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Research Article

BOVINE INTESTINAL OBSTRUCTION: CHANGES IN CYTOLOGICAL AND BIOCHEMICAL PARAMETERS OF BLOOD AND PERITONEAL FLUID

C.N. Bhutia[1], S.K.Uppal[2], S.A.Hussain[3*], N.K.Sood[4]

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ABSTRACT: The present study was conducted on four cattle and one buffalo diagnosed with intestinal obstruction. Hematological analysis showed increase in total leukocyte and neutrophil counts, and decrease in lymphocyte count. Left shift or toxic changes in neutrophils was a consistent finding. The biochemical alterations were deranged liver function tests, increased C-reactive protein, glucose and lactate, and decreased chloride, potassium calcium and phosphorus levels. The peritoneal fluid changes were increased total cell count and number of neutrophils along with higher ALP and lactate concentrations. In conclusion, bovine intestinal obstruction causes detectable changes not only in blood but also in peritoneal fluid.

Key words: Biochemistry, Haematology, Intestinal obstruction, C-reactive protein.

INTRODUCTION

Absence of defecation for more than one day is abnormal and leads to the fatal syndrome of bowel obstruction (Radostits *et al.* 2007). Due to abomasal reflux, the patho-physiological changes of intestinal dysfunction in bovines are remarkably different from those in simple stomach animals (Braun *et al.*1988). Potential causes of intestinal obstruction are mechanical obstruction due to intussusception, volvulus, feed boluses, blood clots or hairballs (Radostits *et al.* 2007). In cattle and buffaloes, there are many causes of obstruction of the small intestine such as intussusception and volvulus (Pravettoni *et al.* 2009). Cattle of any breed, age or sex may be affected by intestinal obstruction at any time throughout the year (Anderson and Ewoldt 2005).The clinical signs are abdominal pain, scanty or absence of faeces, increased heart rate, abdominal distension, progressive dehydration and toxemia (Anderson and Ewoldt 2005, Fubini and Divers 2007). Most of the previous studies on biochemical changes in intestinal obstruction have been carried out on blood parameters. The data on cytological and biochemical changes in peritoneal fluid of intestinal obstruction cases are rare. So the present study was undertaken to investigate peritoneal fluid changes along with hematological and biochemical changes in bovine intestinal obstruction.

MATERIALS AND METHODS

Selection of animals

The present study was conducted on four cattle and one buffalo, out of 147 clinical cases of gastrointestinal disorders presented at Large Animal Clinics of Veterinary Teaching Hospital, Department of Teaching Veterinary Clinical Complex, GADVASU, Ludhiana, India. The diagnosis of intestinal obstruction was done on the basis of exploratory laparotomy (in four out of five cases) or postmortem examination (in one case).

Signalment and anamnesis

Detailed signalment, and history of feed intake, water intake, rumination status, defecation, calving status, any

[1, 2]Department of Veterinary Medicine, [4]Department of Teaching Veterinary Clinical Complex,Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141 004, India.
[3]Division of Clinical Veterinary Medicine, Ethics and Jurisprudence, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir-Shuhama, Alusteng, Srinagar-190 006, Jammu and Kashmir, India.
**Corresponding author. e-mail: draashiqhussain@gmail.com*

complaint in last pregnancy, reduction in milk yield, type of tympany, fever and pain were noted in every case.

Physical examination

Each animal was thoroughly evaluated for its general condition and hydration status. The physical parameters (rectal temperature, heart rate, respiration rate, colour of mucous membrane, muzzle status, rumen consistency and rumen motility) were recorded at the time of presentation in resting animal. Also rectal examination of all the five animals was carried out to perform subjective assessment of intestinal obstruction.

Hematological parameters

Blood samples were aseptically collected from jugular vein in K_3 EDTA coated vials (Accuvete-PLUS, Quantum Biologicals Pvt. Ltd). Hemoglobin (Hb; g/dL), TLC (/µl), Packed cell volume (PCV %) and platelet count (/µl) and differential leukocyte count (DLC %) estimated as described by Hussain *et al.* (2015).

Blood biochemical analysis

Serum was used for estimation of total bilirubin, aspartate aminotransferase (AST), alkaline phosphatase (ALP), gamma glutamyltrasferase (GGT), glucose, lactate, total protein, albumin, blood urea nitrogen (BUN), creatinine, sodium, potassium, chloride, calcium, phosphorus, magnesium and C-reactive protein (CRP). Blood samples (2 ml) were collected in sodium citrate coated vials (Accuvete Disposables) for fibrinogen estimation. VITROS DT-II Chemistry system (Ortho-Clinical Diagnostics, Johnson and Johnson Company) was used for estimation of biochemical parameters as described by Hussain *et al*. (2015). Fibrinogen was estimated by Sysmex CA/50.

