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Assessment of ultrasonographic and endoscopic changes in dogs with gastrointestinale disorders

[*Avaliação das mudanças ultrassonográficas e endoscópicas em cães com distúrbios gastrointestinais*]

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ABSTRACT

The study has been conducted over a period of 4 years, on a total number of 133 dogs, all of those expressing gastrointestinal disorders. Ultrasound and endoscopic examinations were performed in all dogs in order to assess any significant correlations between ultrasonographic and endoscopic findings. The results confirm a significant correlation between the presence of diarrhoea and increased thickness of the large bowel wall, with P<0.5. Another extremely significant correlation we observed is the one between increased thickness of large bowel wall and loss of layering at this level, with P<0.5. Upper GI endoscopy revealed that dilated lacteals in the duodenum are significantly associated with the presence of diarrhoea, P<0.5 and, more importantly, there is a very significant correlation between dilated lacteals and the presence of striations (P<0.5), which confirms previous studies (Sutherland-Smith *et al*., 2007) that say the striated aspect of the intestinal mucosa is due to dilated lacteals.

Keywords: dogs, gastrointestinal tract, ultrasound, endoscopy

RESUMO

O estudo foi conduzido durante um período de quatro anos, em um número total de 133 cães, todos os que expressam distúrbios gastrointestinais. Exames ultrassonográficos e endoscópicos foram realizados em todos os cães, a fim de se avaliarem as correlações significativas entre os achados ultrassonográficos e endoscópicos. Os resultados confirmam uma correlação significativa entre a presença de diarreia e o aumento da espessura da parede do intestino grande, com P<0,5. Outra correlação extremamente significativa observada é a única entre o aumento da espessura da parede do intestino grosso e a perda de camadas a esse nível, com P<0,5. GI superior endoscopia revelou que lacteals dilatados no duodeno estão significativamente associados com a presença de diarreia, P<0,5 e mais importante, não há uma correlação muito significativa entre lacteals dilatados e a presença de estrias (P<0,5), o que confirma estudos anteriores (Sutherland-Smith et al*., 2007) que dizem que o aspecto estriado da mucosa intestinal está a ser dada pelos lacteals dilatados.*

Palavras-chave: cães, trato gastrointestinal, ultrassonografia, endoscopia

INTRODUCTION

Ultrasound and endoscopy are two complementary techniques that provide important information regarding the proper functioning of the gastrointestinal tract.

Ultrasound is a non-invasive and painless imaging technique, which provides real-time data of internal organs functions, particularly those located in the abdominal cavity, while endoscopy, being minimally invasive, represents a diagnostic tool and also a therapeutic one that

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may provide a definitive diagnosis or even remove the cause of a disease (removing foreign bodies).

As complementary diagnostic methods, both ultrasound and endoscopy are suitable only if clinical examination cannot establish a definite diagnosis of the disease or condition, when aiming to detect the suspected lesions or whenever the owners want a thorough review on the health of their pets (Malancus *et al*., 2012).

The importance of using ultrasonography and endoscopy to investigate the segments of the digestive tract is given by the ability of viewing parietal structures, their shape and size, factors which can help establish a definite diagnosis (German, 2005).

The main objective of the study was to assess all the changes that can be identified either by endoscopy or ultrasound and to correlate those in order to distinguish between their significance in the context of expressed clinical changes.

MATERIAL AND METHODS

The study has been conducted over a period of 4 years, between 2011-2015, at the Faculty of Veterinary Medicine in Iasi. One hundred and thirty-three dogs, 70 males and 63 females were examined. Age ranged from 0.5 to 15 years (mean 6.6 years) and no breed was over-represented. Inclusion criteria were digestive diseases manifested with continuous or intermittent diarrhoea, vomiting, weight loss or regurgitation. Upon admission, each dog was submitted to physical examination and the following laboratory tests: haematology and chemistry profile. In addition, an abdominal ultrasound investigation and endoscopic procedures were carried out for each case. Also, gastric, small or large intestinal mucosal biopsies were performed. The inclusion criteria stated that all dogs taken into the study would express GI symptoms (vomiting, diarrhoea, weight loss, protein losing enteropathy, melena or other specific signs – capricious appetite, foreign body ingestion) and have confirmed suffering from a GI disorder.

