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Article

Epidemiology of gastrointestinal proliferative neoplastic-like lesions and tumors in dogs and cats: a retrospective study in two Romanian reference laboratories

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Abstract: Gastrointestinal neoplasms and tumor-like lesions are rare in dogs and cats.. In the current literature, few prospective and retrospective epidemiological studies are described. The aim of these study was to identify epidemiological as well as pathological features of the gastrointestinal lesions in dogs and cats. Epidemiological data were collected from the databases of two laboratories in Romania, covering a period of 10 years. A total of 192 cases of neoplastic and neoplastic-like lesions were selected and subjected to statistical analysis. Older animals were more predisposed for chronic hypertrophic pyloric gastropathy (CHPG) and gastric polyps, while younger individuals showed a higher incidence for feline gastrointestinal eosinophilic sclerosing fibroplasia (FGIESF). Additionally, CHPG and FGIESF were more prevalent in males. Dogs were the main species affected by benign neoplasms, including adenomas (22%) and adenomatous polyps/pedunculated adenomas (5%) mainly located in the anorectal junction and leiomyomas (8%) with gastric involvement. In dogs, malignant neoplasms accounted for 69%, with adenocarcinomas representing 39%, followed by lymphomas (12%), and GIST (9%). In cats, 98.82% of neoplasms were represented by malignant tumors, with lymphomas being the most frequently diagnosed (77%). Both adenocarcinomas in dogs and lymphomas in cats were more common in males, accounting for 61.76% and 52.31% of cases, respectively, with the intestine being the most frequently affected site. This is the first epidemiological study of gastrointestinal tumors in dogs and cats in Romania..

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1. Introduction

The Gastrointestinal neoplasms in dogs and cats account for less than 1% of all neoplastic lesions observed in these species [1-3]. There is a marked variation in the types of tumors that develop in the gastrointestinal tract of dogs compared to cats. In dogs, the most significant neoplasms include adenocarcinomas, lymphomas, gastrointestinal stromal tumors (GISTs), leiomyomas, leiomyosarcomas, and adenomas. Conversely, in cats, lymphomas predominate, followed by adenocarcinomas, adenoma and mesenchymal neoplasms [1-4].

In dogs, gastrointestinal epithelial tumors account for approximately 0.16% to 0.33% of all neoplastic lesions observed in this species [1, 5]. Intestinal adenocarcinomas are more commonly found in the large intestine [1] and predominantly affect male dogs of large breeds [1,5]. Additionally, in recent years, a heterozygous germline mutation similar to that described in humans with familial adenomatous polyposis (FAP) has been identified in Jack Russell Terriers with gastrointestinal adenomas and adenocarcinomas [4,6]. FAP is characterized by the presence of multiple polypoid growths in the colon and rectum of young individuals, which progressively undergo neoplastic transformation with age, occurring in nearly 100% of cases [7,8]. Another potential mechanism implicated in the development of gastrointestinal neoplastic lesions is ”de novo” carcinogenesis, characterized by flat to dome-shaped neoplasms with high malignant potential [9,10].

In cats, the most prevalent gastrointestinal neoplasm is lymphoma, followed by adenocarcinomas and other mesenchymal neoplasms [11]. According to the Veterinary World Health Organization (WHO), alimentary lymphoma can be classified based on the size of the neoplastic cells and their immunophenotype into the following categories: extranodal B-cell lymphoma of the mucosa-associated lymphatic tissue (MALT), small cell intestinal T-cell lymphoma characterized, large granular lymphocyte (LGL) lymphoma with a T-cell phenotype, and multicentric lymphomas that do not involve the gastrointestinal tract [12,13].

Chronic hypertrophic pyloric gastropathy (CHPG) is associated with pyloric obstruction, and results from hypertrophy of the pyloric muscular layer, hyperplasia of the pyloric mucosa, or a combination of both [14]. In human medicine, this pathology is commonly linked to Helicobacter pylori colonization, although its exact etiology remains unclear [15]. Other potential causes include stress, neuroendocrine factors, and excessive mucosal growth [16].

Feline gastrointestinal eosinophilic sclerosing fibroplasia (FGIESF), a rare condition in cats, characterized by masses typically located in the pylorus and ileocecal junction. These masses is composed of collagen trabeculae interspersed with fibroblasts, macrophages, and a large number of eosinophils [17-19]. To differentiate FGIESF from other pathologies, such as neoplasms, immunohistochemistry with the antibody for transforming growth factor β1 (TGF-β1) can be used as a potential diagnostic marker [20].

All of these conditions present similar clinical signs, including progressive weight loss, diarrhea, vomiting, and varying degrees of appetite changes. Diagnosis is often delayed because the clinical presentation mimics chronic gastritis, with suspicions of neoplasia arising only after a lack of response to treatment for inflammatory conditions.

This study represents the first epidemiological investigation of neoplastic and neoplastic-like lesions in the gastrointestinal tract of dogs and cats in Romania.

2. Materials and Methods

In this study, data were retrospectively analyzed over a 10-year period (2012–2022) from two reference laboratories in Romania: the Department of Anatomic Pathology, Faculty of Veterinary Medicine, Cluj-Napoca, and the Department of Veterinary Pathology, Synevovet laboratories from Bucharest. The selected samples included neoplastic and neoplastic-like lesions from both the stomach and intestine of cats and dogs. The databases compiled detailed information for each case, including the animals' age, breed, sex, and histological diagnosis. Additionally, further parameters were evaluated for each case, such as the histopathological type of the neoplasm, the specific layers of the gastric or intestinal wall affected, and the presence of metastases in regional lymph nodes or other organs.

