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## Studies on physiological, hematological and biochemical changes during traumatic compound metatarsal fracture repair by supercutaneous plating technique in bovines

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### Abstract

Six bovine cases which underwent supercutaneous plating for the repair of traumatic compound metatarsal fracture, physiological and hemato-biochemical changes were evaluated before surgery and on 1<sup>st</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. The changes in the physiological and hematological values were within normal range and statistically non-significant throughout the study period due to less surgical stress, very minimal bleeding and medications. The biochemical parameters like serum calcium, phosphorus showed statistically non-significant variations. Whereas, serum alkaline phosphatase levels were elevated up to 30<sup>th</sup> postoperative day and returned to normalcy by the end of the study period.

**Keywords:** Bovines, metatarsal, supercutaneous plating, physiological, hematological, biochemical and serum alkaline phosphatase

### Introduction

Fractures in cattle were common as a result of self-inflicted damage or external sources such as herd mates or farm machinery (Velavan *et al.*, 2014) [13]. Most common clinical complications with the use of external skeletal fixators were instability at the fracture site, pin loosening, pin breaking, pin tract osteolysis, pin tract infection, implant failure, osteomyelitis and delayed union or non-union of the fracture (Singh *et al.*, 2007) [8]. Various physiological, hematological and biochemical changes will vary due to surgical bleeding, inflammation and post-operative healing mechanism. The present study was carried out to evaluate physiological, hematological and biochemical parameters in bovines that underwent supercutaneous plating technique for the repair of traumatic compound metatarsal fracture.

### Materials and Methods

Six bovine clinical cases of compound metatarsal bone 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 15 minutes, Intra Venous Regional Anesthesia was induced by the administration of 10 ml of 2% Lignocaine hydrochloride into the lateral superficial saphenous vein, after application of a tourniquet above the hock joint. These metatarsal bone fractures were stabilized by using supercutaneous plating technique. Physiological parameters like Rectal temperature (°F), Respiration rate (breaths/min) and Heart rate (beats/min) were recorded at regular intervals to check health status of animal. Blood samples were collected in EDTA and serum vials before the surgery and on 1<sup>st</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 for evaluation of both hematological and biochemical parameters, and 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) [9] to arrive at a conclusion.

### Results and Discussion

The mean pre-operative rectal temperature was 101.33±0.24 °F while the post-operative rectal temperature ranged from 101.58±0.20 °F to 102.36±0.29 °F. The mean pre-operative heart rate was 62±1.31 beats/min and post-operative heart rate ranged from 61.66±0.80 beats/min to

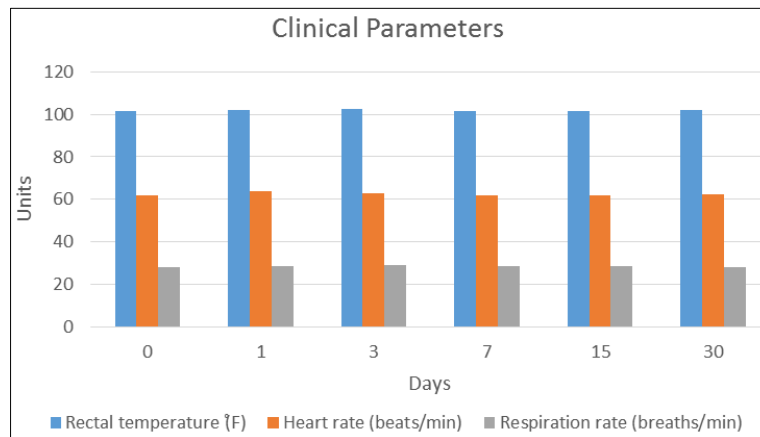
64.00±1.21 beats/min and mean pre-operative respiration rate recorded was 28.00±0.57 breaths/min and post-operatively it ranged from 28.16±0.83 breaths/min to 29.00±0.63 breaths/min. There was a statistically non-significant increase in all the physiological parameters on 1st post-operative day in all the animals and reduced from 3rd day onwards during the study period. This could be due to inflammatory conditions and excitement of animal during handling and surgery (Fig. 1). Similar observations were made by Balappanavar and Anil (2012)<sup>[2]</sup>, Syed (2013)<sup>[10]</sup> and Tejas Yadav (2021)<sup>[11]</sup>.

