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Haematological Changes during Fracture Healing in Goats

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Abstract: *Apparently healthy goats of either sex, aged between one to six years were selected for present study Fracture segment of these animals were brought into apposition and immobilized by dynamic compression plate (DCP). Haematological parameter such as total erythrocyte count (million/µl), total leucocyte count (thousand/µl), differential leucocyte count (per cent), haemoglobin (g/dl) and packed cell volume (per cent) were determined pre-operatively and on 7th , 15th , 30th, 45th, 60th and 90th post- operative day. A non significant decrease in the values of total erythrocyte count, Haemoglobin and Packed Cell Volume, was observed on 7th post-operative day followed by fluctuation of the values within normal physiological range. Total leucocyte count, neutrophil and eosinophil count showed non-significant increase from 0 to 7th day interval. However these values were within normal physiological reference range. Lymphocyte count showed non-significant decrease on 7th day thereafter, significant increase (p<0.5) was observed from 15th day onwards. The basophil and monocyte count also showed non-significant variation at different time intervals.*

Keywords: *Fracture, Haematological parameters, Total erythrocyte count, Total leucocyte count, Differential leucocyte count.*

I. Introduction

Bone is a multifunctional tissue that provides structure to the body. It acts as a protective cage for visceral organ, acts as a fulcrum for the muscles, a store house of calcium, phosphorous and is the site of formation of blood and immune cells (Caplan, 1991 and Hing 2004). Bone can be classified as dense cortical or lamellar and cancellous or trabecullar. Cortical or lammelar bone is responsible for the mechanical strength, whereas trabecular bone is composed of a network of spicules with empty space that contains bone marrow and it forms the central core of bones.

Fracture is the breach in the continuity of hard tissue. Bone is unique among tissue, in that it heals by regeneration and not by scar formation as is evident in muscle, skin, heart etc. Traumatic injuries are the major source of bone fracture. These injuries can occur in several situations and impair the patient's ability to perform their normal day to day activities.

Goat plays a pivotal role in supporting the livelihood of rural, tribal, nomadic and semi-nomadic population. These people frequently wander in and around urban vicinity, where their animal gets encountered with automobile accident leading to fracture of bones. Although automobile accident plays a major contributory factor for fracture in goats other factors such as falling from height, jumping, intentional kicking and fight between animals are too responsible for this condition. Fracture of long bones often compels the owner to sale their only source of income at lower price, which causes economic loss to them.

Haematological parameters play a key role for monitoring fracture healing. Any deviation from normal physiological reference range is often an indication of an infection and it requires an immediate attention, failure to which would lead delayed union, non-union and mal-union. The haemogram is the mirror of the happening in the body and it particularly guides and directs clinicians towards the health status of the body.

Fracture repair can be divided into three phases, inflammatory, reparative and remodeling phase and these haematological attributes are responsible for completion of all these three phases.

II. Materials and Methods

Six clinical cases of goats having long bone fracture presented at Teaching Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, Jabalpur, during the study period were included in the present study. Apparently healthy goats of either sex, aged between one to six years were selected for present study Fracture segment of these animals were brought into apposition and immobilized by dynamic compression plate (DCP).

Five milliliter of blood was collected from jugular vein of each animal pre-operatively and on 7th, 15th, 30th, 45th, 60th and 90th post- operative day for analysis of hematological attributes. Haematological parameter such as total erythrocyte count (million/µl), total leucocyte count (thousand/µl), differential leucocyte count (per

cent), haemoglobin (g/dl) and packed cell volume (per cent) were determined as per method described by Chauhan and Chandra (2007).

III. Results and Discussion

The changes in mean ± SE of haematological parameters at different time intervals are presented in Table – 01. A non significant decrease in the values of total erythrocyte count, Haemoglobin and Packed Cell Volume, was observed on 7th post-operative day followed by fluctuation of the values within normal physiological range. The above findings were in accordance with the findings of Aithal *et al*. (1998), Tembhurne *et al*. (2010) and Rajhans (2013) in dogs, Kumar *et al*. (1999) in calves and Gabriel *et al*. (2014) and Gupta (2015) in goats, who also reported non-significant difference in the values of these parameters and the values fluctuated within normal physiological limit.

A transient decrease in the value of total erythrocyte count in the present study may be attributed to trauma suffered by the goats during fracture and loss of blood pre-operatively and during the surgical procedure.

