ECRONICON OPEN ACCESS

EC VETERINARY SCIENCE
Research Article

Clinico-Pathological and Biochemical Alterations in Cattle Affected with Gastrointestinal Obstruction

B Dwibedi, AK Sahoo*, I Nath and SS Behera

Department of Veterinary Surgery and Radiology, College of Veterinary Science and Animal Husbandry, OUAT, Bhubaneswar, Odisha, India

***Corresponding Author**: AK Sahoo, Department of Veterinary Surgery and Radiology, College of Veterinary Science and Animal Husbandry, OUAT, Bhubaneswar, Odisha, India.

Received: February 19, 2019; **Published:** March 28, 2019

Abstract

Sixteen presented clinical cases of gastrointestinal obstruction in cattle with undetermined diagnosis were subjected to surgical exploration following detailed clinical and clinico-pathological examination. These animals were divided in to two groups (Group-I and II) based on location of obstruction and on the basis of exploratory diagnosis: group I included 10 animals in which the rumen-noreticulum and omasum were involved and group II involved 6 animals with obstructions caudal to omasum or with obstructions due to extra-intestinal causes. Hemato-biochemical parameters and rumen fluid were studied pre and post-operatively. Animals in both groups showed hypokalemia, hypochloremia, hypocalcemia and low rumen protozoa count. Animals in group I appeared vitally stable with alkaline rumen pH, normal leukogram and mild hyponatremia. Animals in group II were found to be more severely affected with profound dehydration, inflammatory leukogram with neutrophilia and acidic rumen pH with elevated chloride content. As a result among both groups, group II animals required more aggressive fluid therapy, resuscitation, postoperative care and monitoring.

Keywords: *Obstructive Gastrointestinal Diseases; Leukogram; Neutrophilia; Hypochloremia; Hyponatremia*

Introduction

Obstructive gastrointestinal diseases are fairly common in bovine practice and pose a significant diagnostic challenge to the veterinarian under field conditions with limited diagnostic facilities. Gastrointestinal obstruction in bovine may be due to physical obstructions like ruminal impaction, trichobezoars [1], ruminal foreign body [2,3], traumatic reticulo-peritonitis/pericarditis [4,5], omasal impaction [6], abomasal impaction [7], abomasal displacement, duodenal obstruction [8], intestinal obstructions, cecal dilation and torsion [9], internal hernia [10] or functional obstructions like vagus indigestion and paralytic Ileus [11,12]. Surgical exploration is often required for definitive diagnosis and successful treatment of these conditions in cattle [13]. This study was carried out on a series of 16 bovine cases unyielding to medical treatment where a definitive diagnosis could not be established with standard diagnostic procedures [14]. A detailed clinical and clinico-pathological examination of the animals was done before and after surgical exploration and treatment. Following exploratory diagnosis and treatment the results of laboratory examination were analyzed in relation to the pre- and postoperative condition of the patients.

Materials and Methods

Approval from the Institutional Animal Ethics Committee was not necessary as all were clinical cases referred for treatment. For the purpose of this study, all the bovine cases exhibiting obstructive gastrointestinal symptoms presented to the Department of Veterinary

Surgery and Radiology, CVSc and AH, OUAT, India over a period of one year were carefully screened. A total of 47 cases were thoroughly examined by the usual diagnostic methods like observing vital signs, rumen motility, clinico-pathological and hemato-biochemical examination as described below. Based on the clinical examination detailed below, in 31 animals (66%) a definitive diagnosis could be done; they were treated by the usual surgical or medical protocols and excluded from the study. In the remaining 16 animals (34%) a definitive diagnosis could not be established and surgical exploration was done through a left ventrolateral oblique laparotomy for diagnosis and treatment. These 16 animals of both sexes and irrespective of age formed the subjects of the present study.

Animals

Out of these sixteen animals, 15 were females (four were heifers and 11 lactating cows); three were non-descript animals and 13 were crossbred Jersey animals. These animals were treated for varying periods by local veterinarians before being referred to the College; they were maintained under various management systems and different feeding practices. These sixteen (16) animals were divided into 2 groups (Table 1) on the basis of exploratory diagnosis: Group I included 10 animals in which the rumenoreticulum and omasum was involved and Group II involved 6 animals with obstructions caudal to omasum or with obstructions due to extra-intestinal causes.

