Original Research

Clinico-Haemato-Biochemical Alterations in Impactive Colic in Horses

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Abstract

A total of sixteen cases of equine impactive colic were admitted to VCC, Hisar and were subjected to complete anamnesis, clinical examination and haemato-biochemical estimation. All the affected animals were exhibiting colicky signs along with lack of defaecation and had decreased or absent gastrointestinal borborygmi. Per-rectal examination revealed pelvic flexure as the most common site of impaction. Mostly females in the age group of 6 to 12 years were susceptible. There was increase in temperature, pulse rate, respiration rate, capillary refill time, haemoglobin, erythrocyte count and packed cell volume due to dehydration and pain. Leukocytosis and thrombocytopenia were observed in most of the affected animals. The serum biochemical parameters exhibited a remarkable increase in LDH, ALT, AST, ALP, total proteins, total bilirubin, glucose, BUN and creatinine indicating compromised liver and kidneys. The value of GGT which is a specific indicator of hepatic disorder was also seen very high in impactive colic cases in our study. Most of the haemato-biochemical parameters were restored within normal range after treatment.

Key words: Equine, Haemato-Biochemical, Impactive Colic, Pelvic Flexure

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Introduction

Colic, though a symptom but it is a difficult task to establish its cause and is a challenge for veterinary practitioners. It is a painful disorder of equines having catastrophic consequences without any forewarning and has been reported to have multifactorial aetiology that may lead to huge health and welfare impacts (Radostits *et al.,* 2007). Impaction is an accumulation of dehydrated ingesta in a portion of the digestive tract and is typically located at sites where the intestinal diameter decreases. The specific pathogenesis for impactions is not fully understood, although risk factors such as poor dentition, decreased water intake,

feeding of coarse roughage, lack of exercise, administration of NSAIDs, infestation with gastrointestinal parasites, motility disorders and typical anatomy of equine intestines make it prone to formation of faecoliths and frequent suffering from impactive colic (Radostits *et al.*, 2007; Plummer, 2009). Early identification of critical cases of impactive colic is important to optimise outcome and prognosis. Therefore the study was designed to determine the clinical observations and haemato-biochemical alterations in equines suffering from impactive colic.

Materials and Methods

The present investigation was conducted on clinical cases of equines specifically horses suffering from impactive colic which were brought to Veterinary Clinical Complex (VCC), LUVAS, Hisar. Detailed anamnesis of affected animals with regard to age, sex, duration of illness, deworming status, details of earliest colic signs, defecation and duration of anorexia or inappetence were obtained from the animal owners/handlers. Complete clinical examination of the affected animals were made which included recording of rectal temperature, pulse rate, respiration rate, the appearance of the ocular mucous membrane, capillary refill time, gut sounds and per-rectal examination. Faecal samples collected per-rectally from clinical cases were processed for microscopic examination by floatation and sedimentation technique for identification of parasitic ova and oocyst, if any (Dryden *et al.*, 2005). Blood samples collected in EDTA were subjected to estimation of haemoglobin (Hb), total erythrocyte count (TEC), total leukocyte count (TLC), differential leukocyte count (DLC), packed cell volume (PCV) and platelet count using Haematology Cell Counter (MS4s, Melet Schloesing Laboratories, France). A Giemsa-stained blood smear was examined for haemoprotozoan parasites (if any) and the positive cases were excluded from the study. Serum samples collected were used for the analysis of γ-Glutamyl transferase (GGT), Alkaline Phosphatase (ALP), Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), Lactate Dehydrogenase (LDH), Glucose, Urea, Creatinine, Total protein, Albumin, Bilirubin Direct (BID) and Bilirubin Total (BIT) using automated Random Access Clinical Chemistry Analyzer (EM Destiny 180 Erba Mannheim GmbH – Germany) with kits procured from Transasia Bio-medicals Limited (Mumbai). Observations were made at day 0 (pre-treatment), 1 and 5 post-treatment. Control values for clinical, haematological and biochemical parameters were taken from literature (Sharma *et al.*, 2009). Repeated measures ANOVA was used to determine the significant difference between three time points i.e. d0, d1 and d5. Further, pair-wise difference between time points was done by using LSD (least significant difference).

