

*Original Research***Management of Tibial Fractures by Intramedullary Pinning in Six Dogs****V. Lalzawmliana^{1*}, S. Warson Monsang¹, M. P. Baishya¹, Sabyasachi Bhattacharya²,
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Abstract

The objective of the study was to evaluate the suitability of intramedullary (IM) pinning for the management and treatment of tibial and fibular fractures in dogs. A total of 6 cases were treated with IM pinning during the year 2018, out of which one was stabilized with adjunct full cerclage wiring; while, one case was treated by using double pinning method. A rapid return to normal function with weight bearing was observed in most of the case, except one with delayed union. The method was chosen due to its low cost, easy to implant, easily available and less time consuming and was employed with a successful clinical outcome.

Key words: Anaesthesia, Fracture, Intramedullary, Tibia**How to cite:** Lalzawmliana, V., Monsang, S., Baishya, M., Bhattacharya, S., Sarkar, K., & William, B. (2019). Management of Tibial Fractures by Intramedullary Pinning in Six Dogs. International Journal of Livestock Research, 9(12), 34-43. doi: 10.5455/ijlr.20190902112017**Introduction**

Fractures are one of the most common clinical presentations observed in dogs, and accidental trauma being the most common etiology. In dogs and cats, fracture of the tibia and fibula accounts for about 20 % of all long bone's fractures (Boone *et al.*, 1986; Hill, 1977; Johnson *et al.*, 1989; Phillips, 1979; Richardson and Thacher, 1993; Whitney and Melhaff, 1987; Unger *et al.*, 1990; Seaman and Simpson, 2004). The most common site of tibial and fibular bone fracture involves the diaphysis (shaft) of the bone (Boone *et al.*, 1986; Richardson and Thacher, 1993), and tibial shaft fracture accounts for nearly 73% of all tibial fractures (Zaal and Hazewinkel, 1996). Tibia is covered by limited amount of musculature and soft tissues, and being an important weight bearing bone, it is very prone for fracture (Harasen, 2003). Due to the less amount of soft tissue surrounding the bone, a larger percentage of these fractures are open compared with fractures of

the upper extremities. The paucity in overlying muscle also minimize the contribution of the extraosseous circulation in the early stages of fracture healing and is the reason for relatively high rate of infection (up to 15%) in tibial fractures (Boone *et al.*, 1986; Richardson and Thacher, 1993). The method of fracture repair and the technique employed is based on fracture type and location, size and age of the animal, the number of bones and limbs involved, and other associated soft tissue injury (De Young and Probst, 1993). Many different methods have been used to repair long bone fractures, such as bone plates, pins, wiring, external fixators, and interlocking nails (Worth, 2007). However, in this present study we have employed intramedullary (IM) pinning fixation method for the fracture of tibia and fibula.

Materials and Methods

History and Diagnosis

The study included 6 dogs having tibia and fibula fracture presented to Teaching Veterinary Clinical Complex, College of Veterinary Sciences and Animal Husbandry, Tripura (West), India during the year 2018 with a history of accidental trauma and non-weight bearing lameness on the affected limb. Signalment including breed, age, weight, sex, bone involved and etiologies were recorded (Table 1).

Table 1: Case history and signalment

Case No.	Breed	Age (months)	Weight (kg)	Sex	Bone Involved	Etiology	Type of Fracture
1.	Spitz	2	2.4	M	Left tibia & fibula	Automobile Accident	Open, compound fracture
2.	Non-descript	9	10	F	Left tibia & fibula	Automobile Accident	Closed, communitated fracture
3.	Labrador	20	31	M	Left tibia & fibula	Falling from height	Open, compound fracture
4.	Rottweiler	12	26	M	Right tibia & fibula	Falling from height	Closed, complete fracture
5.	Non-descript	9	11	M	Left tibia & fibula	Automobile Accident	Closed, complete fracture
6.	Spitz	7	6.3	F	Right tibia & fibula	Automobile Accident	Closed, complete fracture

Tentative diagnosis was made by observing the weight bearing status of the affected limb and the bone involved revealed crepitation sound on manual palpation. Confirmatory diagnosis was made by radiography of the involved bone in lateral view to assess the location, type of fracture and the type of immobilization technique to be employed (Fig. 1).