3. Results

A total of 192 cases were analyzed in this study, with the following distribution: 35 gastric samples from dogs and 26 from cats, while intestinal samples consisted of 65 from dogs and 66 from cats.

3.1. Epidemiology of the gastrointestinal neoplastic-like lesions in dogs and cats

Among the evaluated samples, three primary proliferative neoplastic-like lesions were identified in the gastrointestinal tract of dogs and cats: chronic hypertrophic pyloric gastropathy (CHPG), feline gastrointestinal eosinophilic sclerosing fibroplasia (FGIESF), and gastric polyps (GPs). CHPG and gastric polyps were exclusively observed in the stomachs of dogs, while FGIESF was identified in both the stomach and intestines of cats.

Age differences were significant among the lesions. CHPG and GPs primarily affected older animals, with mean ages of 11.14 years and 9.6 years, respectively. In contrast, FGIESF was more frequently identified in younger cats, with mean ages of 7.25 years for gastric lesions and 5.25 years for intestinal location. Males demonstrated a higher predisposition for CHPG (5/7 cases) and FGIESF (stomach: 2/2 cases; intestine: 2/4 cases). No breed predisposition was observed for CHPG or FGIESF, regardless of gastric or intestinal localization.

Topographically, CHPG lesions were consistently localized to the pyloric region of the stomach. For FGIESF, the gastric localization of lesions was not specified in either of the two cases, but intestinal FGIESF lesions were predominantly located in the duodenum (3/4 cases) and at the ileocecal valve (1/4 cases). In contrast, GPs exhibited no consistent topographical distribution.

A notable distinction among the three conditions was the affected layer of the gastrointestinal wall. CHPG and GPs were confined to the mucosal layer, whereas FGIESF demonstrated transmural involvement, affecting all layers of the gastric and intestinal walls. Histologically, all GPs in both dogs and cats were classified as hyperplastic. Additionally, colonization with *Helicobacter* spp. was observed in two cases of CHPG.

3.2. Epidemiology of gastrointestinal tumors in dogs and cats.

In dogs, malignant neoplastic lesions accounted for 69% of all tumors, with adenocarcinomas representing the most prevalent type (39%). The distribution of all neoplasms in dogs is illustrated in Figure 1.

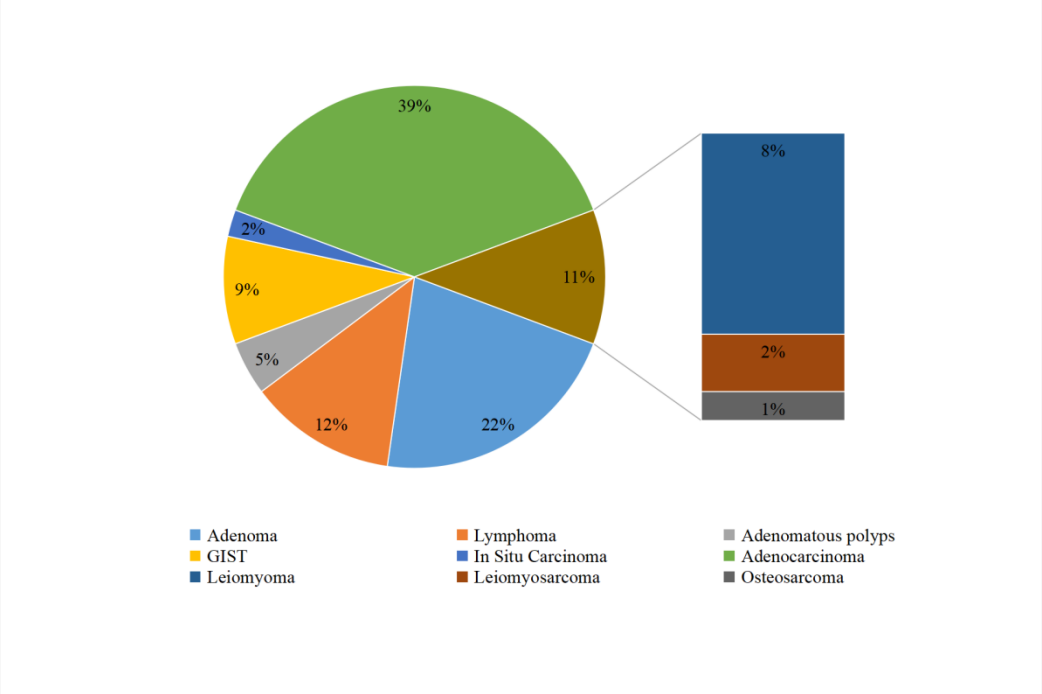

Figure 1. The distribution of neoplastic lesions within the gastrointestinal tract of dogs.

In contrast, within the cohort of cats, malignant neoplasms constituted 98.82% of all cases, a significantly higher proportion compared to dogs. A detailed distribution of gastrointestinal tumors in cats is provided in Figure 2.