Results and Discussion

The present investigation was carried out for a period of one year and a total of 45 cases of equines suffering from various types of colic were admitted to Veterinary Clinical Complex (VCC), Lala Lajpat Rai

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University of Veterinary and Animal Sciences (LUVAS), Hisar. On the basis of history, clinical signs and per-rectal examination, 16 cases of intra-luminal impactive colic were diagnosed and were subjected to clinico-haemato-biochemical estimation and treatment accordingly. Out of 16 cases of impactive colic, nine animals were of 6 to 12 years of age i.e. middle age horses, three animals of 3 to 6 years, three animals of less than 3 years and one animal of more than 12 years of age. Comparable findings have been reported by Enbavelan *et al.* (2015a) with higher incidence in 5 to 10 years aged horses. These animals were showing anorexia and reduced water intake on presentation to clinics. The incidence was recorded high in females (14/16) as compared to males (2/16) and the valid reason could be that more females are being reared for ceremonial and breeding purposes in Haryana and Rajasthan. All the animals were stall-fed and had decreased exercise consequently leading to reduced water consumption leading to the development of impaction and our finding is in confirmation with the report of Plummer (2009). Williams *et al*. (2011) had also reported that the pattern of motility assessed by ultrasound across different regions of the intestine was reduced in stabled horses as compared to pastured horses.

Duration of illness (period for which horses had clinical signs of colic before presentation to clinics) varied from 24 to 66 hours (Table 1) with an average period of 43.38 hours, which is in accordance with Sabev and Kanakov (2008) who reported the duration of illness as 48 hours in case of large colon impaction.

Table 1: Duration of illness, colour of mucous membrane, gastrointestinal borborygmi and site of impaction in horses suffering from impactive colic

Animal No.	Duration of Illness	Colour of Mucous Membrane	Gastrointestinal borborygmi	Site of Impaction
1	66 hours	+++	Absent	Pelvic flexure
2	30 hours	++	Decreased	Pelvic flexure
3	60 hours	+++	Decreased	Right colon
4	36 hours	++	Decreased	Pelvic flexure
5	30 hours	+	Decreased	Left colon
6	40 hours	++	Decreased	Pelvic flexure
7	54 hours	+++	Absent	Pelvic flexure
8	56 hours	+++	Absent	Caecum
9	36 hours	++	Decreased	Pelvic flexure
10	30 hours	++	Decreased	Pelvic flexure
11	24 hours	+	Decreased	Pelvic flexure
12[#]	60 hours	+++	Absent	Left colon
13	56 hours	+++	Decreased	Pelvic flexure
14[#]	28 hours	++	Decreased	Pelvic flexure
15[#]	40 hours	+++	Decreased	Pelvic flexure
16[#]	48 hours	+++	Absent	Small colon

+ Normal, ++ mild congestion, +++ moderate congestion, [#] Animal died during treatment

This is observed due to unawareness or negligence of most of the horse owners to early identify the signs of colic and to seek the veterinary treatment. Normal to moderate congestion of ocular mucous membrane

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was observed during this study, which is in accordance with McGovern and Bladon (2011) and Enbavelan *et al.* (2015a). The gastrointestinal borborygmus in impactive colic horses was decreased or absent (Table 1) and these findings are in agreement with Turkar *et al.* (2014); Wormstrand *et al.* (2014) and Singh *et al.* (2017). Faecal examination revealed that out of 16 affected animals, four were positive for strongyle eggs which may also be one reason of colic as reported by Radostits *et al.* (2007)

The impaction generally occurs at the sites where bowel luminal diameter decreases, usually at large colon (particularly pelvic flexure), small colon, transverse colon and caecum. It is due to dehydration of ingesta, which leads to a progressive reduction in colonic motility. In the present study, pelvic flexure was the most common site of impaction (Table 1) with the incidence of 68.75% (11/16) followed by left colon (12.5%), right colon (6.25%), small colon (6.25%) and caecum (6.25%). Similar findings have also been reported by Plummer (2009); McGovern and Bladon (2011) and Singh *et al.* (2017). Rectal examination was used for identification of the site of impaction in affected horses and was reported as 'gold standard' test for diagnosis of impaction by Cook and Hassel (2014) and Jennings *et al.* (2014). Clinical signs in all 16 animals varied depending on the severity of impaction with slower clinical onset in most cases and mild to moderate clinical signs of pain noticed over an extended period of time (1 to 3 days) with a moderate degree of dehydration. Affected animals manifested a combination of clinical signs of colic (Fig.1) like anxiety, pawing or stamping, flank watching, kicking at the abdomen, rolling, lying down and getting up, grunting, excessive sweating, sham drinking, frequent attempts to urinate, lack of defecation and typical posture such as 'saw-horse' stance. Reports of similar clinical signs were reported by Alsaad and Nori (2009) and Sharma *et al.* (2009).