Fig. 1: Pre-operative radiograph of Case no. 4 revealing complete fracture of right tibia (medio lateral view)

Pre-Operative Preparation and Anaesthesia

All the dogs were administered pre-operative analgesics till the date of operation and the affected limbs were supported with modified Robert Jones's bandage. As a part of pre-operative plan, food was withheld for 12 hours before surgery, but free access to water was provided until the last 6 hours. Pre-operative antibiotic (Ceftriaxone @ of 30 mg/kg b.wt intramuscularly) was administered 3 hours before surgery. All the hairs from the surgical site were clipped and the surgical sites were prepared as per the standard procedure. The animals were premedicated with atropine sulphate @ 0.02 mg/kg b.wt intramuscularly. Balanced anaesthesia was induced by a combination of xylazine @ 1 mg/kg and ketamine @ 8 mg/kg b.wt intramuscularly. Further, anaesthesia was maintained by diazepam and ketamine @ 0.5 mg/kg b.wt and 5 mg/kg b.wt respectively through intravenous route according to the requirement.

Surgical Procedure

The animals were placed in dorsal recumbency with the affected limb up, so that the surgeons had a good exposure to the cranio-medial aspect of the involved bone. Approximately 4-7 inches incision were made at the cranio-medial aspect of tibial bone parallel to the tibial crest to the corresponding limb, and extended to the entire length of the tibia (Fig. 2 A). The fascia and the muscles were dissected, avoiding the medial saphenous vein and nerve (Fig. 2 B). After crossing the middle to distal third of the tibial diaphysis, the

fractured part were carefully exposed. Drilling with intramedullary pin was done on the medial side of the proximal tibia until it reached the medullary space (Fig. 2 C)]. Intramedullary pins (Steinmann pin) of 2 mm to 4 mm diameter with length ranging from 12 to 18 cm were selected for this method according to the size of the bones. The pins were chosen so that approximately two third of the medullary canal was occupied. After appropriate reduction of proximal and distal fragments, further normograde insertion of the pin was performed until it reaches the distal fragments. In addition, a pin of similar length was used to measure the amount of length penetrating the distal fragment. Intraoperative findings like fracture configuration, extent of displacement and overriding of bone fragments, extent of bone loss, extent of soft tissue injury, and adhesion of soft tissue to the bone were recorded. A cerclage wiring was done in case no. 2 to support the immobilization and to maintain the bone in its alignment. Additionally, double pinning was performed in case no. 3 to achieve more stability. Finally, the muscles, subcutaneous tissues and skin were closed in a routine manner (Fig. 2 D).

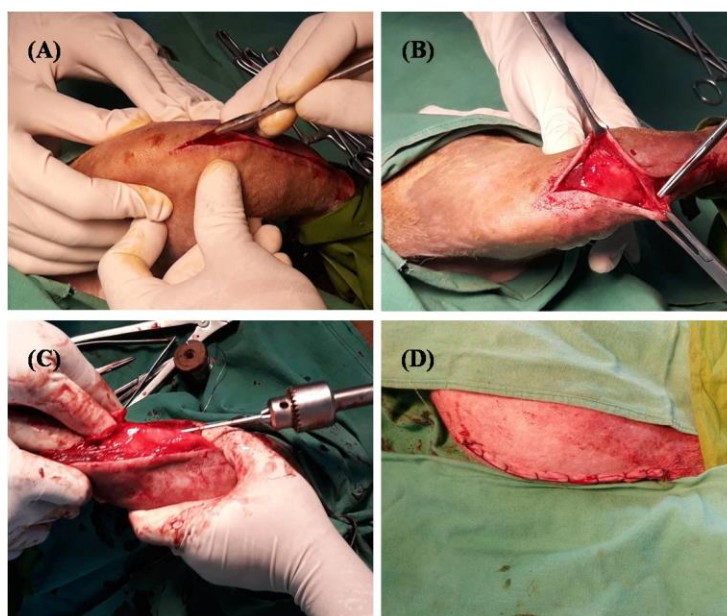


Fig. 2A: Skin incision on the cranio-medial aspect of the bone, (B) separation of skin and fascia, (C) insertion of pin through the proximal tibia and (D) routine closure of the surgical wound