All dogs fasted for 12 h before sonographic examination. The hair was clipped on the ventral abdomen, alcohol and coupling gel was applied and the examinations were performed in right and left lateral recumbency with or without sedation. For all the examinations, a Logiq 7 ultrasound machine was used. A curved array transducer with frequencies between 8 and 14 MHz was used to examine the gastric fundus and antrum, duodenum, jejunum, descending colon, and jejunal lymph nodes. Thickness of the gastric and intestinal wall were measured, layering determined as well as presence of masses or foreign bodies, striations or speckles, gastric and intestinal echogenity and also the aspect of the lesion. In addition, the liver, spleen, pancreas, kidneys, and urinary bladder were also examined.

In order to quantify all lesions, an ultrasound scoring system was adopted (Delaney *et al*., 2003). Fourteen different parameters were considered: wall thickness, layering and echogenity of stomach, small and large intestine, presence of masses, foreign bodies, speckles and striations and the character of the lesion (focal or diffuse).

All cases were endoscopically assessed and the 96 observed changes were scored for each case. We scored the upper GI endoscopy for each dog and the lower GI endoscopy for 10 subjects. For upper GI, we focused on 13 points and for lower GI studies we focused on 22 criteria.

For endoscopy, an Olympus CLV U40 light source and an Olympus CV 240 video processor were used. We also used different types of scopes depending on the size of the animal and the type of endoscopy. For every endoscopy, biopsy samples were taken for histopathologic examination. A minimum number of 8 samples were taken for each examined segment and put in a formalin pot.

Formalin-fixed, paraffin-embedded biopsy samples were sectioned at 4 mm, stained with haematoxylin and eosin stain, and histologically assessed. Qualitative evaluation of the degree of inflammation and overall cellular infiltrate was performed using the 40 objective by a board-certified pathologist, who assigned a score based on previously published guidelines; the pathologist was unaware of the clinical patient parameters when specimens were assessed. A minimum of 5 biopsy specimens from each site were examined histologically. Mild lesions were

those with cellular infiltrates, but without architectural distortion or mucosal epithelial immaturity. Moderate lesions had cellular infiltrates accompanied by mucosal epithelial immaturity and/or solitary epithelial necrosis. Severe lesions consisted of cellular infiltrates accompanied by multifocal epithelial necrosis or extensive architectural distortion with epithelial immaturity. All biopsy samples were assessed for the presence of other changes such as lymphangiectasia and crypt abscessation.

Histopathological and haematology data were used to provide a definitive diagnosis that would allow patients to be included in this study. Serum biochemistryprofile (total protein, albumins, globulins, B12, folate, cholesterol) allowed to introduceinto studies the patients expressing protein losing enteropathy.

Two-tailed Fisher`s exact test was used to analyse contingency tables and examine the significance of two parameters association. The level of statistical significance was $P<0.05$.

RESULTS

The study focused on quantifying the changes observed after physical examination, ultrasound and endoscopy. Upon admission, all dogs had to fit into one of the following categories: vomiting, diarrhoea, melena, GI origin hypoproteinaemia, weight loss or other GI related symptoms. Vomiting has been observed in 33.8% of the dogs (45 patients) and diarrhoea in 53 cases (39.8%), 14 (26.4%) of those 53 cases also presenting melena. In 17.3% of the patients (23 cases) hypoproteinaemia were observed and weight loss in 15.8% (21 cases), while 28.6% of the dogs (38 patients) manifested other GI related clinical signs.