The mean hemoglobin concentration (Hb) pre-operatively was 11.51±0.50 g/dL while the post-operatively it ranged from 11.28±0.50 g/dL to 12.10±0.47 g/dL. The mean pre-operative level of total erythrocyte count (TEC) was 6.85±0.16 millions/cmm and the post-operative values varied from 6.66±0.16 millions/cmm to 7.05±0.15 millions/cmm and mean pre-operative level of total leukocyte count (TLC) varied from 11.58±0.12 thousands/cmm and post-operatively it ranged from 11.30±0.09 thousands/cmm to 11.66±0.10 thousands/cmm. The variations observed were within the normal physiological range and were statistically non-significant (Fig. 2). This might be due to minimum blood loss during the surgical procedure, inflammation and regular administration of antibiotics and anti-inflammatory injections post-operatively. The results were in concurrence with the findings of Rajendra Prasad (2013)<sup>[5]</sup>, Syed (2013)<sup>[10]</sup>, Varalakshmi (2016)<sup>[12]</sup> and Tejas Yadav (2021)<sup>[11]</sup>.

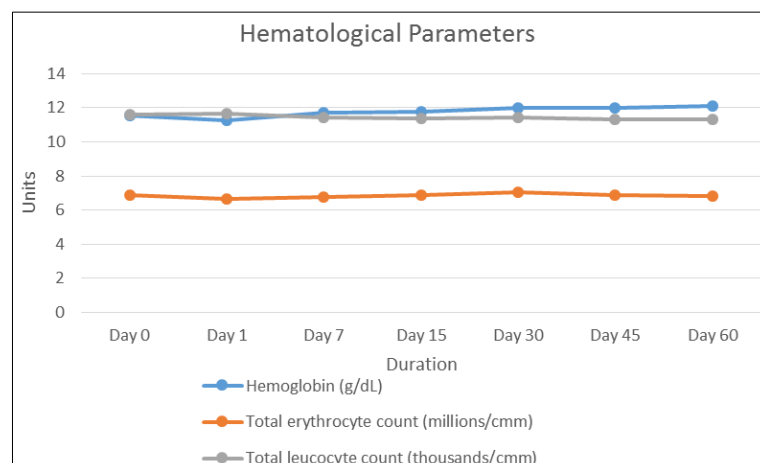
The mean DLC (%) i.e., neutrophils, lymphocytes, monocytes, eosinophils varied from 37.41±0.46 to 37.70±0.56, 70.35±0.86 to 71.25±0.92, 5.46±0.17 to

5.68±0.20, 3.18±0.10 to 3.61±0.06 respectively. Statistically, non-significant variation in mean value of neutrophils, lymphocytes, monocytes, eosinophils was observed (Fig. 3). The findings were in concurrence with that of Varalakshmi (2016)<sup>[12]</sup> and Tejas Yadav (2021)<sup>[11]</sup>.

