The Histological Appearance of Large Intestinal Biopsies in Dogs with Clinical Signs of Large Bowel Disease

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ABSTRACT

Colonic and rectal forceps and excision biopsies of 355 dogs with clinical signs of large bowel disease were investigated. Five percent of the forceps biopsies were unsuitable for examination; all excision biopsies were of good quality. Forceps biopsies were obtained from one to eight sites, up to 60 cm cranial from the anus, while excision biopsies, mostly from tumors, were from the rectoanal region.

Slight to severe colitis and/or proctitis was found in 192 dogs (54%). A single type of colitis was seen in 160 dogs; in 53 cases the lesions were local, in 107 cases multiple. A combination of different types of colitis was found in 32 dogs. Atrophic colitis, diffuse colitis and canine histiocytic ulcerative colitis were the most prominent findings, followed by ulcerative, superficial and eosinophilic colitis. Follicular, hypertrophic and aspecific granulomatous colitis were found in only a few cases. Tumors were diagnosed in 57 dogs (16%). Of these tumors 50 were of epithelial and seven were of mesenchymal origin. A high percentage (61%) of the epithelial tumors consisted of adenomas of the rectoanal region. In ten other dogs (3%) a differential diagnosis of lymphosarcoma or colitis had to be made. Colitis and colorectal tumors were more prevalent in Boxers, German Shepherds, Poodles, Great Danes and Spaniels. In the Boxers simple chronic colitis, as well as canine histiocytic ulcerative colitis were more frequently found, the latter especially in females.

Other biopsy findings were edema, crypt cysts, hemorrhages, an increased number of intraepithelial lymphocytes and an increased or decreased number of goblet cells.

RÉSUMÉ

Cette étude portait sur 355 chiens qui manifestaient des signes cliniques d'un atteinte du côlon et elle consistait à prélever des biopsies du côlon et du rectum, à l'aide d'un forceps ou par excision; 5% des biopsies obtenues avec un forceps s'avérèrent insatisfaisantes pour l'histopathologie, alors que toutes celles qui provenaient d'une excision se révélèrent de bonne qualité. Les biopsies prélevées avec un forceps provenaient d'un à huit sites et d'aussi loin que 60 cm en avant de l'anus, tandis que celles qui résultaient d'une excision intéressaient surtout des tumeurs et provenaient de la région recto-anale.

L'histopathologie de ces biopsies révéla une colite et/ou une proctite sévères, chez 192, i.e. 54% des chiens; une colite simple, chez 160; des lésions locales, dans 53 cas, et multiples, dans 107 autres. Une combinaison de divers types de colite se retrouva, chez 32 chiens. Les colites atrophique, diffuse et histiocytaire ulcéreuse se révélèrent plus fréquentes que les colites ulcéreuse, superficielle et à éosinophiles. Les colites folliculaire, hypertrophique et granulomateuse non spécifique ne représentaient que quelques cas.

Des tumeurs affectaient 57 des chiens, i.e. 16%; 50 d'entre elles étaient de nature épithéliale et sept, d'origine mésenchymateuse. Autant que 61% des tumeurs épithéliales correspondaient à des adénomes de la région recto-anale. Chez dix autres chiens, i.e. 3%, il fallut poser un diagnostic différentiel entre un lymphosarcome et une colite. La colite et les tumeurs du côlon et du rectum affectaient surtout des Boxer, des Bergers allemands, des Caniches, des Grands Danois et des Épagneuls. Les colites chronique simple et histiocytaire ulcéreuse se rencontrèrent plus souvent chez des Boxer et la dernière, surtout chez des femelles.

Les autres lésions microscopiques comprenaient de l'oedème, des kystes des cryptes de Lieberkühn, des hémorragies, une augmentation du nombre de lymphocytes intraépithéliaux, ainsi qu'une augmentation ou une diminution du nombre de cellules à gobelet.

INTRODUCTION

In dogs the technique of forceps biopsy of the colon and rectum during coloscopy has been described (1-8). The method of excision biopsy taken under direct vision (during polypectomy) of the rectoanal region has also been reported (7,9,10).

Histological examination is necessary to confirm the endoscopic findings and to detect minute lesions of the colon mucosa.

Some histological characteristics of large intestinal biopsies in normal dogs have been reported (4); data on dogs with large bowel disease are scarce and chiefly of specific diseases, usually in only a few patients (5,10-12).

The aim of this study was to describe the histological appearance of colonic and rectal forceps and excision biopsies in 355 dogs with clinical signs of large bowel disease in relation to breed, sex and age.

MATERIALS AND METHODS

Colonic and rectal biopsies were taken in 355 dogs. They were admitted to the Small Animal Clinic in Utrecht, Division of Gastroenterology (R.P. Happé), with clinical signs of large bowel disease. Generally the dogs showed frequent defecation, often with mucus and blood, and sometimes tenesmus was reported. Most of the dogs had diarrhea, several times with anorexia, listlessness and some weight loss.

The group contained 29 mongrels; 324 dogs belonged to 57 different purebreeds, including 29 specified mongrel dogs. In two dogs the breed was not recorded. The age ranged from 0.5-15 years; 189 dogs were younger than five years, 116 were from five to ten years old and 45 dogs were ten years or older. In five dogs the age was unknown. In two dogs the sex was not recorded, 210 dogs were males, 143 were females.

