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PRE AND POST EVALUATIONS OF HEMATOLOGICAL AND SERUM BIOCHEMICAL PARAMETERS OF RUMENOTOMY IN CATTLE

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Abstract

This study was aimed at investigating the pre and post rumenotomy evaluations of 13 cattle with various ruminal disorders at University of Gondar veterinary clinic, Gondar town, Ethiopia from September 2013 to May 2014. Hematological and serum biochemical parameters were studied in all the cattle. The comparisons of the means between different stages of hematological and serum biochemical parameters of different ruminal disorders were determined by repeated measure ANOVA to evaluate pre and post rumenotomy changes. In haematology Hb, PCV and TLC levels increased significantly from the presurgical values up to 24 hrs and 48 hrs after rumenotomy. Leukogram revealed significant neutrophilia and lymphopenia from the presurgical values up to 24 hrs and 48 hrs. Biochemical parameters revealed significant increase in ALT, AST and serum creatinine from the presurgical values up to 24 hrs and 48 hrs. Serum TP significantly decreased from the presurgical values up to 24 hrs and 48 hrs.

Keywords: Cattle, Ruminal disorders, Foreign body, Hematology, Rumenotomy, Serum biochemistry.

Introduction

Hematological and serum biochemical profiles provide reliable information on the health status of animals. Besides, examination of blood, blood constituents and rumen fluids has been used to monitor and evaluate health and nutritional status of animals[1].

The physiological responses to surgical stress are leukocytosis, neutrophilia, lymphopaenia and eosinopaenia in cattle after rumenotomy. Decrease in the mean values of haemoglobin concentration in cattle with foreign body rumen impaction indicates anaemia.[2] An increase in haematocrit values in cattle affected with foreign body syndrome is due to contraction of spleen and release of sequestered erythrocytes following increased levels of circulating catecholamine which will increase during stress.[3]

A significant drop in total erythrocytes count in cases of foreign body syndrome in bovine indicate anaemia, which attribute to the loss of blood during penetration of the reticulum or the chronic inflammatory process which may depress bone marrow.[4] A significant increase in total white blood cell counts after rumenotomy in cattle is due to post operative inflammation.[5]

Leukocytosis and neutrophilia are indicative of inflammatory responses in bovine affected with

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traumatic reticuloperitonitis which may be due to infection associated with the penetration of the reticulum and diaphragm. Lymphopenia is caused by sloughing, erosion and inflammatory response due to pressure on the wall of the rumen by foreign bodies.[6, 7]

Hepatic damage due to absorption of toxins from the putrefied rumen ingesta and gastrointestinal stasis cause elevation of liver enzymes in cattle.[8] Serum hepatobiliary enzyme activity increases because of leakage from damage of hepatobiliary cells, elution from damaged cell membranes, or increased synthesis of biliary epithelium.[9] Increase in the level of serum total protein from 7.69 to10.13 g/dl and creatinine from 1.17 to 2.11 mg/dl are observed from the onset of gastrointestinal obstruction in cattle.[10] The decrease in blood total protein concentrations is associated with reduction of feed intake and to dietary protein degradability in cattle.[11] ALT activity increases with severe muscle necrosis, but simultaneous evaluation of serum creatine kinase activity can rule out muscle damage.[12]

The absorption of toxic products from the rumen or alimentary tracts, starvation and constipation will lead to cellular disturbances of liver parenchyma leading to increase in levels of plasma aspartate amino transferase.[13, 14] The increase serum creatine phosphokinase activity generally indicates skeletal and cardiac muscle damage. The level of this enzyme is significantly elevated in cattle with traumatic reticulopericarditis which can indicate damage to myocardial cells.[7, 15]

Rumenotomy is a routine procedure for many diseases in cattle, such as, traumatic reticuloperitonitis; ingestion of toxic plants, chemicals, spoiled roughage, or foetal membranes after parturition; acute and recurrent bloat; placement of a temporary or permanent rumen cannula to relieve bloat; creation of a permanent rumen fistula; and impactions.[16]

Ruminal surgeries in bovine presently create many challenges for the large animal practices. Therefore, early diagnosis and prompt surgical intervention not only reduce the economic loss but also save life of the animal. The present study was designed to investigate the pre and post rumenotomy changes in hematological and serum biochemical parameters of ruminal disorders in cattle.

