

*Original Research***Functional Ileus in Dogs: Radiography, Ultrasonography, Acid-Base and Blood Gas Analysis****Deepa Chirayath**

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Abstract

Ileus is a common sequel to parvoviral enteritis, abdominal surgery, pancreatitis, peritonitis, endotoxemia, hypokalemia and dysautonomia. This study was aimed to characterize the radiographic, ultrasonographic and biochemical features of functional ileus in dogs. The study included six dogs with gastrointestinal tract disturbances like vomiting, anorexia and weakness. In this study functional ileus was radiographically characterized by dilated intestinal loops filled with either air or fluid contents. Ultrasonographically, two patterns were visible. Gas filled dilated intestinal loops created hyperechoic-reflective interfaces with acoustic shadowing with free fluid between the intestinal loops. Fluid filled intestinal loops were visible as hypoechoic fluid filled structures with peristaltic movements. The difference may be due to the chronicity of the disease process. In the initial stages, dilated intestinal loops may be filled with fluid showing peristalsis. Later fluid in the dilated loops may get replaced by gas leading to lack of peristaltic movements and accumulation of free fluid in between. Acid-base disturbance noticed was respiratory alkalosis with increased blood pH, reduced bicarbonate level and reduced pCO₂ were observed in all cases. Lactate and glucose levels were above normal in 83% of the cases. Calcium, potassium and sodium levels were below normal in 83%, 67% and 50% of the cases respectively.

Key words: Acid-Base and Blood Gas Analysis, Functional Ileus, Radiography, Ultrasonography

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Introduction

Functional ileus is a disturbance of the peristalsis of gastrointestinal tract in the absence of mechanical obstruction. Ileus or intestinal distention can be caused by inflammation (adynamic/functional) or by obstruction (dynamic/mechanical). Adynamic ileus is a common sequel to parvoviral enteritis, abdominal surgery, pancreatitis, peritonitis, endotoxemia, hypokalemia and dysautonomia (Hall and German, 2010). In dogs, decreased peristalsis delays transit, manifesting clinical functional ileus. It is a reversible functional

obstruction of the intestine. In enteric infections, ileus is common, promoting further diarrhea, as stasis allows bacterial fermentation. The present paper describes the radiographic, ultrasonographic, acid base and blood gas characterization of functional intestinal ileus in dogs.

Materials and Methods

The dogs presented to the University Veterinary Hospital Kozhikode, Thrissur with digestive disturbances such as anorexia, distention of abdomen and lack of defecation were subjected for detailed clinical examination. Six cases, diagnosed as intestinal ileus without obstruction and confirmed by contrast radiography were used for the study. Contrast radiography of digestive tract was performed using barium suspension @ 8ml/kg body weight orally after 24 hours of fasting. The animals were subjected to right lateral radiography 30 minutes, 1 hour, 2 hours and 20 hours after the barium meal to study the evacuation of contrast material from stomach and intestines. The animals were subjected for abdominal ultrasonography using Esaote Mylab 40 Ultrasound system using convex array probe (Esaote 8-1 CA 541 Appleprobe). Blood samples were collected from cephalic vein of the affected dogs in heparinized vials. Acid base, blood gas and electrolyte analysis was done by Epoc BGEM and the results of were analyzed.

Results and Discussion

On abdominal palpation, all six cases revealed distended intestinal loops. Plain radiography of thorax was normal in all cases. Plain radiography of abdomen revealed generalized dilatation of intestinal loops in all six cases. In four cases, the intestinal loops were filled with air (Fig. 1) where as in the remaining two cases the loops were filled with fluid contents (Fig. 2).

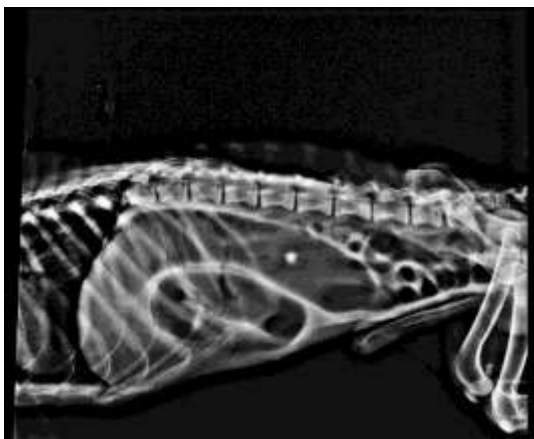


Fig. 1: Plain radiograph showing dilated gas filled intestinal loops (white dot in the descending colon is an artifact)

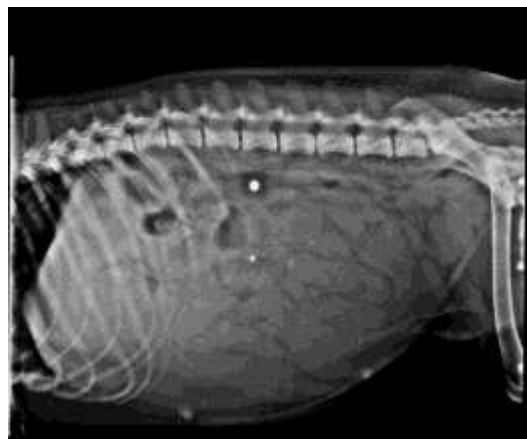


Fig. 2: Plain radiograph showing dilated fluid filled intestinal loops (White dot is an artifact)

Contrast radiography after barium meal was confirmative in all six cases showing dilated intestinal loops filled with barium (Fig. 3). On ultrasonography, two patterns were observed. In four cases, superficially located gas filled intestinal loops created 'crescent shaped' hyperechoic-reflective interfaces with acoustic shadowing and deeper structures were not visible. Accumulation of free fluid could be identified between the loops (Fig. 4); while in other two dogs, dilated loops, filled with hypoechoic fluid contents with peristaltic movements were visible (Fig. 5).