Forceps biopsies only were taken in 307 dogs, excision biopsies only in 43 dogs and a combination of forceps and excision biopsies in five dogs (Table I). Colonic and rectal forceps biopsies were taken during colonoscopy with a fiberscope (model CF-LB, Olympus, as was used for gastroscopy) (13). In general, biopsies were obtained systematically from the rectum and colon up to 60 cm cranial from the anus. From one to eight sites were biopsied, and sometimes more than one biopsy was taken from the same area. The excision biopsies were taken from the rectoanal region under direct observation using a speculum if necessary. This was mostly polypectomy to remove tumors or tumorlike lesions. The numbers of sites, types and quality of large intestinal forceps biopsies, excision biopsies and their combinations are presented in Table I.

As controls the whole colons of five clinically healthy dogs (Bull Terriers) were obtained after euthanasia; three were males and two females. The age ranged from 1.5 to 5.5 years. Samples of the intestinal wall were taken from parts of the colon which were not dilated by large amounts of contents. The mucosal thickness in three different areas, colon ascendens, transversum and descendens, was measured at 15 places each.

TABLE I. Survey of the Number of Sites, Types and Quality of Colonic and Rectal Biopsies in 355 Dogs with Clinical Signs of Large Bowel Disease

	Number of Sites	Number of Dogs	Number of Biopsies of Good Quality	Unsuitable for Examination
Forceps biopsies	1	77	170	21
	2	27	106	2
	3	55	264	15
	4	58	319	6
	5	64	344	21
	6	20	149	8
	7	5	33	4
	8	1	8	—
Forceps and excision biopsies		5	26	1
Excision biopsies		43	90	—
Total		355	1509	78

The large intestinal specimens were fixed in Baker's fixative (14), cut exactly perpendicular to the mucosa and embedded in paraffin. Sections (6 μm) were stained routinely with hematoxylin and eosin (H&E), van Gieson and periodic acid Schiff (PAS). All sections were examined and graded by one pathologist to avoid interpersonal variations.

Colitis and fibrosis were diagnosed if, respectively, the cellular infiltration and the amount of connective tissue exceeded the range found in control dogs. Atrophy was diagnosed if the mucosal thickness was below the normal range and cellular infiltration was not increased.

For the descriptive nomenclature of the type, stage and extension of inflammation the following morphological classification of colitis was used. Acute colitis was divided into three types, i.e. catarrhal, hemorrhagic (-necrotic) and pseudomembranous. Chronic colitis was divided into four main types, i.e. simple, hypertrophic, atrophic and granulomatous colitis. Simple colitis applied to several subtypes of colitis without changes of the mucosal thickness, i.e. superficial, diffuse and follicular colitis, reflecting the distribution of inflammatory cells.

In addition, solitary pathological findings such as crypt cysts, edema, hemorrhages, increased number of intraepithelial cells and an increased or decreased number of goblet cells were noted.

Local changes were distinguished from more generalized changes by multiple biopsies. If only one biopsy showed colitis or proctitis this was classified as local. If the lesions were present in two or more biopsies, the colitis was called multiple. In this study colitis and proctitis were not differentiated, and inflammation of the rectal region was recorded as colitis.

Tumor determination was according to the WHO classification (15).

RESULTS

The colonic mucosa in the control dogs showed straight unbranched crypts, which lay strictly parallel and close to each other (Fig. 1). The mean thickness in the colon descendens was 0.60 mm (range 0.4-0.75 mm; SD = 0.092), the mean thickness of the colon transversum was 0.60 mm (range 0.5-0.7 mm; SD = 0.08) and the mean thickness of the colon ascendens was 0.61 mm (range 0.5-0.75; SD = 0.07). The surface epithelium consisted of simple columnar (absorptive) cells among which a few goblet cells were interspersed. The crypts were lined predominantly by goblet cells next to the columnar cells except for the lowest one third where some undifferentiated as well as a few enteroendocrine cells were found. Mitoses were found only incidentally. The lamina propria contained a delicate connective tissue with some capillaries, and variable, but small numbers of lymphoid cells, plasma cells and some macrophages. Lymphoid follicles were seen incidentally,
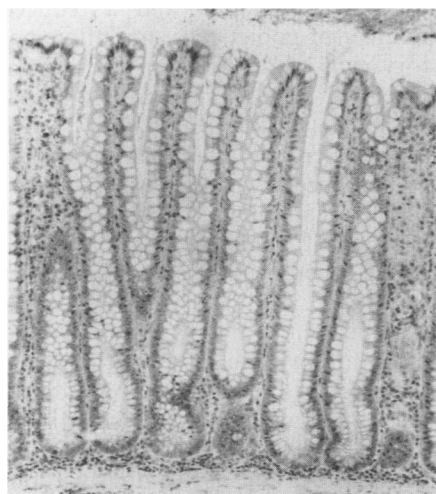
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Fig. 1. Normal colon mucosa: crypts of Lieberkühn lined by goblet and absorptive cells, lamina propria with some connective tissue and a few round cells. (Bull terrier, male, 1.5 year). H & E. X200.