Materials and methods

Preoperative evaluations

All the cattle confirmed for ruminal disorders were subjected to pre surgical evaluation in the clinic. The cattle were examined for approval before surgical management. Rehydration electrolyte imbalance was corrected during preoperative stabilization for surgery. The feed was withheld for 24 hrs to 48 hrs and water for 12 hrs prior rumenotomy to reduce post operative complications.

Hematological parameters

The hematological parameters were estimated by collecting 5 ml of venous blood from the external jugular vein in ethylene diamine tetra acetic acid (EDTA) coated 10 ml sterile tube.

Haemoglobin

Haemoglobin (Hb) value in g/dL was estimated as per the methods described[1] and Sahli's method was used. The graduated measuring tube was filled with one tenth of normal hydrochloric acid up to graduation mark 2 and placed in the haemometer. After mixing the blood sample, it was drawn up to 20 mark in the pipette. The blood was then transferred into the acid in the measuring tube and the pipette was rinsed by drawing the solution in to it three times. The haemoglobin was converted into brown colour acid haematin within 5 to 10 minutes. After 10 minutes one tenth of normal hydrochloric acid was added drop by drop, mixing the solution with the rod. It was added slowly till the colour matches with the standard on either side of the haemometer. The level of the solution in the tube (upper meniscus) was read and haemoglobin value was expressed as g/dL.

Packed cell volume

The packed cell volume (PCV) in percentage (%) was determined by Hawskeymicrohematocrit method.[17] The capillary tubes were filled with blood up to 3/4 of its length. The tubes were sealed at one end with clay and arranged in a special microhaematocrit centrifuge which was fitted with a head for carrying up to 24 capillary tubes. The capillary tubes were arranged in a circular manner with the sealed end outward and the open end

towards the centre. The properly covered microhaematocrit centrifuge was set to rotate for 5 min. at 12,000 rpm. The PCV value was read using microhaematocrit reader in percentage.

Total erythrocyte count

The total erythrocyte count (TEC) in millions per cubic millimetre (10^6/ mm^3) was calculated by using Hayem's diluting fluid as per the methods described.[18] Blood sample was initially drawn into the red blood cell pipette up to the 0.5 mark on the stem. Then the diluting fluid was drawn into the pipette up to the 101 mark. The content in the pipette was further gently mixed for about 2 min and discarding the excess blood was expelled by gently stroking the tip of the pipette on a glass slide and blood was charged in to haemocytometer. The total number of RBCs counted in 5 small squares (4 corners and 1 center) out of 25 small squares and the total number was arrived by multiplying the total number of RBCs by 1000 and result expressed by 10^6/ mm^3.

Total leukocyte count

The total leucocytes count (TLC) in thousands per cubic millimetres (10^3/ mm^3) was counted by standard dilution technique using Thomas fluid as per the method.[19] Blood sample was drown up to 0.5 mark in to WBCs pipette followed by Thomas diluting fluid up to 11 mark and mixed well. Discarding the excess blood was expelled by gently stroking the tip of the pipette on a glass slide and blood was charged in to haemocytometer. The number of cells was counted in each of the four corner squares of the hemocytometer. The total number of WBCs in 4 corners was multiplied by 50 to arrive at the blood count of WBCs/ mm^3.

Differential cell count

A peripheral blood smear was taken from the ear tip from each animal for differential leukocyte count before, 24 hrs and 48 hrs after rumenotomy in all the cattle. The smears were stained by Giemsa stain. Stained smear was examined to determine the percentage of each type of leukocyte present. Each white cell was recorded on a differential cell counter, until 100 white cells were counted. The different types of WBC were expressed as percentage.

Biochemical parameters

Ten ml of blood was withdrawn from the external jugular vein, into sterile acid free dry 10 ml glass test tube without anticoagulant and allowed to clot at room temperature. After clotting, serum was separated by centrifugation at 3000 rpm for five minute. The separated serum was collected and stored in 2 ml vial at -20°C.[20] The blood samples was taken before, 24 hrs and 48 hrs after rumenotomy. The serum total protein (g/dl), aspartate amino traneferase (IU/L), alkaline amino transferase (IU/L) and creatinine (mg/ dL) were analyzed using standard diagnostic kits.

