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TUMOURS OF THE STOMACH AND INTESTINE IN DOGS - ANALYSIS OF 77 BIOPTIC CASES

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ABSTRACT

Biopsies of gastric and intestinal tumours (n=77) from 76 dogs were investigated using histology and immunohistochemistry These neoplasias represented only 0,78% of all biopsies in the evaluated period. 14 tumours were in the stomach of 13 dogs, 17 in the small intestine, 13 in the colon and ceacum and 35 were in the rectum. With exception of the rectum predominated malignant tumours and females were affected more often than males.In the stomach adenocarcinoma was diagnosed in nine cases, carcinoid, gastrointestinal stromal tumour (GIST), haemangiosarcoma and lymphoma one case each. Polyp in the pylorus occured simultaneously with haemangiosarcoma. Adenocarcinoma was diagnosed in five biopsies from the small intestine. Carcinoid, mast cell tumour and Tcell lymphoma were two cases each, neurofibrosarcoma, MALT lymphoma and null cell lymphoma one case each. Only one adenoma appeared in the collection. In the colon and caecum were four adenocarcinomas, three GIST, and each one carcinoid, adenocarcinoid and lymphoma. Adenoma was present in colon of three dogs. In the rectum were 21 adenomas and two leiomyomas versus four adenocarcinomas, three carcinoids, each two lymphomas and mast cell tumours and one haemangiosarcoma. Adenoma in the rectum appeared more often in males than in females and average age of males was lower than in bitches.

INTRODUCTION

Tumours of the gastrointestinal tract in domestic animals are not common [1]. They are relatively prevalent among surgical biopsies from dogs and cats and in sharp contrast to their rarity in horses and food-producing animals. The average age of the dogs suffering from gastric and intestinal neoplasias is 7- 9 years, with range from 1 to 14 years. Malignant neoplasms in the stomach occur more frequently than benign tumours. In many cases, clinical presentation is often late, with a large tumour or extensive involvement of the gastric mucosa and deeper layers. Up to 60% of all intestinal tumours are located in the colon and rectum. Adenocarcinoma in the small intestine it is nearly always annular stenosing and may occur at any level from duodenum to ileum [2]. Adenomas in the small intestine are rare. Rectoanal adenomas, (rectoanal polyps colorectal adenomatous polyps) may be multiple and they are seen in slightly younger animals. Males are affected more often than females. Some rectoanal adenomas have cellular atypia and limited invasion to the submucosa. Second tumour may develope 1 to 18 months after an initial polypectomy and proportion of the dogs develop a carcinomatous recurrence. Carcinoids occur rarely in old animals and usually are located in the stomach, duodenum, colon, and rectum [2].

Neoplasias of mesenchymal histogenesis are represented by vascular tumours, mostly haemangiosarcomas, fibrosarcomas and leiomyomas/ leiomyosarcomas. Tumours of neurogenic orgin are rare. They have been found in the duodenum and caecum of dogs and all were benign [2]. Bemelmans et al [3] described a colorectal hamartomatous polyposis and ganglioneuromatosis in a young dog. The aim of this study was to compare our results with information provided in the literature.

MATERIALS AND METHODS

All biopsies originated from veterinary clinics located in different regions of the Czech Republic. Information on the sex and age of dogs, location, macroscopic appearance and size of tumours, as well as the clinical symptoms were obtained from the application forms filled in by the veterinary clinicians who submitted the biopsies to examination.

With exception of five endoscopic biopsies the samples were surgical excisions.

The biopsies were fixed in 10% neutral buffered formalin and routinely embedded in paraffin wax. Histological sections 5 µm thick were stained with haematoxylin and eosin. PAS reaction, modified van Gieson staining and trichrome staining were done in indicated cases.

Immunohistochemistry

Standard immune peroxidase method was applied to serial sections.

After deparaffinization the antigens were demasked by boiling of the slides for 10 minutes in 0.1 M citrate buffer pH 6. Slides were then incubated in 3% H_2O_2 for 15 minutes to inactivate endogeneous peroxidase. Nonspecific binding of the primary antibodies was eliminated with Protein Blocking Agent (Ultratech HRP, Immunotech Marseille) for 6 minutes. Binding of the primary antibodies was performed in humidified chambers at room temperature for 60 minutes. List of primary antibodies, their origin and dilution is given in table No. 1. Binding of the primary antibodies was "visualized" by means of the Streptavidin-Biotin Universal detection System (Ultratech HRP, Immunotech Marseille) and by DAB Chromogen Kit (Ultratech DAB, Immunotech Marseille). The slides were counterstained with haematoxylin.