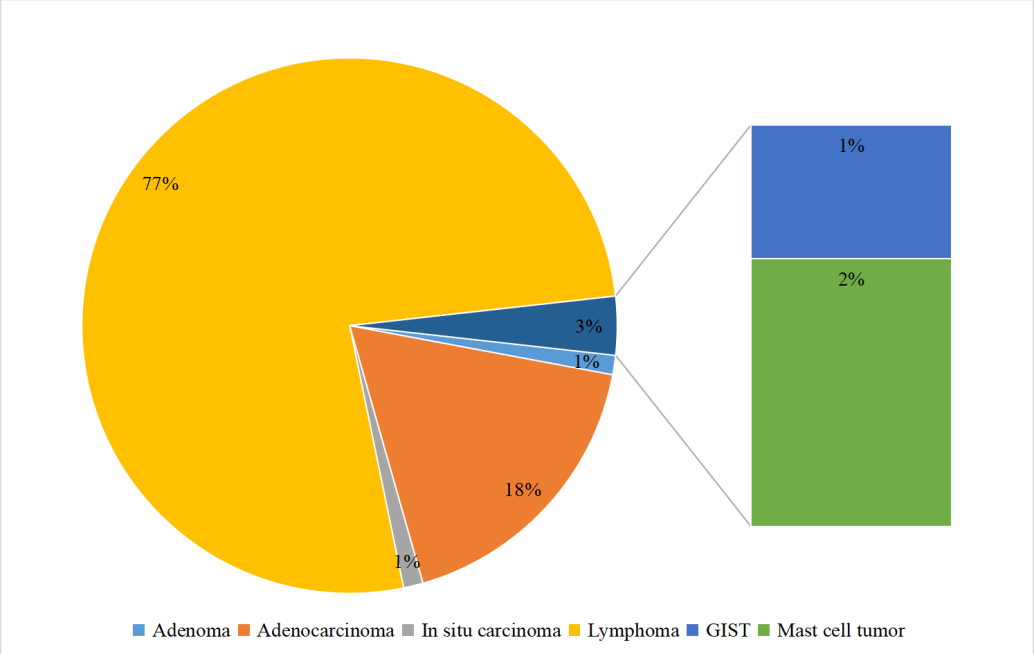

Figure 2. The distribution of neoplastic lesions within the gastrointestinal tract of cats.

3.2.1 Benign tumors of the gastrointestinal tract in dogs and cats

Adenomas were among the most significant benign neoplastic lesions in the gastrointestinal tract of dogs, accounting for 22% of all tumors. The mean age at diagnosis was 6.44 years, with a higher prevalence in males (52.63%). The affected dog breeds included French Bulldogs (15.79%), Golden Retrievers (15.79%), Shih Tzus (15.79%), along with two cases in mixed-breed dogs. Other breeds represented by a single case each included American Akita, Rottweiler, American Staffordshire Terrier, Beagle, Cocker Spaniel, Labrador Retriever, Samoyed, and Yorkshire Terrier.

Histologically, adenomas were classified into tubular (n=3), papillary (n=7), adenomas with areas of in situ carcinoma (n=9), and unspecified types (n=5). All adenomas were localized in the rectum/ anorectal junction and confined to the mucosal layer. In cats, only one case of tubulopapillary adenoma was identified in a 9-year-old male. The specific location of the tumor was not reported.

Four cases of adenomatous polyps/ pedunculated adenomas were identified in the intestines of dogs. These benign neoplasms occurred in younger animals, with a mean age of 5.1 years (range: 4 months to 8 years). No breed predisposition was observed, and all cases occurred in males. Three lesions were located in the rectum, and one was present in the duodenum.

Leiomyomas (n=7) were the only other benign neoplasms identified in dogs. The mean age at diagnosis was 14 years, with females comprising 57.14% of cases. No breed predisposition was noted for leiomyomas. Most gastric leiomyomas were localized in the cardia region (3/6 cases), with one case in the gastric body and two cases without specified localization. A single intestinal leiomyoma was identified in the colon.

3.2.2 Malignant tumors of the gastrointestinal tract in dogs and cats

3.2.2.1 Epithelial neoplasms

In dogs, adenocarcinomas were the most significant neoplasm of the gastrointestinal tract (n=34). The mean age of affected dogs was 9 years, with an age range of 4 to 16 years, and males were more frequently affected, accounting for 61.76% of cases. In terms of breed predisposition, 16% of cases occurred in mixed-breed dogs, followed by Chow Chows (15%), French Bulldogs (9%), and American Staffordshire Terriers (9%). The distribution of other affected breeds is detailed in Figure 3.

