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Research Article

Incidence, haemato-biochemical analysis and ultrasonographic findings in goats with functional ileus

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Abstract

Interference with normal intestinal motility or progressive distal passage of intestinal contents constitutes functional ileus. Ileus represents an abdominal emergency that is potentially life threatening in affected animal and requires immediate diagnosis and treatment. The research work was carried out to study the incidence, haemato-biochemical and ultrasonographic changes in goats with functional ileus. In this study, fifteen apparently healthy goats that were brought to the medical outpatient unit of the Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal for routine checkups and deworming and goats with clinical signs of distended abdomen and/ or not passing dung were subjected to detailed investigations including haemato-biochemical analysis and ultrasonographic imaging. In the present study, significant elevation of packed cell volume and leucocytosis with neutrophilia, hypocalcaemia, hypokalaemia, hypophosphatemia and hypochloraemia were seen in goats with functional ileus. Also, ultrasonography of the abdomen in goats with functional ileus showed hyperechoic and dilated loops of the intestine with marked reduction or absence of motility.

Keywords: Functional ileus, Goats, Haemato-biochemical analysis, Incidence, Ultrasonography

Highlights

- The incidence of functional ileus in goats was 1% out of various medical disease conditions that were brought to the Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal during April 2018 to May 2019.
- Elevation of mean packed cell volume, leucocytosis with neutrophilia, hypocalcemia, hypophosphatemia, hypokalemia and hypochloremia were noticed in goats with functional ileus.
- Ultrasonographic examination of small and large intestine is useful in diagnosis of functional ileus in goats.
- Ultrasonography of abdomen in goats with functional ileus showed hyperechoic and dilated loops of intestine with marked reduction or absence of motility.

INTRODUCTION

Ruminants are often predisposed to gastrointestinal motility disorders associated with many diseases, such as paralytic ileus, intussusception, volvulus and foreign body obstruction. Functional obstruction or paralytic ileus, occurs because of cessation of peristalsis movement of the intestinal tract. The inciting cause of functional obstruction is not well understood; however, they are often associated with dietary or management factors, phytobezoars, parasite infection, enteritis, peritonitis, or electrolyte abnormalities (Constable, 2010). Paralytic ileus has no gross abnormality but is characterized by generalized intestinal hypomotility or atony (Khalphallah *et al*., 2016). In paralytic ileus, there is an increase in the transit time of ingesta and faeces. The faeces are scant, and sequestration of fluids in the intestines may result in varying degrees of dehydration and metabolic alkalosis with hypochloraemia and hypokalaemia (Constable *et al*., 2017). These could lead to production loss and many other complications like muscular weakness, recumbency, and shock that result in mortality unless treated (Marshall *et al*., 2005).

The narrow pelvic cavity of goats makes it difficult to perform transrectal palpation to determine dilated loops of the intestine. Absence of faeces in the rectum or the presence of blood, mucus or fibrin in the faeces helps in tentative diagnosis of ileus. Failure to diagnose these conditions may result in prolongation of the disorder and perhaps irreparable changes. Ultrasonographic examination of the small and large intestine is an important tool for diagnosis of intestinal disorders. Because many of the findings in goats were similar to those in cattle, ileus can be easily diagnosed by ultrasonography in goats (Braun *et al*., 2011).

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Imaging techniques used in conjunction with history, physical examination, haematology and biochemistry helps in improved diagnosis. The present study was undertaken to understand the incidence, haemato-biochemical parameters and ultrasonographic imaging in goats with functional ileus.

MATERIALS AND METHODS

Apparently healthy goats: Fifteen apparently healthy goats that were brought to the medical outpatient unit of Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal for routine checkup and deworming, were utilized for obtaining normal haemato-biochemical values and ultrasonographic imaging of study.

Clinical cases: Goats with clinical signs of distended abdomen and/or not passing dung presented at medical outpatient unit of Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal were screened and subjected to detailed haemato-biochemical and ultrasonographic evaluation as per standard techniques.

Haematology: Venous blood (5 mL) was collected in vacutainer tubes containing ethylene diamine tetra acetate (EDTA K3) as an anticoagulant for haematological investigation. The parameters, including packed cell volume (PCV), haemoglobin (Hb), red blood cell (RBC), white blood cell (WBC) and differential counts (DC), were estimated as per standard methods (Weiss and Wardrop, 2010).

Serum biochemistry: Venous blood (5 mL) was collected in vacutainer tubes without anticoagulant taking all precautions for avoiding haemolysis. Serum calcium, phosphorus, potassium, chloride, gamma glutamyl transferase and creatine phosphokinase were estimated using commercially available kits as per standard methods (Kaneko *et al*., 2008).