Serum total protein

The total protein (TP) level in g per dL was analyzed by Modified Biuret, End Point Assay[19] using commercial clinical kit (total protein test kit). The result was expressed as serum total protein g/dl.

Alanine amino transferase

The serum alanine amino transferase (ALT) level was analyzed by Modified International Federation of Clinical Chemistry (IFCC) method before, 24 hrs and 48 hrs after rumenotomy. A serum alanine amino transferase activity was determined according to recommendations of scientific committee for the IFCC using commercial kit (Kone Instruments Corp.). The result was expressed as ALT IU/L.

Aspartate amino traneferase

The serum Aspartate amino traneferase (AST) level was analyzed by Modified IFCC method [21] before, 24 hrs and 48 hrs after rumenotomy. Serum aspartate aminotransferase activities were determined according to recommendations of scientific committee for the International Federation of Clinical Chemistry (IFCC) by using a commercial kit (Kone Instruments Corp.). The result was expressed as AST IU/L.

Serum creatinine

The serum creatinine level was analyzed as per Jaffe's Alkaline Picrate Method[22] using commercial clinical kit (Creatinine reagent set, India). The difference in absorbance at fixed times during conversion was proportional to the concentration of creatinine in the sample. The result was expressed as mg/ dL.

Surgery

Preparation of surgical site

The left flank was prepared for aseptic surgery. It was washed thoroughly using liquid soap and water. A 30 cm hairless margin around the surgical site was shaved using shaving blades to remove hair. The proposed skin was wiped with clean moist gauze sponge to remove all hair and debris in all the cattle. Scrubbing was done by providone iodine (Betadine®).[23] The scrubbed skin was wiped and checked for remaining dirt and debris by using white gauze sponges soaked in isopropyl alcohol (70%). Gauze containing debris was discarded once it reached the periphery and it was repeated again at the proposed incision site with a new gauze sponge till debris was removed. Ten millilitres of or providone-iodine was added to each time sponges. Scrubbing was continued until the area was free of surgical scrub residue. Finally the entire scrubbed area was sprayed with tincture iodine.

Left paravertebral anesthesia

In the entire cattle anesthesia was achieved by left paravertebral nerve block with 2% lignocaine hydrochloride solution.[24] Standing position with free spaced crush was used which provided less stress and more room for movement.

Left mid flank laparotomy

A 25-30 cm long vertical skin incision starting from 6-8 cm below the left transverse process of the lumbar vertebrae was made 4 cm caudal and parallel to the last rib using scalpel handle No.4 with blade No. 24. The subcutaneous tissues, external and internal oblique muscles, transverses abdominis muscle and peritoneum were incised in the same plane. The pressure on the scalpel to incise the skin was adequate enough to ensure complete penetration of the skin. Dissection of the subcutaneous fascia and oblique muscles were made and the glistening aponeurosis of transverse abdominis muscle was exposed.[24] Muscles along with their fascia were grasped with large animal 20 cm allis tissue forceps and separated by blunt dissection after incised one by one. The peritoneum was grasped with allis tissue forceps and incised taking care not to cause any injury to underlying rumen. The skin incision was long enough to allow the surgeon's arm inside the abdomen.

The dorsal and ventral sac of rumen, urinary bladder, uterus, left kidney and intestinal masses were explored thoroughly. The right cranial abdomen was explored by passing the arm ventral to the superficial layer of greater omentum and directing cranially to locate the pylorus, body and fundus of the abomasum, the omasum, right wall of the reticulum, and left lobe of the liver. A thorough search was made by inserting right hand in the abdominal cavity through the incision and rolling over the rumen on all sides to rule out any herniation, abcessation or foreign bodies.[2]