Table 01: Mean values (± SE) of complete blood count at different time intervals

Days	TEC	Hb	PCV	TLC	N	L	E	B	M
0th	12.68 ± 1.31	10.47 ±0.92	31.07 ± 2.33	14.00[a] ± 0.95	49.33[a] ±3.14	48.83[a] ±3.26	1.50 ±0.34	0.00 ±0.00	0.33 ±0.21
7th	11.31 ± 0.88	9.53 ±0.53	27.67 ± 2.01	16.22[a] ± 1.34	55.67[a] ±4.12	41.17[a] ±4.51	2.17 ±0.17	0.00 ±0.00	1.00 ±0.26
15th	13.48 ± 0.54	10.90 ±0.41	32.67 ± 1.23	10.83[b] ± 0.73	36.33[b] ±2.39	61.50[b] ±2.20	1.50 ±0.22	0.17 ±0.17	0.50 ±0.22
30th	13.89 ± 0.36	10.87 ±0.47	32.33 ± 1.05	9.27[b] ± 0.58	32.17[b] ±2.18	66.00[b] ±2.13	1.17 ±0.17	0.17 ±0.17	0.50 ±0.22
45th	13.97 ± 0.83	11.27 ±0.47	32.93 ± 1.09	9.61[b] ± 0.59	32.17[b] ±1.62	65.83[b] ±1.33	1.33 ±0.33	0.00 ±0.00	0.67 ±0.21
60th	13.76 ± 0.39	11.10 ±0.31	32.33 ± 0.92	8.83[b] ± 0.74	31.17[b] ±2.65	67.00[b] ±2.91	1.17 ±0.31	0.17 ±0.17	0.50 ±0.22
90th	13.29 ± 1.12	10.85 ±0.82	31.33 ± 2.24	8.17[b] ± 0.56	30.17[b] ±1.92	68.67[b] ±1.78	1.00 ±0.26	0.00 ±0.00	0.17 ±0.17

- Values having different superscript ab shows significant difference at 5% level between intervals

Total leucocyte count showed non-significant increase from 0 to 7th day interval. Thereafter, the values decreased significantly ($p<0.5$), from 15th day onwards. These findings were in accordance with the findings of De'Souza (2012), Rajhans (2013), Toth *et al*. (2014), and Singh (2015) in canines and Gabriel *et al*. (2014) and Gupta (2015) in goats, who also reported slight increase in total leucocyte count post-operatively.

Non-significant increase in neutrophil count was observed on 7th day, followed by significant decrease ($p<0.5$) from 15th day onwards. Comparison between groups showed non-significant difference between them.

Tembhurne *et al*. (2010), De'Souza (2012), Rajhans (2013) and Singh (2015) in canine and Gupta (2015) in goats, also observed increase in the value of neutrophil, just after surgery followed by a decrease, after which it fluctuated within normal range.

Increase in the value of neutrophil just after surgery might be due to fact that neutrophils are considered as the first line of defense of the body, therefore an increase in its value is seen just after onset of inflammation, aided by release of chemical mediators of inflammation i.e. bradykinin, cytokines, 5-HT (5- hydroxytryptamine) and prostaglandin of wound hormones i.e. trephones (Schalm *et al*., 1975 and Sastry, 1983).

Lymphocyte count showed non-significant decrease on 7th day thereafter, significant increase ($p<0.5$) was observed from 15th day onwards. These findings were similar to the findings of Aithal *et al*. (1998) Tembhurne *et al*. (2010), Rajhans (2013) and Singh (2015) in dogs, Kumar *et al*. (1999) in calves and Gupta (2015) in goats.

The decrease in lymphocyte count on 7th day can be attributed to inflammatory reaction caused as a result of surgical intervention, which in turn activates the production of immune-regulatory cytokines by macrophage and monocytes. Cytokines are responsible for activation of adrenal axes and in turn increases the production of gulcocoticoides. Increase in the concentration of gulcocorticoides might be responsible for lyses of lymphoid tissue and lysis of circulating lymphocytes (Kaneko, 1997).

Non-significant increase in eosinophil count was observed on 7th day interval. However, the values fluctuated within normal reference range.

These findings are in accordance with the findings of Kumar *et al*. (1999) in calves, Desouza (2012), Rajhans (2013) and Singh (2015) in dogs and Gabriel *et al*. (2014) and Gupta (2015) in goats, who were of opinion that the value of eosinophil fluctuates within normal physiological range during fracture healing.

The basophil count also showed non-significant variation at different time intervals. These findings corroborated the findings of De'Souza (2012) and Singh (2015) in dogs and Gupta (2015) in goats, who reported non-significant variation in the values of basophil count.

Monocyte count showed non-significant difference at different time intervals.These findings were similar to the findings of De'souza (2012), and Singh (2015) in dogs and Gupta (2015) in goats, who reported non-significant variation in the values of monocyte count.

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