RESULTS

Total number of cases is 77 which represents 0.78% of all biopsies examined during analysed period. Summary of tumours in different parts of the gastrointestinal tract is given in table no 2**.**

Stomach

Summary of findings is in table No. 3. **Adenocarcinoma:** Three adenocarcinomas appeared as nodular formations. All were located in the antrum, two of them extended also in the body region. Six adenocarcinomas manifest themselves as mural thickenning (*linitis plastica)* two of them in extension from 80 to 100%. In one case also multiple ulcerations were recorded. In all dogs the antrum was involved. The adenocarcinomas were histologically classified as tubular in three cases, three were papillotubular, one was papillotubular with solid formations and the last two were tubular and solid with diffuse infiltration of the wall by signet ring cells. All adenocarcinomas infiltrated deeper layers of the stomach wall and angioinvasion was noted in all cases. On the basis of cytological properties of the neoplastic cells (marked anisocytosis, anisokaryosis, cellular atypias, atypical mitotic figures), high malignancy was estimated. In one case, in which also regional lymph node was sent to examination, widespread metastases of the adenocarcinoma were observed.

Carcinoid macroscopically appeared as nodular formation in the antrum with dissemination of small tumours on the omentum and peritoneum. Round to oval neoplastic cells were arranged in solid groups, nests or strips and numerous individual cells infiltrated the submucosa and muscular layer of the stomach. Diagnosis was established on basis of chromogranin and S 100 protein positivity.

Gastrointestinal stromal tumour was located in the antrum as well limited nodular formation Histologically it consisted of spindloid cells that were arranged in interlacing fascicles. Mitotic activity was low. Diagnosis was established on strong c-kit positivity, moderate positivity of vimentin and actin, and desmin negativity in the neoplastic cells (Fig. 1 & 2).

Haemangiosarcoma caused ulcerated mural thickenning in the antrum and body. Diagnosis was confirmed on the basis of von Wilebrand factor positivity. Polyp located in the pylorus was simultaneously present in the same dog.

Lymphoma clinically manifested by delayed evacuation of content and by thickenning of gastric wall. Histology revealed a diffuse infiltration of the lamina propria, submucosa and epithelium by neoplastic lymphocytes. CD79 was positive in numerous cells, CD3 was positive in some cells only, and CD18 was negative. The lymphoma was diagnosed as MALT lymphoma.

Small intestine

Summary of findings is in table No. 4.

Adenocarcinoma: In all five cases the tumour caused segmental thickening of the intestinal wall and stenosis of lumen. In one case also small neoplastic formations on serosa of the stomach and on omentum were observed and in other case small nodules of lens size were disseminated on serosa of the jejunum. Three adenocarcinomas were tubulopapilar and two were tubular (acinar). Goblet neoplastic cells were numerous and mucin deposits were present. In all cases the carcinoma intensively infiltrated deeper layers of intestinal wall. In two biopsies the neoplastic formations penetrate into subserosal tissue and mesentery.

Carcinoid: In the first case tumour size of a man's fist and metastatis in the mesenteric lymph node was clinically observed. In the second patient the intestinal wall was thickened in 10 cm long segment. In both tumours the cells were of epitheloid appearance with round to oval nuclei. Anisokaryosis, high mitotic activity, atypical mitotic

figures, and light cytoplasm characterized these cells. On the basis of cytokeratin negativity a chromogranin positivity, carcinoid was diagnosed. (Fig. 3 & 4).

Malignant peripheral nerve sheath tumor (MPNST, neurofibrosarcoma)

A solid tumour with signs of expansive and infiltrative growth into surrounding tissues was situated predominantly in the lamina muscularis. The cells were spindloid, arranged in implied interlacing fascicles. All neoplastic cells were strongly positive for S100, GFAP, NSE but also for actin. Desmin was positive in part of the neoplastic cells and c-kit detection gave only suspect positivity. The tumour was classified as MPNST though positive markers of muscle tissue this diagnosis somewhat calls into question.

Mast cell tumours

In 13- years- old bitch asymetrically thickened wall of the jejunum in 5 cm long segment was clinically found. Poorly differentiated mast cells tumour sporadically infiltrated by eosinophils was histologically diagnosed. Staining after Giemsa proved only few metachromatic granules in the neoplastic cells. C-kit positivity was mild to moderate in some cells. In majority of cells only suspect positivity was found. In the second case the mast cells tumour developed in ileo-caecal orifice in 9-years- old male. Histology revealed marked outnumber of eosinophils over the neoplastic cells. Immunohistochemistry proved c-kit cytoplasmic positivity in the cells disseminated among eosinophils. (Fig. 5 & 6).