Rumenotomy

Rumen exteriorization was done to prevent spilling out of rumen contents into the abdominal cavity by light traction with arms and fixing with Weingarth ring to dorsal commissure of the rumen incision by its thumb screw which was anchored to the ring with the help of two strong rumen forceps placed at dorsal and ventral aspect.[25] The rumen opening was made at the middle portion of an incision 20 cm long, to allow passage of the hand, forearm and arms surgeon. Thick gauze was used to cover the grasping edges of the tissue over the forceps before applying it to minimize trauma. After the rumen was stabilized and incised, enough contents were emptied to permit a through exploration. Transruminal exploration was done to find out the position, size and consistency of contents of rumen, reticulum and abomasum by palpation. Ruminoreticular fold, oesophageal orifice and reticuloomasal orifice were also examined for lesions and the reticulum for foreign bodies.[26]

Closure of rumen and abdomen

The ruminal cut edge were thoroughly cleaned with saline solution and sutured by a double row of continuous inversion suture patterns (Cushing followed by Lembert) using chromic catgut No. 2 in all the cattle.[27] The abdominal musculature was closed in three layers by using a simple continuous pattern of absorbable sutures in the muscle layers. Simple continuous suture pattern was applied on peritoneum and transverse abdominis muscle. The two oblique muscles were sutured together in second layer with simple continuous pattern using No. 3 catgut. The skin was closed with cross mattress with cotton thread.[28]

Post operative management

The animals were administered with antibiotic 8000IU Penicillin G sodium and 10 mg streptomycin per kg body weight for 3-5 days.[29]

Sodium chloride 0.9% and glucose 5% i/v infusion were given to correct the dehydration. The laparotomy wounds were cleaned and dressed daily with povidone iodine and the sutures were removed on the 12-15th post operative day. The animals were allowed to access liquid diet from the third day and easily digestible feeds from the fourth day onwards gradually.

Statistical analysis

The obtained data were stored in Microsoft excel-2007 and analyzed by using STATA 11. The mean and standard error were calculated to describe the variables. Comparisons of hematological and serum biochemical parameters between different stages (before, 24 hrs and 48 hrs after surgery) in all cattle managed under rumenotomy were compared using repeated measure ANOVA. A simple contrast was used in which the 24 hrs and 48 hrs after surgery were compared with the before surgery parameters. Those differences with p value <0.05 were considered statistically significant and those differences with p value <0.01 were considered as highly significance.

Results

Thirteen cattle suffering from major ruminal disorders were underwent rumenotomy at UOG veterinary clinic during September 2013 to May 2014. All the cattle were subjected to routine clinical examination and consent was obtained from the owners for surgical correction.

Hematological parameters

Haemoglobin (Hb)

The mean (±S.E) haemoglobin in g/dl before, 24 hrs and 48 hrs after rumenotomy in all cases were 8.3 ± 0.23, 9.2±0.34 and 10.6±0.43 respectively (Table 1). The mean haemoglobin value showed a highly significant (P<0.01) increase from the presurgical values up to 24 hrs and 48 hrs in all the cattle after rumenotomy.

Packed cell volume (PCV)

The mean (±S.E) packed cell volume (PCV) in percentage before, 24 hrs and 48 hrs after rumenotomy in all cases were 33.2±3.19, 35.0±3.95 and 38.2±2.96 respectively (Table 1). The mean PCV value showed a significant (P<0.05) increase from the presurgical values up to 24 hrs. However, a highly significant (p<0.01) increase was found from presurgical values up to 48 hrs in all the cattle after rumenotomy.

Total erythrocyte count

The mean (±S.E) total erythrocyte count (TEC) in millions/ mm^3 before, 24 hrs and 48 hrs after rumenotomy in all cases were 6.8±0.33, 7.1±0.22 and 7.7±0.26 respectively (Table 1). The mean TEC revealed a non significant increase from the presurgical values up to 24 hrs and 48 hrs in all the cattle after rumenotomy.

Total leukocyte count

The mean (±S.E) total leukocyte count (TLC) in thousands / mm^3 before, 24 hrs and 48 hrs after rumenotomy in all cases were 6.0± 0.32, 6.9 ±0.14 and 7.6±0.13 respectively (Table 1). The mean TLC revealed a highly significant (P<0.01) increase from the presurgical values up to 24 hrs and 48 hrs in all the cattle after rumenotomy.