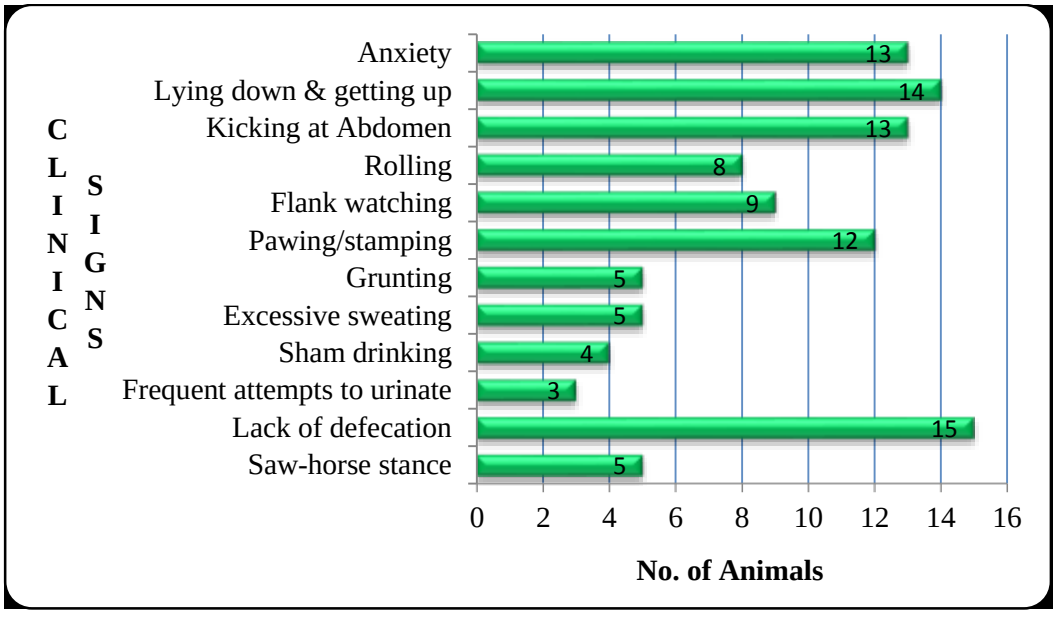

Fig. 1: Clinical signs observed in equines suffering from impactive colic

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Clinical parameters such as temperature, pulse rate, respiration rate and capillary refill time of affected animals were recorded thrice i.e. before the start of the treatment (d0), after one day (d1) and after 5 days (d5) of treatment (Table 2). There was increase in temperature, pulse rate, respiration rate and capillary refill time (CRT) before treatment (d0), due to dehydration and pain. Similar findings have been reported by Singh *et al*. (2017). However, Azizunnesa *et al.* (2008) and Enbavelan *et al.* (2015a) have reported normal temperature in horses suffering from colic. Elevation in heart rate was a useful tool for judging the severity of the disease process because it often indicates severe pain, circulatory compromise and endotoxemia (Cook and Hassel, 2014).

Table 2: Clinical and haematological estimation of impactive colic horses before and after treatment compared with control values

