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Evaluation of hematobiochemical changes after surgical repair of coxofemoral luxation by a modified synthetic capsule technique in dog

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Abstract

The present study evaluated the effect of a modified synthetic capsule technique on hematobiochemical parameters in dogs with coxofemoral luxation. Clinical cases were surgically managed using titanium anchor screws and Fiber Tape suture material. Hematological and biochemical parameters were assessed preoperatively and on the 15th, 30th, 45th, and 60th post-operative days. Haemoglobin, packed cell volume, total erythrocyte count, platelet count, monocytes, eosinophils, basophils, serum calcium, and phosphorus showed non-significant variations within normal physiological limits. Total leukocyte count and neutrophil percentage showed a significant decline, whereas lymphocyte percentage gradually increased during the postoperative period. Serum alkaline phosphatase exhibited mild transient fluctuations. The findings indicate that the modified synthetic capsule technique was well tolerated, with hematobiochemical changes consistent with normal inflammatory resolution and tissue healing.

Keywords: Coxofemoral luxation, haematology, leukocytes, neutrophils

Introduction

Canine lameness is frequently seen in veterinary practice and affects a dog's ability to bear weight or move normally. The most common cause of lameness is traumatic events like car accidents or falls from heights, as well as minor incidents during routine activities such as running, jumping, or playing. Such events can cause orthopaedic injuries like fractures and dislocations. Among joint dislocations in small animals, hip (coxofemoral) luxations have been the most frequent, accounting for nearly 90% of all reported joint dislocations [1, 2, 3]. There are multiple techniques to manage coxofemoral luxations [4, 5]. In this study, the modified synthetic capsule technique was used. [6, 7] Hematobiochemical parameters play a significant role in evaluating patient health and recovery. [8, 9]. It aids in detecting systemic responses to surgical trauma, inflammation, and stress, identifying potential complications such as infection and concurrently evaluating tissue repair and the progression of healing. Monitoring these parameters at different postoperative intervals allows assessment of healing progression

Materials and Methods

Dogs presented with the history of hindlimb lameness were screened and the cases with coxofemoral dislocation were selected in the study. Pre-surgical evaluation was done by clinical examination and radiographic assessment. The dogs underwent open reduction followed by stabilization using the modified synthetic capsule technique using titanium anchor screws and FiberTape.

All animals were fasted for 8–12 hr prior to surgery, with access to water permitted for 2–4 hr before the procedure. Premedications were administered 30 minutes prior to surgery. Antibiotic inj. amoxicillin sulbactam @ 12.5 mg/kg body weight and preoperative analgesia was provided using inj. buprenorphine at a dose of 0.02 mg/kg body weight were administered

intramuscularly. The anaesthetic protocol commenced with the anticholinergic agent inj. atropine sulphate at a dose of 0.04 mg/kg body weight administered subcutaneously, 10 mins later inj. xylazine hydrochloride at 1 mg/kg body weight was given intramuscularly. Once the animal was sedated, general anaesthesia was induced with intravenous administration of inj. propofol at 4 mg/kg body weight till effect. Inj. midazolam was subsequently administered intravenously at 0.1 mg/kg body weight to enhance muscle relaxation. Anaesthesia was maintained used intermittent bolus doses of inj. propofol as required.

Approximately 2–3 ml of venous blood was collected from either the cephalic or saphenous vein in EDTA vials for hematological evaluation. Parameters assessed included haemoglobin, packed cell volume, total erythrocyte count, total leucocyte count, platelet count, and differential leucocyte count. An automated haematological analyser (Nihon Kohden Celltac α Vet (MEK-6550, Nishiochial, Shinjuku-ku, Tokyo, Japan) was used for estimation of above parameters.

For biochemical analysis, 4–5 ml of venous blood was

collected in clot activator vials from the cephalic or saphenous vein. Samples were centrifuged at 3000 rpm for 10 minutes to separate serum, which was used for biochemical estimations. Serum alkaline phosphatase, calcium, and phosphorus levels were recorded. The estimations were done using Autopak Reagent Kits (TRUEchemie ATHENESE-Dx Private Ltd., Tamilnadu.) on the ALTA ADX-CHEM-220 Biochemistry Analyser. The standard Diagnostic kits were used.

Haematobiochemical parameters were evaluated preoperatively (0th day) and 15th, 30th, 45th, and 60th postoperative day.

