plate-rod fixation provided stable biological fixation and favourable fracture healing.

Keywords: Dog, plate-rod fixation, orthopaedics, tibial fracture

Introduction

Tibial fractures are among the most common long bone fractures in dogs because of the bone's subcutaneous location and limited soft tissue coverage (Seaman and Simpson, 2004; Sen, 2020) [6, 7]. Comminuted diaphyseal fractures are difficult to reconstruct anatomically without compromising the vascularity of fracture fragments. Plate-rod fixation combines the bending resistance of an intramedullary pin with the rotational and axial stability of a bone plate, providing a stable biological construct for fracture healing. This report describes the successful management of a comminuted tibial diaphyseal fracture in a juvenile dog using the plate-rod technique.

Case History and Clinical Findings

A seven-month-old intact male Golden Retriever weighing 28 kg was presented with acute non-weight-bearing lameness of the right pelvic limb following a road traffic accident. Orthopaedic examination revealed pain, crepitus, abnormal mobility and soft tissue swelling over the proximal tibia without external wounds.

Orthogonal radiographs revealed a comminuted wedge fracture involving the diaphysis of the right tibia with a large butterfly fragment and an associated complete fibular fracture (Figs. 1A and 1B). The proximal and distal tibial physes remained open. Radiographic examination of the rest of the skeleton ruled out additional fractures. Haematology revealed mild anaemia, while serum biochemistry showed elevated creatine kinase and aspartate aminotransferase activities consistent with muscle injury.

Results and Discussion

A standard medial approach to the tibia was performed while preserving the soft tissue attachments of the butterfly fragment. After restoration of limb length and alignment, a 2.5 mm intramedullary Steinmann pin was introduced in a retrograde manner. A 3.5 mm locking compression plate was then applied medially using four proximal and five distal cortical screws to complete the plate-rod construct (Fig. 1C). Autologous platelet-rich plasma (PRP) prepared from the patient's blood was infiltrated around the fracture site as an adjunctive biological therapy before routine wound closure. Postoperatively, the dog received amoxicillin-sulbactam, butorphanol, carprofen and gabapentin. Bandage changes with wound

dressings were performed every three days, followed by controlled leash walks starting at day 10 and hydrotherapy starting at day 27.

Immediate postoperative radiographs confirmed fracture reduction and implant placement. Follow-up radiographs obtained on postoperative days 9 and 16 demonstrated maintained alignment, stable implants and progressive periosteal callus formation without evidence of implant failure or loss of reduction (Figs. 1D and 1E). Progressive improvement in weight-bearing was observed throughout the postoperative period.



Fig 1: Serial radiographs of the right tibia showing (A, B) preoperative comminuted diaphyseal tibial fracture with an associated fibular fracture; (C) immediate postoperative plate-rod fixation; (D) postoperative day 9 showing maintained reduction with early callus formation; and (E) postoperative day 16 demonstrating progressive fracture healing and stable implants.

The plate-rod construct shares mechanical loads between the intramedullary pin and the plate, thereby reducing implant strain while maintaining fracture alignment, making it particularly suitable for comminuted diaphyseal fractures (Reems *et al.*, 2003) ^[5]. The locking compression plate is designed to minimise plate-to-bone contact, thereby helping preserve periosteal blood supply and supporting biological fracture healing (Frigg, 2001; Miller and Goswami, 2007) ^[1, 4]. Preservation of the soft tissue attachments to the butterfly fragment and the stable construct promoted indirect fracture healing, as evidenced by progressive callus formation during the follow-up period. Similar favourable outcomes have been reported when locking compression plates are used as bridging implants in comminuted fractures (Haaland *et al.*, 2009) ^[2]. Previous studies have suggested that PRP may enhance bone healing by concentrating growth factors involved in tissue repair (Kubota *et al.*, 2018) ^[3], however, its precise contribution to fracture healing in the present case cannot be determined.

Summary

The plate-rod construct was selected to improve resistance to bending forces while reducing the mechanical load borne by the plate because of the comminuted nature of the fracture. The favourable radiographic progression observed by postoperative days 9 and 16 indicated that the plate-rod construct provided sufficient stability for biological fracture healing while preserving the vascularity of the comminuted fragments. The technique therefore represents a practical and reliable option for managing unstable tibial fractures in skeletally immature dogs.

Conflict of Interest

Not available

Financial Support

Not available

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