Ultrasound examination revealed increased thickness of stomach wall in 27 dogs (20.3%) and increased thickness of intestinal wall in 29 dogs (21.8%) (19 cases of increased small bowel wall, 10 cases of increased large bowel wall), 4 dogs (3.0%) presenting a severe increase of gastric and intestinal wall. Twenty-one subjects (15.8%) revealed an alteration or loss of specific wall layering of the gastrointestinal tract. Of those, in 13 cases (61.9%) the changes were in the stomach, while in small and large intestine we observed alteration in 5 (23.8%), respectively 3 cases (14.3%). Gastrointestinal masses were noticed in 9/133 patients (6.8%), ultrasonographic focal lesions in 26/133 (19.5%) and diffuse lesions in 28/133 (21.1%).

Striations were observed in 12 patients (9.0%) and the presence of hyperechoic mucosal spots (speckles) was noticed in just 7 cases (5.3%), only one dog presenting both intestinal striations and speckles (0.8%). Changes in GI tract echogenity was observed in 29 dogs (21.8%), 24 (18.0%) presenting echogenity changes in the small intestine, 8 (6.0%) in stomach and in only one case (0.8%), the changes were localized to large intestine.

Upper GI endoscopy focused on different changes located to stomach and/or duodenum: hyperaemia, oedema, discolouration, friability, haemorrhage, ulceration and lacteal dilation. Forty-five dogs (33.8%) had hyperaemic gastric mucosa, 35 of those cases (77,8%) being accompanied by haemorrhagic lesions while 26 presented gastric ulcerations (57,8%). Increased friability of the stomach mucosa was noticed in 25 dogs (18.8%), with discolouration and oedema in 17 (12.8%), respectively 10 patients (7.5%). As far as duodenal changes concern, 38/133 cases (28.6%) had increased friability of duodenal mucosa, 37/133 (27,8%) presented dilated lacteals with an almost double number of cases with oedema (14.3%) than those encountered when examining the stomach. Hyperaemia was observed in 33/133 (24.8%) with haemorrhagic and ulcerative lesions in 24 (18.0%), respectively 9 dogs (6.8%). Mucosal discolouration was noticed in 20 cases (15.0%).

Lower GI endoscopy was performed in just 10 cases and tried to assess the changes that refer to colon, ileum and caecum (colon hyperaemia, colon friability, colon haemorrhage, colon ulceration, colon intussusception, colon masses, colon strictures, colon foreign bodies, ileum hyperaemia, ileum oedema, ileum discolouration, ileum friability, ileum haemorrhage, ileum ulceration, ileum lacteal dilatation, ileum masses, caecum hyperaemia, caecum oedema, caecum discolouration, caecum friability, caecum haemorrhage, caecum ulceration). Changes in mucosal friability were limited to ileum and colon and was observed in 5/10 dogs (50.0%). In three cases (30.0%) lacteal dilation and hyperaemia in ileum was noticed, while the other

major changes located to colon, referred to hyperaemia (40.0%) with haemorrhage and ulceration (30.0%). Hyperaemia was also observed in caecum in 2 cases (20.0%), one dog (10.0%) presenting also haemorrhagic and ulcerative lesions. Changes such as the presence of colon masses, ileum oedema, discolouration, haemorrhage or caecum discolouration and increased friability were observed in singular cases (10.0%).

DISCUSSION

This is a descriptive, large retrospective study that focuses on multiple changes that occur in canine patients with GI disorders. In order to make it relevant, the study included 133 patients that had undergone at least a physical examination accompanied by ultrasound and endoscopic examination of the GI tract. Fifty-five individual changes that refer to GI related symptoms, ultrasonographic and endoscopic alterations were considered to be representative for this study.

Although the study tried to assess in a relatively similar manner the stomach, small and large intestine, there are some limitations that made it rather difficult to assess both ultrasonographic and endoscopic changes that may occur in the large bowel. Further, lower GI endoscopy has its own limitations, such as ileocecal valve passage not being possible in all cases and blind collection of some biopsies.