Results

To measure hematological parameters, venous blood was collected in EDTA vial. The mean $\pm$ SE values of these parameters is mentioned in table 1.

Hematological Parameters

Parameter (Unit)	Day 0	Day 15	Day 30	Day 45	Day 60
HB (g/dL)	12.97 $\pm$ 0.71 ^a	11.43 $\pm$ 0.40 ^a	11.95 $\pm$ 0.40 ^a	12.27 $\pm$ 0.37 ^a	12.42 $\pm$ 0.40 ^a
PCV (%)	36.67 $\pm$ 2.05 ^a	34.31 $\pm$ 1.21 ^a	35.85 $\pm$ 1.21 ^a	36.82 $\pm$ 1.12 ^a	37.27 $\pm$ 1.21 ^a
TEC ($\times 10^6/\mu\text{L}$)	6.63 $\pm$ 0.31 ^a	5.99 $\pm$ 0.30 ^a	6.31 $\pm$ 0.30 ^a	6.56 $\pm$ 0.26 ^a	6.71 $\pm$ 0.30 ^a
PLT ($\times 10^5/\mu\text{L}$)	3.61 $\pm$ 0.36 ^a	2.80 $\pm$ 0.17 ^a	2.99 $\pm$ 0.14 ^a	3.19 $\pm$ 0.14 ^a	3.36 $\pm$ 0.14 ^a
TLC ($\times 10^3/\mu\text{L}$)	14.45 $\pm$ 1.24 ^b	12.40 $\pm$ 0.96 ^{ab}	10.83 $\pm$ 0.54 ^{ab}	10.45 $\pm$ 0.74 ^a	9.69 $\pm$ 0.47 ^a
Neutrophils (%)	74 $\pm$ 2.43 ^b	72.62 $\pm$ 2.42 ^{ab}	68.87 $\pm$ 2.53 ^{ab}	66.75 $\pm$ 2.09 ^{ab}	64.37 $\pm$ 1.99 ^a
Lymphocytes (%)	19.5 $\pm$ 1.43 ^a	19.5 $\pm$ 2.00 ^a	22.25 $\pm$ 1.97 ^{ab}	24.63 $\pm$ 1.79 ^{ab}	26.75 $\pm$ 1.64 ^b
Monocytes (%)	4.25 $\pm$ 0.77 ^a	4.13 $\pm$ 0.83 ^a	5.25 $\pm$ 0.65 ^a	5.13 $\pm$ 0.55 ^a	5.25 $\pm$ 0.56 ^a
Eosinophils (%)	2.50 $\pm$ 0.33 ^a	2.50 $\pm$ 0.33 ^a	3.25 $\pm$ 0.41 ^a	3.00 $\pm$ 0.33 ^a	3.25 $\pm$ 0.31 ^a
Basophils (%)	0.25 $\pm$ 0.16 ^a	0.38 $\pm$ 0.18 ^a	0.38 $\pm$ 0.18 ^a	0.50 $\pm$ 0.19 ^a	0.38 $\pm$ 0.18 ^a

Different superscripts a and b between columns indicate significant differences ($p < 0.05$)

Haemoglobin levels exhibited a non-significant decrease from Day 0 to Day 15 post-surgery, followed by gradual increase up to Day 60. The values remained within normal physiological limits throughout the study period. Packed cell volume did not differ significantly between observation intervals from Day 0 to Day 60 and remained within normal physiological limits. Total erythrocyte count showed no significant variation during the study. A mild, non-significant increase was observed toward the later observation period, and the values remained within normal physiological range. Total leukocyte count showed significant variation over the study period. The highest values were recorded pre-operatively, followed by a gradual decline toward Day 60. Neutrophil percentage showed a significant decline from Day 0 to Day 60. In contrast to neutrophils, lymphocyte

percentage remained relatively stable during the early postoperative period and gradually increased from Day 30 onward. Significantly higher values were observed at the final observation compared to the initial day. Monocyte count, eosinophil count and basophil count showed non-significant variation throughout the postoperative period across all observation intervals. Platelet count showed a mild reduction on Day 15 followed by gradual increase toward Day 60. However, the variation remained statistically non-significant.

Biochemical Parameters

To measure biochemical parameters, venous blood was collected in clot activator vials. The mean $\pm$ SE values of these parameters is mentioned in table 2.