T cell lymphoma

In the first case it manifested as thickenning of intestinal wall in segment of terminal duodenum and initial part of the jejunum. In the second dog was clinically found segmental thickenning of the jejunum and enlargement of the mesenteric lymph nodes. Diffuse infiltration of intestinal wall and adjacent mesentery by neoplastic lymphocytes with mild epiteliotropism was histologically observed. Great majority of the lymphocytes were CD3 positive. CD18 and CD79 were negative.

Null cell malignant lymphoma manisfested as segmental thickenning of intestinal wall and enlarged mesenteric lymph nodes. Histological finding was wery similar to the T cell lymphoma but the neoplastic cells were CD3, CD18, and CD79 negative.

MALT lymphoma appeared as tumourous formation, located in wall of the jejunum. Neoplastic lymphocytes diffusely infiltrated all structures of the intestinal wall. Immunohistochemistry proved strong cytoplasmic CD 79 positivity in the neoplastic lymphocytes, CD3 and CD 18 were negative.

Adenoma was histologically classified as tubulopapillar adenoma. In additon strips of epithelial cell appearance were present in the lamina muscularis. On the basis of immunohistochemical examination they were idetified as plump endothelial cells because of cytokeratin negativity and von Willebrand's factor positivity.

Colon and caecum

Summary of findings is in table No. 5

Adenocarcinoma

In the first case manifested clinically as ileus and thickening of ileocaecal junction. Tubular mucinous adenocarcinoma with ulceration and pyogranulomatous inflammation in mucosa and submucosa was diagnosed histologically. In the second case size and location of the neoplasia were not determined. Tubulopapillary adenoma was diagnosed in sample of the colon but in regional lymph node were massive metastases of tubular and cystopapillary adenocarcinoma. Heamatochaesia, dyschaesia and mild diarrhea were clinical symptoms in the last two cases. Endoscopy revealed thickening of the colonic wall in one patient. Tubulopapillary adenocarcinoma was diagnosed in endoscopic biopsies from these two patients.

Carcinoid clinically manifested by diarrhoea and haematochaesia. Histologically were found multiple nodular formations and diffuse infiltration of the submucosa and lamina muscularis by neoplastic cells that expressed strong positivity of chromogranin and synaptophysin. Cytokeratin was negative.

Adenocarcinoid appeared as two small nodular formations in the colon ascendens. The neoplasia was located in the subserosal connective tissue and cells were arranged in solid and tubular structures. Pseudorosette formations were around the blood capilaries. Infiltrative growth of the tumour into the interstitial connective tissue was well apparent. Neoplastic cells expressed moderate to strong positivity of chromogranin and cytokeratin, and moderate positivity for NSE. Reaction for synaptophysin was negative.

GIST

In all three dogs the neoplasia was situated in caecal wall. In one case the tumour extended into subserosal connective tissue and in the mesocaecum. Solid tumour arranged in interlacing fascicles of spindloid cells was classified histologically in all three cases. C-kit gave strong positivity, actin was moderately to strongly positive and desmin was negative. In the mesocaecum were also multinucleated cells with nuclei situated in central region of the cells. They were cytokeratin negative, c-kit strongly positive, actin moderately positive and desmin was negative. CD 18 and myeloid/histiocyte antigen were also negative in these cells.

Lymphoma appeared during laparotomy as mild thickeness of the colonic wall and moderate lymphadenopathy of the mesocolic lymph nodes. MALT lymphoma, was diagnosed on the basis of histological arrangement, CD79a positivity and CD3 negativity in the neoplastic lymphocytes. Nodular lymphoma grade III was

diagnosed in the lymph node. However, two weeks after the surgery, a multicentric lymphoma with fatal outcome developed.

Adenoma

In two females and one male nodular formation in the colon was clinically observed. Papillotubular adenoma was histologically diagnosed.

Rectum

Summary of findings in the rectum apart from adenomas is in table No. 6.

Adenocarcinoma

In the first case dyscheasia, swelling of the anus and stenosis of the rectum were clinically observed. Mucinous adenocarcinoma. with marked infiltration of neoplastic cells to the submucosa was diagnosed histologically. The second case manifested by ulceration of terminal part of rectum and anus. Histology revealed massive infiltration of carcinoma into deeper layers of anus. In the third dog a prolaps of polypous mass from the anus was clinically apparent and histologically an acinar carcinoma with infiltration submucosa of the rectum was diagnosed. Dyschesia and tumourous formation in the rectum were in fourth dog. In the first biopsy histology revealed tubulopapilar adenoma. The same type of tumour was diagnosed in second biopsy taken off few months later but massive metastases of tubular adenocarcinoma were in the regional lymph node. Only in the third biopsy, collected after another few months, adenoma and adenocarcinoma were simultaneously present in the rectum.