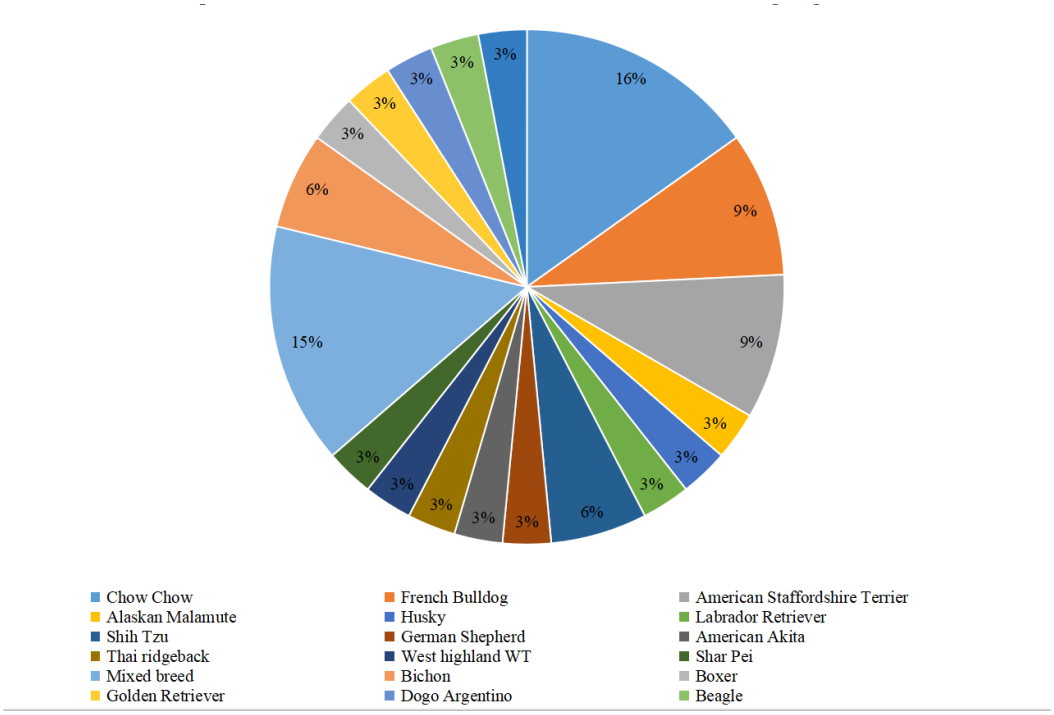

Figure 3. Proportional distribution of gastrointestinal adenocarcinoma among dog breeds

In dogs, 64.70% of adenocarcinomas were located in the intestines, while 35.29% were found in the stomach. Within the intestines, nine cases were located in the rectum, seven in the colon, and the remainder in the small intestine. In the stomach, only one case was identified in the pyloric region, with the exact location unspecified for the other cases. Histologically, adenocarcinomas in dogs were classified as tubular (4/34 cases), signet ring cell (4/34 cases), mucinous (3/34 cases), papillary, tubulopapillary, and poorly differentiated (2 cases each). Three cases were classified as mixed types, while the histological subtype was unspecified in 14 cases. Approximately 85% of the tumors were infiltrative and transmural. Metastasis to regional lymph nodes was reported in two cases, and vascular emboli were noted in seven cases. In three gastric tumors, *Helicobacter* spp. colonization was observed.

In contrast to dogs, adenocarcinomas accounted for only 18% of gastrointestinal neoplasms in cats. The mean age of affected cats was 12.73 years (range: 3 to 17 years). Unlike dogs, females were predominantly affected, comprising 73.33% of cases, with more than half of the females (n=7) being spayed (Table 1). Similarly, 3 out of 4 affected males were neutered. Approximately 73% of the cats were mixed-breed, with the remaining cases observed in British Shorthairs (n=2), Siamese (n=1), and Maine Coon (n=1).

Similar to dogs, topographically, the majority of feline adenocarcinomas (86.66%) were located in the intestines, with only two cases involving the stomach. A detailed distribution of adenocarcinomas in cats is provided in Table 2.

Table 1. Gender-based distribution of gastrointestinal neoplastic and neoplastic-like in canine and feline populations.

		Gender	Hormonal status	CHPG	FGIESF	Polyp	Adenoma	In situ carci-noma	Adenocarci-noma	Carci-noma	Leiomy-oma	Leiomyosar-coma	GIST	OSA	Lym-phoma	Mast cell tumor	Total
Dogs	Stomach	F	Spayed	1	-	1	-	-	1	0	0	-	-	-	1	-	4
			Intact	1	-	2	-	-	1	2	4	-	-	-	2	-	12
		M	Castrated	1	-	1	-	-	1	1	0	-	-	-	1	-	5
			Intact	4	-	1	-	-	5	1	2	-	-	-	1	-	14
	Intestine	F	Spayed	-	-	0	2	1	6	-	0	1	1	0	1	-	12
			Intact	-	-	0	7	1	3	-	0	0	3	0	1	-	15
		M	Castrated	-	-	0	2	0	1	-	0	1	1	0	1	-	6
			Intact	-	-	4	8	0	12	-	1	0	3	1	3	-	31
Cats	Stomach	F	Spayed	-	0	1	0	0	0	-	-	-	-	-	2	-	3
			Intact	-	0	0	0	0	2	-	-	-	-	-	4	-	6
		M	Castrated	-	2	0	1	1	0	-	-	-	-	-	7	-	11
			Intact	-	0	0	0	0	0	-	-	-	-	-	6	-	6
	Intestine	F	Spayed		1	-	-	-	7	-	-	-	1	-	15	1	25
			Intact		0	-	-	-	2	-	-	-	0	-	10	0	12
		M	Castrated		1	-	-	-	3	-	-	-	0	-	11	0	15
			Intact		1	-	-	-	1	-	-	-	0	-	10	1	13

M - male
F - female

		Location	CHPG	FGIESF	Polyp	Adenoma	In situ carcinoma	Adenocarcinoma	Carcinoma	Leiomyoma	Leiomyosarcoma	GIST	OSA	Lymphoma	Mast cell tumor
Dogs	Stomach	Cardia	0	-	0	-	-	0	-	3	-	-	-	0	-
		Gastric body	0	-	0	-	-	0	-	0	-	-	-	2	-
		Pylor	7	-	0	-	-	0	1	0	-	-	-	0	-
		Not mentioned	0	-	5	-	-	8	3	2	-	-	-	3	-
	Intestine	Small intestine	-	-	1	0	0	5	-	0	1	4	0	3	-
		Duoden	-	-	0	0	0	0	-	0	0	2	0	1	-
		Jejun	-	-	0	0	0	1	-	0	0	1	1	1	-
		Ileon	-	-	0	0	0	0	-	0	0	0	0	1	-
		Ileocecal	-	-	0	0	0	0	-	0	1	1	0	0	-
		Colon	-	-	0	0	0	7	-	0	0	0	0	0	-
		Rectum	-	-	3	19	2	9	-	0	0	0	0	0	-
		Large intestine	-	-	0	0	0	0	-	1	0	0	0	0	-
Cats	Stomach	Cardia	-	0	0	0	0	0	-	0	0	0	0	0	0
		Gastric body	-	0	0	0	0	0	-	-	-	-	-	5	-
		Pylor	-	0	0	0	0	0	-	-	-	-	-	1	-
		Not mentioned	-	2	1	1	1	2	-	-	-	-	-	13	-
	Intestine	Small intestine	-	0	-	-	-	7	-	-	-	0		22	0
		Duoden	-	3	-	-	-	0	-	-	-	1		5	0
		Jejun	-	0	-	-	-	1	-	-	-	0		17	0
		Ileon	-	0	-	-		1	-	-	-	0		2	0
		Ileocecal	-	1	-	-	-	1	-	-	-	0		2	0
		Colon	-	0	-	-	-	2	-	-	-	0		0	2
		Rectum	-	0	-	-	-	1	-	-	-	0		0	0

