



A Clinical Study on Role of Radiographic Findings in Diagnosis of Gastroenteritis and Foreign Body Syndrome in Dogs

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ABSTRACT

Background: Gastrointestinal disorders are the most encountered preliminary ailments in a clinical establishment especially pertaining to gastroenteritis and foreign body obstruction in dogs. A persistent diagnostic protocol in these conditions helps in the future therapeutic decision-making process. The present study was conducted to evaluate the role of radiographic findings and ratio of maximum small intestinal diameter to the L5 mid-vertebral diameter as a quantitative diagnostic aid in gastrointestinal disorders i.e., gastroenteritis and foreign body syndrome in dogs.

Methods: In this study a total of 86 dogs were divided into 3 groups viz. group 1 (n=12) included apparently healthy dogs, group 2 (n=61) included dogs suffering with gastroenteritis and group 3 (n=13) included dogs with foreign body syndrome.

Result: Radiographically foreign body was visible in 4 out of 13 cases and presence of diffuse and segmental dilation was noted in dogs suffering with gastroenteritis and foreign body syndrome respectively. A significant increase ($p < 0.05$) in Max SI/L5 of dogs suffering with foreign body syndrome (2.93 ± 0.12) was seen as compared to dogs with gastroenteritis (1.68 ± 0.09) and apparently healthy dogs (0.71 ± 0.04). Also, there was significant increase ($p < 0.05$) of Max SI/L5 in dogs suffering with gastroenteritis (1.68 ± 0.09) and those which were apparently healthy (0.71 ± 0.04). The following study concluded that radiographic findings such as pattern of dilation and Max SI/L5 ratio can be used as a diagnostic aid in gastrointestinal ailments and value of Max SI/L5 ratio > 1.6 is indicative of obstruction in dogs.

Key words: Dogs, Foreign body syndrome, Gastroenteritis, Gastrointestinal tract, Max SI/L5, Radiography.

INTRODUCTION

Radiography, has significantly advanced the diagnosis of various animal ailments (Fowler and Ilyas, 2011). While it has been extensively used to visualize and diagnose abdominal soft tissue lesions in vital organs such as liver, spleen and kidneys, its utility in examining gastrointestinal tract is limited due to the existence of inter-observer and intra-observer variability exacerbated with the presence of gases, fluids (Vander Hart and Berry, 2015) and variations arising due to side of recumbency (Armbrust *et al.*, 2000) during the x-ray exposure, influencing the visualisation of lesions. Furthermore, it has also been pointed out that experience along with knowledge of general anatomy (Mavromatis *et al.*, 2018) can influence the diagnosis. However, instead of qualitative examination, a more objective and quantitative method would help in choosing the right treatment protocol as survey abdominal radiography is commonplace in any veterinary establishment.

Keeping this in mind, the following study was conceptualized with the primary objective of utilizing the ratio of maximum small intestinal diameter to mid-vertebral diameter of L5 and general radiographic findings as a step towards enhancing reliability and consistency of radiographic assessment in diagnosing gastrointestinal disorders in dogs with special emphasis towards foreign body syndrome and gastroenteritis.

MATERIALS AND METHODS

The present study was conducted on a total of 86 client owned dogs brought to the Veterinary Clinical Complex

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(VCC), Faculty of Veterinary Science and Animal Husbandry, SKUAST- Jammu from September, 2021 to May, 2022 (9 months). The dogs included in the study were divided into three groups viz. Group 1 (n=12) included the ones which were brought to the clinics for routine check-up or vaccination and formed the control group. The Group 2 (n=61) included dogs having gastroenteritis (exhibiting signs such as vomiting, diarrhoea, inappetence, anorexia) and group 3 (n=13) included dogs with foreign body

syndrome (exhibiting signs such as intractable vomiting apparent just after food intake since a few days). Three radiographic views (left lateral, right lateral and ventro-dorsal) of the abdomen were made using Carestream CR Machine. The exposure factors ranged from 10-15 mAs and 60-80 kVp. The focal film distance was kept at 90 cm and wherever the abdominal thickness exceeded 10 cm, grid was used. In each animal the anatomical location of different segments of gastrointestinal (GIT) tract *i.e.* stomach (fundus and pylorus), duodenum and jejunum were observed and recorded along with evidence of any enlargement or presence of foreign bodies and percentage of the of cases with radiographically visible foreign bodies were calculated. The nature of dilation in the intestine was also ascertained *i.e.*, segmental, or diffuse dilation as a diagnostic radiographic sign in diagnosing the nature of ileus. Ratio of maximal small intestinal diameter in the jejunal loops and mid vertebral diameter of 5th lumbar vertebrae (Max SI/L5) was also calculated and recorded in lateral radiograph of each case (Fig 2, 3) in group 1 (n=12), group 2 (n=61) and group 3 (n=13).

