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**Tejas Yadav P**

Department of Veterinary  
Surgery and Radiology, Hebbal,  
Bengaluru, Karnataka, India

**Nagaraja BN**

Department of Veterinary  
Surgery and Radiology, Hebbal,  
Bengaluru, Karnataka, India

**V Mahesh**

Department of Veterinary  
Surgery and Radiology, Hebbal,  
Bengaluru, Karnataka, India

## Studies on percutaneous tibial fracture repair by intramedullary pinning in bovines

**Tejas Yadav P, Nagaraja BN and V Mahesh**

### Abstract

Six bovine clinical cases with closed diaphysial tibial fractures were selected and were stabilized by percutaneous intramedullary pinning. Occurrence of tibial fracture was more in less than a year age of calves and relatively more females were affected. Variation in the physiological and haematological parameters were statistically non-significant. The biochemical parameters like serum calcium, phosphorus showed statistically non-significant variations. Whereas, serum alkaline phosphatase levels were elevated upto 30<sup>th</sup> postoperative day and returned to normalcy by the end of the study period. Radiographic evaluation revealed satisfactory bone healing with sufficient callus formation at the fractured site on 45-60<sup>th</sup> postoperative days. All the animals started bearing weight on 30<sup>th</sup> postoperative day and complete weight bearing by 60<sup>th</sup> postoperative day. Based on the observations of the study, it could be concluded that the technique of percutaneous intramedullary pinning showed effective immobilization of the fracture, minimally invasive and feasible to be used in the field conditions.

**Keywords:** bovines, tibial fracture, percutaneous intramedullary pinning

### Introduction

Fracture treatment in large ruminants demands economical, effective immobilization techniques and utmost post-operative care to attain functional recovery and fracture union. Treatment of long bone fractures in large ruminants has been a challenge for Veterinarians due to their heavy body weight, temperament, poor muscle covering on certain bones, angular placement and conical shape of hind limb (Dingwall *et al.* 1971 and Gill and Tyagi, 1972) <sup>[3, 4]</sup>, high cost of treatment and owner non-compliance; especially under rural field conditions where the owners prefer culling the animal rather than opting for treatment due to economic reasons and time needed for recovery as the animals cannot be used for draft purpose until recovery. Transfixation pinning is accomplished by placing two or more pins transversely through the proximal and distal bone fragments and fixing the protruding ends with external wooden bars. Pin track infection or osteomyelitis was one of the most common post-operative complications in any orthopaedic surgery and could be expected more in bovines due to poor post operative management. Hence, percutaneous intramedullary pinning or any minimally invasive surgical techniques could prove successful with satisfactory outcome.

### Materials and Methods

Six bovines with closed tibial fractures presented to the Department of Veterinary Surgery and Radiology, Veterinary College Hospital, Hebbal, Bengaluru were selected for the study. The animals were sedated with Inj. Xylazine hydrochloride @ 0.1 mg/kg BW IM and after 10 minutes, Intra Venous Regional Anesthesia was induced by the administration of 10 ml of 2% Lignocaine hydrochloride into the lateral superficial vein just below the stifle joint, after application of a tourniquet above the stifle joint. In all the animals stifle joint was held in 90° of flexion, using manual chuck, in some cases unable to penetrate even we have used power drill, a full-length trocar pointed Steinmann pin of suitable length and diameter was inserted into the proximal tibial fragment percutaneously without opening the fracture site surgically and entered the medullary canal at the fracture site and was driven in a craniomedial direction into and through the proximal tibial cortex, then tibial crest and exited through skin. The fracture fragments were reduced and held in reduction as the pin was directed into the distal bone fragment. The pin left protruding from the skin, was cut by using pin cutter and limb was immobilised with Thomas splint. Pre and post-operative injection Ceftriaxone tazobactam @ 10 mg/kg BW IV and injection Meloxicam @ 0.2 mg/kg BW IM was administered to all the animals.

