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ABSTRACT

KEY WORDS: Ultrasonography, Radiology, Endoscopy, Stomach, Intestine, Canidae

PhD thesis entitled "THE USE OF MEDICAL IMAGING TECHNIQUES FOR IMPROVING DIAGNOSIS OF GASTROINTESTINAL DISORDERS IN DOGS" has the character of originality by using all three imaging methods to investigate the gastrointestinal tract, by the extent of the study given the large number of patients and by creating a protocol of complementary diagnosis of gastrointestinal disorders in dogs after assessing suitability of each type of examination.

The thesis contains a number of 236 pages and is divided into two parts.

The bibliographic part extends over a number of 52 pages and is systematized into four chapters presenting data from the specialized literature related to: symptoms for the approached theme, use of ultrasound, radiology and endoscopy for diagnosing the gastrointestinal tract disorders in dogs.

The second part, personal contributions, has a number of 129 pages and contains eight chapters, which covers the purpose and importance of research, materials and methods, results obtained from performing each type of examination and related discussions, and general conclusions that have emerged from research.

The presented data are supported by a table and 24 figures inserted into the bibliographic study, 9 tables and 119 figures inserted in the personal contributions part. Reference list of literature titles totals 208 local and international papers, standards of working methods and internet files with specialized content. In the contents of the thesis are found personal data published in scientific papers in the Symposium with international participation organized by the Faculty of Veterinary Medicine Iași and in the Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca.

Importance of the thesis derives from the thesis theme that aims to create a diagnostic protocol based on the use of complementary imaging methods for stating a definitive diagnosis for gastrointestinal disorders. Overwhelming importance of digestive diseases makes early and correct diagnosis a goal to be achieved as early as possible in the development of gastric and intestinal disorders.

By effectiveness of methods used for the diagnosis of gastrointestinal disorders we can establish a clear protocol depending on condition and stage of development combining or using individual diagnostic imaging methods: radiological, ultrasound and endoscopic examination. Each of these imaging methods has advantages and disadvantages, linking data from all three methods of investigation providing a suitable medium for confirmation or refutation of data from clinical examination of animals. Besides the common diagnostic function of three types of examination, gastrointestinal endoscopy effectively combines its diagnostic and therapeutic role (removal of foreign bodies and administration of drugs through the endoscope working channel).

In the context of global trends, close attention is given to animal welfare requiring from the clinician to develop a correct diagnosis using all available means. Thus, by using diagnostic imaging methods, the degree of gathered information optimizes to an increased level of knowledge and interpretation for underlying disease pathology of the digestive tract.

Based on these considerations, this paper has the following objectives and activities:

- Ultrasound diagnosis of gastrointestinal disorders in dogs:
 - ✓ Identification of casuistry by clinical examination;
 - ✓ Performing ultrasound investigation to confirm the diagnosis;
- Radiological diagnosis of gastrointestinal disorders in dogs:
 - ✓ Performing radiological examination;
 - ✓ Establishing the correlation between radiological and ultrasound data for confirmation of gastrointestinal disorders diagnosis;
- Use of endoscopy to diagnose gastrointestinal pathology in dogs:
 - ✓ Performing endoscopic examination to diagnose gastrointestinal disorders;
 - ✓ Diagnostic optimisation of gastrointestinal disease by using combined imaging methods.

Ultrasound has been performed on a number of 217 patients, changes that could be detected by ultrasound counting the stomach and intestinal wall size, maintaining normal parietal structure, presence of foreign bodies or intraluminal masses, presence of striations or speckles in the intestinal wall, echogenic changes in the investigated segments and diffuse or localized appearance of lesions. Along with assessing changes the study attempts to correlate ultrasound with the presence of clinical signs such as the presence vomiting, diarrhea, weight loss and the presence of melena or amount of total protein in patients who have been ordered and carried out an additional biochemical examination.

Obtained data were tabulated and statistically interpreted using Fisher's exact test, which

provides details on the statistical significance of values for contingent 2x2 tables.