Ultrasonography: All the animals under study were subjected to ultrasonographic examination using EsoateMylab 40 Vet Ultrasound system with 5.0 MHz convex transducer as described by Braun *et al*. (2013). Hair was clipped on both sides of the body, and contact gel was applied to the skin. Rumen was examined from the eighth to twelfth intercoastal spaces and the flank on the left side and from the twelfth intercoastal spaces and the flank on the right side. Reticulum was examined from the linea alba, the left and right paramedian regions. Abomasum was scanned from the ventral midline and from the left and right paramedial regions. Omasum was examined at all intercoastal spaces on the right from caudal to cranial and from dorsal to ventral with the transducer kept parallel to ribs and perpendicular to the omasum. Small and large intestines were assessed on the right side, from the eighth rib to the caudal aspect of the flank.

Statistical analysis: The data obtained were statistically analysed by t-test to find if the mean of parameters under study between two groups (apparently healthy goats and goats with functional ileus) differ significantly, as described by Daniel and Cross (2018).

RESULTS

Incidence: In the present study, out of 1591 cases of goats which were brought to medical outpatient unit of the Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal for various medical disease conditions during the study period of April 2018 to May 2019, 16 were functional ileus which accounts 1% of total cases. Also, out of 16 cases of functional ileus in goats, 7 goats were of 0-3 months of age group, which accounts for 43.75%.

Haemato-biochemical examination: The mean haemato-biochemical values of apparently healthy goats and goats with functional ileus are presented in Tables 1 and 2.

Table 1. Haemogram in apparently healthy goats and goats with functional ileus (Mean ± S.E.)

Parameters	Apparently healthy goats (n=15)	Goats with functional ileus (n=15)	Calculated t value
Haemoglobin (g/dL)	10.70±0.34	10.85±0.47	0.24^{NS}
Packed Cell Volume (%)	31.60±0.71	35.73±1.44	2.56**
Red blood cell count (10^6/cumm)	10.65±0.72	10.46±0.41	0.22^{NS}
White blood cell count (10^3/cumm)	9.54±0.54	13.40±0.91	3.62**
Neutrophils (10^3/cumm)	4.15±0.43	6.36±0.67	2.56**
Lymphocytes (10^3/cumm)	5.10±0.38	5.35±0.55	0.37^{NS}
Monocytes (10^3/cumm)	0.17±0.05	0.16±0.12	0.03^{NS}
Eosinophil (10^3/cumm)	0.11±0.09	1.12±1.09	0.91^{NS}
Basophil (10^3/cumm)	0	0.04±0.04	1.00^{NS}

** P<0.01 and NS = Non-significant (P>0.05)

Table 2. Serum biochemistry in apparently healthy goats and goats with functional ileus (Mean ± S.E.)

Parameters	Apparently healthy goats (n=15)	Goats with functional ileus (n= 15)	Calculated t value
Calcium (mg/dL)	7.14±0.21	6.07±0.25	3.20**
Phosphorus (mg/dL)	5.14±0.33	4.03±0.25	2.64**
Potassium (mEq/L)	3.66±0.16	2.98±0.19	2.70**
Chloride (mEq/L)	91.16±2.06	80.51±1.20	4.45**
Total Protein (g/dL)	4.74±0.38	4.45±0.25	0.62^{NS}
Albumin (g/dL)	2.91±0.12	2.59±0.19	1.38^{NS}
GGT (units/L)	41.40±4.60	42.26±5.98	0.11^{NS}
Creatine phosphokinase (units/L)	234.33±18.87	265.53±10.76	1.43^{NS}

** P<0.01 and NS = Non-significant (P>0.05)

Ultrasonography of apparently healthy goats: Ultrasonographic examinations of abdomen in apparently healthy goats were carried out, and the observations were recorded. The reticulum appeared as a crescent shaped structure with an even contour immediately adjacent to the diaphragm (Fig. 1). In the sternal region reticulum could be seen in midline as well as paramedian areas on both sides. The different layers of the reticular wall could be identified only occasionally. On the left, most of the rumen was situated immediately adjacent to the abdominal wall and its wall appeared as a thick echogenic line. Differentiation of various compartments could be appreciated due to echogenic prominent longitudinal groove. The dorsal gas cap was distinct and easily identified based on the echoic rumen wall and reverberation artefacts medially. On the right, the rumen could be seen at the flank and at the twelfth intercostal space (Fig. 2). The omasum appeared as a curved echogenic line. The omasal laminae and the omasal wall furthest from the transducer could not be seen because of its proximity to the diaphragm. The omasum sometimes moved synchronously and passively with respiration (Fig. 3). The abomasum appeared as heterogenous moderately echogenic structure with echogenic stripling. It could well be visualized from the ventral midline, and abomasal