TABLE II. Survey of the Different Types of Single Chronic Colitis, Age and Sex Ratio in 160 Dogs with Clinical Signs of Chronic Large Bowel Disease

Type of Colitis	Number of Dogs	Number of Dogs with Colitis Local	Multiple	Age in Years 0-4	5-9	10-15	?[a]	Average Age	Sex Ratio F:M
Superficial	12	2	10	6	4	2	—	5.1	2:10
Diffuse	40	14	26	23	11	6	—	4.5	12:27[b]
Follicular	3	3	—	—	3	—	—	7.5	1: 2
Hypertrophic	2	2	—	—	2	—	—	7.5	0: 2
Atrophic	53	23	30	29	15	7	2	5.2	24:29
Granulomatous	1	—	1	—	1	—	—	5.5	1: 0
CHUC[c]	26	2	24	24	2	—	—	2.1	17: 9
Ulcerative	14	3	11	5	7	2	—	5.9	6: 8
Eosinophilic	9	4	5	5	4	—	—	3.9	3: 6
Total	160	53	107	92	49	17	2		66:93

[a] Age unknown
[b] In one dog the sex was unknown
[c] Canine histiocytic ulcerative colitis

sometimes extending into the submucosa. Few intraepithelial lymphocytes were present.

A total number of 1488 colonic and rectal forceps biopsies and 99 excision biopsies were taken (Table I). The quality of the forceps biopsies was variable. In 61% they included the full thickness of the mucosa with muscularis mucosae and often a small amount of the submucosa. In 34% full length crypts were present, but the muscularis mucosae was absent. If the biopsies were still more superficial or cut obliquely (5% in total) they were classified as unsuitable for histological examination. The quality of all excision biopsies was good. In most patients with tumors a large part of the tumor, surrounding mucosa, muscularis mucosae, submucosa and sometimes even the muscular layer was present in the excision biopsies. Some pressure artifacts were found.

The different types of single chronic colitis found in the biopsies of 160 dogs are represented in Table II. A survey of combined colitis in 32 dogs is given in Table III. Examples of the different types of colitis are shown in Figs 2-8, i.e. superficial colitis (Fig. 2), diffuse colitis (Fig. 3), follicular colitis (Fig. 4), hypertrophic colitis (Fig. 5), atrophic colitis (Fig. 6), canine histiocytic ulcerative colitis (CHUC) (Fig. 7) and ulcerative colitis (Fig. 8).

Acute colitis was found in four dogs in combination with different types of chronic colitis and several times in dogs with tumors.

A survey of the breeds and the number of diseased dogs with colitis and/or large intestinal tumors are given in Table IV. In these groups dogs were included which showed phenotypic characteristics of a special breed although they were not purebred. Canine histiocytic ulcerative colitis was found in 25 Boxer dogs and in one

French Bulldog. Eosinophilic colitis was seen in three German Shepherd dogs, a mongrel shepherd dog and two Afghans.

In those excision biopsies of the rectoanal region which were covered with squamous cell epithelium and in which the glandular rectal part was not inflamed, the term proctitis or colitis was not used. This occurred in three dogs with a catarrhal, a simple diffuse and a nonspecific granulomatous inflammation, respectively. Local

TABLE III. Survey of the Different Types of Combined Colitis, Age and Sex Ratio in 32 Dogs with Clinical Signs of Large Bowel Disease

Type of Colitis	Number of Dogs	Age in Years 0-4	5-9	10-15	Average Age	Sex Ratio F:M
Superficial and diffuse	2	2	—	—	1	1:1
Superficial and atrophic	8	6	2	—	3	3:5
Superficial and eosinophilic	1	1	—	—	1	0:1
Superficial and catarrhal	1	—	—	1	10.5	1:0
Diffuse and atrophic	11	7	3	1	4.09	6:5
Diffuse and eosinophilic	1	1	—	—	3	0:1
Atrophic and ulcerative	1	1	—	—	4	0:1
Atrophic and catarrhal	1	1	—	—	3.5	0:1
Superficial, diffuse and atrophic	2	2	—	—	1	1:1
Superficial, diffuse and eosinophilic	1	1	—	—	2	0:1
Diffuse, atrophic and ulcerative	1	—	1	—	9	0:1
Diffuse, atrophic and hemorrhagic	1	1	—	—	3	0:1
Diffuse, atrophic and catarrhal	1	1			2.5	1:0
Total	32	24	6	2		13:19
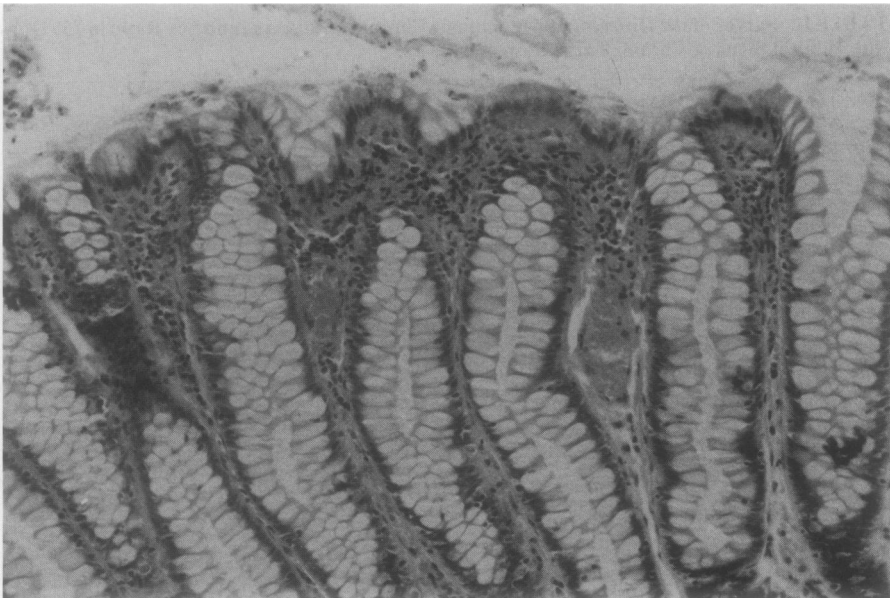
Fig. 2. Superficial colitis: round cell infiltration in the superficial layer of the lamina propria; slight increase of goblet cells. (Golden Retriever, male, 0.5 year). H & E. X200.