Parameters	Control values-Mean	Mean ± SE (range) of Colic Animals		
		d0	d1	d5
Temperature (˚F)	100.5	101.18^{a} ± 0.20 (99.8-102.4)	100.77^{b} ± 0.17 (100.0-102.3)	100.31^{c} ±0.13 (99.8-101.4)
Pulse rate (per minute)	35	59.31^{a} ± 2.53 (38-74)	52.56^{b} ± 2.43 (38-72)	42.17^{c} ± 1.17 (36-48)
Respiration rate (per minute)	10	38.81^{a} ± 1.80 (28-59)	37.63^{a} ± 2.31 (28-64)	29.67^{b} ± 1.20 (25-36)
Capillary Refill Time (in seconds)	< 2 second	2.86^{a} ± 0.16 (1.8-4.0)	2.07^{b} ± 0.12 (1.4-3.4)	1.65^{c} ± 0.05 (1.3-1.9)
Haemoglobin (g/dl)	10.8 g%	12.89^{a} ± 0.44 (9.6-15.7)	11.51^{b} ±0.41 (8.3-14.3)	11.47^{b} ± 0.43 (8.6-13.9)
Total erythrocyte count (10^6/µl)	6.9 x 10^6/µl	9.23^{a} ± 0.34 (7.11-12.18)	8.43^{b} ± 0.29 (6.27-10.4)	8.30^{b} ± 0.39 (5.81-10.78)
Packed Cell Volume (%)	36.00%	41.37^{a} ± 1.43 (33.0-54.2)	37.03^{b} ± 1.16 (30.0-43.1)	36.62^{b} ± 1.21 (27.3-43.5)
Platelet count (10^3/µl)	176 x 10^3/µl	134.63^{c} ± 6.89 (104-198)	192.69^{b}±10.87 (125-295)	252.58^{a}±13.24 (187-366)
Mean corpuscular volume (fl)	42.52 fl	45.15^{a} ± 1.20 (36.1-53.0)	44.21^{a} ± 1.07 (37.1-52.2)	44.63^{a} ± 1.43 (36.1-54.1)
Mean corpuscular haemoglobin (pg)	13.18 pg	14.00^{a} ± 0.36 (12.1-16.6)	13.88^{a} ± 0.33 (11.6-16.7)	13.92^{a} ± 0.46 (11.2-17.3)
Mean corpuscular haemoglobin concentration (g/dl)	33.34	31.26^{a} ± 0.75 (27.7-37.1)	31.07^{a} ± 0.67 (27.5-36.4)	31.37^{a} ± 0.82 (27.0-35.7)

Means bearing different superscripts (a,b,c) differ significantly ($p<0.05$) in column for each parameter.

Haemoglobin, TEC and PCV values were markedly elevated (Table 2) in all affected animals before treatment (d0). It was probably because of the haemoconcentration occurred as a consequence of pain/stress/excitement leading to splenic contraction due to release of catecholamines and compartmental

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fluid shifts (Radostits *et al.*, 2007 and Orsini, 2011). However, Varshney and Yadav (1995) and Enbavelan *et al.* (2015b) did not find any significant difference in Hb and TEC values of horses suffering from distension or impactive colic. The most probable reason for the difference in the observations could be due to varying degree of dehydration in colic cases as equines in our study were having less water intake. Many workers (Radostits *et al.*, 2007; Alsaad and Nori, 2009 and Enbavelan *et al.*, 2015b) studied the prognostic significance of PCV and reported that generally, the higher the PCV, the poorer the outcome. Before treatment, all the affected animals were having lowered platelet count. The basic reason reported by Alsaad and Nori (2009) is the release of endogenous mediators such as platelet activating factor in inflammatory disorders inducing changes in the coagulation system causing disseminated intravascular clotting. The other possible explanation may also be endotoxin absorption from intestines in our study and is in agreement with various other workers such as Sandholm *et al.* (1995) and Weiss and Rashid (1998). Affected animals were showing mildly elevated values of MCV, MCH and MCHC which was probably due to haemoconcentration and dehydration causing increased Hb, TEC and PCV.

