The Pharma Innovation Journal 2023; SP-12(11): 2288-2291

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(11): 2288-2291
© 2023 TPI
www.thepharmajournal.com
Received: 17-08-2023
Accepted: 22-10-2023

Pooja D
MVSc Scholar, Department of Veterinary Surgery and Radiology, Veterinary College, Hebbal, KVAFSU, Bengaluru, Karnataka, India

V Mahesh
Assistant Professor, Department of Veterinary Surgery and Radiology, Veterinary College, Hebbal, KVAFSU, Bengaluru, Karnataka, India

KM Srinivasa Murthy
Associate Professor, Department of Veterinary Surgery and Radiology, Veterinary College, Hebbal, KVAFSU, Bengaluru, Karnataka, India

BN Nagaraja
Professor and Head, Department of Veterinary Surgery and Radiology, Veterinary College, Hebbal, KVAFSU, Bengaluru, Karnataka, India

MH Girish
Assistant Professor and Head, Department of Veterinary Anatomy, Veterinary College, Hebbal, KVAFSU, Bengaluru, Karnataka, India

Corresponding Author:
Pooja D
MVSc Scholar, Department of Veterinary Surgery and Radiology, Veterinary College, Hebbal, KVAFSU, Bengaluru, Karnataka, India

Haemato-biochemical variations in dogs undergoing supracondylar femoral fracture fixation by modified dynamic condylar screw plate with a lagscrew

Pooja D, V Mahesh, KM Srinivasa Murthy, BN Nagaraja and MH Girish

Abstract
Haemato-biochemical variations were assessed in 6 dogs that underwent supracondylar femur fracture fixation using modified dynamic condylar screw plate with a lag screw during the study period of 60 days in the Department of Veterinary Surgery and Radiology, Veterinary College Hospital, Bangalore. Haematological parameters *viz.*, haemoglobin, total erythrocyte count, total leukocyte count & differential leukocyte count and biochemical parameters *viz.*, serum creatinine, serum calcium, serum phosphorus, serum alanine aminotransferase & serum alkaline phosphatase were recorded before & immediately after surgery and on 7th, 14th, 28th, 45th and 60th post-operative days. Non-significant increase in total leucocyte was observed in the beginning of the study period which gradually decreased after 7th post operative day. Total erythrocyte count and haemoglobin increased non-significantly upto 60th day after surgery. The serum calcium and serum phosphorous and serum creatinine values varied non-significantly within the normal physiological range. Serum alkaline phosphatase increased significantly from 0th post-operative day upto the 14th day, with peak on 14th post-operative day. Later values decreased gradually and the values were higher than the normal range from 14th day upto 60th day.

Keywords: Dog, haemato-biochemical, modified dynamic condylar screw plate, supracondylar femur fracture,

1. Introduction
Femur is the longest and most weight bearing bone in the animal body which is frequently subjected to fracture in dogs. Fractures of the distal extremity of the femur is due to the significant number of forces acting at the caudal bowing of femoral condyles (Harasen, 2002) [3]. Open reduction and surgical repair are necessary for proper fixation as conservative treatment by external coaptation fails due to the substantial muscle mass around the bone (Ojus *et al.*, 2022) [11] and caudal displacement of distal fracture fragment by the pull of gastrocnemius muscle.
It is essential to choose an implant system that can encourage early bone healing while successfully balancing out all disruptive forces at the fracture site. The process of fracture healing involves formation of new organic bone matrix known as osteoid followed by its mineralization resulting in filling of the bone defect. Fracture healing is assessed by physical and series of radiographic examination. Various physiological and haemato-biochemical changes that occur during fracture healing may also be useful to assess bone healing when radiographic analysis is limited.

2. Materials and Methods
The present study was undertaken in six clinical cases of dogs with supracondylar femoral fractures presented to the Department of Veterinary Surgery and Radiology, Veterinary College Hospital, Hebbal, Bengaluru, that underwent fixation using modified dynamic condylar screw plate with a lag screw. Haematological parameters *viz.*, haemoglobin, total erythrocyte count, total leukocyte count & differential leukocyte count, biochemical parameters *viz.*, serum creatinine, serum calcium, serum phosphorus, serum alanine aminotransferase, serum alkaline phosphatase were recorded before & immediately after surgery and on 7th, 14th, 28th, 45th and 60th post-operative days.
Haematological parameters were assessed using an auto haematology analyzer (Mindray BC-2800Vet). Biochemical parameters were recorded using biochemical semi auto analyser (RX-50). The statistical analysis was done using One-way Analysis of Variance (ANOVA).

