The concordance between endoscopic and histological diagnosis in 114 dogs affected by gastric disease

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Summary
Endoscopy is a common, minimally invasive diagnostic technique that can be used to observe internal organs, e.g. the stomach, and to obtain mucosal bioptic samples for histo pathological examination. The aim of this study was to analyse the concordance between endoscopic and histological evaluation of gastric diseases in dogs. One hundred twenty-nine medical records of dogs undergoing gastroscopy have been received and stored by the Veterinary Hospital of Perugia University (Perugia, Italy) between 2009-2012. The concordance between endoscopic and histological reports of acute and chronic gastritis or gastric tumours was assessed by Cohen's k coefficient. Considering histological diagnosis as the "gold standard", sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the endoscopic report have been calculated. Frequencies of gastritis types differed between macroscopic and microscopic analyses. The evaluation of histological and endoscopic agreement was fair (0.35). Endoscopy showed sensitivity of 45%, 88%, and 100% for acute gastritis, chronic gastritis, and gastric tumours, respectively; and specificity of 84%, 71%, and 100%. The positive predictive value and NPV resulted to be 25% and 93% for acute gastritis, 93% and 60 % for chronic gastritis, 100% and 100% for gastric tumours. The results of this study show that gastric endoscopy cannot be performed as a screening exam, and that to optimise diagnosis both endoscopic and histological exam should be conducted.

Concordanza tra la diagnosi endoscopica e istologica in 114 cani affetti da patologie gastriche

Riassunto
La gastroscopia è una tecnica diagnostica mini-invasiva che consente di visualizzare il lume gastrico e prelevare frammenti bioptici di mucosa necessari per le indagini istopatologiche. Obiettivo del presente studio è stato di analizzare la concordanza tra valutazione endoscopica ed istologica di patologie gastriche nel cane. Presso l'Ospedale Universitario Didattico di Perugia sono state esaminate 129 cartelle cliniche di cani sottoposti a gastroscopia tra il 2009-2012. I dati ottenuti sono stati analizzati mediante il coefficiente K di Cohen ed è stata valutata sensibilità, specificità, valore prognostico positivo (PPV) e negativo (NPV) dell'indagine endoscopica. L'età ha mostrato un effetto significativo riguardo la predisposizione a tumori gastrici e gastropatia nodulare (P < 0.001). La frequenza dei tipi di gastrite è risultata diversa tra le interpretazioni macroscopiche e microscopiche. La concordanza tra valutazione istologica ed endoscopica è stata scarsa (0.35). Usando i tre reperti istologici (gastrite acuta, cronica e tumori gastrici) come "gold standard", l'esame endoscopico ha mostrato una sensibilità del 43%, 88% e 100% e una specificità del 84%, 71%, 100% per la gastrite acuta, cronica e tumori gastrici. PPV e NPV dell'endoscopia sono risultati 25% e 93% per la gastrite acuta, 93% e 60% per la cronica e 100% per i tumori gastrici. In base ai risultati, la gastroscopia non può essere effettuata come esame di screening. Considerando le limitazioni legate al campionamento bioptico e la soggettività nella valutazione endoscopica della mucosa, si raccomanda di effettuare sia l'esame endoscopico che quello istopatologico.

Introduction

Gastric diseases are frequent in dogs (Hall 2000). Endoscopy is a common, minimal invasive diagnostic technique used to evaluate the stomach and to obtain mucosal bioptic samples from 1 or more gastric sites (Mansell and Willard 2003, Evans *et al.* 2006). As a result, nowadays the diagnosis and following treatment of gastric diseases in dogs is frequently based on gastroscopy; it also allows for the collection of mucosal bioptic samples. The histopathological interpretation of these samples has proved to be the most contentious and frustrating step during the diagnostic process for both clinicians and pathologists (Day *et al.* 2008), as it often happens that the number of samples or their quality is inadequate for a safe histological evaluation. Different studies have shown (Mansell and Willard 2003, Washabau *et al.* 2010) how quality of tissue samples obtained through a flexible endoscope plays a great role in determining biopsy diagnostic sensitivity. Another important consideration is that often there is no association among clinical data, endoscopic findings, and histopathological results (Gad 1986, Lidbury at al. 2009). To the best of our knowledge, no other study has investigated the concordance between endoscopic and histopathological findings in a group of dogs with symptoms of gastric diseases. In order to evaluate the degree of concordance between these 2 sets of data, we retrospectively reviewed the records of 129 dogs undergoing gastroscopy for gastric symptoms.