Peritoneal fluid sampling and analysis

Abdominocentesis, as per the method of Radostits *et al.* (2007), was performed in all the five animals. Peritoneal fluid samples were analyzed for total cell count (p/r µl), differential cell count, glucose, total protein, lactate, and ALP, by methods as described for blood samples.

Rumen liquor sampling

Rumen liquor samples were collected using 16-gauge, 4 inch long needle inserted perpendicularly into the left paralumbar fossa and was analyzed for chloride concentration (Hussain *et al.* 2013, 2014).

RESULTS AND DISCUSSION

The animals were 1-6 years old females and one four year old male, and mean duration of illness was 6.40±1.36 days. These animals had partial or complete anorexia, reduced water intake and loss of defecation. On physical examination the animals had congested mucous membrane, fever (102.76±0.45^{o}F), increased heart rate (91.20±11.28/min) and respiration rate (38.20±5.90/min), ruminal hypomotility (0.60±0.40/2min) and also were depressed and dehydrated. Severe abdominal pain characterized by kicking, rolling, frequently lying down and getting up, and prolonged standing was observed in three animals. Two animals had bilateral abdominal distension. The inflamed peritoneum may have resulted in paresis of abdominal organs due to pain and toxaemia leading to ruminal atony/hypomotility (Hussain *et al.* 2015). Rectal examination revealed no or mucous coated negligible faeces, sticky mucosa and restricted hand movements in all the five cases. Intestinal obstruction was not palpable in any case but dilated intestines were palpable in pelvic cavity. Caecal dilatation was palpable in one case and tear in intestinal mucosa (about 1.5 feet distance from anus) was palpable in other case. These clinical findings were similar to that of Radostitis *et al.* (2007) and Tharwat (2011). In one case excessive fluid was present in intestines on auscultation and percussion of lower right abdomen.

In present study, all the five animals were operated surgically out of which one animal with jejunojejunal intussusception survived and four died. Out of four dead animals, one had jejunojejunal intussusception, two had jejunal volvulus. In fourth dead animal, the diagnosis was not estabished on sugery but the animal was eutahnised due to generised adhesive peritonitis. On post-mortem the animal had volvulus of proximal ileum.

Hematology and Biochemical Findings

The mean Hb, PCV, absolute lymphocyte count and platelet count were within the normal range (Table 1). The mean TLC (15670.00±2552.96/µL) and mean neutrophil count (10949.8±2326.30/µL) were higher than normal range. The inflammatory leukogram with increased number of immature neutrophils may be due ischemic necrosis of the intestine (Anderson and Ewoldt 2005). Anderson *et al.* (1993) also reported leukocytosis with mild left shift in intestinal volvulus of cattle.

In present study, hematology of dead animals revealed neutrophilic leukocytosis with moderate left shift and mild to moderate toxic changes in neutrophils and the surviving animal had relative neutrophilia. Further the survining

Table 1. Hematological and biochemical parameters of blood from five animals with intestinal obstruction (Mean±SE).

Measurement	Intestinal obstruction (n=5)	Reference range (Radostitis *et al.* 2007)
Hb (g/dL)	10.40±0.61	8-15
PCV (%)	36.48±1.18	24-46
TLC(/µl)	15670.00±2552.96	4000-12000
Neutrophils (/µl)	10949.8±2326.30	600-4000
Lymphocytes (/µl)	4720.2±545.56	2500-7500
Platelet count ($x10^3$/µl)	452.00±130.54	100-600
TEC ($x10^6$/µl)	6.60±0.22	5-10
Total Bilirubin (mg/dL)	0.96±0.32	0.01-0.5
AST (U/L)	213.60±51.93	78-132
ALP (U/L)	74.84±28.66	27-107
GGT (U/L)	31.20±2.83	15-39
Total protein (g/dL)	5.92±0.57	5.7-8.1
Albumin (g/dL)	2.42±0.19	2.1-3.6
Globulin (g/dL)	3.50±0.45	2.9-4.9
BUN (mg/dL)	50.40±14.39	6-27
Creatinine (mg/dL)	1.84±0.33	1-2
Glucose (mg/dL)	87.80±19.66	45-75
Lactate (mmol/L)	7.74±1.28	0.6-2.2
CRP (mg/dL)	2.28±0.56	0-1
Fibrinogen (g/dL)	426.42±68.14	200-700
Sodium (mmol/L)	132.80±3.98	132-152
Potassium (mmol/L)	3.28±0.21	3.9-5.8
Chloride (mmol/L)	88.00±5.32	97-111
Calcium (mmol/L)	7.90±0.41	9.7-12.4
Phosphorus (mmol/L)	5.48±1.12	5.6-6.5
Magnesium (mmol/L)	2.26±0.16	1.7-3

animal had not peritonitis while all the dead animals had perinotis on peritoneal fluid examination or on exporatory surgery.