**Corresponding Author:****Tejas Yadav P**

Department of Veterinary  
Surgery and Radiology, Hebbal,  
Bengaluru, Karnataka, India

All the physiological, haematological and biochemical parameters were assessed at regular intervals. Degree of lameness (weight bearing pattern) by the animals was evaluated prior to surgery and on the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, 15<sup>th</sup>, 30<sup>th</sup>, 45<sup>th</sup> and 60<sup>th</sup> post-operative days. During the study period as per the grading scale described by Anderson *et al.* (2014) [2], the weight bearing was graded as Grade-0 (normal), Grade-1 (mild lame), Grade-2 (moderate lame), Grade-3 (severe lame) and Grade-4 (catastrophe). Radiography of postero-anterior and latero-medial views of the tibia were taken on 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, 15<sup>th</sup>, 30<sup>th</sup>, 45<sup>th</sup> and 60<sup>th</sup> day after surgery to check pin insitu and assess bone healing. All the results of physiological, haematological and biochemical parameters were statistically analyzed using one way Analysis of variance (ANOVA) using computer based statistical programme, Graph Pad Prism and interpreted as per the procedure described by Snedecor and Cochran (1996) [8] to arrive at a conclusion.

### Results and Discussion

The occurrence of tibial fracture was 14.75% (n=9) out of all the bovine fracture cases (n=61) reported. The results were in accordance with Ferguson (1982) [5]. Relatively more bovine tibial fractures were recorded in females (n=5, 56%) than in males (n=4, 44%). Higher incidence of fractures in younger animals was recorded this might be related to their agile temperament. Highest occurrence of tibial fractures in bovines were recorded due to automobile accidents, this might be due to an increase in the road traffic in recent years Varalakshmi (2016) [13]. Six animals were subjected for percutaneous tibial fracture repair by intramedullary pinning technique. Both Physiological and haematological parameters varied non-significantly throughout the study period. Similar observation made by Syed (2013) [10] and Varalakshmi (2016) [12]. A significant increase in the peak value of serum alkaline phosphatase was observed on the 15<sup>th</sup> to 30<sup>th</sup> post-operative day and receded to normalcy by 60<sup>th</sup> post-operative day. This finding in the present study was in accordance with Mohamed (2003) [6].

Degree of lameness was recorded, and on 45<sup>th</sup> post-operative day, one animal showed normal weight bearing, five animals showed mild lameness. This finding was in accordance with the findings of Aithal *et al.* (2004) [1]. On 60<sup>th</sup> post-operative day all the animal showed complete weight bearing with nearing to normal gait. Similarly St-Jean *et al.* (1991) [9] reported complete weight bearing in treated animals by 8 weeks post operatively. Overall, an early ambulation and reduced post-operative pain was observed in all the animals.

Radiographs taken at different intervals revealed gradual and progressive mineralisation of bone callus at different stages of healing. The radiographs obtained immediately after the surgery revealed good alignment of fracture fragments. Radiographs obtained on 3<sup>rd</sup> and 5<sup>th</sup> post-operative day revealed clear contour of fracture fragments and pins were insitu. On 7<sup>th</sup> post-operative day, slight periosteal reaction was seen in four among the six cases. This early sign of periosteal reaction revealed improved blood supply to the periosteum. The callus was not visible in any of the cases and pin was insitu. Images obtained on 15<sup>th</sup> post-operative day revealed this early sign of periosteal reaction, improved blood supply to the periosteum very small amount of the callus was visible in all cases. This finding was in concurrence with Aithal *et al.* (2004) [1], Tambe (2010) [11] and Patel *et al.* (2012) [7]. Radiographs obtained on 30<sup>th</sup> post-operative day revealed

formation of callus cuff and radiograph obtained after 45<sup>th</sup> post-operative day revealed clear bridging between fractured fragments. Similar findings were also recorded by Tambe (2010) [11], Patel *et al.* (2012) [7]. The radiographs obtained on 60<sup>th</sup> post-operative day revealed intensified and excess callus formation at fracture site and fracture groove almost disappeared. These results were in concurrence with the findings of St-Jean *et al.* (1991) [9], Aithal *et al.* (2004) [1].