RESULTS AND DISCUSSION

The normal location of the stomach extended from caudal aspect of the liver up to the 3rd or 4th lumbar vertebrae when filled, with fundus to the left and pylorus to the right of the midline. The normal location of the intestine was variable depending on the degree of distension of intestine and of stomach. The location of the colon which comprises of three sections *i.e.*, ascending colon which is present in proximity of duodenum/pancreas, transverse colon which is present near the caudal border of stomach/liver (right medial liver lobe) and descending colon which is present on dorsal border bladder/prostate/uterus respectively all parts of which did not show any alteration in its anatomical landmarks or position. There was no difference with respect to anatomical location of different segments of gastrointestinal tract *i.e.* duodenum, jejunum and colon among the groups 1, group 2 and group 3, as reported by Steiger-Vanegas and Frank (2018), Riedesel (2018), Schwarz (2012) and they were present in their normal anatomical location. Also, in the present study no case of GDV was encountered thus no change in the location of pylorus and fundus of stomach was evidenced as reported by Aslanian *et al.* (2014) and Belandria *et al.* (2009).

In group 3 radiopaque foreign bodies (Fig 1) were visible in 4 dogs out of the total 13 dogs *i.e.*, 30.8% cases which were confirmed by exploratory laparotomy of the suspected animals. The nature of pattern of dilation was found to be segmental in suspected cases of obstruction *i.e.*, group 3 whereas diffuse pattern of dilation of intestines was visible in group 2. The radiopacity or radiodensity of an object is influenced by both its atomic number and its material density, the prime example of it being metallic objects (except aluminium), bone or glass foreign body appearing radiopaque due to their high atomic number,

material density whereas plastic or wooden foreign bodies appearing radiolucent owing to their less atomic number and material density making the x-rays to completely pass through them and interact with the emulsion layer of the film thereby making their visualization poor and necessitating their diagnosis by other methods or modalities. (Hunter and Taljanovic, 2003; Campbell and Wilbert, 2023), thus the radiopaque and radiolucent foreign bodies which were evidenced follow the aforementioned principle of image formation.

The Mean $\pm$ SE of ratios of Max SI/L5 ratio of group 1, group 2 and group 3 are given in Table 1. Mean $\pm$ SE of ratio of Max SI/L5 ratio of group 2 (1.68 ± 0.09) and group 3 (2.93 ± 0.12) were significantly higher ($p < 0.05$) than group 1 (0.71 ± 0.04). Moreover, Max SI/L5 ratio of group 3 was significantly higher ($p < 0.05$) than that of group 2. Max SI/L5 ratio of dogs suffering with foreign body syndrome (2.93 ± 0.12) was significantly higher (Fig 2) than those dogs which were apparently healthy, points to its sensitive nature of diagnosing obstruction along with segmental dilation which should be taken into consideration especially when the foreign body is translucent or is difficult to be viewed in a radiograph and similar findings were reported by Graham *et al.* (1998) who found the values of more than 1.95 has 80% probability in diagnosing a mechanical obstructive cases whereas in our study the mean was found to be 2.93 thus proving its efficacy. Moles *et al.* (2010) found the ratio of more than 2.19 in majority of cases as beneficial in

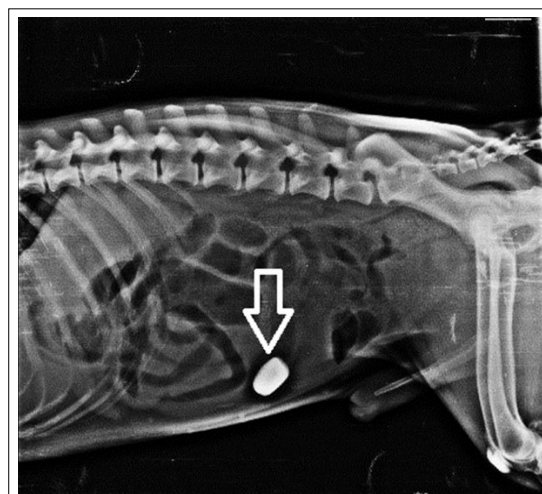


Fig 1: Lateral radiograph of abdomen showing gas filled intestine and presence of radiopaque foreign body in the jejunum (arrow).

Table 1: Max SI/L5 ratios (Mean $\pm$ SE) of group 1, group 2 and group 3.