Carcinoid

All three tumours manifested clinically as haematochaesia, dyschaesia, in two cases prolaps of tumourous mass from anus was observed. Diagnosis was established on chromogranin positivity in the neoplastic cells.

Lymphoma

In one case was segmental thickenning of rectal wall, in the second dog manifested as a bleeding tumourous mass of walnut size in anorectal region. In both cases a diffuse lymhoma was diagnosed. In the first dog an epitheliotropism was apparent, in the second one it cannot be estimated because of ulceration of the mucosa. CD3 was in both cases negative.

Mast cell tumours

In both dogs haematochesia and hazelnut size tumour in the rectum were clinically observed. In both cases mast cell tumour of II. grade was diagnosed.

Haemangiosarcoma formed a relatively large tumour, bulging into lumen of the rectum. Histologically it was capillary haemangiosarcoma with haemorrhages. Diagnosis was confirmed by immunohistochemical detection of von Willebrand factor.

Leiomyoma appeared in terminal segment of the rectum in one female and in one male.

Rectoanal adenoma

Sex and age of dogs are presented in table No. 7.

In addition to papillotubular structures, disseminated foci of dysplastic epithelial cells characterized by eosinophilic or lightly basophilic cytoplasm and prominent nucleoli were observed in some cases. These cells lined tubules or form solid nodules. In several cases part of the tubules, lined by basophilic epithelium, invaded the submucosa. In these places laminarly arranged *lamina muscularis mucosae* was replaced by disorganized smooth muscle tissue. (Fig. 7& 8).

Table 1. List of primary antibodies, their origin and dilution

Antibody	Origin	Dilution
Actin, clone HHF35	Dako Denmark, Glostrup, DK	1:50
CD3, rabbit polyclonal anti-human	Dako Denmark, Glostrup, DK	1 : 25
CD18, clone CA16.3C6	Dr. Moore, Vet. Med. Univ. Davis, California, USA	1 : 10
CD79αcy, clone HM57	Dako Denmark, Glostrup, DK	1 : 25
CD117 (c-kit), rabbit polyclonal, anti-human	Dako Denmark, Glostrup, DK	1 : 100
Cytokeratin, clone MNF116	Dako Denmark, Glostrup, DK	1 : 50
Cytokeratin 8, rabbit polyclonal	Diagnostic BioSystems, Pleasaton, CA	1 : 50
Desmin, clone D33	Dako Denmark, Glostrup, DK	1 : 50
Epithelial membrane antigen, clone E29	Dako Denmark, Glostrup, DK	1 : 50
Myeloid/Histiocyte Antigen, clone Mac 387	Dako Denmark, Glostrup, DK	1 : 100
Neuron-Specific Enolase, clone BBS/NC/VI-H14	Dako Denmark, Glostrup, DK	1 : 100
S100 Protein, rabbit polyclonal	Dako Denmark, Glostrup, DK	1 : 300
Synaptophysin, clone SY38	Dako Denmark, Glostrup, DK	1 : 100
von Willebrand factor	Dako Denmark, Glostrup, DK	1 : 300

Table 2. Number of tumours in different parts of the gastrointestinal tract

Organ	Number	Percentage of total	Males	Females	Av. age (years)	Range (years)
Stomach	14	18.18%	3	10	9.04	6-13.5
Small intestine	15	19.49%	5	10	9.87	5-15
Colon and caecum	13	16.88%	5	8	9.15	1-14
Rectum	35	45.45%	19	16	7.76	2-13.5

Table 3. Summary of findings in the stomach

Sex	Age in years	Diagnosis	Location
Male	11	Adenocarcinoma	Antrum
Female	10	Adenocarcinoma	Antrum
Female	8	Adenocarcinoma	Antrum and body
Female	9	Adenocarcinoma	Antrum
Female	11	Adenocarcinoma	80% of stomach wall
Female	8	Adenocarcinoma	Antrum
Female	6	Adenocarcinoma	Antrum and body
Female	6	Adenocarcinoma	100% of stomach wall
Male	13.5	Adenocarcinoma	Antrum and body
Female	9	Carcinoid	Antrum
Female	11	GIST	Antrum
Male	8	Haemangiosarcoma, polyp	Antrum and bodyPylorus
Female	7	Lymphoma	100% of stomach wall

