



Correlation of Endoscopy, Radiography and Ultrasonography Findings of Upper and Lower GIT Cases in Dogs

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ABSTRACT

Background: Gastrointestinal (GI) disorders are frequently encountered in dogs but remain difficult to diagnose due to non-specific clinical signs. The study aimed to correlate the endoscopic findings with that of radiography and ultrasonography of upper and lower gastrointestinal tract (GIT) cases in dogs.

Methods: Sixty adult dogs included in the study, comprised of 40 dogs diagnosed with upper or lower GI disorders and 20 normal dogs, served as controls for evaluating the normal GI tract. The clinical features of these disorders were assessed and diagnostic techniques such as radiography, ultrasonography and endoscopy were employed. Endoscopic procedures were performed under general anaesthesia using butorphanol (0.2 mg/kg IV), midazolam (0.2 mg/kg IV) and induction with tiletamine-zolazepam (2 mg/kg IV).

Result: The study identified upper GI disorders such as erosive gastritis (7.5%), gastritis (10%), gastric ulcers (12.5%), foreign bodies (5%) and oesophageal affections (15%) including oesophagitis, oesophageal diverticulum and oesophageal nodule., while lower GI disorders included colitis (30%), rectal oedema (7.5%) and adenomas (12.5%). German shepherds aged 24-36 months were mostly affected, with males outnumbering females. Radiography effectively detected space-occupying lesions, while ultrasonography identified structural and textural changes. Endoscopy enabled direct visualization, biopsy collection, foreign body retrieval and provided superior diagnostic accuracy, even in cases with subtle mucosal alterations underscoring its relevance and utility in gastrointestinal diagnostics.

Key words: Anaesthesia, Endoscopy, Gastrointestinal disorders, Radiography, Tiletamine-zolazepam, Ultrasonography.

INTRODUCTION

Gastrointestinal affections are very common in small animals. Their treatment is complicated in the absence of clinical, diagnostic, histopathological and therapeutic standards. Typical stomach disorders encompass different conditions, such as chronic vomiting, gastric erosion/ulcers, neoplasia, foreign bodies, dilatation and volvulus (Gualtieri, 2001). Clinically, regurgitation and vomiting are typical signs of both gastrointestinal as well as extra-gastrointestinal diseases which results in the loss of electrolytes, contributing to metabolic alkalosis and hypokalaemia (Harvey *et al.*, 2008). Radiographic and ultrasonographic gastrointestinal examinations are important diagnostic tools, but do not always provide sufficient information about the gastrointestinal mucosa (Fossum, 2012).

Endoscopy is a highly effective, least invasive technique for oesophageal affections followed by gastric and intestinal affections, whereas radiography and ultrasonography were more sensitive for imaging of affections of upper gastrointestinal tract in the order of intestinal affections followed by gastric affections and least for oesophageal affections (Souto *et al.*, 2023). Radiography, ultrasonography and endoscopy together effectively diagnose upper gastrointestinal disorders in dogs (Kumar *et al.*, 2025). The objective of the present study was to correlate the endoscopic findings with that of radiography and ultrasonography in upper and lower GIT cases in dogs.

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MATERIALS AND METHODS

Data collection

A study was conducted on 60 adult dogs from January 2024 to April 2025 to correlate endoscopic findings with that of radiography and ultrasonography in upper and lower gastrointestinal tract (GIT) cases. Forty clinical cases with sub-acute to chronic vomiting, regurgitation or melena were evaluated alongside 20 normal cases. Dogs (30.41±3.42 kg) were allotted to two groups of 20 each viz., Groups I (upper GIT disorders) and II (lower GIT disorders). For this study, a flexible fiber optic endoscope with a working length of 250 cm, outer diameter of 7.9 mm and channel diameter of

2.8 mm (KARL STORZ Veterinary Video-endoscope Xenon 100) was utilized. Radiography was performed using an RMS MDX-100 X-ray machine (100mAs). Ultrasonography was carried out using a Siemens Diagnostic Ultrasound System (ACUSON X 300 PE).

Patient preparation and anaesthesia

Before endoscopic examination food was withheld for 12-24 hours and water for 4-6 hours. For colonoscopy, food was withheld for 24-48 hrs. Warm water or soap water enemas (20-30 ml/kg), 2-3 hours prior to colonoscopy were given (Willard 2001). Premedication included butorphanol (0.2 mg/kg IV) and midazolam (0.2 mg/kg IV). Anaesthesia was induced and maintained with tiletamine-zolazepam (2 mg/kg), with incremental doses as needed (Leela *et al.*, 2023).

