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Research article

Evaluation of tibial fracture management by using dynamic compression plating with two proximal and two distal cortical screws- a case report in dog

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A B S T R A C T

Tibio-fibular fractures are very common in dog and cat. Such fractures are usually corrected by either internal or external fixation method. Internal fixation like dynamic compression plating with a minimum of total six to ten cortical screws is usually used for the management tibial fracture in dog. The objective of the present case study is to evaluate the efficacy of dynamic compression plating with a minimum of two cortical screws in each proximal and distal fracture fragments. The clinical case was performed in a five month old indigenous intact female dog weighing 12 kg which was suffering from mid-shaft left comminuted tibia and fibular fracture. Lameness grade, functional limb outcome and fracture healing were observed for the final outcome of dog. At 30th post-operative day, lameness grade was improved, functional limb outcome was excellent and progressive secondary bone healing was noticed without any complications.

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1. INTRODUCTION

Bone fracture is the lameness condition in which there is a partial or complete discontinuity of the bone. The clinical signs are varied depending on which bone is affected and is characterized by lameness, swollen and bleeding. Dogs constitute the majority of domestic pet population. These pets are more susceptible to long bone fractures, which are frequently caused by traumatic injuries or bone pathology. Fractures of the tibia account for 15% to 20% of all fractures in small animals (Johnson and Boone, 1993; Dixon et al., 1994; Hulse and Johnson, 1997 and Pope, 1998). Roush (2014) reported that tibia/fibula is the second most common bone where fracture occurs 22% in dog and 19% in cat. Jain et al, 2018 also reported that tibia-fibula is the second highest fractured bone in dogs where incidence was (28.99%). Abo-Soliman et al., (2020) found that the incidence of tibia and fibula fractures in dog and cat is 22.3% and 18.7% respectively. Isolated tibial fractures (i.e., with the fibula intact) account for 15% in all canine and feline tibial fractures (Zaal and Hazewinkel, 1996). Such highest incidence of fractures represent serious injuries, take a long time to heal and historically have a very poor outcome (Caudle and Stern, 1987; Johnson et al., 1994; Tornetta et al., 1994; Singer and Kellam, 1995; Gorse, 1998 and Harason, 2003).

Considering the facts, there have been changes in the management of diaphyseal fractures, toward less rigid fixation techniques which result in bridging the fracture gap without

reconstruction of the fracture fragments by using either buttress plate (bridging plate), plate-pin construct, external skeletal fixator or interlocking nail (Aron et al., 1995; Braden et al., 1995; Johnson et al., 1998 and Palmer, 1999). Proper implant selection and surgical technique are critical to a successful outcome (Perren, 1991; Gautirer et al., 1992 and Stiffler, 2004). So, the objective of the present research work was to evaluate the efficacy of two cortical screws in each side in bridging plate technique in dog.

2. MATERIALS AND METHODS

Case history and observation

A five month old indigenous intact female dog weighing 12 kg was registered to SAQTVH (Shahedul Alam Quadery Teaching Veterinary Hospital) with the history of limping in left hind limb since two days with unknown causes. The case was referred to surgery unit for detail investigation. Clinical examination revealed active and alert dog and non weight bearing limping in left hind limb. Orthopaedic examination shown swelling, pain and crepitation in mid shaft of the tibia. The case was further investigated by radiographic examination which confirmed mid-shaft left comminuted tibia and fibular fracture (Figure 1). On the basis of fracture patient assessment score (FPAS), the case was corrected by using dynamic compression plate.

Figure 1. X-ray revealed left comminuted tibia fibular fracture

Fracture management and post operative care

The surgery was performed with the pre-anesthetic xylazine hydrochloride at the dose rate of 1mg/kg body weight and induction and maintenance was done by ketamine hydro-chloride and diazepam. For induction, ketamine hydrochloride was used at the dose rate of 5 mg/kg body weight and diazepam at the dose rate of 0.05 mg/kg body weight intravenously and for maintenance, same anaesthetics were used considering the condition of the patient. After aseptic preparation of the surgical areas, the patient was positioned on operation table in left lateral recumbency. Through medial approach, a linear skin incision was done and separated the muscle fiber and exposed the fracture fragment. A 2.7mm 10 hole DCP (Dynamic compression plate) was used for the fixation of fractured bone (Figure 2). Two cortical screws were used in each proximal and distal end as fixation method. After stabilization of the fractured bone, surgical wound was closed (Figure 3) as standard procedure. A modified Robert Jones Bandage (Figure 4) was used as further stabilization. For postoperative care, antibiotics- Ceftriaxone (Renacef vet®, Renata Ltd, Mirpur, Dhaka) used for five days intramuscularly at the dose 50 mg/kg body weight, pain killer- Meloxicam® (Melvet®, Acme Ltd, Savar, Dhaka) used for three days subcutaneously at the dose 0.2mg/kg body weight and antihistaminic- Pheniramine maleate (Alerin®, SK+F Ltd, Tongi, Dhaka) used for five days intramuscularly at the dose 0.5mg/kg body weight. The advice was given to the owner 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.