atrophic epithelium and a reduced number of goblet cells; no inflammatory cells were found in the lumen. One dog had an increased mucosal thickness without inflammation.

An increased number of intra-epithelial cells was found in 185 dogs, often in combination with a reduced number of goblet cells and chronic colitis. Increased numbers of goblet cells were found in 48 dogs with chronic colitis, in 24 with tumors and in 13 dogs without other pathological changes of the colon. A reduced number of goblet cells was found in 61 dogs with chronic colitis, in six dogs with tumors and in five dogs without other lesions. In 17 dogs with chronic colitis the goblet cells were increased in number in some places and decreased elsewhere. The most obvious decrease in the number of goblet cells was found in CHUC.

In cases of mild to moderate colitis the superficial epithelium showed minor changes consisting of a reversion to a flatter epithelium, often with small erosions (sometimes artifacts could not be excluded). In many cases of severe colitis, the distance between the base of the crypts and the muscularis mucosae was obviously increased by infiltrations of lympho-

fibrosis and erosions were also found.

Hemorrhages, fibrin and neutrophils without colonic mucosa were found in one dog, with colonic mucosa and ulceration in another dog.

In two dogs an intussusception of the small intestine into the large intestine was diagnosed. In one dog the intussuseption was combined with a multiple superficial colitis.

In five dogs edema was found without inflammatory cells or tumors. Crypt dilation or crypt cysts were seen in 38 dogs, in some cases without obvious inflammatory changes of the mucosa. These crypts often had an