Materials and methods

We reviewed 129 medical records of dogs that underwent gastroscopy at the Veterinary Hospital of Perugia University (Perugia, Italy) because of vomiting, lack of appetite, and weight loss, during the years 2009-2012. Cases have been excluded if no gastric biopsies were obtained or if a mass was found inside the stomach. Information gained from medical records consisted of signalment, gastroscopy results, and histological diagnosis.

Gastroscopy was performed on all patients after general anaesthesia (Medetomidine, Ketamine, and Diazepam) with a 6 mm ø × 1100 mm flexible endoscope (Pentax EG-1840; Pentax, Japan) equipped with an instrumental portal to insert biopsy forceps. The animal was positioned in left lateral recumbence and gastroscopy was performed according to the technique described by Guilford (Guilford 2005). Three biopsies of each gastric region were obtained, using 2.4 mm biopsy forceps. The same, highly experienced endoscopist performed all endoscopic investigations. Findings were first classified according to macroscopic view in acute gastritis (Figure 1), chronic gastritis (Figure 2), or nodular gastropathy (Figure 3). Specifically, acute gastritis was diagnosed if mucosa was hyperaemic and had a prominent light reflectivity, thus suggesting oedema. While a thickened mucosa and a grainy texture were indicative of chronic gastritis; moreover, in this condition mucosal folds usually were hypertrophic or reduced in number and size. Finally, nodular
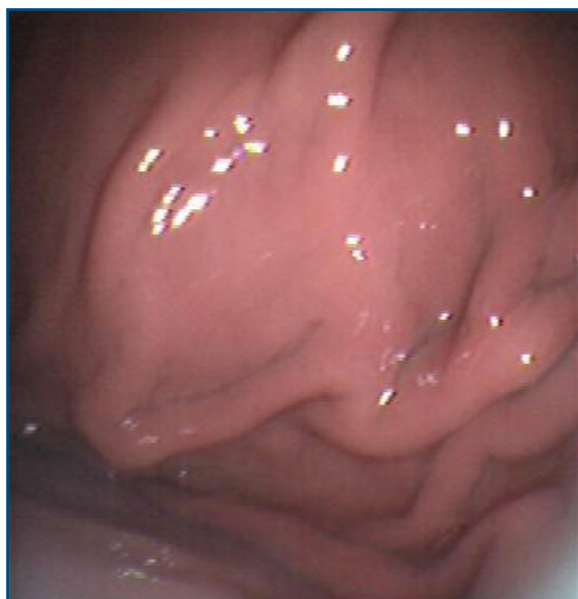
Figure 1. *Endoscopy finding of acute gastritis in dogs undergoing gastric endoscopy at Veterinary Teaching Hospital of Perugia University (Perugia, Italy) between 2009-2012. The mucosa was hyperaemic and had a prominent light reflectivity, thus suggesting oedema.*
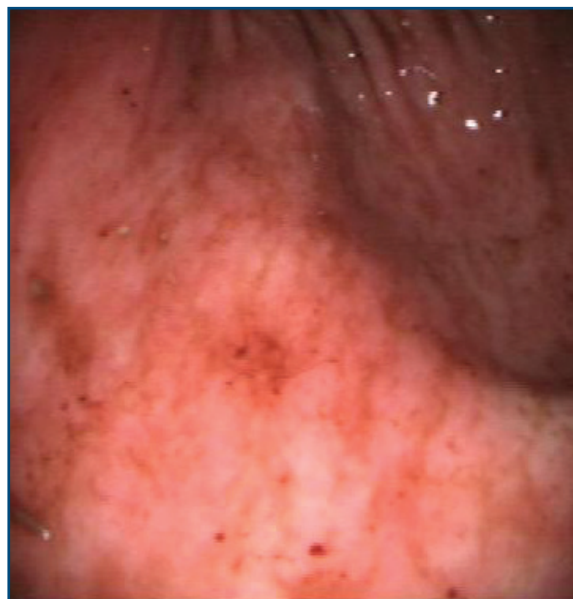
Figure 2. *Endoscopy finding of chronic gastritis in dogs undergoing gastric endoscopy at Veterinary Teaching Hospital of Perugia University (Perugia, Italy) between 2009-2012. The mucosa was thickened and has a grainy texture.*
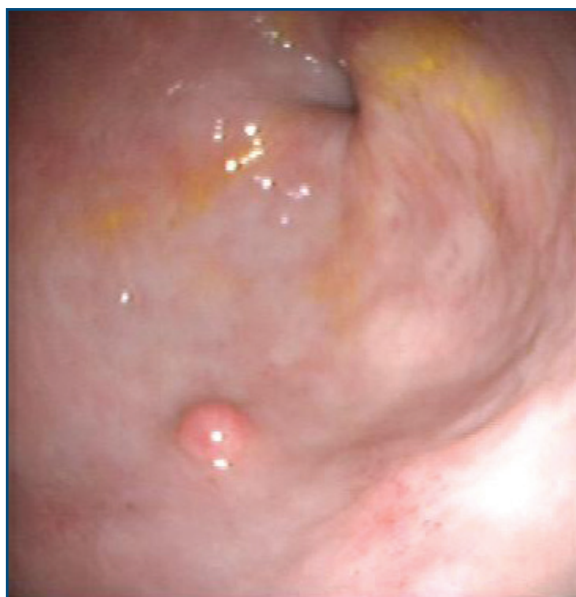
Figure 3. *Endoscopy finding of nodular gastropathy in dogs undergoing gastric endoscopy at Veterinary Teaching Hospital of Perugia University (Perugia, Italy) between 2009-2012.* The mucosa presented nodules.