Lameness evaluation

A lameness grade was assigned on the basis of severity of clinical signs on preoperatively and postoperative different day of dog to assess the response to treatment. Weight bearing was graded as follows (Vasseur et al., 1995).

Grade I - Normal weight bearing on all limbs at rest and when walking.
Grade II - Normal weight bearing at rest, favours affected limb while walking.
Grade III - Partial weight bearing at rest and while walking.
Grade IV - Partial weight bearing at rest and does not bear weight on affected limb while walking.
Grade V - Does not bear weight on limb at rest or while walking.

Functional outcome

Functional outcome was evaluated on the 30th postoperative day and categorized as excellent, good, fair and poor in all the groups of animals (Clark, 1986). The assessment was subjective and based on individual evaluation.

Excellent : No lameness compared to the dog's opposite limb, no post operative complications

Good : Moderate occasional lameness, does not require treatment, no postoperative complications

Fair : Moderate persistent lameness requiring treatment

Poor : Persistent severe lameness, may require revision surgery.

Figure 2. Tibial fracture was fixed by using 2.7mm 10 hole dynamic compression plate

Figure 3. The surgical wound was closed by cross mattress using silk

Figure 4. A modified Robert Jone's Bandage was applied

3. RESULTS

To evaluate the efficacy of DCP technique in tibial fracture management, lameness grade, functional limb outcome and radiographic examination were observed at different interval (day1, 3, 17 and 30). At post-operative day 1, radiographic examination revealed implant in position (Figure 5) The surgical wound was healed at 7th post-operative day without any complication. Postoperatively lameness grade was gradually improved (Figure 6) at successive interval and day 30th, lameness grade was 1 from 5. The progressive secondary bone healing was noticed at 17th (Figure 7) and 30th post-operative day. Similarly, function limb outcome was recorded as excellent at postoperative day 30th (Figure 8).

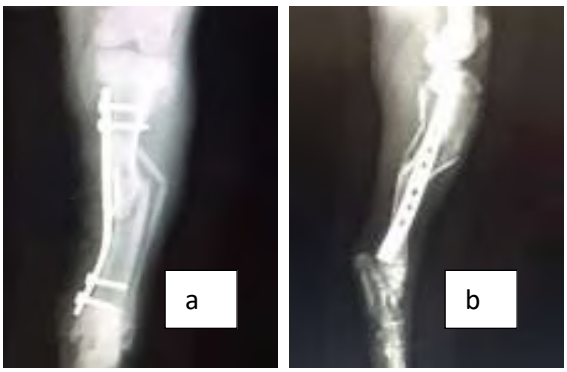

Figure 5. Cranio-caudal (a) and Lateral (b) radiograph revealed implant in position at day 1

Figure 6. Postoperative day 3: Improved weight bearing noticed (lameness grade 3)

Figure 7. Lateral radiograph revealed implant in position and healing progress at PO day 17

Figure 8. Functional limb outcome was excellent at postoperative day 30

4. DISCUSSION

The time of clinical union of bone fracture at 3-6 months old small animals was 2- 3 months which was corrected by bone plating (Piermattei and Flo, 1997) but in present case study, bone healing was observed since 17th postoperative day. Though clinical union was not recorded due lack of owner co-operation of radiographic examination. Malunion and non-union are more frequent fracture complica-tions because difficulty in reducing and keeping the reduction of bones in the presence of muscles that exert various deform forces over to the fractured bony fragments. Generally an open reduction and internal fixation (ORIF) is a best method of treatment for diaphyseal fracture, even though closed reduction may be achieved (Crenshaw et al, 2008). Treatment by closed reduction and cast immobilization usually results in a poor functional outcome caused by prolong bed rest, malunion, nonunion and joint stiffness. Now-a-days various types of plates are available for ORIF using plate and screws. Kotwal (2008) mentioned that among different plates, the dynamic compression plate (DCP) is the best quality for internal fixation of diaphyseal long bones fractures management. In the present case study, a 2.7mm 10 hole dynamic compression plates was used as bridging plate for open reduction and internal fixation of tibial fracture and no complication was recorded during the study period.

Piermattei and Flo (1997) stated that an absolute minimum of four screws (two screws in each proximal and distal) should be used in the bone fragments in small animals but a minimum of three to four screws are ideal and are mandatory for bridging plates in small animals. The numbers of screws do not vary with the size of the animal, as the plate sizes vary to allow approximately the same number of screws per unit of bone length. The authors also recommended that 2.7mm DCP can be used for 10-20 kg animal. In the present clinical study used two cortical screws on each side of the fracture as a brining plate where there was no complication found in the functional activities upto 2 month post-operative observation period. So the present case study suggests that the dogs weighing less than 15kg, tibial fracture can be managed by using two cortical screws on each side in 2.7mm dynamic compression plate with modified Robert Jones bandage and proper postoperative care.

5. CONCLUSION

The clinical case study concluded that mid-shaft comminuted tibial fracture can be managed in young dog by dynamic compression plating with a minimum of total four cortical screws and application of ancillary modified Robert Jone's Bandage.

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