Table 2. Epidemiological distribution of neoplastic and neoplastic-like lesions in the gastrointestinal tract of dogs and cats

Histologically, most feline adenocarcinomas (n=6) were classified as tubular, followed by tubulopapillary and mucinous types (2 cases each), and one case was classified as undifferentiated. In four cases, the adenocarcinoma subtype was not specified. All tumors in cats exhibited transmural invasion. Metastasis to regional lymph nodes was reported in approximately 46% of cases, and carcinomatosis was identified in six cases.

3.2.2.2 In situ carcinoma

In the cohort, only two cases of in situ carcinoma were identified in dogs and one in a cat.

In dogs, the in situ carcinomas were diagnosed in two females: a 7-year-old Beagle and an 11-year-old mixed-breed dog. Both lesions were localized in the rectum. In the cat, the in situ carcinoma was observed in a 4-year-old neutered male British Shorthair, with the neoplasm located in the stomach.

3.2.2.3 Lymphomas

Lymphomas were the most prevalent tumors in cats, accounting for approximately 77% of all gastrointestinal neoplasms. The affected cats had a mean age of 10.16 years, with an age range from 2 to 24 years. Males comprised 52.31% of the cases. Additionally, more than 50% of the males were neutered, and 54.48% of the females were spayed. Mixed-breed cats were predominantly affected, accounting for 85% of the cases. The distribution of other breeds is presented in Figure 4.

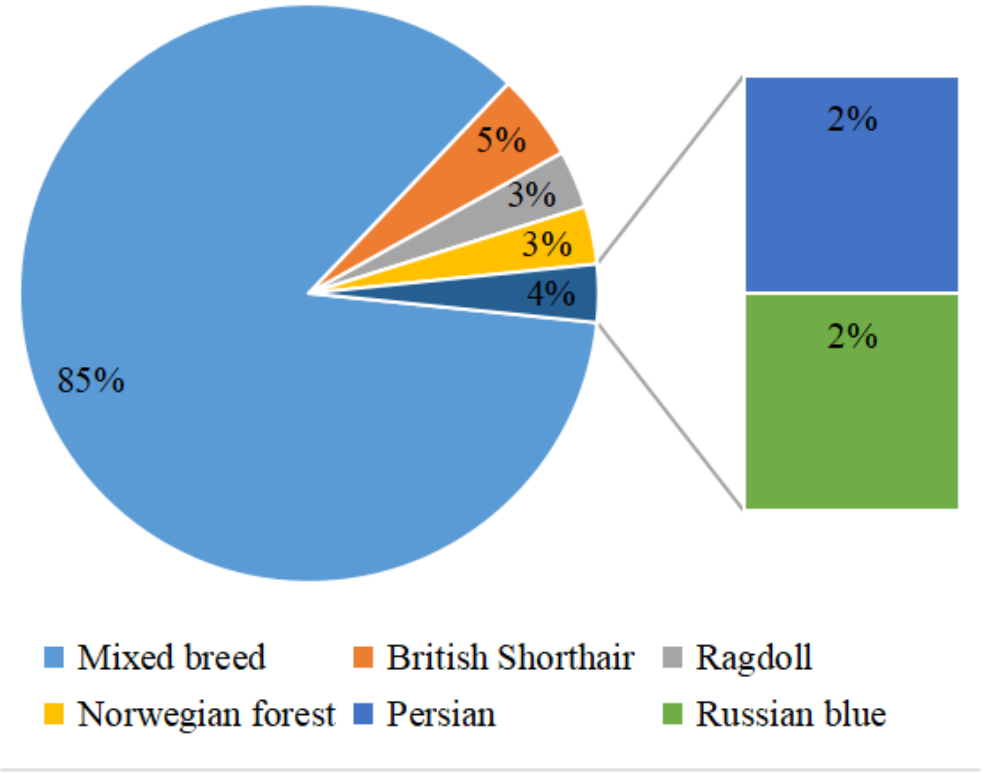

Figure 4. Proportional distribution of gastrointestinal adenocarcinoma among cat breeds

Approximately 70% of lymphomas in cats were located in the intestine, with the remaining cases found in the stomach. Within the intestine, the distribution was as follows: 6 cases in the duodenum, 18 in the jejunum, and three in the ileum, while 29 cases lacked specification of the exact intestinal segment. Additional locations included three cases in the ileocecal valve, four in the colon, and one in the rectum. The gastric location of lymphomas was specified in six cases, with the gastric body being the most commonly affected site (five cases).