Fig. 3. Diffuse colitis: diffuse round cell infiltration, decrease of goblet cells, increase of intraepithelial cells. (Mongrel dog, female, 1 year). H & E. X200.
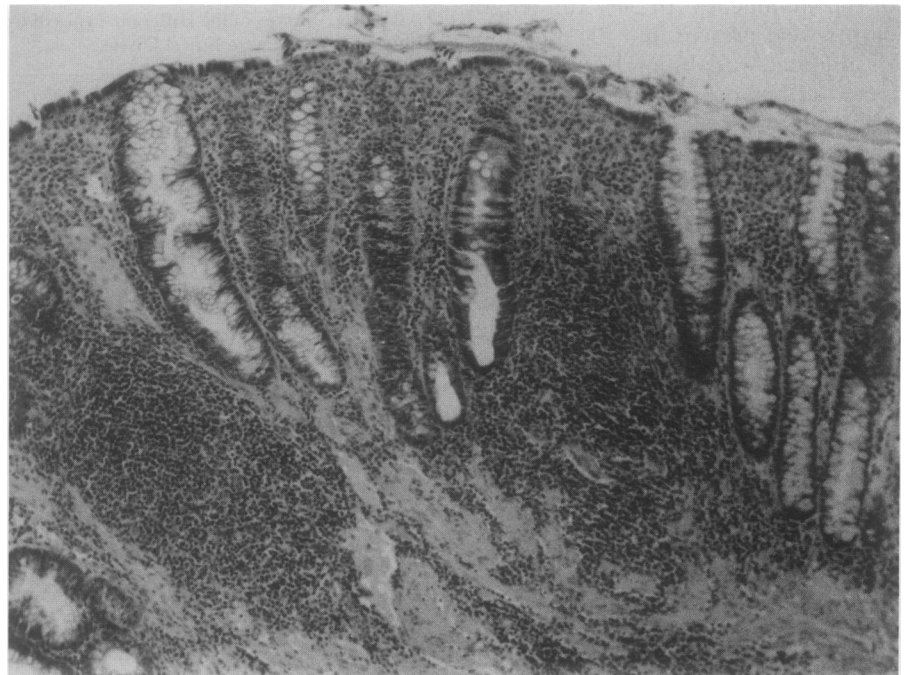
Fig. 4. Follicular colitis: increased size of follicles, diffuse round cell infiltration in the remaining lamina propria, slight fibrosis, (German Shepherd, male, 9 years). H & E. X100.
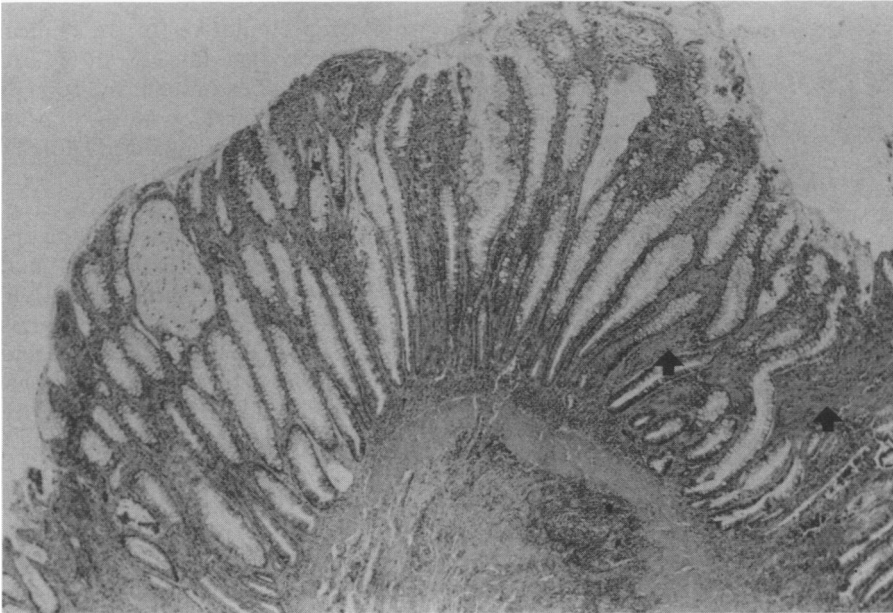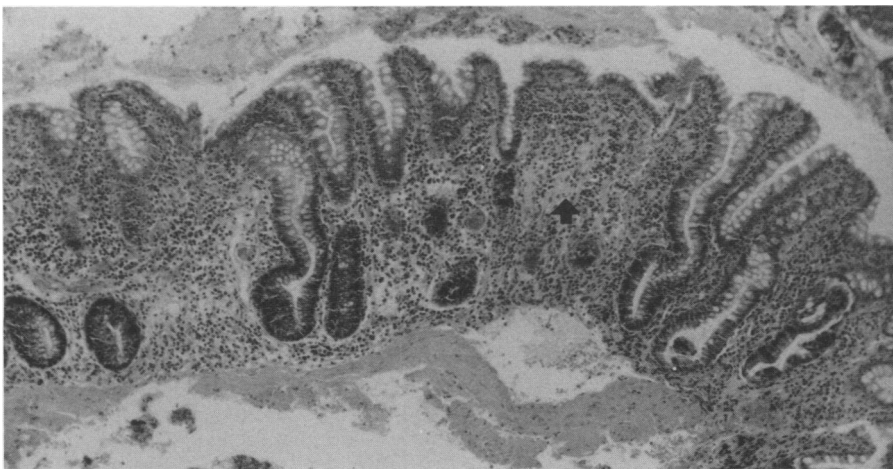
Fig. 5. Hypertrophic colitis: increased thickness of the mucosa with elongation of the crypts of Lieberkühn and increase of goblet cells with diffuse round cell infiltration in the lamina propria and slight fibrosis (arrow). (Collie, female, 8 years). H & E. X40.
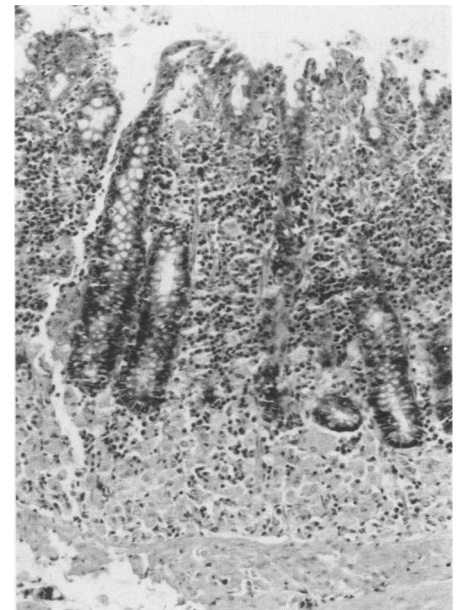
four cases the severity of the dysplasia was such that no conclusive diagnosis of adenoma was possible; in addition some extension into the connective tissue seemed to exist, so a differential diagnosis of adenoma or carcinoma was made.

DISCUSSION

Both forceps and excision biopsy techniques appeared to be safe methods for obtaining colonic and rectal mucosal specimens in dogs, as no complications were observed after biopsy sampling in 355 dogs.

Forceps biopsy yielded suitable specimens in 95% of cases, while all the excision biopsies were satisfactory, although some pressure artifacts were present.