During endoscopy, normal or abnormal findings regarding the oesophageal and stomach wall appearance, thickness, lower oesophageal sphincter (LOS), secretions, mucosal colour, cardia location, lesion depth or type and ease of passing endoscope were recorded. For colonoscopy, mucosal irregularities, lesions, or thickening, were noted and compared to normal. Additionally, the length of the endoscope was measured from the lower incisor tooth to the affected region during oesophagoscopy or gastroscopy and from the anal region to the affected area during colonoscopy. Dogs with suspected chronic mucosal lesions underwent biopsy, with 2-3 mm tissues samples collected and preserved in 10% buffered formalin for histopathology (Mangham and Athanaso, 2011).

Statistical analysis

Data were analyzed using SPSS, with a 95% confidence interval. Descriptive statistics summarized case distribution by breed, sex and age. Chi-square tests assessed associations between sex and GI disorder type and between breed and disorder distribution. The Kruskal-Wallis test compared age variations. A p-value <0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Normal upper and lower GIT cases (20 dogs)

Radiographs and ultrasound showed normal GI organ size, position and wall thickness (stomach <5 mm, intestine <3 mm), with no lesions or abnormal findings. Endoscopy revealed healthy, pale pink oesophageal mucosa, a pinkish stomach with prominent rugal folds and occasional mucus or foam and a creamy pink to light red duodenum (Fossum 2012).

The length of endoscope from incisors to base of heart ranged from 18-47 cm across breeds and from incisors to lower oesophageal sphincter, 25-60 cm. For colonoscopy, dogs were positioned in left lateral recumbency; colonoscope length from anus to descending colon ranged from 30-55 cm. In healthy dogs, mucosa appeared pale pink, smooth and uniform, with deeper colonic segments harder to visualize (Fig 1) (Willard 2001).

Diseased cases (40 dogs)

The case wise distribution of clinical data on the basis of breed, age, sex, procedure performed and endoscopic findings are mentioned in Table 1. The distribution of endoscopic and colonoscopic diagnoses among the 40 dogs showed a statistically significant association between breed and type of GI disorder ($\chi^2 = 18.05$, $p = 0.035$), with German Shepherds and Mongrels more prone to gastric ulcers and rectal conditions likely due to genetic predispositions and breed-specific anatomical or immune traits, as reported by Parrah *et al.* (2013). No significant association was found between sex ($\chi^2 = 0$, $p = 1.00$) or age ($H = 0.256$, $p = 0.613$) and GI disorder type (Table 1), possibly because digestive issues can affect dogs of any sex or age.

Most cases occurred in male dogs and those aged 24-36 months, suggesting a trend towards middle-aged, male dogs probably due to increased activity, roaming and exposure to pathogens, as also observed by Rakha *et al.* (2015) (Table 1).

Oesophagitis

Two dogs (1 and 2) were presented with a month-long history of inappetence, eager eating followed by regurgitation and vomiting 2-3 times daily. Radiographs (Lateral and VD views) of the neck showed a normal oesophagus and an interstitial lung pattern. Ultrasonography was limited by reverberation artifacts from air and cardiac motion, obscuring the underlying structures, as described by Quien and Saric (2018). Endoscopy revealed oesophagitis with mucosal inflammation, erythema, erosions, white plaques, friable mucosa and bile reflux in the middle to caudal thoracic oesophagus (Fig 2), consistent with chronic irritation from repeated regurgitation and vomiting (Gualtieri, 2001).



Fig 1: Normal colon, pale pink to light red with papillae (arrow).



Fig 2: White plaques in the middle to caudal thoracic oesophagus.

Oesophageal diverticulum (megaoesophagus)

Radiographs revealed gas-filled cranial thoracic dilation at the level of 2nd-3rd intercostal space (ICS), with an alveolar lung pattern and gastric distension, consistent with findings of Harjes *et al.* (2018). Contrast radiography confirmed a diverticulum spanning the 3rd to 9th ICS, displacing the heart

and diaphragm (Fig 3). Ultrasonography identified a fluid/ingesta-filled thoracic oesophageal pouch (wall thickness 2.2 mm) ventral to the trachea (Fig 4). Endoscopy demonstrated ulcerated, scarred pouch-like dilatations at the heart base (35 cm in 3, 30 cm in 4) with wall thickening and inflammation (Fig 5). Findings aligned with

Table 1: Distribution of clinical data of endoscopic/colonoscopic findings.