Group	Sl No	Exploratory Diagnosis	No of cases	Treatment
I	1	Obstruction of reticulo-omasal orifice with phytobezoar	1	Removal of the phytobezoar by rumenotomy
	2	Omasal impaction	2	Omasal flushing
	4	Rumenoreticular foreign bodies	2	Removal of polythene and metallic foreign bodies
	6	Traumatic Reticulitis	1	Removal of nails
	7	Traumatic Reticulo-peritonitis (localized)	1	Removal of nails
	8	Rumenoreticular foreign bodies with omasal impaction	3	Retrieval of foreign bodies and omasal flushing
II	1	Cecal dilation and displacement	1	Typhlotomy
	2	Intestinal volvulus	1	Resection and anastomosis
	3	Pyloric obstruction with phytobezoar	1	Abomasotomy
	4	Cecal dilation, ventroflexion and necrosis	1	Total typhlectomy
	5	Diaphragmatic hernia	2	Diaphragmatic herniorrhaphy declined by owners

Table 1: *Classification of animals into groups I and II based on obstruction in GI tract.*

Clinical examination

The vital signs like temperature, respiration and pulse rate were examined. Rectal mucosal temperature was measured with the Hick's thermometer for 2 minutes. Respiration rate was determined by counting movement of chest wall or flank over 1 minute period and recorded as breaths/minute. Pulse rate was measured by palpating the middle coccygeal artery and heart rate was determined by auscultation with a stethoscope.

Laboratory tests

Clinico-pathological parameters like rumen pH, rumen protozoa, rumen chloride and hemato-biochemical parameters like differential count (DC), total leukocyte count (TLC), hematocrit (PCV), hemoglobin content, serum calcium, serum sodium, serum potassium and serum chloride were determined. All the laboratory tests were performed on the day of operation (day 0), 3rd and 7th post-operative days to assess the condition of the animal before surgery, to monitor therapy and to evaluate the response to treatment.

Collection of rumen fluid was done either by introducing a lubricated probang [15] or by rumenocentesis [16]. The rumen liquor was then analyzed for pH (by wide range pH paper), protozoa count [17,18] and chloride content (by colorimetric method with the help of an autoanalyzer (Turbochem-100).

For hemato-biochemical studies, blood samples were collected by jugular venupuncture for estimation of PCV, hemoglobin, differential count, total leukocyte count, serum sodium, potassium, calcium and chloride. Estimation of hemoglobin was done with Sahli's hemoglobinometer, packed cell volume (PCV) by Wintrobe's microhematocrit method, TLC with a Neubauer's slide and differential count (DC) done by counting WBC's on a Giemsa stained smear. Serum sodium, potassium, calcium and chloride were estimated using diagnostic kits with the help of an auto analyzer (Turbochem-100).

Statistical Analysis

Analysis of variance (ANOVA) was used to compare the means on different days among different groups. Paired "t" test was used to compare the mean values on different days with their respective base value in each group [19]. A '*P*' value of less than 0.05 was considered significant.

Results

Clinical Examination

In group I the mean ± SE of body temperature on the day of operation was 101.07 ± 0.27 ^{0}F which significantly ($p < 0.01$) increased on 1st and 2nd post-operative day and decreased significantly ($p < 0.01$) to normal basal value on 3rd and 7th post-operative day. In group II the mean ± SE of body temperature on the day of operation was 102.13 ± 0.18 ^{0}F which significantly ($p < 0.05$) increased on 1st and 2nd post-operative day and decreased significantly ($p < 0.01$) to normal values on 3rd and 7th post-operative day. The body temperature of group II was significantly ($p < 0.05$) higher than Group I on the day of operation and 7th post-operative day but no significant difference ($p > 0.05$) was observed on 1st, 2nd and 3rd post-operative days. In group I the mean ± SE of pulse rate was 78.6 ± 2.01/min on the day of operation which decreased insignificantly ($p > 0.05$) on day 3 but significantly ($p < 0.05$) on day 7 and the day 7 pulse rate was significantly ($p < 0.05$) lower than the base value. In group II the mean ± SE of pulse rate was 83 ± 8.54/min on the day of operation which decreased gradually but insignificantly ($p > 0.05$) on day 3 and day 7. The pulse rate of group II was insignificantly higher ($p > 0.05$) on day 0, but lower on day 3 and day 7 than that of group I. The mean ± SE of respiration rate in group I was 19.4 ± 0.83 breaths/minute and in group II was 18.67 ± 2.87 breaths/minute which did not show any significant ($p > 0.05$) variation on different days, and the variation between the groups on different days was also insignificant ($p > 0.05$).