Neutrophils

The mean (±S.E) neutrophil in percentage before, 24 hrs and 48 hrs after rumenotomy in all cases were 44.0±3.41, 51.0±3.30 and 56.0±7.42 respectively (Table 1). Statistical analysis revealed highly significance difference (p<0.01) increase total neutrophil percentage from the presurgical values up to 24 hrs and 48 hrs in all the cattle after rumenotomy.

Lymphocytes

The mean (±S.E) lymphocyte in percentage before, 24 hrs and 48 hrs after rumenotomy in all cases were 49.6±2.61, 44.8±3.68 and 38.9±10.22 respectively (Table 1). The mean lymphocyte count indicated a highly significant (P<0.01) decrease from the presurgical values up to 24 hrs and 48 hrs in all the cattle after rumenotomy.

Monocyte

The mean (±S.E) monocyte in percentage before, 24 hrs and 48 hrs after rumenotomy in all cases were 3.6±0.66, 3.2±2.73 and 2.6±0.49 respectively (Table 1). The mean monocyte count indicated a non significant decrease from the presurgical values up to 24 hrs and 48 hrs after surgery in all the cattle after rumenotomy.

Eosinophils

The mean (±S.E) eosinophil in percentage before, 24 hrs and 48 hrs after rumenotomy in all cases

were 2.69±0.39, 1.85±1.38 and 1.46±0.21 respectively (Table 1). The mean eosinophil count revealed a non significant decrease from the presurgical values up to 24 hrs and 48 hrs in all the cattle after rumenotomy.

Table No. 01: The mean (±S.E) values of hematological parameters observed in cattle before and after rumenotomy

Hematological parameters	Before Surgery	24 hrs after surgery	48 hrs after surgery
Hb (g/dl)	8.3± 0.23 [a]	9.2±0.34[b]	10.6±0.43[b]
PCV (%)	33.2± 3.19[a]	35.0±3.95[b]	38.2±2.96[b]
TEC (10^6/mm^3)	6.8± 0.33	7.1±0.22	7.7±0.26
TLC (10^3/ mm^3)	6.0± 0.32[a]	6.9±0.14[b]	7.6±0.13[b]
Neutrophil (%)	44.0± 3.41[a]	51.0±3.30[b]	56.0±7.42[b]
Lymphocytes (%)	49.6±2.61[a]	44.8±3.68[b]	38.9±10.22[b]
Monocyte (%)	3.6±0.66	3.2±2.73	2.6±0.49
Eosinophil (%)	2.6±0.39	1.8±1.38	1.4±0.21

[a, b] Mean bearing different superscript in a row differs significantly.

Biochemical parameters

Serum total protein

The mean (±S.E) serum protein (TP) in g/dl level before, 24 hrs and 48 hrs after rumenotomy in all cases were 7.4± 0.24, 7.3 ±0.26 and 6.5 ± 0.13 respectively (Table 2). The mean serum total protein revealed a significant (P<0.05) decrease from the presurgical values up to 24 hrs after rumenotomy but highly significant (P<0.01) reductions in serum total protein was found from presurgical values up to 48 hrs in all the cattle after rumenotomy.

Alanine amino transferase

The mean (±S.E) alanine amino transferase (ALT) in IU/L before, 24 hrs and 48 hrs after rumenotomy in all cases were 23.0±6.76, 27.3±5.65 and 35.0±3.25 respectively (Table 2). The mean ALT level showed a highly significant (P<0.01) increase from the presurgical values up to 24 hrs and 48 hrs after surgery in all cattle underwent rumenotomy.

Aspartate amino traneferase

The mean (±S.E) serum aspartate amino transferase (AST) level in IU/L before, 24 hrs and 48 hrs after rumenotomy in all cases were 81.61±6.92, 85.56 ±8.61 and 92.73 ±19.00 respectively (Table 2). The mean AST level showed a highly significant (P<0.01) increase from the presurgical values up to 24 hrs and 48 hrs after surgery in all cattle underwent rumenotomy.

Serum creatinine

The mean (±S.E) serum creatinine in mg/ dL before, 24 hrs and 48 hrs after rumenotomy in all cases were 1.1±0.04, 1.4±0.02 and 1.9±0.07 respectively (Table 2). The mean serum creatinine level revealed a highly significant (P<0.01) increase from the presurgical values up to 24 hrs and 48 hrs after surgery in all cattle underwent rumenotomy.