The representative symptoms of GI disorders refer to the presence of diarrhoea and vomiting, signs that were encountered in 53 (39.8%), respectively 45 cases (33.8%). Diarrhoea is consistent with intestinal disorders while vomiting is the main symptom for the patients complaining gastric disorders (Penninck *et al.,* 2003). Fourteen cases evolved as associated gastric and intestinal disorders, expressing both vomiting and diarrhoea.

Physical examination revealed the presence of symptoms consistent with GI disease, besides diarrhoea and vomiting, noticing weight loss, hypoproteinaemia, melena, capricious appetite or the presence of foreign bodies in the stomach. There are no significant correlations that any of these clinical symptoms would be strictly associated with in GI disorders in dogs.

Ultrasound examination revealed a dissipate picture in matters of ultrasonographic changes that correlate to a specific condition. The changes indicate either an inflammatory condition (diffuse change in echogenity, presence of striations and speckles, thickening of the wall, alteration of specific wall layering), or a neoplastic process (loss of layering, focal increase in wall dimensions, presence of parietal masses) (Malancus, 2015). Strictly based on these results, as other studies confirm (Gaschen *et al.,* 2008*)*, there are no significant correlations between GI disorders and a particular condition.

Ultrasound examination confirms clinical expression as ultrasonographical changes observed in our study are predominantly localized to small and large bowel, thus diarrhoea being the most important clinical sign we have noticed. There is a significant correlation between the presence of diarrhoea and increased thickness of the large bowel wall, with $p<0.5$. Another extremely significant correlation we observed is the one between increased thickness of large bowel wall and loss of layering at this level, with $p<0.5$. It is worth considering that although there are no significant correlations between the ultrasonographic changes in small intestine or stomach, those that are localized in large bowel are more specific.

Endoscopic examination was performed in order to further assess any significant changes or correlations that would occur between endoscopic and ultrasonographic or clinical findings. The results for lower GI endoscopy are inconclusive given the small number of dogs that have undergone this procedure. More than that, large intestine`s investigated segments are mainly restricted to colon and ileum, the caecum being in most of the cases difficult to examine (German, 2005).

Upper GI endoscopy revealed that dilated lacteals in the duodenum are significantly associated with the presence of diarrhoea, $p<0.5$ and more important, there is a very significant correlation between dilated lacteals and the presence of striations ($P<0.5$), which confirms previous studies (Sutherland-Smith *et al.,* 2007) that say the striated aspect of the intestinal mucosa is being given by the dilated lacteals. It is worth mentioning that our study establishes a connection between increased friability of the

duodenum and the presence of speckles. By some authors (Melzer and Sellon, 2002), speckles are partial sections through the intestinal villi or cellular debris, mucus or even intraluminal proteinaceous content (Sutherland-Smith *et al.,* 2007).

We consider that future studies should perform a proper endoscopic examination of the large bowel in order to clearly assess the changes that appear in canine population with GI disorders and correlate those results with the ultrasonographic findings.

CONCLUSION

The results confirm a significant correlation between the presence of diarrhoea and increased thickness of the large bowel wall, with $p<0.5$. Another extremely significant correlation we observed is the one between increased thickness of large bowel wall and loss of layering at this level, with $p<0.5$. Upper GI endoscopy revealed that dilated lacteals in the duodenum are significantly associated with the presence of diarrhoea, $p<0.5$ and, more importantly, there is a very significant correlation between dilated lacteals and the presence of striations ($p<0.5$), which confirms previous studies (Sutherland-Smith *et al.,* 2007) that say the striated aspect of the intestinal mucosa is being given by the dilated lacteals. We consider this study to be representative due to its large number of individuals and the changes that have been assessed, confirming previous studies and providing original useful data regarding gastrointestinal disorders in dogs and their proper approach.

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