In group I, there was a lower mean ± SE of rumen motility (1.6 ± 0.52/ 5 min) which significantly ($p < 0.05$) increased on day 3 and day 7 to normal. In group II, the basal mean ± SE of rumen motility was 4.5 ± 2.26/5 min which gradually but insignificantly ($p < 0.05$) increased on day 3 and day 7. The rate of rumen motility in group II was insignificantly ($p < 0.05$) higher than that of group I. In group I, the mean ± SE of rumen pH was 8.1 ± 0.23 which significantly ($p < 0.01$) decreased to normal values on day 3 and day 7. In group II, the mean ± SE of rumen pH was 6 ± 0.36 which insignificantly ($p > 0.05$) increased to normal values on day 3 and day 7. There was a significant difference among the two groups on day 0 ($p < 0.01$) and day 3 ($p < 0.05$), but no difference on day 7. In group I, the basal mean ± SE of rumen protozoa count on day 0 was low which increased steadily and significantly ($p < 0.01$) on day 3 and day 7. In group II, the basal mean ± SE of rumen protozoa count on day 0 was also low which increased insignificantly ($p > 0.05$) on day 3, but significantly ($p < 0.05$) on day7. There was no significant difference ($p > 0.05$) among the groups on different days. In group I, the mean ± SE of rumen chloride concentration was 22.9 ± 1.04 mEq/L which decreased significantly ($p < 0.01$) on day 3 and day 7. In group II, the mean ± SE of rumen chloride concentration was 32.17 ± 2.90 mEq/L which decreased significantly ($p < 0.05$) on day 3 and day 7. Comparison among the groups revealed significant difference ($p < 0.05$) on different days.

Hematologic parameters

In group I, the mean ± SE of PCV was 38.9 ± 0.98% on day 0 which gradually and significantly ($p < 0.01$) decreased on day 3 and day 7. In group II, the mean ± SE of PCV was 37 ± 1.97% on day 0 which also gradually and significantly decreased on day 3 ($p < 0.01$) and day 7 ($p < 0.05$). No significant difference among the groups was found on comparison. In group I, the mean ± SE of hemoglobin was 9.01 ± 0.31 gm% on day 0 which decreased significantly ($p < 0.01$) on day 3 and day 7. In group II, the mean ± SE of hemoglobin was 8.67 ± 0.36 gm% on day 0 which slightly and insignificantly ($p > 0.05$) decreased on day 3 but insignificantly ($p > 0.05$) increased on day 7. No significant difference was observed between the groups on comparison. In group I, the mean ± SE of TLC was 10,985 ± 1004.55/mm^3 on day 0 which slightly and insignificantly ($p > 0.05$) decreased on day 3 and day 7. In group II, the mean ± SE of TLC was 14,483.33 ± 2205.21/mm^3 on day 0 which slightly and insignificantly ($p > 0.05$) decreased on day 3 and day 7. On comparison the values for group II were found to be insignificantly higher ($p > 0.05$) than that of group I. In group I, the basal mean ± SE of neutrophils was 49.3 ± 5.84% which decreased

insignificantly ($p > 0.05$) on day 3 and significantly ($p < 0.05$) on day 7. In group II, the basal mean ± SE of neutrophils was 62.17 ± 7.92% which decreased significantly ($p < 0.05$) on day 3 and 7. There was no significant difference between the groups on comparison. In group I, the basal mean ± SE of lymphocytes was 45.4 ± 5.42% which increased insignificantly ($p > 0.05$) on day 3 and significantly ($p < 0.05$) on day 7. In group II, The basal mean ± SE of lymphocytes was 35 ± 8.06% which increased significantly ($p < 0.05$) on day 3 and 7. There was no significant difference ($p > 0.05$) between the groups.