Table No. 02: The mean (±S.E) values of serum biochemical analysis in cattle observed before and after rumenotomy

Hematological parameters	Before surgery	24 hrs after surgery	48 hrs after surgery
Total protein (g/dl)	7.4± 0.24a	7.3±0.26b	6.5± 0.13b
ALT (IU/L)	23.0±6.76a	27.3±5.65b	35.0±3.25b
AST (IU/L)	81.6±6.92a	85.5±8.61b	92.7±19.00b
Serum creatinine (mg/ dL)	1.1±0.04a	1.4±0.02b	1.9±0.07b

[a, b] Mean bearing different superscript in a row differs significantly.

Discussion

In the present study increased mean haemoglobin concentration at 24 hrs and 48 hrs after surgery had been recorded in all the cattle. The findings in the present study concurred with the records. Where in the author stated that no variation in Hb level was observed in bovine in response to ingestion of foreign body. The observation disagreed with

earlier reports in cattle[30] who reported decreased mean values of haemoglobin concentration in animals with foreign body rumen impaction indicate anaemia during penetration of the reticulum. The increase in the level of haemoglobin could be due to chronic nature of the disease and degree of dehydration.

In the hematological profile in PCV values were increased at 24 hrs and 48 hrs after surgical procedure. This could be attributed to the stress associated with surgery. Similar observations were reported.[3] The increase in the PCV might be due to depressed appetite nature and duration of the disease condition and dehydration status of the animal.

The non significant increase in the mean total erythrocytic count was observed in the present study.2[9] reported similar observations higher TEC values in foreign body syndrome affected cases in cattle where as reported a significant drop in TEC values in cases of foreign body syndrome in bovine indicate anaemia, which could be attributed to the loss of blood during penetration of the reticulum or the chronic inflammatory process.[2, 4, 31, 32] The increased TEC in animals of this study could be due to careful surgical procedure without much bleeding.

Significant increase in the mean total leukocyte was observed in the present study at 24 hrs and 48 hrs post rumenotomy. Similar observations were reported.[5, 7] This marked increase in TLC, observed in diseased cattle could be attributed to tissue injury leading to inflammation and purulent exudation after the surgical management.

In the hematological profiles, neutrophilic leukocytosis at 24 hrs and 48 hrs after surgery was noticed in the present study. This was in accordance with[5-7] who attributed neutrophilia due to the inflammation in the surgical condition and stress.[33, 34] reported similar findings of neutrophilia which have been indicative of diffuse traumatic reticuloperitonitis and extra-reticular fibrous nodules. Neutrophilia might be due to the surgical trauma and subsequent surgical stress and inflammatory process after the surgical procedure and appearance of immature neutrophil in blood during acute inflammatory disease.

The highly significant decrease in mean values of lymphocyte with a significant increase in mean neutrophils values noticed at 24h and 48h after surgery. In the hematological profiles, lymphopenia were evident in cattle with ruminal affections. These findings were in agreement with[3, 7, 35] who reported that endogenous corticosteroid release secondary to stress may cause lymphopenia by cell redistribution; circulating lymphocytes do not re-enter the lymphatics but become sequestered in lymphoid tissue and bone marrow. The observed decrease in mean lymphocytic values might suggest increased susceptibility to infection in cattle with foreign body impaction and could be due to a reduction in cellular immunity associated with the stress of penetration or impaction. Lymphopenia with leukocytosis may be due to the inflammatory surgical conditions, surgical trauma and wound infection due to release of corticosteroids as a result of stress.

Monocyte count did not show any significant difference before and after surgery. Similar findings were reported.[35] Monocytopaenia might be due to acute inflammation caused by surgical trauma.

Eosinophilia and eosinopenia were difficult to be evaluated in large animals but stress induced eosinopenia may occur secondary to increased circulatory catecholamine and corticosteroids. During inflammatory and infectious process eosinopenia followed administration of corticosteroids.[36] Eosinopaenia could be due to acute infection during surgical management.