The implant was removed based on the radiographic evaluation of the clinical union of fractures evidenced by the presence of hard callus at fracture site. In all the animals, implant was removed on 45<sup>th</sup> post-operative day based on radiographic evaluation, and this allowed satisfactory limb usage after removal of implant. These findings were in accordance with St-Jean *et al.* (1991) [9]. Complications like slight pin migration on 3<sup>rd</sup> post-operative day in one case and slight pin bending on 5<sup>th</sup> post-operative day were observed. Similar complications were also observed on 15<sup>th</sup> post-operative day by Patel *et al.* (2012) [7].

### Summary

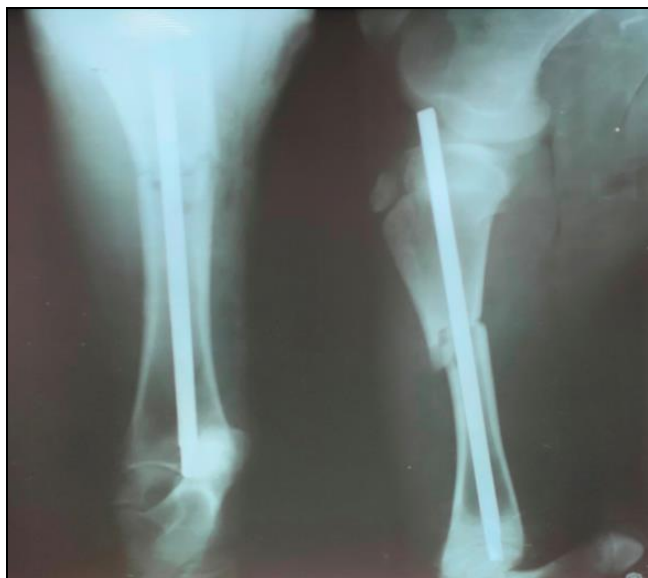
Percutaneous intramedullary pinning for tibial fracture repair in bovines was performed without any difficulty in all the six bovine cases. Post-operative radiography revealed proper alignment of bone fragments up to 60<sup>th</sup> day postoperatively. Satisfactory and complete recovery was seen in all the six treated bovine cases and early restoration of normal limb function in treated animals with negligible complications. Based on the observations, it could be concluded that this technique is minimally invasive, provide early limb usage and weight bearing and economically feasible under field conditions.



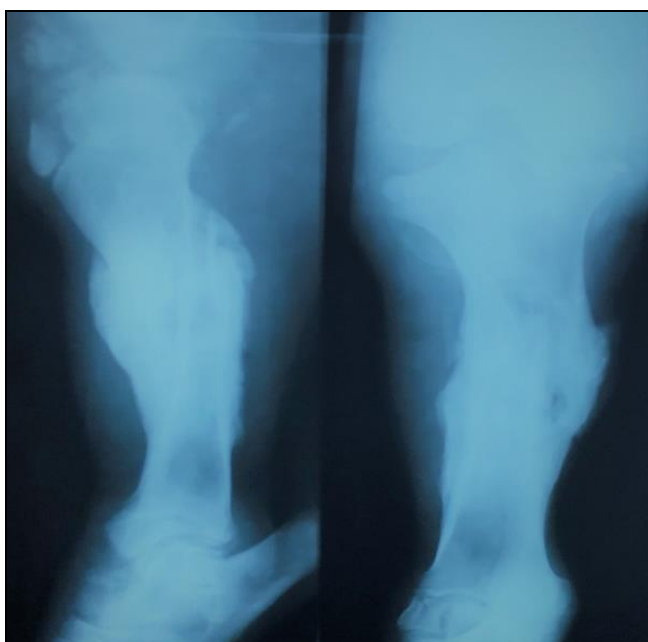
**Fig 1:** Photograph showing placing of intramedullary pin into proximal fragment and exiting at tibial crest



**Fig 2:** Photograph showing placing of pin into the distal fragment of tibia after proper reduction of fragments



**Fig 3:** Skiagram showing intramedullary pin in situ on 1<sup>st</sup> day post-operative



**Fig 4:** Skiagram showing complete union of fracture with cortical continuity on 60<sup>th</sup> day post-operative

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