Serum electrolytes

In group I, the mean ± SE of serum sodium was 129 ± 1.98 mmol/L on day 0 which significantly ($p < 0.01$) increased on day 3 and day 7. In group II, the mean ± SE of serum sodium was 133.83 ± 1.35 mol/L on day 0 which significantly increased on day 3 ($p < 0.05$) and day 7 ($p < 0.01$). Comparison revealed significant difference ($p < 0.05$) between the groups on day 7, no significant difference ($p > 0.05$) on day 0 and day 3. In group I, the mean ± SE of serum potassium was 3.48 ± 0.13 mmol/L on day 0 which significantly ($p < 0.01$) increased on day 3 and day 7. In group II, the mean ± SE of serum potassium was 3.17 ± 0.11 mmol/L on day 0 which significantly increased on day 3 ($p < 0.05$) and day 7 ($p < 0.01$). There was no significant difference ($p > 0.05$) between the groups on different days. In group I, the mean ± SE of serum calcium was 8.82 ± 0.28 mg/dL on day 0 which significantly ($p < 0.01$) increased on day 3 and day 7. In group II, the mean ± SE of serum calcium was 8.67 ± 0.27 mg/dL on day 0 which significantly ($p < 0.01$) increased on day 3 and day 7. There was no significant difference ($p > 0.05$) among the groups on different days. In group I, the mean ± SE of serum chloride was 87.9 ± 3.69 mmol/L on day 0 which significantly ($p < 0.01$) increased on day 3 and day 7. In group II, the mean ± SE of serum chloride was 86.83 ± 2.6 mmol/L on day 0 which significantly increased ($p < 0.01$) on day 3 and day 7. There was no significant difference ($p > 0.05$) among the groups on different days. All the results have been summarized in table 2.

Mean ± SE values of parameters	Group I			Group II		
	Day 0	Day 3	Day 7	Day 0	Day 3	Day 7
Temperature (^{0}F)	101.07 ± 0.27a	101.15 ± 0.18a	100.81 ± 0.16a	102.13 ± 0.18b	101.6 ± 0.24a**	101.46 ± 0.07a**
Pulse (rate/min)	78.6 ± 2.01b	77 ± 1.46b	75 ± 1.19a*	83 ± 8.54	74.6 ± 6.33	70.2 ± 4.61
Respiration (breaths/ minute)	19.4 ± 0.83	18.3 ± 0.68	18.2 ± 0.66	18.67 ± 2.87	16.8 ± 2.87	17.4 ± 2.87
Rumen motility (contractions /5 min)	1.6 ± 0.52a	3.4 ± 0.73b**	6.5 ± 0.34c**	4.5 ± 2.26	6.4 ± 1.69	8 ± 1.05
Rumen pH	8.1 ± 0.23b	7.1 ± 0.1a**	7 ± 0a**	6 ± 0.36	6.6 ± 0.24	7 ± 0
Rumen protozoan count§	0.8 ± 0.25a	1.7 ± 0.21b**	2.5 ± 0.17c**	1 ± 0.36a	1.6 ± 0.24	2.2 ± 0.2b*
Rumen chloride (mEq/L)	22.9 ± 1.04b	18 ± 0.47a**	18.7 ± 0.33a**	32.17 ± 2.90b	20 ± 0.55a*	20.2 ± 0.37a*
PCV (%)	38.9 ± 0.98b	37.7 ± 1.03a**	37.5 ± 0.98a**	37 ± 1.97b	34.4 ± 1.54a**	34.6 ± 1.43a*
Hemoglobin (gm %)	9.01 ± 0.31b	8.79 ± 0.29a**	8.79 ± 0.29a**	8.67 ± 0.36	8.46 ± 0.41	8.66 ± 0.38
TLC	10985 ± 1004.55	10475 ± 694.95	10055 ± 578.43	14483.333 ± 2205.21	12200 ± 1589.65	11200 ± 1156.29
Neutrophil count (%)	49.3 ± 5.84b	44.2 ± 3.57	40.1 ± 1.89a*	62.17 ± 7.92b	47.6 ± 5.77a*	39.4 ± 2.56a*
Lymphocyte count (%)	45.4 ± 5.42a	51 ± 3.02a	56.2 ± 1.67b*	35 ± 8.06a	47.8 ± 5.95b*	52.2 ± 5.40b*
Serum sodium (mmol/L)	129 ± 1.98a	134.4 ± 0.97b**	136.4 ± 0.37b**	133.83 ± 1.35a	136 ± 1.87b*	138.8 ± 1.39c**
Serum potassium (mmol/L)	3.48 ± 0.13a	3.89 ± 0.11b**	4.17 ± 0.06c**	3.17 ± 0.11a	3.62 ± 0.17b*	4.26 ± 0.06c**
Serum calcium (mg/dL)	8.82 ± 0.28a	9.56 ± 0.19b**	9.96 ± 0.07c**	8.67 ± 0.27a	9.78 ± 0.30b**	10.16 ± 0.30b**
Serum chloride (mmol/L)	87.9 ± 3.69a	96.9 ± 1.46b**	100 ± 0.60c**	86.83 ± 2.6a	94 ± 2.66b**	98.2 ± 0.92b**