Table 4. Summary of findings in the small intestine

Sex	Age in years	Diagnosis	Location
Female	13	Adenocarcinoma	Jejunum
Female	12	Adenocarcioma	Jejunum
Male	11	Adenocarcioma	Jejunum
Female	12	Adenocarcinoma	Jejunum
Male	10	Adenocarcinoma	Jejunum
Female	8	Carcinoid	Jejunum
Female	8	Carcinoid	Jejunum
Female	7	Neurofibrosarcoma	Jejunum
Female	13	Mast cell tumour	Jejunum
Male	9	Mast cell tumour	Ileocaecal junction
Female	15	T cell lymphoma	Dudenum, jejunum
Female	11	T cell lymphoma	Not specified
Female	13	Malignant lymphoma	Jejunum
Male	8	MALT lymphoma	Jejunum
Male	5	Adenoma	Not specified

Table 5. Summary of findings in the colon and caecum

Sex	Age in years	Diagnosis	Location
Female spayed	8	Adenocarcinoma	Colon
Female	9	Adenocarcinoma	Colon
Female	9,5	Adenocarcinoma	Colon
Male	10	Adenocarcinoma	Colon
Male	1	Carcinoid	Colon
Female	11	Adenocarcinoid	Colon
Female	12	GIST	Caecum
Male	14	GIST	Caecum
Male	12	GIST	Caecum
Female	11	Lymphoma	Colon
Female	8	Adenoma	Colon
Female	8,5	Adenoma	Colon
Male	5	Adenoma	Colon

Table 6. Summary of findings in the rectum except adenomas

Sex	Age in years	Diagnosis
Male	9	Adenocarcinoma
Male	8	Adenocarcinoma
Female	12	Adenocarcinoma
Female	11	Adenocarcinoma + adenoma
Female	12	Carcinoid
Female	10	Carcinoid
Male	12,5	Carcinoid
Male	13,5	Lymphoma
Male	9	Lymphoma
Female	5	Mast cell tumour
Female spayed	10	Mast cell tumour
Female	Not determined	Haemangiosarcoma
Female	7	Leiomyoma
Male	12,5	Leiomyoma

Table 7. Sex and age of dogs with papillotubular adenoma in the rectum.

Sex	Number	Age in years	Average age
Male	13	2; 2.5; 3; 5; 6; 7; 7; 7; 7.5; 8; 9; 9; 6	5.5
Female	8	3; 5; 5; 5; 9; 11; 11; 12	7.22

Figure 1. GIST in the stomach. Tumour of sarcomatous appearance consisting of spindloid cells. Staining with HE.

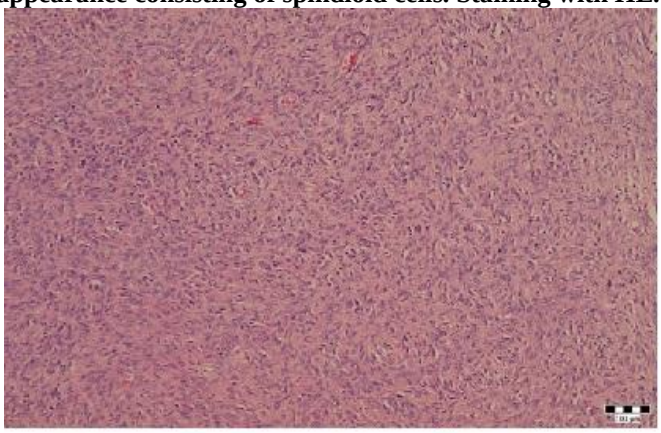


Figure 2. GIST in the stomach. The neoplastic cells are c-kit positive. Immunoperoxidase method.

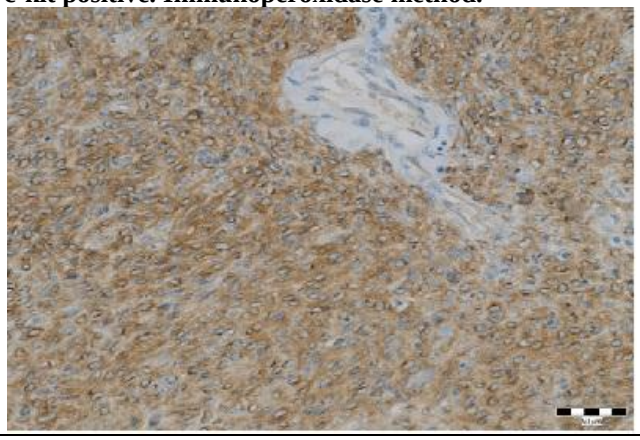


Figure 3. Carcinoid in the small intestine. Infiltration of the muscular layer by epithelioid neoplastic with numerous mitotic figures (arrows). Staining with HE.