Absorption of toxic products from the rumen or alimentary tract, starvation and constipation leading to cellular disturbances of liver parenchyma could have resulted in increased levels of total bilirubin and AST (Kaneko *et al.* 2008). The increase in glucose level may be due to stress caused by obstruction which leads to adrenocorticosteroid release, which has glycogenolytic effect, causing hyperglycemia (Mann and Boda 1966). The lactate level of blood is elevated when the rate of lactate production exceeds its use. In present study, dehydration could be the causes for hypoperfusion and increased lactate level (Allen and Holm 2008).

Table 2. Cytological and biochemical parameters of peritoneal fluid in three animals suffering from intestinal obstruction (Mean±SE).

Measurement	Intestinal obstruction (n=3)	Reference range
Total cell count (/µl)	4666.67±3816.67	<3000
Neutrophils (%)	58.67±14.44	50
Lymphocytes (%)	41.33±14.43	50
Glucose (mg/dL)	46.67±3.33	40-50
Total protein (g/dL)	2.70±0.17	2.4-3
ALP (U/L)	93.67±3.18	88-99
Lactate (mmol/L)	2.93±0.06	2.8-3

The explanation for normal total protein and lower albumin has been described by Hussain *et al*. (2015). They proposed that due to intestinal obstruction and subsequent necrosis, there is probable peritoneal cell injury leading to release of vasoactive amines, further leading to increased vascular permeability and plasma exudation in to the peritoneal cavity. This plasma exudation may be the probable cause for lower albumin and lower total protein. CRP is one of the most abundant acute phase proteins in animal serum. The liver rapidly synthesizes CRP when animals are sick or under severe stress (Sarikaputi *et al.*1991, Godson *et al.*1996). The mean value of CRP was higher than the reference value. The increased CRP level may beattributed to inflammatory response due to ischemic necrosis of the obstructed part of intestine (Hussain *et al*. 2015).

Hypochloremia and hypokalemia in the present study may be attributed to abomasal reflux (rumen chloride, 41.75±8.32 mEq/L) which has been reported in bovine digestive disorders like intestinal obstruction (Hussain *et al*. 2015), abomasal ulceration (Hussain *et al*. 2017), caecal dilatation (Hussain *et al*. 2012), peritonitis (Hussain and Uppal 2014), late pregnancy indigestion (Hussain *et al*. 2014) and pyloric stenosis (Braun *et al.* 1990). Blood acid base gas analysis was carried out in two cases and it revealed hypochloremic hypokalemic metabolic alkalosis with compensatory respiratory acidosis. These findings were consistent with the previous study on bovine intestinal obstruction (Hussain *et al.* 2015). The increased BUN level could be attributed to decrease renal blood flow as a part ofcompensatory mechanism to maintain circulation in hypovolemia associated with dehydration (Kaneko *et al.* 2008). Hypocalcaemia and hypophosphatemia may be due to less assimilation of feed materials as a result of anorexia (Sethuraman and Rathore 1979, Radostits *et al.* 2007).

Peritoneal fluid changes

Abdominocentesis yielded free flowing yellow colour peritoneal fluid in three animals only. It is important to mention that in bovines, failure to obtain peritoneal fluid does not always rule out peritonitis. Total cell count ranged from 850-12300/µl with a mean of 4666.67±3816.67/µl (Table 2). The reason for higher cell count may be the ischemic necrosis of intestine resulting into peritonitis. The mean percent neutrophil count was 58.67±14.44%. There was presence of markedly degenerated neutrophils and mesothelial cells. Mean ALP (93.67±3.18 U/L), and lactate (2.93±0.06 mg/dL) levels were toward higher side of the normal reference range, indicating intestinal necrosis (Wittek *et al.* 2010).

CONCLUSION

The hematological changes were increase in total leukocyte and neutrophil counts along with left shift or toxic changes in neutrophils. The biochemical alterations were altered liver function, increased CRP, glucose and lactate, and decreased chloride, potassium, calcium and phosphorus levels. The predominant peritoneal fluid changes were increased total cell count and number of neutrophils along with higher ALP and lactate concentrations.

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