Regarding the size of the neoplastic lymphocytes, a notable difference was observed between the stomach and intestinal locations. In the stomach, three of the 19 lymphoma cases were classified as large-cell, two as small-cell, and the remaining four had unspecified cell morphology. In contrast, within the intestine, small-cell lymphoma was the most common (n=23), followed by medium-cell lymphoma (n=2), large-cell lymphoma (n=14), and seven cases with unspecified cell morphology.

Most of the lymphomas (78.46%) were transmural, and metastasis was identified in regional lymph nodes (n=15), the pancreas (n=3), liver (n=2), kidneys (n=1), and lungs (n=1).

In dogs, lymphomas accounted for only 12% of gastrointestinal neoplasms. The mean age of affected dogs was 7.72 years (range: 3 to 13 years), with a higher prevalence in males (72.72%). No breed predisposition was identified, with cases observed in Bichon Frises (n=2), French Bulldogs (n=2), mixed-breed dogs (n=2), and one case each in Rottweilers, Alaskan Malamutes, Shih Tzus, and Beagles.

Similar to cats, lymphomas in dogs primarily developed in the intestine (54.54%), specifically affecting the small intestine in all cases. Compared to cats, large-cell lymphoma (n=5) was the only subtype of lymphoma identified in the gastrointestinal tract of dogs, affecting both the stomach and intestine. In the remaining six cases, subtype information was not provided. Most of the lymphomas (88.88%) were transmural, with metastasis noted in regional lymph nodes (n=4).

3.2.2.4 Mast cell tumor

In our cohort, mast cell tumors were observed in two mixed-breed cats, a 9-year-old male and a 10-year-old female, both located in the colon. One neoplasm was confined to the mucosal layer, while the other was transmural and exhibited metastasis to the regional lymph nodes.

3.2.2.5 Mesenchymal tumors

In dogs, a total of 11 mesenchymal neoplasms were identified, including gastrointestinal stromal tumors (GISTs) (n=8), leiomyosarcomas (n=2), and one osteosarcoma (OSA).

For GISTs, the mean age at diagnosis was 9.75 years, with a range of 2 to 14 years. Both males and females were equally affected, and no breed predisposition was observed. All GISTs cases were located in the intestine, predominantly in the small intestine (87.5%), with one case found at the ileocecal junction. In all instances, the neoplasms were transmural, and one case exhibited invasion into the mesentery.

In cats, a single case of GIST was reported in an 11-year-old neutered British Shorthair, with the tumor located in the duodenum. Similar to dogs, the neoplasm was transmural, affecting the entire wall of the intestine.

Leiomyosarcomas and osteosarcoma were identified exclusively in dogs. Like GISTs, leiomyosarcomas were observed in older dogs (ages 10 and 11 years), with one male and one female affected. One lesion was located at the ileocecal junction, while the location of the other intestinal tumor was not provided. Both tumors were transmural.

The osteosarcoma was identified in an 8-year-old male Greyhound, with the neoplasm located in the jejunum. Consistent with the other mesenchymal tumors, this lesion was also transmural.

4. Discussion

In this study, a total of 192 neoplastic and neoplastic-like lesions in dogs and cats were retrospectively analyzed based on routine pathology reports.

Feline gastrointestinal eosinophilic sclerosing fibroplasia (FGIESF) has previously been described in cats, with a mean age range between 5.25 and 7 years, and an age range spanning from 2 to 11 years [18,19]. Our findings align with these reports, revealing a mean age of 7.25 years for gastric FGIESF and 5.25 years for intestinal FGIESF. When considering both gastric and intestinal locations together, the average age of development was 6.25 years. Additionally, male cats were more predisposed to developing this condition, with 4 out of 6 affected, which is consistent with the literature [18,19]. In this retrospective study, no breed predisposition was noted, with most cases reported in mixed-breed cats, while only one case each of Persian and Ragdoll cats were observed. Notably, the literature suggests a predisposition for Ragdoll cats [18,19]. However, the limited sample size of 6 cases in this study warrants caution in drawing definitive conclusions, given the rarity of this lesion. Another difference observed in our study compared to the literature is the localization of FGIESF. While the literature often reports the ileocecal region as the most common site [18], our study found that the duodenum was the primary location (3/4 cases), followed by the ileocecal junction

(1/4 cases). A recent study of 60 cases also reported a higher incidence of lesions in the intestine compared to the ileocecal junction, with gastric involvement being less frequent [19]. In line with previous reports, the neoplastic-like masses in this study were typically transmural, affecting all layers of the gastric and intestinal walls [21]. Further studies, including genetic assessments, are recommended to investigate potential breed predispositions for this condition.

Regarding chronic hypertrophic pyloric gastropathy (CHPG), the adult form is more commonly diagnosed in middle-aged to older dogs, particularly male brachycephalic breeds and small breeds such as Shih Tzus, Pekingese, Maltese, and Lhasa Apsos [22-24]. In our study, we did not observe a specific breed predisposition; however, out of seven cases, one Bichon, one French Bulldog, one Pekingese, and one Shih Tzu were identified. Males represented the majority of cases, accounting for 71.42%. The mean age of affected dogs was 11.14 years, consistent with existing literature [24]. All cases of CHPG were mucosa-associated.

Regarding gastric polyps, no significant sex or breed predisposition was observed. The exact location of the lesions within the stomach was not consistently reported, which may account for the lack of a defined location pattern. However, the literature suggests that gastric polyps most commonly occur in the antrum region, where polypoid growths are frequently observed [25]. Histologically, gastric polyps are classified as either hyperplastic or inflammatory types according to the World Health Organization, with hyperplastic polyps being more prevalent [13]. Our study also found that all gastric polyps were hyperplastic. The development of gastric polyps is believed to be associated with *Helicobacter* spp. [25], and in our study, *Helicobacter* spp. colonization was identified in two cases.