Case no.	Breed	Age (Months)	Sex	Procedure performed	Endoscopic/colonoscopic diagnosis
1	Mongrel	14	M	Oesophagoscopy	Oesophagitis
2	German shepherd	30	M		Oesophageal diverticulum
3	Rottweiler	22	F		
4	Dachshund	20	M		
5	Beagle	13	F		Oesophageal nodule
6	German shepherd	36	M		Erosive gastritis
G1	Labrador retriever	17	F		
G2	Rottweiler	36	M	Gastritis	
G3	Pomeranian	18	M		
G4	Mongrel	23	M		
G5	German shepherd	24	F	Gastrosocopy	Gastric ulcer
G6	Labrador retriever	34	M		
G7	Mongrel	18	F		
G8	German shepherd	36	M	Colonoscopy	Gastric foreign body (Bottle cap)
G9	German shepherd	34	M		
G10	Mongrel	28	M		
G11	German shepherd	36	M		Gastric foreign body (Aluminum foil)
G12	German shepherd	26	M		
G13	Pomeranian	24	F		
G14	German shepherd	24	M		Colitis
C1	German shepherd	36	M		
C2	Golden retriever	24	M		
C3	Pug	13	M		
C4	Beagle	18	F		
C5	Golden retriever	36	F		
C6	Pug	22	M		
C7	German shepherd	32	M		
C8	Siberian husky	36	M		
C9	German shepherd	36	F		
C10	Mongrel	30	F		
C11	Shih Tzu	28	M		
C12	German shepherd	34	M		
R1	Mongrel	36	M	Rectal adenoma	
R2	Labrador retriever	24	F		
R3	Siberian husky	28	F		
R4	German shepherd	40	M		
R5	German shepherd	38	F		
R6	German shepherd	24	M		Rectal oedema
R7	German shepherd	34	M		
R8	Pug	24	M		
	$\chi^2 = 18.05$	H = 0.256	$\chi^2 = 0$		
	p = 0.035*	p = 0.613	p = 1		

χ^2 - Chi square; * Significant at p<0.05; H= Kruskal-wallis.

oesophageal diverticulum with secondary megaesophagus (Singh *et al.*, 2018).

Oesophageal nodule

Cervical radiographs in two dogs (5 and 6) showed mild air-filled oesophageal distention and no surrounding abnormalities, consistent with early lesions often being radiographically occult due to overlapping structures, which aligned with the findings of Sasani *et al.* (2014). Ultrasonography was non-diagnostic because of reverberation artifacts. Endoscopy revealed large intraluminal masses at the heart base, occupying about half of the oesophageal lumen consistent with *Spirocerca lupi* nodules causing obstruction. Similar findings were reported by Suryawanshi *et al.* (2018).

Both cases showed a partially open oesophageal sphincter and prominent submucosal vessels over the nodule (Fig 6). Endoscopic guided biopsy revealed increase in number of cells with enlarged nucleus suggesting glandular hyperplasia of oesophageal mucosa.

Gastric erosion and gastritis

Radiographs in gastritis cases showed generalized gastric distension, but no specific findings for erosive gastritis. Contrast studies revealed delayed gastric emptying. Ultrasonography showed thickened gastric wall (>6 mm) and echogenic gastric contents mixed with gas bubbles. Similar results were reported by Terracciano *et al.* (2024). Gastroscopy in G1-G7 confirmed hyperaemic, mucosal erosions at the fundus and pylorus, while G2 showed drug-induced gastritis with petechiae, inflammation and loss of rugal folds after prolonged NSAID use, as highlighted by Reimer *et al.* (1999).

Gastric ulcer

Plain radiographs in five gastric ulcer cases were normal, but contrast radiography revealed irregular mucosal surfaces in the stomach body and pylorus. Ultrasonography revealed focal gastric wall thickening (5.8 mm, 5.5 mm, 5.2 mm, 5.8 mm and 6.1 mm in G8, G9, G10, G11 and G12, respectively), loss of layering and free peritoneal fluid, suggesting perforation or inflammation. Gastroscopy identified ulcers with haemorrhagic foci and thickened borders at the fundus-pyloric junction, especially along the lesser curvature. Similar results were reported by Çolakoğlu *et al.* (2017).