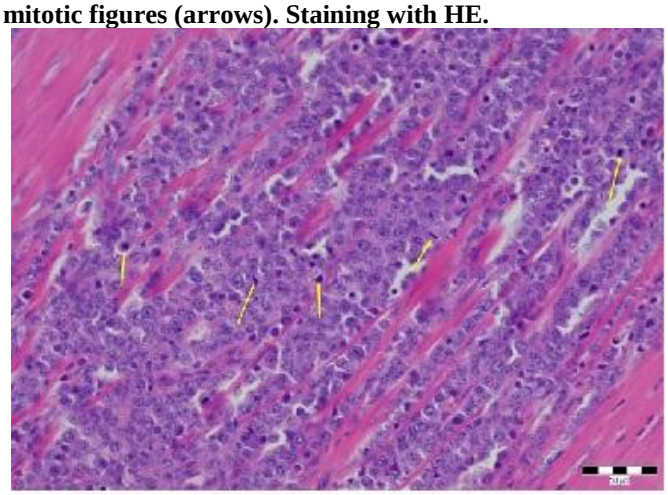


Figure 4. Detection of chromogranin in carcinoid cells. Immunoperoxidase method.

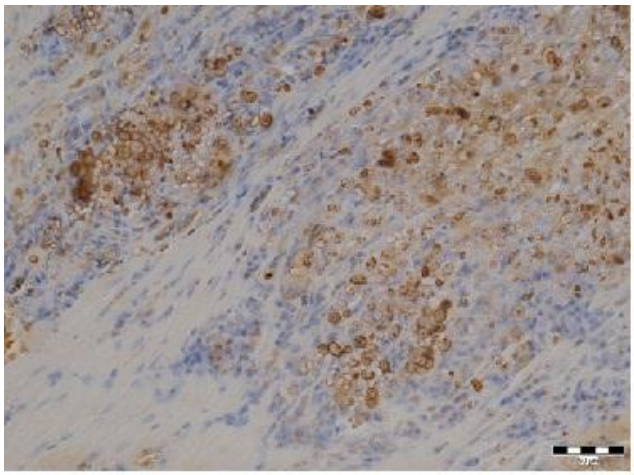


Figure 5. Anaplastic mast cell tumour in the small intestine. Marked anisocytosis and anisokaryosis of the neoplastic cells. Only sporadic eosinophils are present (arrows). Staining with HE.

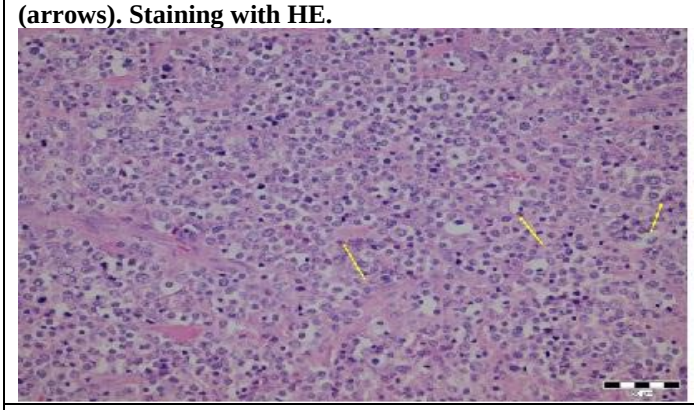


Figure 6. Mast cell tumour in the small intestine with great outnumber eosinophils. Only sporadic neoplastic mast cell are present (arrows). Staining with HE.

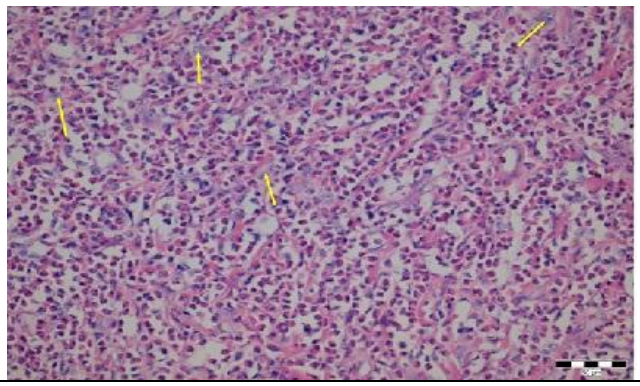


Figure 7. Basal part of papillotubular adenoma and laminarly arranged lamina muscularis mucosae (arrows). Staining with HE.