In terms of benign neoplastic lesions, a notable difference was observed between the types of benign neoplasms found in the stomach and intestines. Leiomyomas were the only benign neoplasms identified in the stomach, comprising approximately 26.08% of all gastric neoplasms in dogs. This finding is consistent with the literature, which reports leiomyomas accounting for approximately 19% of gastric neoplasms [12]. Leiomyomas in dogs are typically diagnosed in older animals, with no significant sex predisposition. Some reports suggest a higher predisposition in small terrier breeds [26-29]. In our study, no breed predisposition was identified, with affected dogs having a mean age of 14 years. Interestingly, in our study, a higher prevalence of leiomyomas was observed in female dogs (57,14%), which contrasts with other reports. Most of the leiomyomas were located in the cardia region (50%). This finding is in accordance with both human and veterinary studies, which commonly report the development of leiomyomas in the gastroesophageal junction, cardia, fundus, and pylorus [27, 30-32].

A notable difference was observed between benign neoplasms in the stomach and those in the large intestine. The benign neoplasms identified in the large intestine were predominantly adenomas (79.16%) and adenomatous polyps (16.66%). French Bulldogs (15.79%), Golden Retrievers (15.79%), Shih Tzus (15.79%) were the main breeds in which this lesion developed. In contrast, a recent study found that Jack Russell Terriers and Miniature Dachshunds were overrepresented and predisposed to these types of lesions [4]. However, in our study, neither of these breeds presented with benign neoplasms in the large intestine. Regarding tumor localization, all adenomas were located in the rectal region. This finding aligns with the literature, where most adenomas are reported to be located in the rectum [4]. Histologically, the adenomas were predominantly classified as papillary (n=7), followed by tubular, with the remaining cases lacking specific classification. Interestingly, areas of in situ carcinoma were identified in 9 of the adenomas, suggesting a potential for malignant transformation. In human medicine, both adenomas and adenomatous polyps are known to undergo malignant transformation through a mechanism referred to as the "adenoma-carcinoma sequence" [33]. Other studies have indicated that adenomas may develop into carcinomas due to mutations in tumor suppressor genes and oncogenes [34]. A recent study by Saito (2018) reported that of 52 dogs diagnosed with inflammatory polyps, all were Miniature Dachshunds, and 14% developed neoplastic lesions after treatment, suggesting that inflammatory polyps may represent potential preneoplastic lesions [35].

The most common neoplastic lesions in the gastrointestinal tract of dogs were adenocarcinomas, which accounted for 38,64% of all neoplasms and 54.23% of malignant gastrointestinal tumors. These results align with the existing literature [1,4]. Specific breeds, such as Belgian Shepherds, Groenendaels, Tervuerens, Chow Chows, and Norwegian Elkhounds, have been found to be more predisposed to developing these tumors [5,36-38]. In our study, Chow Chows were overrepresented (15%), followed by French Bulldogs (9%) and American Staffordshire Terriers (9%). However, a recent study identified a predisposition for Jack Russell Terriers and Miniature Dachshunds to develop these types of tumors [4]. Gastric adenocarcinomas typically develop in the pyloric region and lesser curvature [18-21], while intestinal adenocarcinomas predom-

inantly affect the large intestine, particularly the rectum, with less frequent involvement of the small intestine [4]. In our study, the exact location of the 12 gastric adenocarcinomas was not specified, but in the case of the intestines, most adenocarcinomas were located in the large intestine (72.72%), specifically in the rectum, which is consistent with the literature.

In the current literature, the histopathological pattern of gastrointestinal adenocarcinomas is not considered to have significant relevance for prognosis [12]. According to the WHO classification of gastrointestinal tumors [13], gastric adenocarcinomas are classified as tubular, papillary, tubulopapillary, mucinous, signet-ring cell, squamous, and undifferentiated, while intestinal adenocarcinomas are classified as acinar, papillary, mucinous, signet-ring cell, adenosquamous, and undifferentiated. In our study, we did not identify any squamous or acinar adenocarcinomas, although these types have been previously reported [4,39]. A more recent study highlighted the importance of tumor growth patterns, specifically polypoid versus non-polypoid, showing that all non-polypoid tumors presented with invasion and/or metastasis, while only 12% of polypoid tumors exhibited these characteristics [4]. Interestingly, 90.9% of the adenocarcinomas in our cohort invaded all layers of the intestinal wall, with a lower frequency of transmural invasion in the stomach (58.33%).

Lymphomas and mesenchymal neoplasms were equally represented in our cohort, with 11 cases of each identified in the gastrointestinal tract of dogs. Lymphomas were almost equally distributed between the stomach (n=5) and intestine (n=6), which contrasts with the literature, where lymphomas are predominantly reported in the intestine, with less frequent involvement of the stomach [40].

All mesenchymal neoplasms in our study were localized in the intestine. In contrast to the literature, we did not identify any breed predisposition for lymphoma, although breeds such as Boxers, Shar-Pei, and more recently, Shiba Inus, have been reported to be overrepresented in lymphoma cases [41-43]. Previous studies have noted that most lymphomas affecting the gastrointestinal tract of dogs are large cell lymphomas, with a lesser incidence of small cell lymphomas [44-47]. In our study, no small cell lymphomas were noted, with the remaining cases being classified as large cell lymphomas (n=5). However, it is important to note that the cell size was not specified in 6 cases. An interesting observation was that 8 out of the 11 lymphoma cases were transmural, which aligns with findings in the literature [48].