gastropathy was diagnosed if mucosa presented disseminated nodules.

Biopsy specimens were fixed in 10% buffered formalin, embedded in paraffin, sectioned at 4 μm and stained with Haematoxylin and Eosin. The same pathologists reviewed all slides, and cases were classified according to histological presentation in acute gastritis, chronic gastritis, or gastric tumors.

Statistical analysis

The role of sex in influencing frequency of endoscopical and histological reports has been tested using the Fisher's "exact" test; while the effect of age has been tested by means of a logistic model.

Table I. *Dogs undergoing gastric endoscopy at Veterinary Teaching Hospital of Perugia University (Perugia, Italy) between 2009-2012: concordance between macroscopical diagnosis (rows) and microscopic report (columns).*

		Histology				Total
		Acute gastritis	Chronic gastritis	Gastric tumor	Negative	
Gastroscopy	Acute gastritis	5	15	0	3	*23*
	Chronic gastritis	6	76	0	4	*86*
	Nodular gastropathy	0	0	5	0	*5*
	Total	*11*	*91*	*5*	*7*	**114**

The agreement between endoscopic and histological reports of acute and chronic gastritis or gastric tumours was assessed by Cohen's *k* coefficient. Considering histological diagnosis as the "gold standard", we calculated sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the endoscopic report.

Statistical analysis was performed using "R" software (R Core Team 2013).

Results

We examined 129 medical records of dogs referred for gastric endoscopy because of vomiting, lack of appetite, and weight loss. Among those animals, 15 dogs were excluded because no gastric biopsies were collected, or because a mass was found in the stomach: in the end, 114 dogs were included in this study.

No significant effect of sex was found on endoscopic or histologic diagnosis, while age showed a significant effect on liability to gastric tumours and nodular gastropathy ($P < 0.001$).

Frequencies of gastritis types were different between macroscopic and microscopic views: at endoscopical examination there were 23 diagnoses of acute gastritis (20.1%), 86 of chronic gastritis (75.4%), and 5 of nodular gastropathy (4.5%). Frequencies of histological diagnoses were as follows: acute inflammation in 11 cases (9.6%), chronic inflammation in 91 cases (79.8%), and gastric neoplasia in 5 cases (4.5%). No lesions were detected in the 7 remaining cases (6.1%). The reports are summarized in Table I.