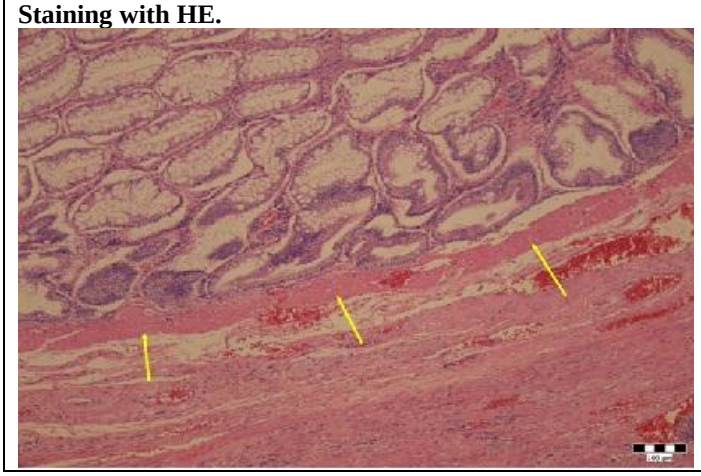
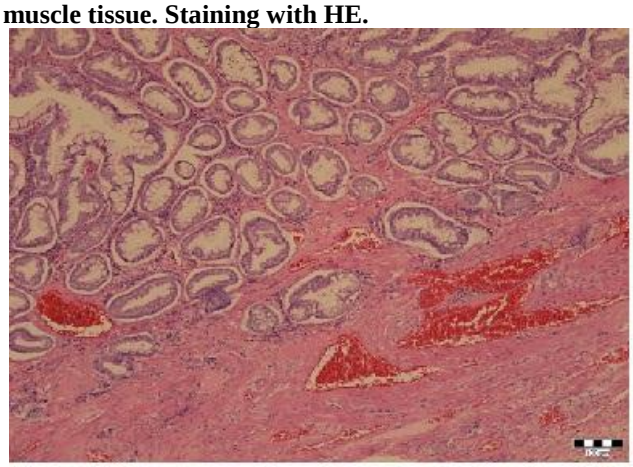


Figure 8. Basal part of papilotubular adenoma. Herniation of the crypts and disorganized smooth muscle tissue. Staining with HE.



DISCUSSION

Similarly as Sautter and Hanlon [4] but unlike to Frgelecova et al [5], we did not find breed predisposition to any type of neoplasia. This is the reason why pedigree of dogs is omitted in text of the contribution.

We found marked predominance of malignant neoplasias in the stomach that is in accordance with literature [1]. Antrum was affected in all animals. Most authors have found a predispostion in males [6], but in our cases females were more frequently affected.

According to the literature gastric carcinomas in dogs consist primarily of poorly differentiated signet-ring cell adenocarcinomas with excesive fibrosis [1,2]. In our cases, however, three carcinomas were tubular, three were papillotubular and solid and one was arranged in tubular and solid formations. Diffuse infiltration of the stomach wall by signet ring cells was present only in two cases. Munday et al [7] described in three Cairn terrier littermates hypertrophic gastropathy with histological features of Ménétrier diasease in humans. All three dogs developed later adenocarcinoma in the stomach. Nothing similar was recorded in the cases. Carcinoid (neuroendocrine carcinoma) and gastrointestinal stromal tumour in the stomach of dogs were rarely recorded in the literature and insufficient are data as concern their location, but it seems to be predilection for the large intestine [2,6]. In the our collection of tumours, one carcinoid was in the stomach, two were in the small intestine, and four plus one adenocarcinoid were in the large intestine. These numbers correspond to the literature cited above, however in our cases carcinoids represented 7.15% of tumours of the stomach, 13.3% tumours of the small intestine and 9.3% tumours of the large intestine. Carcinoids are generally regarded as slow growing malignant neoplasms that metastasize in a similar manner to adenocarcinomas. Alberts et al [8] described a poorly differentiated gastric carcinoids in the antral mucosa, that metastasized to a number of internal organs.

Bettini el al [9] have published analysis of 105 gastric and intestinal tumours of the dog. 17 of them were mesenchymal and five of these were GIST. Gillespie et al [10] proved that 55% of canine cases previously diagnosed as smooth muscle tumors were reclassified as GISTs according to c-kit immunoreactivity. Frost et al [11] found

CD117 positivity only in 52% of GIST in dogs. 29% of patients had metastasis in the liver or abdominal cavity. Romagnoli et al [12] detected c-kit positivity in 96% of human GIST. We diagnosed GIST only on base of c-kit positivity.