Table 2: *Mean ± SE value of different physiological and biochemical parameter in both groups.*

** Significantly different from the base value (Day 0) (P < 0.05) ** (P < 0.01).*

Values with different subscripts in a row differ significantly.

§: For ease of statistical analysis protozoan count has been given numerical values: 1 (0 - 9 protozoa/ field), 2 (10 - 19 protozoa/field) and 3 (20 - 30 protozoa/field).

Discussion

The preoperative rumen pH in group I was alkaline which significantly ($P < 0.01$) decreased to normal values on day 3 and day 7, however in group II, the initial rumen pH was acidic which insignificantly ($P > 0.05$) increased to normal values on day 3 and day 7. Ruminal pH in cattle is usually maintained between 6.2 and 7.2 [12] and is the result of a delicate balance between the fermentative activity of cellulolytic and amylolytic ruminal flora and the action of alkaline saliva [11]. The initial rumen pH in group I was alkaline due to obstruction of the forestomachs that prevented onward transport of ingesta, lack of food intake that made substrates unavailable for microbial fermentation and consequent acid production and continuous ingestion of alkaline saliva [16]. In group II, the ruminal pH was found to be acidic. As many animals in this group had obstructions caudal to the omasum, the abomasal secretion was probably refluxed in to the rumen causing an acidic ruminal pH [8]. Following relief of the obstruction and after taking the relevant corrective measures the rumen pH gradually returned to normal in both the groups.

In group I, the basal mean ± SE of rumen protozoa count on day 0 was low which increased steadily and significantly ($P < 0.01$) on day 3 and day7. In group II, the basal mean ± SE of rumen protozoa count on day 0 was also low which increased insignificantly ($P > 0.05$) on day 3, but significantly ($P < 0.05$) on day 7. There was no significant difference ($P > 0.05$) among the groups on different days. The rumen functions as a fermentation vat where efficient digestion of plant materials is brought about by the rumen microbes that operate in a state of dynamic equilibrium in a complex ecosystem, and hence rumen microbial health is of paramount importance in maintaining dairy cow health [18]. Rumen protozoan activity is a rapid and valuable indicator of overall ruminal microbial health, and is closely related with a good appetite and wellbeing. Both groups of animals had lower protozoa count on the day of operation because of change in rumen pH which increased steadily and significantly following surgical correction of the condition. Improvement in protozoa count and appetite was due to putting of yeast tablets into the rumen during closure of rumenotomy incision and subsequent correction of rumen pH and rumen cud transplantation in the postoperative period.

Group I animals had normal basal ruminal chloride which slightly but significantly decreased on day 3 and day 7 due to emptying of ruminal contents and correction of obstruction. In group II, the animals had a slightly higher ruminal chloride content which also decreased significantly to normal values on day 3 and day 7 of operation. As many animals in group II had obstruction caudal to theomasum, there was sequestration of gastric acid in the lumen and its reflux in to the rumen probably lowered the ruminal pH and elevated ruminal chloride [9].

The PCV values were in the higher side of normal range on day 0 in both the groups which gradually but significantly decreased till the day 7 of operation. The mildly elevated PCV on the day of the operation was due to the varying degrees of dehydration present in the animals. As the animals' appetite resumed following surgery and the dehydration was corrected by fluid therapy the PCV decreased gradually.