3. Results and Discussion

3.2 Haematological parameters

3.2.1. Haemoglobin (g%)

Throughout the study period, there were statistically non-significant variations in the mean haemoglobin levels. These insignificant variations could be be due to minimal haemorrhage during surgery. However, a progressive increase in haemoglobin was observed during post-operative days upto 60th day indicating erythropoiesis (Table 1). This was in agreement with the findings of Patil *et al.* (2017) [12], Reddy *et al.* (2020) [4] and Rahul *et al.* (2021) [13].

3.2.2 Total erythrocyte count (10^6 cells/mm^3)

A non-significant increase was observed upto 60th post-operative days (Table 1) occurring under normal physiological limit which could be due to erythropoiesis. This was in agreement with Patil *et al.* (2017) [12], Reddy *et al.* (2020a) [4], Rahul *et al.* (2021) [13].

3.2.3 Total leukocyte count (10^3 cells/mm^3)

There was no statistically significant difference between the mean values of total leukocyte count in dogs during the study period. Leucocytosis was observed in the beginning of the study period which gradually decreased after 7th post operative day (Table 1). This could be due to corticosteroid release in state of stress, pain, anaesthesia, trauma, surgical manipulation and inflammation at surgical site. Similar observations were documented by Maiti *et al.* (1999) [8], Mahesh (2009) [7], Patil *et al.* (2017) [12] and Rahul *et al.* (2021) [13].

3.2.4 Differential leukocyte count

Neutrophils, lymphocytes, monocytes and eosinophils counts showed no statistically significant variations and values were within normal physiological range (Table 1). This was in agreement with the findings of Patil *et al.* (2017) [12] and Rahul *et al.* (2021) [13].

3.3 Biochemical parameters

3.3.1 Serum creatinine (mg/dL)

These variations were statistically non-significant and the values fluctuated were within the normal range (Table 2, Fig 1). This shows that the antibiotics, anaesthetic protocol, analgesics and surgical procedure did not affect the kidney function. Similar findings were earlier recorded by Mahesh (2009) [7] and Tembhurne *et al.* (2010) [16].

3.3.2 Serum calcium (mg/dL)

The variations in the mean values of serum calcium were statistically insignificant and the values fell within the normal range. There was non-significant gradual decrease in mean serum calcium levels upto 14th post-operative day after which it increased gradually (Table 2, Fig 1). This could be explained by the mechanism that occur during fracture repair. Osteoblasts secrete large quantities of ALP which increases the concentration of local, inorganic phosphorus (P). Increase in extracellular concentrations of P results in deposition of calcium salts, thus lowering the extracellular Ca concentrations. Later stimulates the secretion of hormones related to calcium (Ca) metabolism to maintain balance. This was in agreement with the findings of Komnenou *et al.* (2005) [5], Jain *et al.* (2018) [4] and Chaurasia *et al.* (2019) [1]. Tembhurne *et al.* (2010) [16] observed statistically nonsignificant fall in serum calcium up to the 20th post-operative day. Nilajagi (2021) [10] observed non-significant decrease in the serum calcium levels upto 30th post-operative day, which increased non-significantly upto the 60th day. Kumar *et al.* (2019) [6] found significant rise of the serum calcium on 14th day which reached to normal physiological level on 45th day after surgery.

3.3.3 Serum phosphorus (mg/dL)

A statistically non-significant rise in serum phosphorus was observed till 14th postoperative day which later reduced gradually (Table 2, Fig 1). The variations in the mean values of serum phosphorus were within the normal range. This increase could be due to necrotic disintegration of the cells at fracture site and alkaline phosphatases which increases the concentration of local inorganic P by hydrolysis of pyrophosphate. Similar findings were documented by Komnenou *et al.* (2005) [5] and Rahul *et al.* (2021) [13]. Nilajagi (2021) [10] observed non-significant increase upto the 7th post-operative day and later varied non-significantly upto the 60th day. Ojus *et al.* (2022) [11] observed that the mean values gradually increased from the pre-operative day up to the 30th day, later gradually reduced till the 60th post-operative day.

3.3.4 Serum alkaline phosphatase (IU/L)

The mean values of serum alkaline phosphatase were found significantly increased from 0th post-operative day upto the 14th day. Later decreased gradually and the values were higher than the normal range from 14th post-operative day upto 60th day (Table 2, Fig 2). This could be due to osteoblastic proliferation at the fracture site and maximum contribution from periosteum of destructed bone, which is a rich source of alkaline phosphatase. This was in agreement with the findings by George *et al.* (2007) [2], Mukhopadhyay *et al.* (2011) [9] and Singh *et al.* (2021) [15]. Mahesh (2009) [7] recorded non-significant variations throughout the study period. Tembhurne *et al.* (2010) [16] observed statistically significant increase upto 20th post-operative day before returning to normal on the 45th post-operative day. Patil *et al.* (2017) [12] recorded significantly higher levels of serum alkaline phosphatase levels on pre-operative days when compared to the post-operative days whereas Nilajagi (2021) [10] observed significant increase from the third to the 30th post-operative day and later decreased gradually till the 60th post-operative day. Rahul *et al.* (2021) [13] mentioned that there was significant elevation of mean serum alkaline phosphatase values on 7th post operative day with peak value on 14th post-operative day and there was significant decrease from 14th to 45th post operative day.