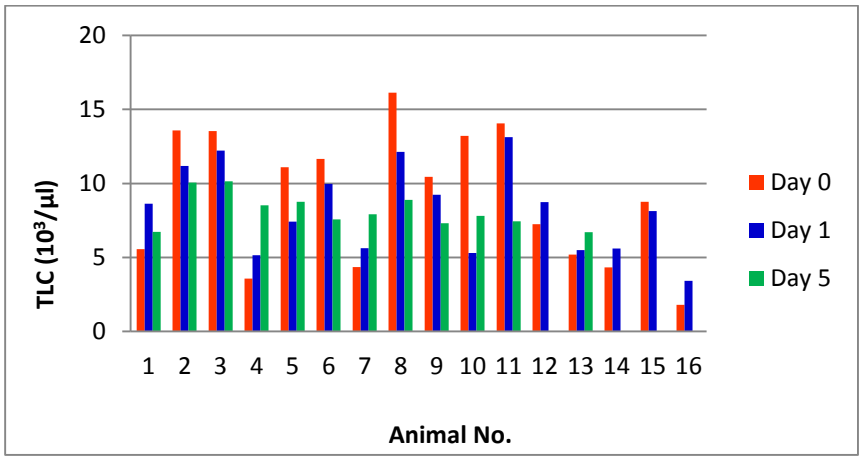

Fig. 2: Total leukocyte count of horses suffering from impactive colic

The mean values of TLC before treatment was remarkably increased with a mean of 9.03 x 10^3/µl in animals suffering from impactive colic. For individual affected animals, leukocytosis and leukopenia were recorded in 12 and 4 horses, respectively (Fig. 2). Leukocytosis might be due to bacterial infection and subsequent inflammation of the impacted gut segment causing neutrophilia whereas leukopenia was probably due to pressure necrosis causing ischemia and subsequent infection by gram-negative bacteria resulting in endotoxemia (Radostits *et al.*, 2007). Very low numbers of leukocytes might be the reason for non-survivors in animals due to impacted mass causing pressure necrosis and mucosal damage, hence is of prognostic value. Before treatment, relative neutrophilia and lymphocytosis (Fig. 3) were observed in most of the clinical cases of impactive colic horses leading to leukocytosis (Singh *et al.*, 2017). However, few affected

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animals showed neutropenia or lymphopenia suggesting endotoxemia as reported by Bayly and Reed (1980). Reports showed that neutrophilia may also be accompanied by an increase in lymphocytes as the adaptive immune response develops and lymphopenia is usually the result of increased cortisol levels, which alter lymphocyte kinetics and cause a decrease in their efflux from lymphoid tissues as well as redistribution within hematopoietic tissues (Lester *et al.*, 2015). However, values of monocytes, eosinophils and basophils were clinically non-significant in our study.

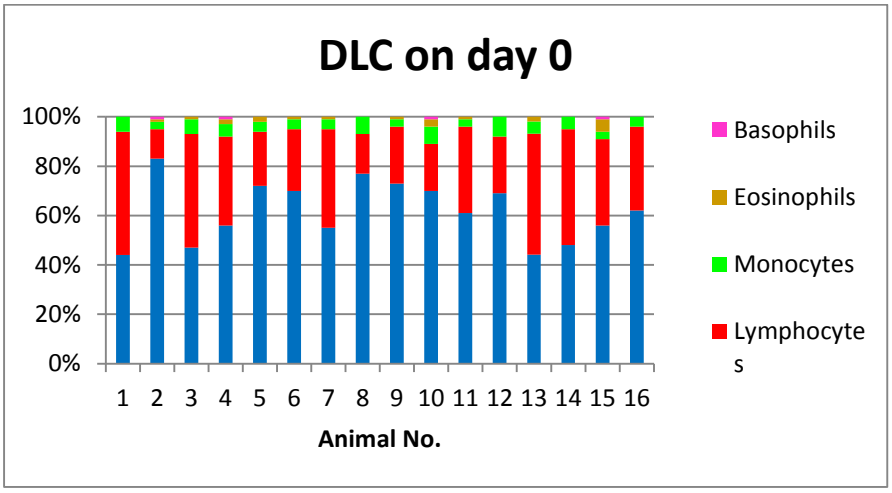

Fig. 3: Differential leukocyte count of impactive colic horses

Values of liver function biochemical parameters such as LDH, ALT, AST, GGT, ALP, direct bilirubin and total bilirubin (Table 3) were highly elevated in horses suffering from impactive colic, probably due to increased muscular activity during colic because of pain/stress and suspected liver damage. AST, LDH and ALP are poorly specific for hepatic damage while GGT is the most sensitive indicator of hepatic damage in horses (Sprayberry and Robinson, 2015). In our study also, elevation in liver function enzymes, specifically GGT indicated liver dysfunction in clinical cases of impactive colic horses. Total bilirubin can increase with anorexia up to 5 times the reference interval, which makes the test less specific indicator of hepatic function (Lester *et al*., 2015).

Mean values of total serum proteins, albumin, glucose, BUN and creatinine were also elevated in horses suffering from impactive colic. The increase in total proteins is attributed to haemoconcentration and dehydration causing loss of plasma water and is associated with high PCV (Orsini, 2011). Blood glucose concentration becomes dysregulated due to the action of endotoxins (absorbed across compromised intestinal mucosa), release of cortisol and adrenaline in response to the stress/pain causing insulin resistance which leads to hyperglycaemia (Toth *et al.*, 2009) which is associated with poor prognosis. Serum creatinine and BUN are useful indicators of hydration status and renal function in horses with colic.