Increased size of the stomach or intestinal wall is considered to be associated with the presence of inflammation at this level. Setting size change of intestinal or gastric wall was achieved by evaluating the parietal thickness and scoring from 1 (unchanged) to 4 (over 8 mm wall thickening). Notes 2 and 3 were given for increasing wall thickness between 1-4 mm and 4-8 mm. Appreciation of these changes has been made individually for each segment: stomach, small intestine and large intestine.

Regarding the integrity of the five parietal layers, ultrasound investigation tried to assess the structural changes, cases being divided into two categories: subjects who have preserved mural stratification of the stomach and intestine and subjects who lost specific individualization. Loss of stratification is characteristic for tumors where according to the nature and origin of mass, is affected a particular layer. But changes may be also characteristic of inflammatory processes only if the loss of characteristic individualization is accompanied by increased wall thickness.

This study sought to observe the presence of foreign bodies or tumors at gastric or intestinal level, differentiation being accomplished after a comprehensive review and assessment of the detected structure relationship with the wall. If the ultrasound appearance of a foreign body is characterized by a free structure within gastric or intestinal lumen, often with different echogenicity, tumors appear as intramural or intraluminal formations attached to the wall and with a specific echogenicity as the parietal layer of origin.

A particularly important aspect followed in the research has been represented by the presence of striations (parallel hyperechoic bands located in the intestinal wall structure, most commonly present in the small intestine) or speckles located in the intestinal wall, areas commonly associated with the presence of inflammatory processes.

Radiological examination was performed on a total of 152 patients, this investigation being a complementary diagnostic method with high diagnostic value for gastro-intestinal tract disorders. Because of its complementarity with ultrasound, X-ray enjoys extensive use in the diagnosis of gastric and intestinal disease whereas the presence of air and bone structure are not an impediment as for ultrasound examination.

Gastrointestinal disorders with the largest share that have been diagnosed:

- Dilated stomach or bowel - 49 cases;
- Gastritis, 41 cases;
- Enteritis, 36 cases;
- Presence of foreign bodies, 19 cases.

In contrast have been found

- Intestinal strictures, 3 cases;
- Intestinal intussusception, 2 patients;
- Gastric or intestinal tumors, 2 cases.

The diagnosis of gastric or intestinal dilation has been stated based on the radiological observed changes represented by the excessive accumulation of air in the stomach or intestinal lumen, accumulation accompanied by the dilation of the organ. Radiological signs that accompanies gastric dilation are the increased stomach size with caudal displacement of the intestines.

Following radiological examination the diagnosis of gastritis can be set based on gastric wall thickening, flocculation of barium sulphate from the production of excess mucus and thickening of folds. Also, gastric emptying is faster than normal. The diagnosis of ulcerative gastritis should consider that when using contrast agent, ulcers, seen in profile, appear as depressions in the gastric wall thickness and directly seen appear as circular areas filled with contrast agent.

Radiological signs leading to the diagnosis of enteritis are the abnormal amounts of gas present along the bowel without producing its expansion, rapid passage of barium sulphate through intestine showing hypermotility at this level and filling defects of contrast substance, barium sulfate being irregularly disposed.

The presence of foreign bodies is often diagnosed by performing a direct radiography because of radiopaque character of the many foreign bodies. For radiolucent foreign bodies is necessary the use of contrast radiography, that helps in assessing the contour and size of foreign objects reaching stomach or intestinal level.

Diagnosis of intestinal strictures has been stated by performing plain radiographs but in most cases using radiological examination with contrast substances. Barium sulphate covers the intestinal lumen, molding on walls and showing where the stricture is located.

The diagnosis of intestinal intussusception has been stated following the observation of characteristic radiological appearance represented of thin gas lines around invaginated portion as well as the observation of circular mucosal folds in the invaginated portion, when using contrast agent.

Tumors located at gastric or intestinal level have been diagnosed based on the observation of regular masses, highlighted by gas at this level and also after the use of contrast substance by considering the contour of tumor.