3.3.5 Serum alanine aminotransferase (IU/L)

The variations in the mean values of serum alanine aminotransferase were statistically non-significant and the values were within the normal range (Table 2, Fig 2). This was suggestive of no hepatic damage caused by the surgical protocol followed. This was in accordance with Mahesh (2009) [7] and Tembhurne *et al.* (2010) [16].

Table 1: Mean ± SE values of Haemoglobin, Total Erythrocyte Count (10^6 cells/mm^3) and Total Leukocyte Count (10^3 cells/mm^3) and Differential leukocyte count (%) in dogs

Days	Haemoglobin (g %)	TEC (10^6 cells/mm^3)	TLC (10^3 cells/mm^3)	Neutrophils (%)	Lymphocytes (%)	Monocytes (%)
Before surgery	12.55±0.16	5.60±0.09	14.13±0.97	74.33±0.49	21.38±0.50	3.05±0.62
0	12.18±0.14	5.32±0.07	13.98±0.82	73.80±0.79	20.78±0.48	3.82±0.37
7	12.42±0.16	5.38±0.07	12.97±0.95	73.89±0.41	20.76±0.76	3.73±0.77
14	12.43±0.14	5.57±0.24	15.92±1.47	73.01±0.37	21.41±0.39	3.82±0.74
28	12.46±0.11	5.70±0.16	16.82±1.77	72.68±0.29	22.28±0.58	3.49±0.55
45	12.71±0.25	5.74±0.25	14.05±1.35	72.73±0.31	22.08±0.45	3.27±0.49
60	12.80±0.23	5.96±0.29	12.53±1.34	72.80±0.30	21.77±0.40	3.32±0.56

Table 2: Mean ± SE values of Serum Creatinine (mg/dL), serum calcium (mg/dL) serum phosphorous (mg/dL), Serum Alkaline Phosphatase (IU/L) and Serum Alanine Amino-Transferase (IU/L) in dogs.

Days	Creatinine (mg/dL)	Calcium (mg/dL)	Phosphorus (mg/dL)	Alkaline Phosphatase (IU/L)	Alanine Amino-Transferase (IU/L)
Before surgery	0.98±0.09	9.56±0.11	4.02±0.12	142.83±12.33^a	39.1±0.61
0	0.97±0.09	9.43±0.18	4.24±0.27	233.67±6.66^b	38.93±0.48
7	1.00±0.05	9.37±0.16	4.5±0.30	260.00±14.96^c	39.83±1.02
14	0.93±0.08	9.34±0.12	4.53±0.33	368.72±8.13^d	38.92±0.79
28	1.03±0.07	9.69±0.11	4.32±0.23	340.27±13.23^e	39.15±0.79
45	1.00±0.08	9.73±0.07	4.02±0.14	296.43±16.85^f	39.42±0.63
60	0.93±0.10	9.83±0.13	4.04±0.16	318.83±11.64^g	39.70±0.73

(The mean values bearing different superscripts (a, b, c, d, e, f, g) within the columns vary significantly at p<0.05)

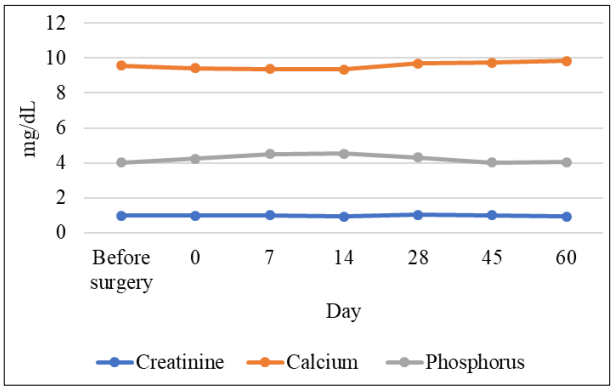

Fig 1: Changes in serum creatinine, calcium and phosphorus values during the study period

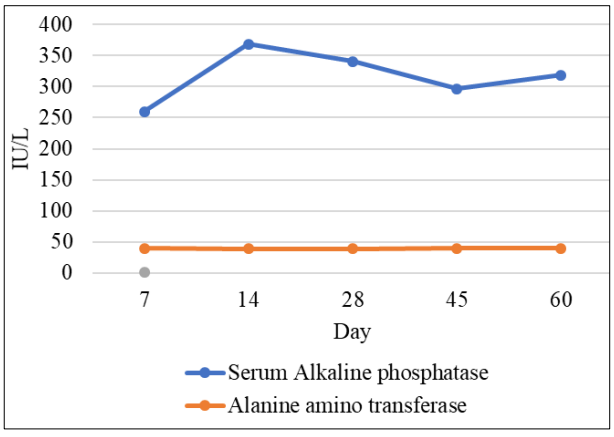

Fig 2: Changes in Serum Alkaline Phosphatase (IU/L) and Serum Alanine Amino-Transferase (IU/L) during the study period