Gastric foreign body

Radiography in one case revealed radiopaque objects and gas-filled intestines, while another showed only gastric distension. Radiolucent objects were not visible on radiographs, so ultrasonography was used, revealing wall thickening in G13 (6.4 mm) and enteritis in G14 (3.6 mm). Endoscopy in G13 identified a bottle cap in the fundus (Fig 7), while in G14, aluminum foil was found in the pylorus, causing mucosal injury (Fig 8). Endoscopic retrieval is a less invasive and preferable alternative to conventional gastrotomy, as suggested by Mohanambal *et al.* (2018).

Colitis

Granulomatous or ulcerative colitis primarily affects young Boxers and French Bulldogs (Romano *et al.*, 2025). Radiography in 12 dogs (C1-C12) showed colonic wall thickening, gas or faecal retention and mucosal irregularities, while a barium meal (5-8 ml/kg) enhanced

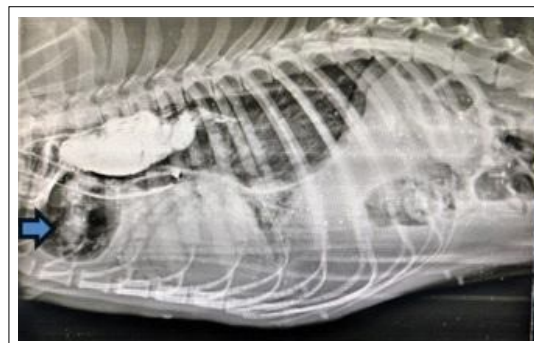


Fig 3: Lateral thoracic radiograph revealed generalized dilation of mid and caudal thoracic oesophageal lumen from 3rd-9th ICS and gas-filled dilation (arrow) in the cranial thoracic area on ventral side.



Fig 4: Sonogram of oesophagus (ESO T) of a dog in a transverse section with oesophageal diverticulum/ megaesophagus with the wall thickness of 2.2 mm filled with ingesta and fluid/mucoid artifact and trachea was seen on the ventral side of oesophagus.



Fig 5: Pouch-like dilatation of the oesophageal wall (arrow) in the thoracic oesophagus, particularly at the level of the base of the heart (ulceration and scarring).

visualization of the colonic wall. Ultrasonography revealed colonic wall thickening (3.3-4.2 mm) with hypoechoic mucosa and hyperechoic pericolic fat in 8 dogs, consistent with the findings of Huynh and Berry (2018) and Linta *et al.* (2021), while 4 dogs had normal findings. Colonoscopy showed erythema, hyperaemia, oedema and ulcerations 24-38 cm from the anal region mainly in the distal to mid-colon (Fig 9). These findings are consistent with inflammatory colitis, as reported by Kalaiyarasan *et al.* (2023) and Bhavani *et al.* (2023).

Rectal oedema

Rectal diseases such as perineal hernias can lead to rectal distension and oedema (Moraes *et al.*, 2013). Radiographs showed abnormal gas distension with some intestinal loops disproportionately dilated, as noted by Moraes *et al.* (2013). Ultrasonography revealed jejunal gas with normal wall thickness (3.2 mm) but disrupted mucosal detail from fluid/gas artifacts. Colonoscopy showed swollen, thickened, pale to mildly erythematous rectal mucosa 8 cm (R6), 10 cm (R7) and 7 cm (R8) from the anal region in the distal rectum, due to submucosal and mucosal fluid accumulation (Fig 10).

Rectal adenoma

Adenocarcinoma, the most common malignant rectal tumour showed no distinct mass on radiographs, though mild colonic distension was observed (Sahoo *et al.*, 2023).

Contrast studies revealed no mucosal defects, except mucus or poorly formed stools in R2. Ultrasonography identified mild colonic wall thickening (3.1 mm, 3.3 mm, 3.2 mm and 3.3 mm) in R1, R2, R4 and R5 respectively, while R3 exhibited a large, heterogenous mass (59.3 mm) along the ventrolateral wall of the descending and transverse colon (Fig 11), with luminal narrowing, mimicking inflammatory bowel disease, consistent with the findings Webb *et al.* (2007). Enlarged mesenteric lymph nodes had increased vascularity but rare metastasis. Loft *et al.* (2022) reported that endorectal ultrasound with shear-wave elastography effectively differentiates adenomas from early rectal cancers, with 79% sensitivity and 89% specificity.



Fig 8: Aluminum foil in gastric fundus close to pylorus.



Fig 6: Oesophageal nodule occupying approximately half of oesophageal lumen with discernible sub mucosal vessels.