It seems unnecessary to biopsy multiple sites in a dog with endoscopically obvious diffuse large bowel disease or in cases of rectal polyps. However, in other cases it is essential to take multiple biopsies, if possible, from the areas which show most marked changes by endoscopy, to ensure that the pathological findings

cytes and plasma cells. The same pattern was also found in cases of severe CHUC, caused by histiocytic infiltration.

Dogs with large lymphoid follicles in the biopsies often showed a thinner mucosa superficial to the follicles.

In 57 dogs tumors were diagnosed (Table V). Fifty of the tumors were of epithelial origin (Figs 9 and 10) and seven of mesenchymal origin (Fig. 11). In ten dogs a differential diagnosis of lymphosarcoma or colitis had to be made. In dogs with tumors, colitis or proctitis was frequently found in the superficial area, as well as the surrounding mucosa. Often a hyperplasia of goblet cells was present in the area around the tumor, sometimes with elongation of the crypts and without inflammation. In most dogs with exophytic growing adenoma-like tumors a mild to severe dysplasia of the epithelial cells could be found. In

Fig. 6. Atrophic colitis: decreased thickness of the mucosa, shortening of crypts, decrease of goblet cells, increase of basophilic, undifferentiated cells especially in the basal area of the crypts of Lieberkühn, diffuse round cell infiltration in the lamina propria and slight fibrosis (arrow). (Steenbrak, male, 9 years). H & E. X40.

Fig. 7. Canine histiocytic ulcerative colitis (CHUC): infiltration with plasma cells, lymphocytes, neutrophils and histiocytes, the latter especially between the bases of the crypts of Lieberkühn and the muscularis mucosae. (Boxer, female, 2 years). H & E. X200.
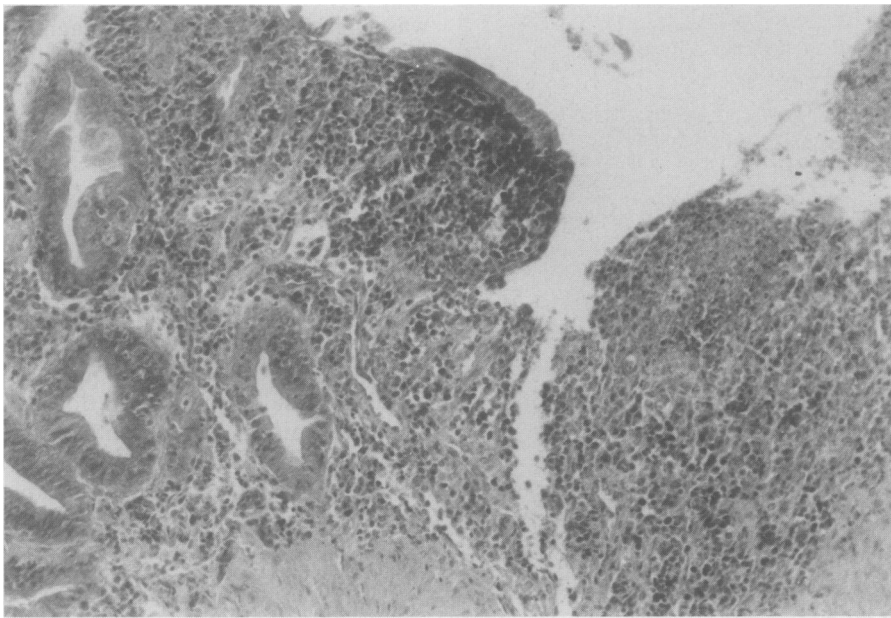
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Fig. 8. Ulcerative colitis: erosion and infiltration with inflammatory cells and loss of crypts at the edge of the ulcer. (German Shepherd, male, 7 years). H & E. X200.

will be representative for the clinical and colonoscopic data. So in 66% of the 307 dogs examined by forceps biopsies only, three or more biopsies were taken at different sites (Table I). Often pathological changes were found only in one biopsy (Table II).

Atrophic, diffuse and canine histiocytic ulcerative colitis were found most frequently, and ulcerative, superficial and eosinophilic colitis less often. Sometimes a follicular and hypertrophic colitis was present. Atrophic and diffuse colitis are described in dogs as chronic colitis with and without atrophy (5,8). Canine ulcerative colitis has been mentioned in a group of 133 dogs, including 57 Boxers with CHUC (20). Superficial, follicular and hypertrophic colitis has not been described in veterinary handbooks (7,8,16-18). Although hyperplasia of crypt epithe-

TABLE IV. Breeds and Number of Dogs with Colitis and/or Colorectal Tumors, Atrophy and Fibrosis