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Table 3: Biochemical estimation of impactive colic horses before and after treatment compared with control values

Parameters	Control Values-Mean(range)	Mean ± SE (range) of Colic Animals		
		d0	d1	d5
Lactate dehydrogenase (U/l)	287 U/l (162-412)	766.75^{a} ± 41.64 (447-1033)	625.44^{b} ± 37.99 (334-939)	384.17^{c} ± 18.74 (236-458)
Alanine aminotransferase (U/l)	13 U/l (3-23)	31.95^{a} ± 5.14 (5.3-73.0)	23.20^{ab} ± 3.09 (7.1-55.0)	15.15^{b} ± 1.12 (8.0-20.8)
Aspartate aminotransferase (U/l)	296 U/l (226-366)	519.05^{a} ± 44.96 (345.9-977.4)	426.39^{b} ± 29.17 (258.8-684.6)	283.86^{c} ± 10.94 (236.6-370.0)
ɤ-Glutamyl transferase (U/l)	8.85 U/l (4.3-13.4)	19.22^{a} ± 1.18 (13.9-33.8)	16.04^{b} ± 1.20 (11.4-30.1)	10.68^{c} ± 0.45 (8.8-13.5)
Alkaline phosphatase (U/l)	269 U/l (143-395)	308.56^{a} ± 39.75 (121-720)	251.19^{a} ± 25.77 (124-446)	223.83^{a} ± 22.13 (136-375)
Bilirubin direct (mg/dl)	0.2 mg/dl (0-0.4)	0.45^{a} ± 0.05 (0.2-1.0)	0.35^{a} ± 0.02 (0.2-0.5)	0.30^{b} ± 0.03 (0.2-0.4)
Total bilirubin (mg/dl)	1.5 mg/dl (1-2)	3.11^{a} ± 0.20 (1.8-4.4)	2.69^{b} ± 0.19 (1.3-4.2)	1.83^{c} ± 0.12 (1.2-2.4)
Total protein (g/dl)	6.55 g/dl (5.2-7.9)	7.61^{a} ± 0.17 (6.7-8.7)	6.97^{b} ± 0.16 (6.2-8.2)	6.70^{b} ± 0.13 (6.2-7.5)
Albumin (g/dl)	3.15 g/dl (2.6-3.7)	3.58^{a} ± 0.07 (3.0-3.9)	3.24^{b} ± 0.08 (2.6-3.7)	3.23^{b} ± 0.07 (2.7-3.5)
Glucose (mg/dl)	95 mg/dl (75-115)	118.74^{a} ± 2.52 (99.3-138.0)	104.71^{b} ± 3.89 (81.4-140.2)	93.40^{c} ± 2.38 (83.5-107.3)
Blood urea nitrogen (mg/dl)	17 mg/dl (10-24)	24.58^{a} ± 1.30 (18.0-38.6)	21.79^{b} ± 1.08 (14.9-29.8)	17.78^{c} ± 0.91 (12.9-23.8)
Creatinine (mg/dl)	1.55 mg/dl (1.2-1.9)	2.58^{a} ± 0.28 (1.3-5.3)	2.20^{b} ± 0.22 (0.9-3.7)	1.59^{c} ± 0.12 (1.1-2.3)

Means bearing different superscripts (a,b,c) differ significantly ($p<0.05$) in column for each parameter.

The increase in BUN and creatinine was presumably due to dehydration, decreased renal blood flow and glomerular filtration rate impairing the excretion of urea and creatinine, thus leading to pre-renal azotemia (Orsini, 2011 and Lester *et al.*, 2015) and may progress to acute renal failure in severe cases of colic (Radostits *et al.*, 2007).

Conclusion

Incidence was observed high in middle aged female horses having stall fed habits. Clinico-haemato-biochemical alterations were seen in horses suffering from impactive colic and parameters such as CRT, PCV, TLC, glucose, BUN and creatinine serves as good prognostic indicators. Elevated GGT value is specific for liver dysfunction and serves as better prognosticating factor. The values of biochemical parameters significantly decreased after treatment and most of them restored to the normal range, but mean

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values of liver function enzymes were still higher than control mean values indicating convalescence period of few more days for restoration to control values.

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