Parameter	Day 0	Day 15	Day 30	Day 45	Day 60
Ca (mg/dl)	9.28 $\pm$ 0.41 ^a	9.25 $\pm$ 0.34 ^a	9.48 $\pm$ 0.35 ^a	9.63 $\pm$ 0.27 ^a	9.77 $\pm$ 0.26 ^a
P (mg/dl)	4.11 $\pm$ 0.25 ^a	4.24 $\pm$ 0.37 ^a	4.20 $\pm$ 0.34 ^a	4.42 $\pm$ 0.45 ^a	4.55 $\pm$ 0.45 ^a
ALP (IU)	99.50 $\pm$ 7.18 ^a	104.93 $\pm$ 6.54 ^a	98.71 $\pm$ 8.56 ^a	93.44 $\pm$ 2.35 ^a	92.13 $\pm$ 1.60 ^a

Serum ALP levels showed non-significant fluctuations within the normal physiological range throughout the study period. The highest mean value was observed on day 15, while the lowest was recorded on day 60. A rise was noted on the 15th post-operative day, followed by a gradual, significant decline up to day 60. Serum calcium levels showed non-significant variation and remained within normal physiological limits during the postoperative period. Serum phosphorus levels demonstrated non-significant variation throughout the study period and remained within normal physiological limits.

Discussion

The mild decline in haemoglobin and PCV observed during the early postoperative period may be attributed to surgical blood loss. Similar findings were reported by Trostel *et al.* (2000) [10], Brar *et al.* (2002) [11], Singh *et al.* (2008) [12], Smitha (2014) [13], Shivakumar (2015) [14] and Mehendale (2025) [15]. The mild increase in TEC during later postoperative period may be attributed to enhanced reticuloendothelial activity and initiation of erythropoiesis during healing. Comparable findings were reported by Brar *et*

al. (2002)^[11], Smitha (2014)^[13] and Amith (2016)^[16]. The significant decline in total leukocyte count from Day 0 to Day 60 suggests gradual resolution of inflammatory response. Elevated preoperative leukocyte count may be attributed to stress, pain and trauma. Sashtry (1998)^[17] reported that leukocytosis occurs due to corticosteroid release in response to physiological stress. Similar observations were reported by Smitha (2014)^[13], Shivakumar (2015)^[14] and Chaurasia *et al.* (2019)^[9]. The significant reduction in neutrophil percentage further supports resolution of inflammation following surgical stabilization. Comparable findings were reported by Amith (2016)^[16], Bhargav (2025)^[18] and Mehendale (2025)^[15]. Chaurasia *et al.* (2019)^[9] also noted that decline in neutrophil count indicates return to normal physiological condition. The gradual rise in lymphocyte count could be attributed to a relative change in neutrophil levels, which, after an initial increase, returned to normal due to resolution of inflammation. Similar findings were reported by Bhargav (2025)^[9].

Monocyte, eosinophil and basophil counts remained within physiological limits throughout the study, indicating absence of systemic inflammatory or allergic response. Similar observations were reported by Brar *et al.* (2002)^[11], Amith (2016)^[16] and Mehendale (2025)^[15].

Platelet count remained within normal limits, indicating absence of postoperative hemorrhagic complications, consistent with findings of Smitha (2014)^[13], Shivakumar (2015)^[14] and Amith (2016)^[16].

Serum alkaline phosphatase showed mild early postoperative increase, which may be attributed to surgical trauma, muscle injury and adrenal hyperfunction, as suggested by Willard and Tvedten (2012)^[19]. Similar findings were reported by Smitha (2014)^[13], Polat *et al.* (2021)^[20] and Mehendale (2025)^[15].

Serum calcium and phosphorus remained stable throughout the study, indicating normal metabolic status and favorable healing environment. Comparable findings were reported by Budhwar *et al.* (2021)^[21] and Polat *et al.* (2021)^[20]. Qiao *et al.* (2022)^[22] observed that dogs with normal serum calcium levels exhibited better joint healing compared to those with hypocalcemia.

Conclusion

Overall, hematological and biochemical parameters showed only mild transient variations during the postoperative period, with most values remaining within normal physiological limits. The significant decline in total leukocyte and neutrophil counts indicated resolution of inflammation and progressive healing. The stability of platelet count, monocytes, eosinophils, basophils, serum calcium and phosphorus further suggested absence of systemic complications. Mild fluctuations in serum alkaline phosphatase were consistent with tissue repair processes. These findings collectively indicate that the surgical procedure was well tolerated and associated with satisfactory postoperative recovery.

Conflict of Interest

Not available

Financial Support

Not available

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