Postoperative Care and Follow-up

Post-operatively, the operated limb was immobilized by external support in the form of modified Robert Jones's bandage for 2 cases and Thomas splint for the other 4 animals (Fig. 3 A & B) with antiseptic dressing of the wound which was done on alternate days for 10 days and extended if the wound does not heal completely. The animal was administered with ceftriaxone and meloxicam for 7 and 3 days respectively, which were extended based on the condition of the wound. Calcium and vitamin D supplement were also given for 1 month. The clients were advised to restrict the activity of the animal for first 2 weeks

and later the dogs were allowed leash walk. Post-operatively, the dogs were evaluated for any complications, the extent of weight bearing and the function of the involved limb. The radiograph taken immediately after surgery and subsequently at a regular interval were evaluated for fracture reduction, pin position, any complication, time taken for callus formation and time taken for complete bone healing. The sutures were removed after complete healing of the surgical wounds. Healing was considered complete when the callus was radiographically visible at both the fracture levels (Table 2).

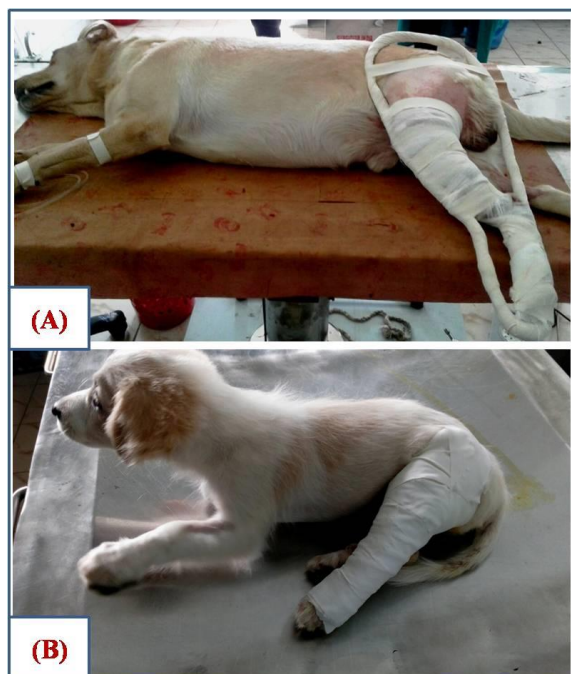


Fig. 3: Post-operative external coaptation showing (A) Modified Thomas splint in Case no. 3 and (B) Modified Robert Jones's bandage in Case no. 1

Table 2: Post-operative findings

Case No.	Technique/ implant used	External coaptation	Post-operative complications and infection	Complete healing of surgical wound and suture removal (days)	Earliest weight bearing (days)	Clinical union (weeks)	Clinical outcome (after 5 months)
1.	Single IM pinning	Modified Robert Jones's bandage	Present	25	7	12	Excellent
2.	Single IM pinning + full cerclage wiring	Modified Thomas splint	Absent	10	4	8	Excellent
3.	Double IM pinning	Modified Thomas splint	Present	30	9	16	Good with slight lameness
4.	Single IM pinning	Modified Thomas splint	Present	20	7	12	Good with slight lameness
5.	Single IM pinning	Modified Robert Jones's bandage	Absent	10	5	10	Excellent
6.	Single IM pinning	Modified Robert Jones's bandage	Absent	14	4	10	Excellent