Radiological diagnostic is one of the most practical complementary methods of diagnosis

for gastrointestinal disorders, the knowledge of normal and pathological character of the examined organs leading to precise determination of the diagnosis.

When performing endoscopic gastric and intestinal examination has been noted that out of 82 patients 14 had foreign bodies, 66 had inflammatory processes and 9 cases were reported with neoplastic processes. It should be noted that some of these problems have evolved combined, the presence of foreign bodies and neoplastic processes being often accompanied by inflammation of the stomach or bowels. Thus 15.73 % of endoscopically diagnosed diseases has been represented by the presence of foreign bodies, inflammatory disease represented 74.15 % and the remaining 10.12% has been represented by the presence of neoplastic processes.

If the presence of foreign bodies is easily diagnosed through observation of the ingested objects during examination, the diagnosis of inflammatory or neoplastic lesions involves observing all encountered lesions, their appreciation and possibly biopsy sample gathering in order to formulate a correct diagnosis.

The diagnosis of gastritis has been made based on common discoloration (redness, discolored areas), observation of ulcers (ulcerative gastritis) or gastric bleeding and also after establishing the degree of mucosal friability.

Diagnosing neoplastic processes can be made with difficulty where there is a diffuse neoplastic formation, located neoplastic structures immediately demonstrating the presence of a tumor disease, the only thing to be determined being the type of neoplastic process. The lesions detected in diffuse tumors are similar to those observed in gastritis, in most cases, tumor disease being accompanied by an inflammatory process.

Enteritis and especially colitis is endoscopic characterized mainly by intestinal mucosal edema, hyperemia and an increase in brittleness. Sometimes ulcers can also be detected.

Neoplastic processes in the colon are either localized evolving as polyps or carcinomas or diffused, evolving as lymphoma. Those that are diffuse are characterized by marked hyperemia of the intestinal mucosa, presence of ulcer areas and increased brittleness when taking biopsies.

Endoscopic examination also tried to assess the degree of air distension of the stomach and duodenum, gastric and duodenal content and ease of passage through the pylorus, all of these greatly influencing the assessing of gastric and proximal duodenum lesions.

Regarding the main changes that can be observed when investigating the stomach and duodenum, mucosal hyperemia has been detected in 23 cases, gastric edema in 2 cases, increased brittleness in 12 patients, the presence of gastric hemorrhage in 21 dogs and the presence of ulcers in 20 cases.

After performing colonoscopy, hyperemia was detected in 12 subjects, bowel wall edema

in 11 cases, increased brittleness in 15 cases, the presence of bleeding in the colon in 8 cases and the presence of ulcers in the same number of patients.

The chapter of general discussion tried to assess the major observed changes and to establish correlations between the presence of various structural lesions.

The obtained results have been compared with those published in the national and international specialized literature, confirming the obtained data.

The conducted research gave us the right to make some proposals regarding the diagnosis of gastrointestinal disorders in dogs using imaging diagnostic methods.

- Use of ultrasound examination is necessary when has been suspected the presence of an inflammatory process, tumor or topographical disorders;
- Use of radiological examination is justified when the clinical patient investigation identifies the presence of gastric or intestinal dilation, presence of foreign bodies, ulcers or topographical disorders;
- Use of endoscopic examination is indicated in the presence of foreign bodies, when the use of other imaging methods failed to establish a certain diagnosis or when it is necessary to make further investigations (histopathology, etc.).

To state a correct diagnosis, this study recommends the use of ultrasound examination technique as primary investigation method as it presents low cost and duration and data can provide a definite diagnosis.

Because of more than 90% of evaluated patients (414 of 451 patients) have been diagnosed using ultrasound and radiological examination, we recommend these methods as the primary imaging methods of diagnosing gastrointestinal disorders in dogs.

Following the protocol established in this PhD thesis allows to state a prompt and definite diagnosis and also reduces costs and time needed to investigate and formulating a correct diagnosis.