Groups	1 (n=12)	2 (n=61)	3 (n=13)
Max SI/L5 ratio	0.71 ± 0.04^a	1.68 ± 0.09^b	2.93 ± 0.12^c

Note: Different a, b, c....in superscript in a row denotes significant difference between groups ($p < 0.05$).

concluding mechanical obstruction; Finck *et al.* (2014) reported ratio of more than 2.4 as beneficial in providing an objectivity to the diagnosis despite of the subjective differences. However, it contrasted with the findings of Ciasca *et al.* (2013) who reported a lesser sensitivity of 66% and attributed it to interobserver variability along with difference in time periods both pertaining to exposure of the patient for radiography and interpretation by the radiologist as the cause of the variation. Max SI/L5 (Mean $\pm$ SE) of dogs suffering with gastroenteritis (1.68 ± 0.09) was significantly higher than those of healthy dogs (Fig 3), as in some conditions like parvovirus enteritis (Farrow and Back, 1980) there is damage of enteric villi and inflammation of the intestinal mucosa leading to increase in the intestinal diameter and diffuse intestinal dilation. Other aetiologies such as paralytic ileus, pseudo-obstruction (Moore and Carpenter, 1984), congenital segmental dilation (Johnson *et al.*, 2019) can also produce ratio of more than 1.6 and radiographic changes similar to mechanical obstruction but

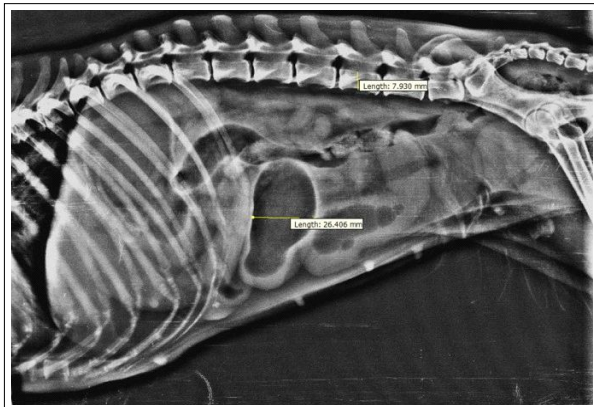


Fig 2: Lateral abdominal radiograph showing segmental dilation of jejunal loops and Max SI/L5 ratio >1.6 i.e., 3.89.

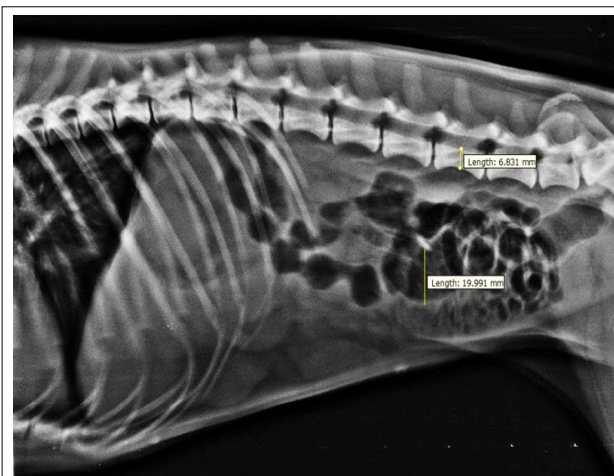


Fig 3: Lateral abdominal radiograph showing elevated Max SI/L5 ratio >1.6 i.e., 2.9 but diffuse dilation of jejunal loops indicative of gastroenteritis.

in gastroenteritis in contrast to foreign body obstruction, there is generalised diffuse distension (Zacuto *et al.*, 2016) caused by fluid accumulation in the intestine in majority of the cases. This fluid accumulation can be a consequence of autoimmune disorder exhibited as leio-myositis causing increase in Max SI/L5 ratio along with functional ileus in patients.

CONCLUSION

The result of this study points to the utility of using both Max SI/L5 ratio of >1.6 and pattern of intestinal dilation as a marker for decision making process for moving forward with exploratory laparotomy in dogs as it was increased significantly ($p < 0.05$) in foreign body syndrome afflicted group especially when nature of material is radiolucent. Also, increasing the ratio limit should be investigated by future clinical studies as in some cases of nonobstructive gastrointestinal disorders the threshold limit is breached.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

All animal procedures for experiments were approved by the committee of experimental animal care and handling techniques were approved by the University of Animal Care Committee.

Conflict of interest

None of the authors has a financial or personal relationship with other people or organizations that could inappropriately influence or bias the content of the paper.

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