Fig 9: Lining of colon appeared reddened due to inflammation and erosion.



Fig 7: Plastic bottle cap in gastric fundus and normal smooth rugal folds.



Fig 10: Oedema and haematoma of rectal mucosa.

Colonoscopy of five dogs with rectal adenomas revealed well-defined polypoid or pedunculated masses (Adamovich-Rippe *et al.*, 2017), protruding into the rectal lumen at varying distances from the anal region: 7 cm in R1 (Mongrel), 5 cm in R2 (Labrador Retriever), 10 cm in R3 (Siberian Husky), 12 cm in R4 (German Shepherd) and 14 cm in R5 (German Shepherd). Additionally, R3 exhibited a whitish plaque in the descending colon. The adenomas were smooth, round, or oval, with intact or mildly erythematous mucosa, some exhibited ulceration and

bleeding. Masses in R1, R2, R4 and R5 were located in the distal rectum near the rectal ampulla, while R3 had a mass at the recto-colic junction (Fig 12). Histopathology showed well-differentiated glandular structures with mild dysplasia, hyperchromatic nuclei, vacuolated cytoplasm, minimal mitotic figures and intact basement membranes, indicating a benign nature (Fig 13). The correlation of radiographic, ultrasonographic and endoscopic findings in case of upper and lower GIT disorders are mentioned in Table 2.

Table 2: Correlation of radiographic, ultrasonographic and endoscopic findings in case of upper and lower GIT disorders.

Dog breed	Disease	Radiography	Ultrasonography	Endoscopy
Mongrel	Oesophagitis	-	-	+
German shepherd		-	-	+
Rottweiler	Oesophageal diverticulum	+	+	+
Dachshund		+	+	+
Beagle	Oesophageal growth	-	-	+
German shepherd		-	-	+
Labrador retriever		-	-	+
Rottweiler	Erosive gastritis	-	-	+
Pomeranian		-	-	+
Mongrel		-	+	+
German shepherd	Gastritis	-	+	+
Labrador retriever		-	+	+
Mongrel		-	+	+
German shepherd		-	-	+
German shepherd		-	-	+
Mongrel	Gastric ulcer	-	-	+
German shepherd		-	-	+
German shepherd		-	-	+
Pomeranian	Gastric foreign body (Bottle cap)	+	+	+
German shepherd	Gastric Foreign body (Aluminum foil)	-	+	+
German shepherd		-	+	+
Golden retriever		-	+	+
Pug		-	-	+
Beagle		-	+	+
Golden retriever		-	-	+
Pug	Colitis	-	+	+
German shepherd		-	+	+
Siberian husky		-	+	+
German shepherd		-	+	+
Mongrel		-	-	+
Shih Tzu		-	+	+
German shepherd		-	-	+
Mongrel		-	-	+
Labrador retriever		-	-	+
Siberian husky	Rectal adenoma	-	+	+
German shepherd		-	-	+
German shepherd		-	-	+
German shepherd		-	-	+
German shepherd	Rectal oedema	-	-	+
Pug		-	-	+

+ = Confirmatory finding; - = No finding.



Fig 11: Sonogram of descending colon (normal wall thickness of 1.4 mm) with proximal colonic mass and heterogenous echotexture of parenchyma (reverberation artifact).



Fig 12: Two to three pedunculated masses in recto-colic junction.

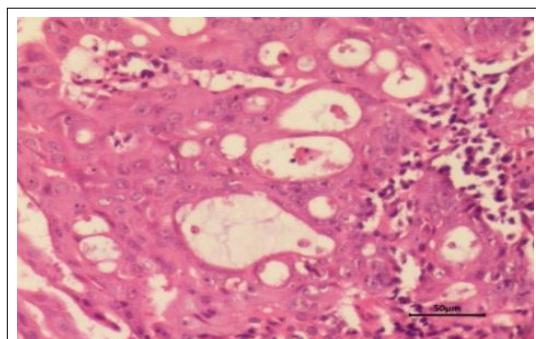


Fig 13: Mild to moderate dysplasia, with elongated nuclei, minimal mitotic figures and vacuolated cytoplasm.

CONCLUSION

Space occupying lesions can be diagnosed easily with radiography and conditions with changes in tissue texture require ultrasonography, however endoscopic examination can diagnose the lesions even with subtle mucosal changes. Compared to radiography and ultrasonography, endoscopy remains the most definitive diagnostic tool for both upper and lower GIT conditions in dogs.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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