4. Conclusion

The present study provides information regarding variations in haemato-biochemical parameters throughout fracture healing phase. Haemoglobin and erythrocytes increased gradually in a normal physiological range suggestive of erythropoiesis and their statistically insignificant variations suggests minimal blood loss during surgery. Leucocytosis during initial 7 days was due to stress, inflammation at the fracture site. The variations in the biochemical parameters were due to osteoblastic activity, formation of new bone matrix and mineralization. Their correlation with fracture healing stages serves as a useful tool to assess bone healing along with physical and radiographic examination

5. References

1. Chaurasia A, Jawre S, Singh R, Shahi A, Pathak R, Das B, *et al*. Evaluation of haemato-biochemical parameters using different biomaterials in fracture healing of dogs. International Journal of Current Microbiology and Applied Sciences. 2019;8(5):2265-2271.
2. George C, Nagarajan L, Manohar BM. Stainless steel and acrylic external skeletal fixators as adjuncts to intramedullary pinning for femoral fracture repair in dogs. Indian Journal of Veterinary Surgery. 2007;28(1):37-38.
3. Harasen G. Fractures involving the distal extremity of the femur: Part 2-The mature patient. Canadian Veterinary Journal. 2002;43(2):131.
4. Jain R, Shukla BP, Nema S, Shukla S, Chabra D, Karmore SK. Incidence of fracture in dog: A retrospective study. Veterinary Practitioner. 2018;19(1):63-65.
5. Komnenou A, Karayannopoulou M, Polizopoulou ZS, Constantinidis TC, Dessiris A. Correlation of serum alkaline phosphatase activity with the healing process of long bone fractures in dogs. Veterinary Clinical Pathology. 2005;34(1):35-38.
6. Kumar PS, Latha C, Rao TM, Purushotham G. Clinical study on the use of limited contact dynamic compression plate (LC-DCP) for stabilization of long bone fractures in dogs. The Pharma Innovation Journal. 2019;8(12):323-329.
7. Mahesh V. Studies on external skeletal fixation for radius fracture treatment in dogs. Ph. D. Thesis, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, India; c2009.

8. Maiti BK, Sen TB, Sanki S. Haemato-biochemical changes following application of Ilizarov technique in treatment of femur fractures in dogs. Indian Journal of Animal Health. 1999;38:133-134.
9. Mukhopadhyay M, Sinha R, Pal M, Bhattacharyya S, Dan A, Roy MM. Role of common biochemical markers for the assessment of fracture union. Indian Journal of Clinical Biochemistry. 2011;26(3):274-278.
10. Nilajagi A. Studies on typre Ia external skeletal fixator with tie-in configuration for the treatment of comminuted diaphyseal femur fractures in dogs. M.V.Sc. Thesis, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, India; c2021.
11. Ojus S, Dilipkumar D, Bhagavantappa B, Vijay Kumar M, Halmandge S, Patil M, *et al*. Physiological and biochemical analysis of dogs undergoing femoral fracture repair using advanced locking plate system II and locking compression plate. The Pharma Innovation Journal. 2022;11(1s):1137-1141.
12. Patil M, Dilipkumar D, Shivaprakash BV, Kasaralikar VR, Tikare VP, Ramesh BK. Physiological and haemato-biochemical changes during repair of femur fracture in dogs. The Pharma Innovation Journal. 2017;6(8):381-385.
13. Rahul PA, Mahesh V, Narayanaswamy HD, Nagaraja BN, Ranganath L, Srinivasa Murthy KM. Haemato-biochemical observations on treatment of femoral diaphyseal fracture using titanium alloy (Ti-6Al-7Nb) nails with elastic stable intramedullary nailing technique in dogs. The Pharma Innovation Journal. 2021;10(10):482-485.
14. Reddy GAK, Kumar VG, Raghavender KBP, Kumar DP. Evaluation of haemato-biochemical parameters for assessment of fracture healing in dogs. The Pharma Innovation Journal. 2020;9(9):123-125.
15. Singh T, Kumar A, Udehiya RK, Gill KK, Rai TS, Mahajan SK. Outcome of Open Long Bone Fractures in Dogs Stabilized with Linear External Skeletal Fixator. Indian Journal of Animal Research. 2021;1:6.
16. Tembhurne RD, Gahlod BM, Dhakate MS, Akhare SB, Upadhye SV, Bawaskar SS. Management of femoral fracture with the use of horn peg in canine. Veterinary World. 2010;3(1):37-41.