The hemoglobin values were in lower normal ranges on the day of operation in both groups. The significant decrease in group I and slight but insignificant decrease in group II on the day 3 and day 7 of operation was mainly due to restoration of body fluid deficits and could be partially due to intra-operative hemorrhages. The low normal basal levels of hemoglobin in both groups were unrelated to the primary disease and probably reflected the suboptimal level of nutrition in the animals prior to the development of the gastrointestinal obstruction.

The earliest manifestation of inflammation is leukocytosis with neutrophilia and neutrophilia is clearly visible in inflammatory conditions of cattle as lymphocyte is the dominant leucocyte [11]. In group II, there was leukocytosis with neutrophilia due to involvement of intestines or caecum which resulted in more severe inflammation. The leukogram in group I was almost normal with subtle changes in some animals suggesting minimal inflammatory changes. Therapy with antibiotics and anti-inflammatory drugs resolved inflammation and there was gradual reduction in TLC and neutrophil count in both groups. As the neutrophil number reduced there was a consequent rise in lymphocyte percentage in both groups suggesting a favourable change in the leukogram towards normalcy.

A mild hyponatremia found in group I animals in this study may be due to lack of intake and absorption of sodium from the gastrointestinal tract. However, with continued fluid and electrolyte therapy serum levels gradually but significantly increased to normal values

in both the groups. This is similar to report of Constable., *et al.* [20] where a mild hyponatremia was seen in 57 cattle affected with intussusceptions but contrary to report of Hussain., *et al.* [6] where serum sodium levels were found to be significantly unaffected in 11 cases of omasal impaction.

Anorexia in ruminants for any reason leads to development of moderate and clinically occult hypokalemia for which administration of oral potassium chloride has been recommended as a supportive therapy [21]. All the animals in this study had varying degrees of anorexia and consequent reduced intake of potassium contributed mostly to the development of hypokalemia in both groups. Sequestration of gastric acid in the gastrointestinal lumen in some animals might have contributed to the development of hypokalemia. Surgical correction of the obstruction and fluid and electrolyte therapy in both groups lead to significant improvement of serum potassium and restoration of normal levels in both groups.

Both groups of animals in this study had a mild hypocalcemia which is consistent with the finding of earlier reports [6,8,20]. Lack of intake and interference in absorption of calcium has led to development of hypocalcemia in all animals. Additionally, drainage of calcium in milk in the lactating animals in this study contributed further to the development of hypocalcemia. As per Braun., *et al.* [9], intestinal obstruction initially leads to increased myoelectric activity of the intestine which consumes calcium and lowers serum levels. Although a profound hypocalcemia (serum calcium levels < 5 mg/dL) is required for recumbency in cattle, a mild to moderate degree of hypocalcemia leads to depression of muscle tone and GI motility and aggravates the ileus developing in physical obstruction.

In both groups of animals there was a mild hypochloremia which is consistent with the observations of Karapinar and Kom [22]. In obstructive diseases of the gastrointestinal system, ruminants develop a hypokalemic and hypochloremic alkalosis and the more proximal the lesion, more rapid is the development of this biochemical abnormality [23]. Sequestration of hydrochloric in gastrointestinal lumen in case of gastrointestinal obstruction was the principal cause of hypochloremia in these animals.

Conclusion

The study on clinco- pathological and biochemical alteration in rumen fluid, blood and serum profile in sixteen (16) bovine cases affected with undetermined gastrointestinal obstruction which were classified into two groups (I and II) revealed that Group I animals showed an alkaline rumen pH, normal leukogram and mild hyponatremia whereas Group II animals showed an acidic rumen pH, higher body temperature, inflammatory leukogram with neutrophilia, normonatremia and mildly elevated rumen chloride concentration. Both groups showed hypokalemia, hypochloremia and hypocalcemia. In this study hemato-biochemical findings were extremely useful in assessing the initial general systemic state of the patients and served as an invaluable aid in monitoring post-operative treatment and response to therapy.

The study recommends use of more advance techniques such as X-ray, Ultrasonography, high grade metal detector etc. to overcome the limitations in diagnosing the undetermined cases of bovine gastrointestinal obstruction.