Tumours in the small intestine may occur at any level from duodenum to ileum. In the collection the jejunum was the most affected by neoplastic proces, in 11 of 14 cases. According to literature adenocarcinomas are usually solitary, nearly always annular stenosing and rapidly spreading by permeation of tissue spaces and lymphatics to mesenteric lymph nodes. Peritoneal carcinomatosis and haematogeneous spread to the liver are less common, and metastasis to the lung or other organs are rare. Spreading carcinoma into the intestinal wall and in the adjacent mesenterium was recorded in all our cases. Head et al [2] classify carcinomas in four categories. Adenocarcinoma forming tubules or acini in which are some goblet cells. Mucinous adenocarcinoma in which more than 50% of the cells produce mucin. Signet ring cell carcinoma implies that more than 50% of the tumour is composed of isolated cells with intracellular mucin. Undifferentiated (solid) carcinoma in that neither glands or mucin can be identified. In the our cases three adenocarcinomas were tubulopapilar and two were tubular. Numerous goblet neoplastic cells and mucin deposits were present in the all adenocarcinomas. Adenocarcinoma of the ileum in one year old female Keeshond was described by Howard et al [13]. The tumour invaded of the intestinal muscular layer but did not metastasized into the regional lymph node.

Six carcinoids and one adenocarcinoid were located in the intestine in our collection. Two were in the small intestine, one carcinoid and adenocarcinoid were in the colon and three carcinoids were in the rectum. In the small intestine the carcinoids were located in the jejunum and in one dog metastasis in regional lymph node was noted. On the basis of articles published by Giles et al [14], Syke and Cooper [15] and Sako et al [16], it seems that carcinoid in dogs is more malignant than in humans.

Only one adenoma of the small intestine was diagnosed in set of our cases. According to literature, diagnosis of mast cell tumours in the intestine usually consists on presence of eosinophils. However, Giemsa stain may not prove metachromatic granules and c-kit is usually negative, because mucosal mast cells are not the same as mesenchymal ones and require fixation by Carnoy's fixative to enhance metachromasia. Moreover cytoplasmic granules may not stain because either the cells are anaplastic or degranulated. In the our cases of mast cell tumours in the small intestine some metachromatic granules in the neoplastic mast cells were proved by means of Giemsa stain and c-kit imunoreactivity was positive, although mostly was week. In the rectum, however, histological properties of mast cell tumours was similar to ones located in the skin. On the other hand Ozaki et al [17] described T-cell lymphoma with eosinophilic infiltration involving the intestinal tract in 11 dogs. In all the cases the lymphocytes were CD3 positive and mast cell tryptase negative, though in one case c-kit positivity was present.

A lymphoma was diagnosed altogether in seven cases of our collection. B cell lymphoma was in the stomach. One MALToma, one T cell lymphoma, and one lymphoma CD3, CD18 and CD79a negative were in the small intestine. One MALToma and two epitheliotropic, CD3 negative, lymphomas were in the large intestine. These findings do not correspond with Coyle and Steinberg [18], who found 75% of CD3 positive lymphoma in canine gastrointestinal tract. In eight of 41 analysed cases the neoplastic lymphocytes were both CD3 and CD79 negative. The authors assume that it could be either due immature cells or true null cells.

When presence of neoplasias in all parts of the large intestine is evaluated, their 55% incidence in the our colletion corresponds to literary data – up to 60%. No sex predominance and mild predominance of benign tumours – 26 to 22 malignant are apparent. The results are rather different, if the colon with caecum are evaluated separately from the rectum. In the colon and caecum predominated malignant tumours – 8 to 3 benign and slightly predominated females – 7 to 4 males. Adenocarcinoma, adenoma and adenocarcinoid were located in the colon, carcinoid affected colon and caecum and all GISTs, were present in the caecal wall.

Benign tumours predominated in the rectum including anorectal region – 23 versus 12 malignant ones, and males were lightly more affected than females – 19 versus 16. Differentiated crypts situated in the submucosa were present in some of our cases of colerectal adenoma (rcctal papillary adenoma). In these cases the *lamina muscularis mucosae* disapeared and was replaced by disorganized smooth muscle tissue. Similar finding was observed in normal human colon and in human ulcerative colitis, as well as in inflammated colon of primates, and it was named mucosal herniation of the crypts [19,20]. It seems therefore that for presence of differentiated crypts in submucosa associated with papillary adenomas in dogs, the term herniation of the crypt could be more appropriate than invasion.

In the analyzed collection of tumours, no fibrosarcoma, leiomyosarcoma, or benign tumor of neuronal origin were diagnosed, but in one dog neurofibrosarcoma appeared, which is not in accordance with Head et al [2] who report that malignant tumours of neurogenic origin were not been observed.

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