An important aspect regarding the phenotype of gastrointestinal (GI) lymphomas in dogs is that T-cell lymphomas are the predominant subtype in both the stomach and intestine. Additionally, most lymphomas in dogs are low-grade, which generally results in a favorable prognosis, especially when chemotherapy is involved [40]. Unfortunately, phenotypic information regarding the neoplasms in this study was not available. This limitation is primarily due to the fact that immunohistochemistry is not routinely performed, as it implies additional costs for the owners, and in many cases, owners opt not to pursue these investigations, further limiting our study.

In terms of mesenchymal neoplasms in the intestine, three malignant cases were identified: gastrointestinal stromal tumors (GISTs) (66.66%), leiomyosarcomas (16.66%), and one osteosarcoma. These findings are consistent with those reported in the literature. Historically, GISTs were often misdiagnosed as leiomyomas or leiomyosarcomas (66-85%) (49,50), a situation that changed with the introduction of immunohistochemistry using markers such as KIT or DOG1, which revealed a higher incidence of GISTs in the GI tract of both humans and animals [51,52]. Our study did not identify any breed or gender predisposition for GISTs, which aligns with existing reports [53,54].

GISTs in dogs most commonly arise in the cecum and small intestine, with a lower frequency in the stomach [53,54]. In contrast, our study found that 87.5% of GISTs were located in the small intestine, with one case at the ileocecal junction. This result may be less precise due to the small sample size in our cohort. An important observation was that all GISTs in our study were transmural, with one case exhibiting mesenteric invasion. Metastasis to the mesentery, serosa, lymph nodes, liver, and spleen has also been reported in dogs [54]. Interestingly, in humans, two significant prognostic factors for GISTs are tumor diameter and mitotic count. Tumors larger than 5 cm and those with more than 50 mitoses per 50 high-power fields (HPF) are more likely to metastasize [55]. However, these parameters are not as important in canine GISTs [56].

For leiomyosarcomas and osteosarcomas, the findings in our study are consistent with previous reports [49,57-59].

Regarding cats, no breed predisposition for lymphoma was observed, with approximately 80% of cats being mixed breed, which is in agreement with a recent study [60]. However, a study conducted in the USA found Siamese cats to be overrepresented [3,11]. In our cohort, only one Siamese cat was included. The high-

est proportion of neoplastic lesions in cats was found in lymphomas, which accounted for 47% in the stomach and 74.19% in the intestine. These proportions are consistent with previous studies, where the incidence ranged from 41% to 79% [11, 60-62].

Almost all lymphoma cases involved the intestine (n=48), with only 2 cases located at the ileocecal junction and 19 cases in the stomach, which is consistent with prior studies [60]. A notable difference was observed in the lymphocyte size distribution between the intestine and stomach; in the intestine, most lymphomas were classified as small cell (n=23), while the majority of lymphomas in the stomach (n=13) were large cell lymphomas. No phenotypic characterization was performed on the lymphoma samples due to the lack of owner requests and funding limitations for additional investigations such as immunohistochemistry.

In terms of benign neoplasms in cats, a small number were observed: one stromal tumor and two mast cell tumors, and the mean age at diagnosis for neoplastic lesions in cats was over 10 years, in agreement with previous studies [3,11,60-62]. Another notable finding was that approximately 70% of the lymphomas were transmural. A reduced proportion of adenocarcinomas was observed, with 9% in the stomach and 21% in the intestine, which is consistent with current literature [60,61]. The locations of these adenocarcinomas were primarily in the small intestine (66.66%), followed by the large intestine (20%) and stomach (13.33%). These results align with studies showing that the small intestine is the primary site for the development of adenocarcinomas [3,12,63]. However, a more recent study published in 2022 on 860 cats found that the highest incidence of adenocarcinomas occurred in the large intestine (58.1%), with a lower incidence in the small intestine (32%) and stomach (2.5%).

Another notable difference in our study was the higher representation of females, who accounted for 86,66% of cases, whereas in other studies, males were more commonly affected, with over 70% of cases [60,64]. In our cohort, tubular adenocarcinoma was the most common histological type, accounting for approximately 40%, which is consistent with other studies [3,60,64]. Interestingly, some studies have also reported acinar adenocarcinomas as common in the intestines of cats, whereas in our study, only one case was classified as acinar. Furthermore, all adenocarcinomas in our study were transmural.

Only one mesenchymal neoplasm was identified in our study, located in the small intestine, specifically the duodenum. Other studies have indicated that the small intestine is the primary location for these types of neoplasms [11], although more recent studies have reported an equal distribution between the small and large intestine [60]. The identified mesenchymal neoplasm was a GIST. While extensive studies have not identified any cases of GISTs in cats, our review of the literature found only two case reports of GISTs in the gastrointestinal tract of cats [65], and the characteristics described in those reports are similar to those observed in our study.

5. Conclusions

This is the first epidemiological study in Romania to examine both the gastrointestinal tract in dogs and cats, including neoplastic-like lesions. The definitive diagnosis of gastrointestinal masses requires histological and molecular analyses. In cats, the most common gastrointestinal tumors are malignant and represented by lymphomas. In dogs, mesenchymal tumors including leiomyomas, GISTs and leiomyosarcomas cause obstructive effects. Both gastric and intestinal adenocarcinomas are infiltrative tumors with a high risk of dissemination to the regional lymph nodes and peritoneum.

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