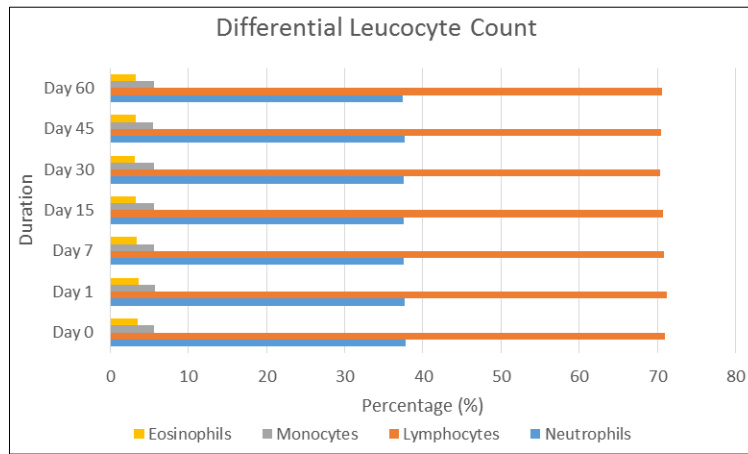
The mean pre-operative serum calcium level was 10.81±0.09 mg/dL and mean postoperative serum calcium levels varied from 10.68±0.12 mg/dL to 11.02±0.14 mg/dL. The mean pre-operative serum phosphorus mean value was 5.36±0.03 mg/dL and post operatively it ranged from 5.32±0.02 mg/dL to 5.41±0.04 mg/dL. The mean pre-operative serum alkaline phosphatase level was 167.31±14.99 IU/L and post operatively it ranged from 158.50±15.45 IU/L to 244.00±9.63 IU/L. Statistically non-significant variation in serum calcium, serum phosphorus levels was observed in the present study and the values were within the normal physiological range in all the animals (Fig. 4). Similar results were also observed by Ramesh (2000)<sup>[7]</sup>, Manojkumar (2018)<sup>[3]</sup> and Tejas Yadav (2021)<sup>[11]</sup>, but this is in contrary to Ramanathan (1996)<sup>[6]</sup> and Mohiuddin *et al.* (2018)<sup>[4]</sup> since they observed decline in serum calcium levels during their study. Ramesh (2000)<sup>[7]</sup> observed significant decrease in serum phosphorus from 15<sup>th</sup> to 30<sup>th</sup> post-operative day and increased until 60<sup>th</sup> day. Significant increase in the peak value of serum alkaline phosphatase was observed from 1<sup>st</sup> day to 30<sup>th</sup> post-operative day and receded to normalcy by 60<sup>th</sup> post-operative day. This increase might be due to the increased osteoblastic activity during the fracture healing period (Aithal *et al.*, 2007)<sup>[1]</sup>. The results of this study was in close approximation with Manojkumar (2018)<sup>[3]</sup> and Tejas Yadav (2021)<sup>[11]</sup>.



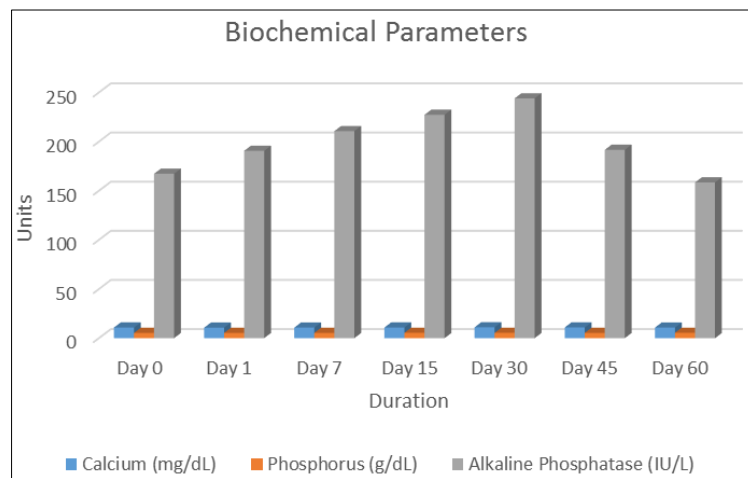
**Fig 1:** Variations in Rectal temperature, Respiratory rate and Heart rate.



**Fig 2:** Variations in Hemoglobin, TEC and TLC.



**Fig 3:** Variations in DLC



**Fig 4:** Variations in serum calcium, phosphorus and alkaline phosphatase.

**Summary and Conclusion**

In all the six animals which undergone compound metatarsal fracture repair by supercutaneous plating technique, physiological, hematological and biochemical parameters were assessed at regular intervals. Physiological and hematological parameters varied non-significantly throughout the study period due to minimally invasive technique and negligible bleeding during the surgery. In biochemical parameters, serum calcium and serum phosphorous varied non-significantly but serum alkaline phosphatase increased significantly from 1<sup>st</sup> to 30<sup>th</sup> post-operative days and returned to normalcy by the end of study period. The supercutaneous plating technique for metatarsal fractures in bovines showed effective immobilization of the fracture fragments, quick to apply, minimally invasive, adaptable, induces minimal stress on animals, minimal bleeding and feasible to be used in the field conditions.

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