Breed	No of Affected/ Submitted Dogs	Simple Colitis	Combined Colitis	Adenoma	Adenoma/ Carcinoma	Carci- noma	Lympho- sarcoma	Lympho- sarcoma/ Colitis	Sarcoma	Atrophy	Atrophy/ Fibrosis
Mongrel	25/29	9	3	7	1	—	1	2	—	2	—
Boxer	58/63	45	7	2	—	1	1	—	—	1	1
Shepherds[a]	36/41	22	3	—	—	2	—	2	—	6	1
Poodle	25/35	12	1	5	—	2	—	2	—	3	—
Terriers[b]	25/27	9	3	4	—	1	1	2	—	4	—
Bouvier	20/20	8	5	3	—	1	—	—	—	3	—
Danish Dog	14/15	8	1	3	—	—	—	—	—	2	—
Dachshound	13/15	5	1	1	—	—	1	—	1	4	—
Spaniel	12/15	4	1	1	—	1	1	—	—	3	1
Collie	12/16	3	2	3	2	1	—	—	—	1	—
Pointer	8/9	5	—	—	—	1	—	—	—	1	1
Setters	7/7	3	1	1	—	—	—	—	—	2	—
Dob. pinscher	4/7	—	—	2	—	—	—	1	—	1	—
Greyhounds[c]	4/5	3	—	—	—	—	—	—	—	—	1
Retriever	4/7	3	—	—	—	1	—	—	—	—	—
Dalmation	3/3	3	—	—	—	—	—	—	—	—	—
Dr. Patrijs	3/3	2	—	—	—	—	—	—	—	1	—
Schnautzer	2/3	2	—	—	—	—	—	—	—	—	—
Schw. Laufhund	2/3	—	1	—	—	—	—	1	—	—	—
Basset	2/2	1	—	1	—	—	—	—	—	—	—
Foxhound	2/2	—	1	—	—	—	—	—	—·	1	—
Heidewachtel	2/2	2	—	—	—	—	—	—	—	—	—
Keeshond	2/2	—	—	1	—	—	—	—	—	1	—
Lhasa Apso	2/2	1	—	—	—	—	—	—	—	1	—
Rottweiler	2/2	2	—	—	—	—	—	—	—	—	—
French Bulldog	1/2	1	—	—	—	—	—	—	—	—	—
Saint Bernard	1/2	—	—	1	—	—	—	—	—	—	—
Steenbrak	1/2	—	1	—	—	—	—	—	—	—	—
Other breeds[d]	12/12	7	1	—	1	—	—	—	1	1	1
Unknown	1/2	—	—	—	—	—	—	—	—	—	1
Total	304/355	160	32	35	4	11	5	10	2	38	7

[a]German Shepherd dogs and different Belgian Shepherd dogs
[b]Airdale, Bedlington, Border, Cairn, Fox, Irish and Welsh terrier
[c]Afghan hound and Whippet
[d]Alaskan Malamute, Beagle, Bernese Mountain dog, Briard, English Bulldog, Kooiker, Kuvasz, Maltese, Old English Sheepdog, Visla, Welsh Corgi and Wetterhoun

TABLE V. Survey of the Different Types of Large Intestinal Tumors or Tumor-like Lesions, Age and Sex Ratio in 67 Dogs with Clinical Signs of Large Bowel Disease

Type of Tumor	Number of Dogs	Age in Years				Average Age	Sex Ratio F:M
		0-4	5-9	10-15	?[a]		
Tubular adenoma	16	—	9	6	1	8.6	7:9
Papillar adenoma	8	1	5	2	—	7.9	3:5
Papillotubular adenoma	11	4	3	3	1	6.3	4:7
DD[b] adenoma/carcinoma	4	—	3	1	—	8.3	3:1
Carcinoma	11	1	6	4	—	8.8	3:8
Sarcoma	2	—	1	1	—	8	0:2
Lymphosarcoma	5	—	5	—	—	7	3:2
DD Lymphosarcoma/ colitis	10	2	5	3	—	7.7	5:5
Total	67	8	37	20	2		28:39

[a]Age unknown
[b]Differential diagnosis
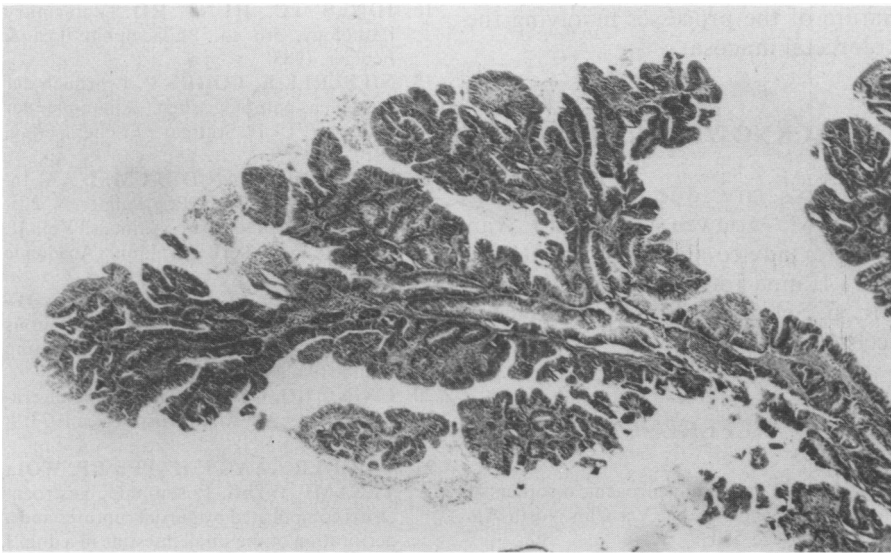
Fig. 9. Papillar adenoma. (Poodle, male, 9.5 years). H & E. X100.