Results and Discussion

The present study was conducted specifically for fracture of tibia and fibula in canine which was immobilized by employing IM pinning technique. Total number of 6 canine tibia and fibula fractures cases were included and stabilized with K-wire or Steinmann pin. In addition, case no. 2 was supported and immobilized with full cerclage wiring; whereas, double IM pinning method was employed in case no. 3. Out of 6 animals, 4 were closed fracture and other 2 animals were open fracture, among which case no. 2 was communitated fracture. Among them, 2 were female and 4 were male animals. In majority of cases, the etiologies were automobile accident (4 animals) and followed by fall from height (2 animals). In case no. 1, the nature of fracture was open fracture of tibia with extensive accidental wound. Normograde IM pinning of tibia was done with post-operative Modified Robert Jones's bandage. Here, due to extensive tissue lost there was severe infection of soft tissue and various complications, resulting long time for healing (25 days). Nonetheless, with good antibiotic cover the animal recovered uneventfully with excellent clinical outcome (Fig. 4 A, B, C & D). In case no. 2, the type of fracture was closed but communitated. As a result, IM pinning with additional full cerclage wiring was employed. The animal recovered without any complications (Fig. 5). In case no. 3, there was open fracture due to falling from the height and was stabilized with stack pinning method. There were several complications including post-operative infection, delayed union and pain in the stifle joint due to penetration of the joint by the pins. As a result, second operation was done to remove the pins after proper clinical union. The animal eventually recovers, but still exhibit slight lameness even after 5 months (Fig. 6 A, B & C). Case no. 4 was presented with closed complete fracture, which was immobilized with single IM pinning and Modified Thomas splint. Even though there was mild post-operative complications and infection, the animal recovered uneventfully with good result. Case no. 5 and no. 6 were having closed complete fracture and were immobilized using single IM pinning technique. In case no. 5, there was bending of the implant, may be due to small diameter. However, these animals recovered without much complications and excellent clinical outcome (Fig. 7 A & B).

All the cases in the present study involved fracture of the shaft, which was the most common site of fractures reported with tibia and fibula (Boone *et al.*, 1986; Richardson and Thacher, 1993). The method of fracture fixation should be chosen based on various factors *viz.*, type of fracture, type of bones, location, size and age of the animal, limbs involved, and the existing soft tissue injury (De Young and Probst, 1993). Methods commonly used for management of long bone fractures include bone plates, pins, wiring, external fixators, and interlocking nails (Worth, 2007), which can also be used in case tibia and fibula fracture as well. The objective was to maintain rigid stabilization so that movements of the involved bones were restricted. In this study, IM pinning fixation method was employed for fracture repair due to some advantages like its low cost, availability, easy implantation, and short implantation time. Sometime, internal fixation alone may be inadequate and secondary external support may be necessary (De Young and Probst, 1993); as a

result, all the cases were supported with external coaptation. The advantages of coaptation were that it was inexpensive and the materials necessary were readily available; however, the drawback was that it may require substantial maintenance and was prone to complications (Scott, 2005). External coaptation of tibial fractures was also beneficial to resist the bending forces. In addition, rotational forces were also partially neutralized by ensuring that the cast incorporated the adjacent joints (i.e., from digits to the inguinal area) (Smith and Torg, 1985). Moreover, it was observed that full cerclage wiring provided additional support in case of oblique fracture.

Generally, the pin should be chosen such that it fills approximately two thirds of the medullary canal (Howard, 1991), but in one case the pin was small which resulted in slight bending. Retrograde pinning from the fracture site must be avoided because the pin exits within the stifle joint and causes severe joint damage (Dixon *et al.*, 1994; Lesser, 1984; Pardo, 1994). As a result, the normograde insertion was performed from the medial side of the proximal tibia at the point halfway between the tibial tuberosity and the medial collateral ligament (Howard, 1991). Placement of the pin must not interfere with the normal joint function, especially in the stifle joint. Multiple IM pins (“stack pinning”) could also be inserted into the tibia; however, the procedure was technically difficult and adds only slightly to rotational stability (Kegan, 1983; Vasseur *et al.*, 1984), and it interferes with the stifle joint. However, after removal of the pin, the animal recovered successfully. Here, the pin should be inserted completely in the proximal tibial bone to avoid complications. It was also observed the most post-operative infection and complications in case of open fracture. The paucity of soft tissue surrounding the bone might contribute to the possibility of open fractures. The paucity in overlying muscle also minimize the contribution of the extraosseous circulation in the early stages of fracture healing and was likely to cause relatively high rate of infection (up to 15%) in tibial fractures (Boone *et al.*, 1986; Richardson and Thacher, 1993). In addition, it might result in high complication rate, resulting high frequency of delayed unions and nonunions (Fossum, 2007).