Bibliography

1. Abu-Seida AM and Al-Abbadi OS. "Recurrent rumen tympany caused by trichobezoars in buffaloes (Bubalusbubalis): A series report". *Thai Journal of Veterinary Medicine* 44.1 (2014): 147-151.

2. Abu-Seida AM and Al- Abbadi OS. "Studies on Sharp Foreign Body Syndrome in Iraqi Buffaloes and its Impact on Milk Production". *Asian Journal of Animal Sciences* 9.3 (2015): 128-133.

3. Abu-Seida AM and Al-Abbadi OS. "Recent advances in the management of foreign body syndrome in cattle and buffaloes: A Review". *Pakistan Veterinary Journal* 36.4 (2016): 385-393.

4. Khalphallah A., *et al*. "Laboratory, radiographic and ultrasonographic findings of acute traumatic reticuloperitonitis in buffaloes (Bubalusbubalis)". *Asian Journal of Animal and Veterinary Advances* 11.11 (2016): 675-683.

5. Abdelaal AM., *et al*. "Ultrasonographic findings in hardware diseased buffaloes (Babulusbabilus)". *Research Journal of Pharmaceutical, Biological and Chemical Sciences* 7.5 (2016): 1644.

6. Hussain SA., *et al*. "Clinical characteristics, hematology and biochemical analytes of primary omasal impaction in bovines". *Turkish Journal of Veterinary and Animal Science* 37 (2013): 329-336.

7. Erickson N and Hendrick S. "Sand impactions in a Saskatchewan beef cow-calf herd". *Canadian Veterinary Journal* 52.1 (2011): 74-76.

8. Braun U., *et al*. "Duodenal ileus caused by a calf feeding nipple in a cow". *BMC Veterinary Research* 7 (2011): 2.

9. Braun U., *et al*. "Clinical findings and treatment in cattle with cecal dilatation". *BMC Veterinary Research* 8 (2012): 75.

10. Armstrong O., *et al*. "Internal hernias: anatomical basis and clinical relevance". *Surgical and Radiologic Anatomy* 29.4 (2007): 333-337.

11. Smith BP. "Large Animal Internal Medicine". Elsevier Mosby, St. Louis, Missouri, 5th edition (2015): 739-842.

12. Constable PD., *et al*. Diseases of the alimentary tract- Ruminant, in Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats. 11th edition, Elsevier, 3251 Riverport Lane, St. Louis, Missouri (2017): 436-621.

13. Fubini SL and Ducharme NG. "Farm Animal Surgery". St. Louis, Missouri: Elsevier, Inc (2017): 223-343.

14. Radostits OM., *et al*. "Veterinary clinical examination and Diagnosis". WB Saunders, Harcourt Publishers Limited (2000).

15. Garrett EF., *et al*. "Diagnostic methods for the detection of subacute ruminal acidosis in dairy cows". *Journal of Dairy Science* 82.6 (1999): 1170-1178.

16. White DG. "Rumen healthcare in the dairy cow". *In Practice* 26 (2004): 88-95.

17. Mishra PC., *et al*. "Changes in rumen and abomasal contents following experimentally induced pyloric obstruction in cattle". *Indian Journal of Animal Science* 59.4 (1989): 460-462.

18. Cockcroft P and Jackson P. "Clinical examination of the abdomen in adult cattle". *In Practice* 26.6 (2004): 304-317.

19. Snedecor GW and Cochran WG. "Statistical methods". 8th edition, Iowa State University Press, Ames, IA (1994).

20. Constable PD., *et al*. "Intussusceptions in cattle: 336 Cases (1964-1993)". *Journal of American Veterinary Medical Association* 210.4 (1997): 531-536.

21. Divers TJ and Peek SF. "Non infectious diseases of the gastrointestinal tract, in Rebhun's diseases of dairy cattle". 2nd edition, Saunders Elsevier (2008): 130-199.

22. Karapinar T and Kom M. "Transrectal ultrasonographic diagnosis of jejunoileal intussusception in a cow". *Irish Veterinary Journal* 60.7 (2007): 422-424.

23. Horne MM. "Colonic intussusception in a Holstein calf". *Canadian Veterinary Journal* 32.8 (1991): 493.

Volume 4 Issue 2 April 2019