Twenty-eight cases (24.6%) were misdiagnosed at endoscopy. Among the 7 cases with negative histological report, 3 were diagnosed as acute gastritis during gastroscopy, and the remaining 4 as chronic gastritis. Fifteen cases diagnosed as acute gastritis during gastroscopy resulted to be chronic at histological exam, the opposite situation occurred in 6 dogs. The evaluation of histological and endoscopic agreement by Cohen's *k* coefficient (and its Confidence Interval, CI) indicated a value of 0.35 (CI 95%: 0.14-0.56). If the 7 cases with no histological

Table II. *Specificity and sensitivity of the endoscopic exams using the histological findings as the "gold standard" for dogs undergoing gastric endoscopy at Veterinary Teaching Hospital of Perugia University (Perugia, Italy) between 2009-2012.*

	Specificity	**Sensitivity**
Acute gastritis	84%	45%
Chronic gastritis	71%	88%
Gastric tumors	100%	100%

lesions were excluded, Cohen's *k* coefficient would have slightly risen to 0.40 (CI 95%: 0.17-0.63). Using the 3 histological findings (acute gastritis, chronic gastritis, and gastric tumors) as "gold standard", the endoscopic exam showed a sensitivity of 45%, 88%, and 100% for acute gastritis, chronic gastritis, and gastric tumours respectively and a specificity of 84%, 71%, and 100% (Table II).

Finally, the positive predictive value (PPV) and negative predictive value (NPV) of endoscopy resulted to be 25% and 93% for acute gastritis, 93% and 60 % for chronic gastritis, and 100% and 100% for gastric tumours.

Discussion

Application of the endoscopic technique was possible in all dogs with gastric symptoms, and it has always allowed for a good visualization of the 4 gastric regions. In our study, chronic gastritis was the most common finding by both endoscopic (75.4%) and histological exams (79.8%). As reported by other authors (Lidbury *et al.* 2009, Washabau *et al.* 2010), diagnosis of acute gastritis is rare because it is often a self-limiting condition or it responds to palliative treatment, therefore biopsy specimens are seldom obtained. In our study, 28 cases were misdiagnosed during endoscopy. We then calculated the Cohen's *k* coefficient to assess the agreement between endoscopic and histological findings obtaining a *k* value of 0.35, that indicates a "fair agreement". The difference in diagnosis could be related to the difficulty of revealing some macroscopic lesions by endoscopic exam (Lidbury *et al.* 2009) or to histological misinterpretations due to the inadequate number or quality of biopsy samples. Different studies have provided ample information about these possibilities (Mansell and Willard 2003, Day *et al.* 2008, Washabau *et al.* 2010). The actual number of endoscopic specimens could also influence the fairness of the concordance, because it is common to obtain inadequate samples during an endoscopic exam (Washabau *et al.* 2010). However, excluding the 7 cases of macroscopic lesions not histologically confirmed, the Cohen's *k* coefficient raises only to 0.40.

The Cohen's *k* values obtained in this study suggest that, in order to achieve a definitive diagnosis of gastric lesions, it is always necessary to perform a histological exam on biopsy specimens obtained by endoscopy. Moreover, the rate of agreement between these 2 exams may improve if the number of biopsy samples is increased, as pointed out by Willard and colleagues (Washabau *et al.* 2010).

Using the 3 histological findings (acute gastritis, chronic gastritis, and gastric tumors) as "gold standard", gastroscopy reached a good negative predictive value (NPV) for acute gastritis and a good positive predictive value (PPV) for chronic gastritis. Endoscopy showed a perfect agreement with histological findings in the diagnosis of stomach tumours. However, it must be noticed that tumours had a limited prevalence in our review and that histological evaluation is mandatory for this kind of lesions because of their severity. The PPV of endoscopic exam was only 25% in dogs affected by acute gastritis. This could be due to low ability of the operator to differentiate between a normal mucosa and a fairly inflamed one, as well as to the high prevalence of acute gastritis. A similar misinterpretation could happen also in diagnosing chronic gastritis, due to the difficulty of recognizing a variation of mucosae granularity. Furthermore, assessing the mucosa granularity variations can be another challenge for the operator. The subjective aspects in defining the mucosal texture, colour, and contour described above have also been reported by Gurjeet and Mahendra (Gurjeet and Mahendra 2002).

From our results, it can be concluded that gastric endoscopy cannot be performed as a screening exam in veterinary medicine. Nonetheless, this technique is useful in diagnosing the most common gastric diseases of the dog. Even if macroscopic evaluation of the mucosa during gastroscopy showed a good ability in diagnosing chronic gastritis and gastric tumours, we do recommend performing biopsies. In conclusion, after analysing the concordance between endoscopic and histological diagnosis in dogs with gastric disease, specifically considering the limitations related to biopsy sampling (Washabau *et al.* 2010) and subjectivity in endoscopic evaluation of the mucosa, it is recommended to conduct both the endoscopic and histological exam.

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