Fig. 10. Carcinoma: small spot of epithelial tumor cells in the edematous lamina propria. (Bouvier des Flandres, male, 5 years). H & E. X200.

lium has been mentioned (6) this has not been called hypertrophic colitis. Aspecific granulomatous colitis, which was seen only once in the present study, does not resemble the eosinophilic granulomatous colitis described in a Bouvier de Flandres (19). Although it is very important for the diagnosis whether a colitis is transmural or not, often this can not be determined in the biopsies. In CHUC, as well as in ulcerative colitis, indications of a transmural inflammation, which points to a bad prognosis (6), were sometimes found.

One of the aims of this detailed classification of colitis was to examine if a correlation exists between special types of chronic colitis and breed, sex and/or age.

There is a high prevalance of colitis in the Boxer breed, not only of CHUC, but also of simple chronic colitis. Eosinophilic colitis is best known in German Shepherd dogs (18), as was seen in the present study. In a recent series of 136 cases Bush (3) mentioned the highest incidence of colitis in the Collie breeds, the Spaniel breeds, the Golden Retriever and the German Shepherd. This was only partly confirmed in this study.

All types of colitis except for granulomatous colitis (especially CHUC), were more frequent in males than in females.

The average age of dogs with simple superficial and diffuse colitis, atrophic, aspecific granulomatous and ulcerative colitis varied from 4.5 to 5.8 years. This was in contrast to dogs suffering from CHUC or eosinophilic colitis, which were younger, and with follicular and hypertrophic colitis which were found in older dogs. According to Ewing and Gomez (20) 57.9% of non-Boxer dogs developed ulcerative colitis before two years of age, while in the present study this figure was only 23% (data not shown). In the literature, all dogs with eosinophilic colitis were younger than five years (21). In this study three dogs were five years or older (two seven years old). If the different types of colitis are part of one dynamic process then a correlation between the average ages of the groups of dogs and the different types of colitis could be expected. The only evidence of this was in the dogs with follicular and
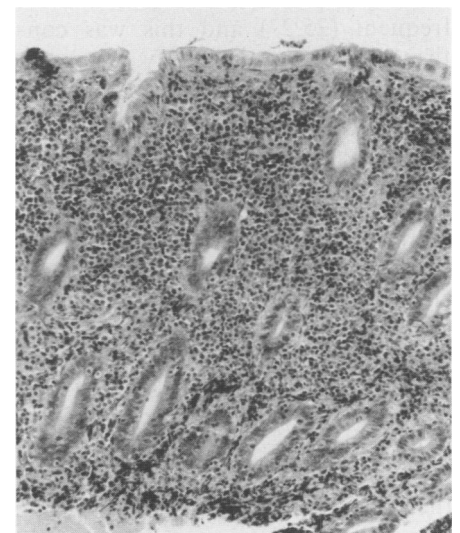
Fig. 11. Lymphosarcoma: diffuse infiltration of lymphoblasts in the lamina propria. Note the absence of lymphocytes in the epithelial layer. (Mongrel dog, female, 8 years). H & E. X200.

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hypertrophic colitis, which could be an end stage of other colitides. Bush (3) has reported that the onset of colitis in dogs could occur at any age but mainly in young adults before five years (with a peak between one and two years) and a second smaller rise in incidence between seven and eight years of age. This is in accord with the present findings. The young age of dogs with eosinophilic colitis may be correlated with a parasitic or allergic pathogenesis (8). The young age of Boxer dogs with CHUC may be due to an immunological deficiency or to an enzyme-deficiency of histiocytes (22,23). Another hypothesis concerning the pathogenesis of CHUC is that those Boxer dogs are exposed to (an) agent(s) which cause(s) aspecific colitis in other breeds as well and that Boxers are unusual in that they respond with an accumulation of PAS-positive histiocytes (24). Kent and Moon (24) have raised the question whether Boxers are able to develop chronic colitis without such histiocytic accumulation. Based on our study this question can be answered positively as there were 28 Boxers with different types of chronic colitis without PAS-positive histiocytes, and some of them were older than the age range of CHUC.

Neoplasms of the canine intestinal tract are uncommon compared with human intestinal neoplasms (25,26). Among canine intestinal tumors those of the distal colon and rectum are most frequent (25,27) and this was confirmed in the present study. A mild to severe atypia is present in some adenomas. This phenomenon may be a sign of malignant progression as has been found in papillotubular adenomas (10). Comparing our dogs with epithelial tumors to those described in the veterinary literature there are some similarities concerning breed, age and sex. A prevalence for Poodles, Airdale terriers, and Collies described by others (28-30) was also seen in this study.

In general the age of all dogs with tumors is above five years. Whether the colorectal tumors really occur more frequently in males than in females, as appears in this population,

cannot be decided since male dogs are kept more often than females.

It may be of interest that some breeds, such as Boxers, German Shepherds, Poodles, Great Danes and Spaniels appear to be more susceptible than other breeds to inflammatory and neoplastic large bowel changes.

Although a limiting factor in making a reliable diagnosis on colonic forceps biopsies is the small size of the tissue specimens available, especially if only a few biopsies have been taken, important information can be obtained in most cases about the nature of the processes involving the colorectal mucosa.

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