Fig. 3: Contrast radiograph showing dilated intestinal segments of the dog in Fig. 2 at 20 hours of barium ingestion. The contrast radiography showing no obstructive lesion and the barium has passed upto rectum.



Fig. 4: Ultrasonogram showing dilated gas filled bowel segments



Fig. 5: Ultrasonogram showing dilated fluid filled bowel segments.

According to Grassi *et al.*, 2004, presence of free fluid between the dilated intestinal loops and total lack of peristaltic movement indicate the worsening of ileus. Whereas, fluid filled intestinal loops with altered peristaltic activity indicate low grade ileus. According to Miller and Kemberling 1984, in children, real time ultrasound examination revealed normal to somewhat increased peristaltic activity in functional ileus

and variable (absent to markedly increased) peristaltic activity in mechanical ileus. Nyland and Mattoon 1995, described that functional ileus results in generalized dilatation of intestine whereas mechanical ileus results in segmental dilatation. Decreased gastrointestinal motility is usually seen with functional and chronic ileus. Ambily *et al.* (2018) reported a case of paralytic ileus in a four year old Labrador dog with gas filled intestinal loops. In the present study, fluid filled dilated intestinal loops with peristaltic activity was observed in two cases which might be representing the initial stages of functional ileus whereas the remaining four cases with gas accumulation and lack of peristaltic movements and free fluid accumulation might be chronic stages of ileus.

Results of blood gas and electrolyte analysis are presented in Table 1. Respiratory alkalosis with increased blood pH, reduced bicarbonate level and reduced pCO₂ were observed in all the six cases. Base excess was below normal in four cases. Lactate and glucose levels were above normal in five out of six cases. Potassium and calcium ions were below normal in four out of six cases. Sodium level was below normal in three out of five cases. In one case, sodium level reading was not available.

Table 1: Venous blood gas and electrolyte analysis of six dogs with intestinal ileus

Parameters	pH L- Low H- High	pCO ₂ mmHg	HCO ₃ ⁻ mmol/L	BE (ecf) mmol/L	Na ⁺ mmol/L	K ⁺ mmol/L	Ca ⁺⁺ mmol/L	Lac mmol/L	Glu mg/dL
Case 1	7.498 H	28.4 L	22	-1.2	134 L	3.8 L	1.05L	4.1 H	114 H
Case 2	7.497 H	26.4 L	20.4 L	-2.8 L	124 L	3.7 L	1.12L	5.17 H	136 H
Case 3	7.469 H	24.8 L	18 L	-2.8 L	147	4.1	1.33	1.24	106
Case 4	7.488 H	15.4 L	11.7 L	11.7 L	142	3.1 L	1.24 L	7.69 H	190 H
Case 5	7.539 H	27.5 L	23.4 L	0.9	128 L	4.1	1.07L	5.31 H	121 H
Case 6	7.504 H	33.9 L	26.7	3.6 H	-	2.8	1.09 L	4.73 H	117 H
Mean	7.49±0.02	26.06±6.07	20.36±5.15	2.81±5.38	135±9.53	3.6±0.53	1.15±0.11	4.70±2.09	130.66±30.7
Normal Venous (cephalic) Blood Values (Dog)	7.36±0.02	43±3	24±2	-2-3	140-150	3.9-4.9	1.25-1.5	0.5-2.0	65-112

The acid base change detected in all the six cases was respiratory alkalosis. Respiratory alkalosis was characterized by increased blood pH, decreased HCO₃⁻ and decreased PCO₂. Respiratory alkalosis results from hyperventilation due to primary respiratory disorders, acute pain, psychological distress or gram negative sepsis (Felver, 2013). The six dogs with intestinal ileus were free from primary respiratory problems as evidenced from normal thoracic radiographs. Since they were having gastrointestinal (GI) disturbances, the respiratory alkalosis might have resulted from gram negative bacterial infections of GI tract. High lactate and glucose levels also indicate the possibility of gram negative sepsis associated with intestinal ileus. Low potassium level can lead to motility disturbances in the intestinal loops leading to ileus (Hall and German, 2010). In the present study, calcium and potassium levels were low in four out of six affected dogs.

Conclusion

Radiographically, functional ileus in dogs show dilated/distended intestinal loops with no obstructive signs on contrast radiography. Ultrasonographically, functional ileus shows findings corresponding to radiographic findings with either gas filled dilated intestinal loops and free fluid in between the intestinal loops or fluid filled intestinal loops with or without peristaltic movement. Respiratory alkalosis with increased pH, reduced bicarbonate level and reduced pCo₂ in dogs suffering from functional ileus. Altered lactate, glucose, calcium, potassium and sodium levels may also be recorded in dogs suffering from functional ileus.

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