Fig. 1. Ultrasonography of reticulum (Re)

Fig. 2. Ultrasonography of rumen (Ru)

Fig. 3. Ultrasonography of omasum (Om), echogenic wall (W), liver (Li)

Fig. 4. Ultrasonography of abomasum (Ab), echogenic abomasal fold (F)

folds appeared as prominent echogenic bands (Fig. 4). The sections of small intestine were commonly seen in ventral right flank and were mostly seen in cross section and rarely longitudinally. They were characterized by strong motility and the intestinal contents were homogenous and echogenic. The large intestine was readily visualized dorsally in the right flank and sometimes ventrally (Fig. 5)

Increase in diameter of the intestine and visualization of number of dilated loops of intestine were observed in goats with ileus (Fig. 6 and Fig. 7).

Fig. 5. Ultrasonography of intestine – cross sectional view of intestine with (In) with echogenic contents

DISCUSSION

Higher incidence of functional ileus in 0 to 3 months age group could be due to separation of young ones from the dam which were allowed for grazing in the morning causing reduced availability of calcium/ milk to the young ones. One of the important factors influencing gastrointestinal motility disorders in ruminants is electrolyte disturbance. Serum calcium concentration represents a key factor in the cascade of smooth muscle contractions. Corrections of pre-

Fig. 6. Increase in diameter of distended loops of intestine

Fig. 7. Increase in diameter of distended loops of intestine

existing hypocalcaemia and other electrolyte imbalances with rehydration are crucial to every protocol dealing with the treatment of gastrointestinal motility disorders (Steiner, 2003).

In the present study, goats with functional ileus had significant elevation of mean packed cell volume, leucocytosis and neutrophilia with significant reduction in mean serum calcium, phosphorus, potassium and chloride levels when compared to the respective mean values of apparently healthy goats. Higher red blood cell parameters observed in these cases might be due to subclinical or clinical dehydration associated with decreased food consumption, and increase in neutrophil counts could be due to inflammatory conditions, as described by Brooks *et al*. (2022). Weiss and Wardrop (2010) reported that leucocytosis and hypoproteinaemia could be noticed in animals with prolonged anorexia, stress and pain. Leucocytosis and hypoproteinaemia observed in the present study might be due to anorexia, motility disturbances and pain related to distension of intestinal segments. Pugh *et al*. (2020) reported that mild hypocalcaemia might be encountered in some

small ruminants with gastrointestinal atony. Reddy *et al*. (2018) reported hypocalcaemia, hypokalaemia, hypochloraemia and hyponatremia in cattle with functional gastrointestinal motility disorders. The haemato-biochemical changes noticed in goats with functional ileus in the present study were supported by the reports of above authors.

Braun *et al*. (2013) reported that with ileus, the small intestine was non motile and dilated. Khalphallah *et al*. (2016) reported that increased diameter of intestine and numbers of dilated loops of intestine were seen according to the site of involvement. Braun (2009) reported that the number of dilated loops of small intestine increased if the localization of the ileus was more distal. The ultrasonographic features of dilated intestine observed in the present study were in accordance with the reports of above authors. No appreciable change in the forestomach and abomasum could be appreciated through ultrasonography in those animals.

In conclusion, goats with functional ileus had significant elevation of packed cell volume and leucocytosis with neutrophilia, hypocalcaemia, hypokalaemia, hypophosphatemia and hypochloraemia when compared with the respective mean of apparently healthy goats. Ultrasonography of abdomen is complementary to clinical and radiographic evaluation for the early diagnosis of functional ileus in goats, in which hyperechoic and dilated loops of intestine with marked reduction or absence of motility are appreciated.

Conflict of interest: The authors have no conflict of interest in this study.

Authors contribution: PAA: Conducted the investigation, analysis of data, collected the literatures, performed statistical analysis and wrote draft manuscript; GV: Designed the protocol of study and critically reviewed the manuscript; SS: Critically reviewed the manuscript; SK: Critically reviewed the manuscript.

Data availability statement: All data generated or analyzed during this study are included in this article. The corresponding author is willing to provide the raw data upon reasonable request.

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