The average days for healing of the surgical wound were 18 days. From these, the time taken for wound healing was more in case of open fracture. In addition, the average days for weight bearing in the involved limb was 6 days and the average clinical union was at 11 weeks. From all the observations, the clinical outcomes were more favourable in case of animals with lower body weight. It was reported that in intramedullary pinning, the pin couldn't be left in place unless loss of function and pin loosening was present (Piermattei and Flo, 1997). So, in majority of the cases the pin was not removed, except in one case where it caused pain in the stifle joint and weight bearing issues. It was interesting to note that out of 2 compound fractures, one progressed with non-union and delayed union which was similar to the findings by Raghunath *et al.* (2012). Additionally, there was delayed healing of the surgical wound in both the open fracture cases. This may be due to the fact that open fractures associated with severe soft tissue injury, having a less

favourable biological environment, which might delay healing of the wound and lead to non-union (Johnson, 1994). Nevertheless, all the animals recover with successful clinical outcome.

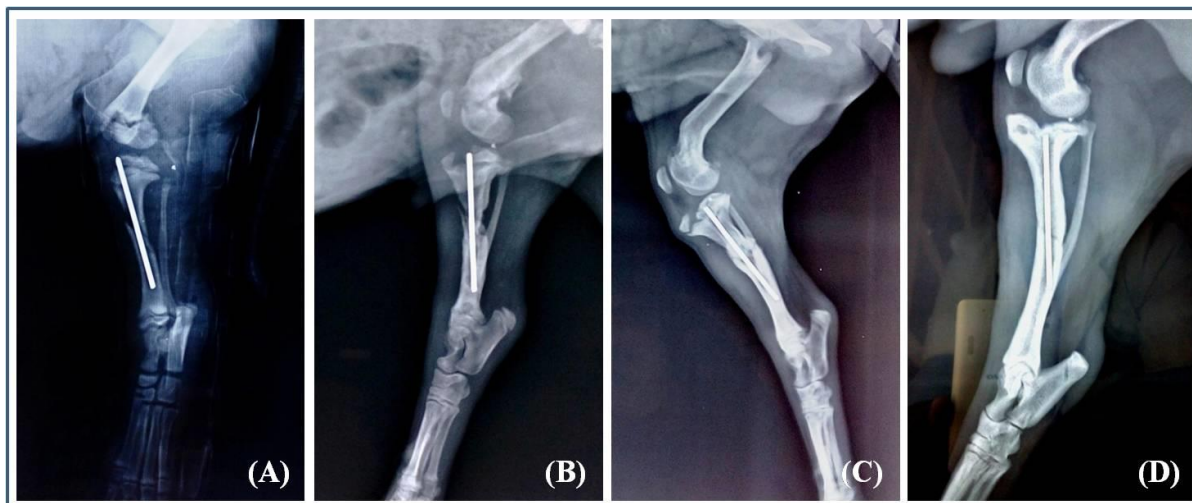


Fig. 4: Post-operative radiograph showing the sequence of fracture healing (A) immediately after operation, (B) 8 weeks post-operative, (C) 12 weeks post-operative and (D) 4 and half months after the operation of case No. 1 (lateral view)



Fig. 5: Radiograph showing IM pinning with full cerclage wiring of Case no. 2 immediately after the operation (lateral view)