The decrease in the total protein (TP) from normal values in this study could be due to lack of proper diet or poor absorption of dietary constituents from gastrointestinal tract. Similar findings were reported.[11] On the contrary[13, 10] who reported that an increased level of TP was due to release of some acute phase proteins and increased globulin concentration in response to inflammation, stress, or dehydration. The decrease in TP levels in surgical conditions might be due to progressive loss of appetite and reduced intake of feed and water.

The increase in ALT activity suggests that ruminal affections associated with impaired hepatic function that might be due to hepatic damage secondary to foreign bodies which were in

agreement.[8, 12] The increase in liver enzymatic activity suggests that foreign body syndrome was associated with impaired hepatic function that might be due to hepatic damage secondary to ruminal disorders.

Elevations of AST above the base levels at 48 h after surgeries were in accordance[28, 13, 25] who reported an increased level of AST might due to tissue damage that occurred during handling and surgical procedures. The elevation of aspartate aminotransferase was suggestive of inflammatory changes in the body not only traumatic reticuloperitonitis or pericarditis. This could provide important clues for the presence of inflammatory changes. Furthermore, the enzymatic activity of AST and ALT was significantly suggestive of more severe damage to the liver and muscles with ruminal affections.

The increased creatinine levels could be attributed to decrease in renal blood flow as a part of compensatory mechanism to maintain circulation in hypovolemia associated with dehydration, leading to azotemia.[7, 15] The CK was elevated in the majority of patients with muscle disease but may be normal in slowly progressive myopathies.

All the animals with different ruminal disorders were subjected to laprorumenotomy. Rumenotomy performed with Weingarth apparatus provided adequate fixation of rumen and prevented spillage of ruminal contents in to peritoneal cavity.[25, 37] have stated that the recommended techniques for rumenotomy were suturing the rumen to the skin, prior to rumenotomy, or using fixation devices, such as, a Weingarth's ring later being better technique. On contrary[5] reported that skin suture fixation was superior to Weingarth's ring and the stay suture techniques. However in the present study the use of Weingarth's ring prevented the spillage of ruminal contents into the peritoneal cavity and development of peritonitis.

In the present study post operative care was aimed to prevent surgical infection, correct dehydration, acid base and electrolyte disturbances and restoration of normal ruminal motility. Intravenous fluid, dextrose normal saline in the present study to correct electrolyte loss and dehydration favoured wound healing and recovery as similarly suggested.[9] Post operative management especially daily wound dressing and lavaging with disinfectants, provision of balanced ration and sufficient drinking water were given for normal recovery as reported.[9, 38] Post operative care given in the present study was helpful for complete recovery of all cattle following rumenotomy.

Conclusion and recommendations

This study was aimed at investigating the pre and post rumenotomy outcomes of 13 cattle with various ruminal disorders. Hematological and serum biochemical parameters were studied in all the cattle.

In haematology Hb, PCV and TLC levels increased significantly from the presurgical values up to 24 hrs and 48 hrs after rumenotomy. Leukogram revealed significance neutrophilia and lymphopenia from the presurgical values up to 24 hrs and 48 hrs. However, monocyte and eosinophil count indicated non significant decrease from the presurgical values up to 24 hrs and 48 hrs after surgery.

Biochemical parameters revealed significant increase in ALT, AST and serum creatinine level from the presurgical values up to 24 hrs and 48 hrs after rumenotomy. Serum TP significantly decreased from the presurgical values up to 24 hrs and 48 hrs.

Rumenotomy through left flank approach using paravertebral nerve block by lignocaine 2% was safe for surgical intervention of various ruminal disorders. Streptopenicillin, dextrose normal saline favoured wound healing and recovery.

Therefore, based on the above conclusions, the following recommendations are forwarded:

- Farmers/livestock owners should be cautioned against unsupervised grazing of cattle as there in danger of accidental ingestion of disposed vegetable waste/kitchen waste in plastic bags.
- The cattle owners should strictly follow the post operative management advices given by the surgeon.
- The preoperative correction for dehydration, antimicrobials to prevent possible infection and replenishing the ruminal content to restore the ruminal ecosystem should be taken into consideration for successful rumenotomy.

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