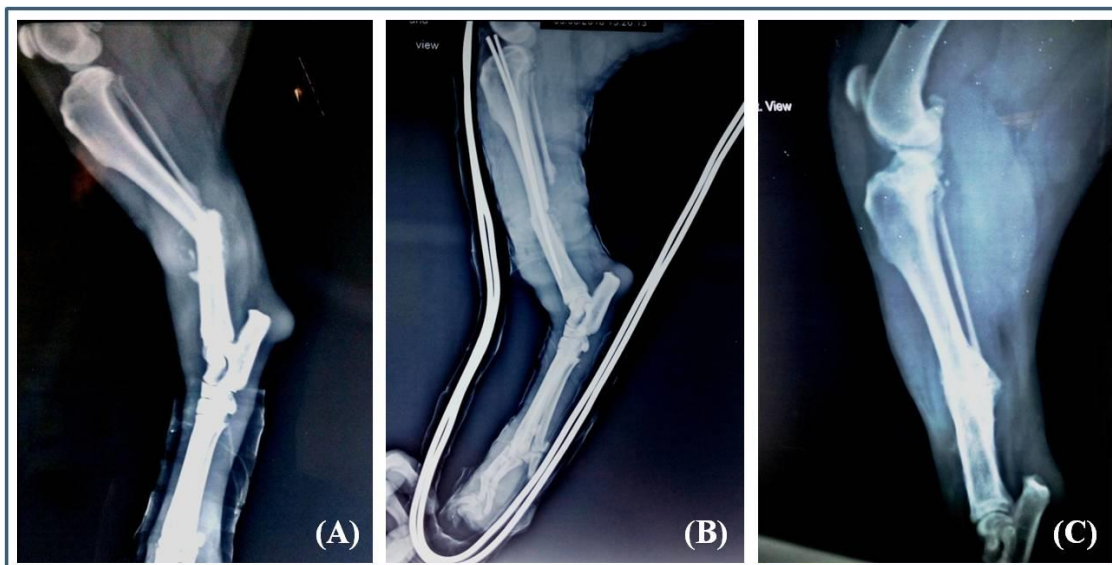


Fig. 6: (A) Pre-operative, (B) 8 weeks post-operative with the pins penetrating the stifle joint, and (C) 5 months radiograph after removal of the pin in Case no. 3 showing sequence of fracture healing (lateral view)

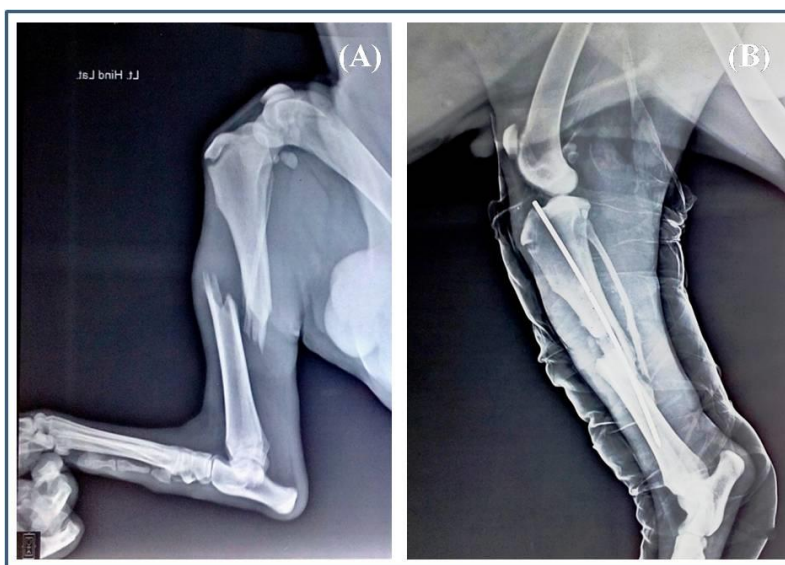


Fig. 7: (A) Pre-operative radiograph and (B) 6 weeks post-operative radiograph of Case no. 5 showing sequence of fracture healing

Conclusion

From the above results and findings, it was concluded that tibial and fibular fracture could be successfully managed by using IM pinning method if a correct technique was applied with appropriate pin size.

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