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Colonoscopic and histologic features of rectal masses in dogs: 82 cases (1995–2012)

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Abstract

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OBJECTIVE—To evaluate colonoscopic and histologic features of rectal masses in dogs.

DESIGN—Retrospective case series.

ANIMALS—82 client-owned dogs with rectal masses that underwent colonoscopy.

PROCEDURES—Medical records of dogs with rectal masses that underwent colonoscopy were reviewed. History, signalment, clinical signs, results of physical examination, diagnostic imaging findings, and results of colonoscopy (including complications) were recorded. When available, tissue samples obtained during colonoscopy and by means of surgical biopsy were reviewed by a single board-certified pathologist. Histologic features and tumor grade (when applicable) of tissue samples obtained during colonoscopy versus surgical biopsy were compared.

RESULTS—Multiple rectal masses were observed during colonoscopy in 6 of the 82 dogs, but no lesions were visualized orad to the colorectal junction. Results of histologic evaluation of surgical biopsy specimens were consistent with a diagnosis of epithelial neoplasia in 58 of 64 dogs, of which 71% were classified as benign adenoma or polyp and 29% were classified as adenocarcinoma in situ or adenocarcinoma. Complications of colonoscopy occurred in 3 of 82 dogs but were considered minor. A discrepancy in diagnosis occurred in 5 of 16 dogs for which both colonoscopic and surgical biopsy samples were available for histologic review.

CONCLUSIONS AND CLINICAL RELEVANCE—Results suggested that multiple rectal masses are uncommon in dogs, and secondary lesions orad to the colorectal junction were not found in this study. Colonoscopy was associated with few complications, but the need for colonoscopic assessment of the entire colon in this patient population may merit reevaluation.

The prevalence of gastrointestinal neoplasia is relatively low in dogs, reportedly accounting for 3% to 10% of all tumors.[1–5] Up to 60% of gastrointestinal tumors affect the large intestine[3–5]; 50% to 60% of those are malignant tumors, with adenocarcinoma being the most common.[1,3–7] Other less frequently reported colorectal malignancies include lymphoma, leiomyosarcoma, hemangiosarcoma, and plasmacytoma.[4,7–9] Adenomatous polyps account for most benign rectal tumors,[3,4] but leiomyoma and fibroma have also been reported.[6] Carcinoma in situ exhibits histologic atypia, which can progress to invasive malignancy in 17% to 50% of dogs.[2–4,6,10–13]

The initial diagnosis of a mass or masses in the rectum is often made on the basis of results of digital rectal palpation performed either as part of a wellness examination or in response to signs such as hematochezia, dyschezia, or tenesmus. To accurately diagnose and localize rectal masses, evaluate for multiplicity of lesions, and collect biopsy samples for histologic diagnosis, a complete colonoscopy extending from the anocutaneous junction to the ileocecocolic valve is often recommended.[5,14] Comprehensive evaluation of the colon and rectum via colonoscopy requires the large intestinal lumen to be free of fecal material. Evacuation of the entire colon is a time-consuming and potentially complicated procedure that can add considerable expense. It requires withholding food for at least 24 to 36 hours and typically involves oral administration of polyethylene glycol solution or bisacodyl tablets and multiple enemas.[15] The oral administration of osmotic preparations is not a benign procedure and has been associated with vomiting and fatal aspiration pneumonia in dogs.[16] A recent study[16] reported complications in 30 of 355 (8.5%) dogs undergoing

flexible colonoscopy, although most of the complications were minor and death was rare (0.28% [1 dog]).

The purpose of the study reported here was to assess the results of colonoscopy as a diagnostic tool in a large cohort of dogs with rectal masses. Our primary hypothesis was that multiplicity of rectal lesions with additional masses orad to the colorectal junction is rare in dogs. Our secondary hypothesis was that biopsy specimens obtained during colonoscopy are inferior to surgical biopsy or necropsy specimens for providing a histopathologic diagnosis in dogs with rectal masses.

Materials and Methods

Case selection

Medical records of all dogs with a rectal mass that underwent a full preoperative colonoscopy at the William R. Pritchard Veterinary Medical Teaching Hospital at the University of California-Davis, the Matthew J. Ryan Veterinary Hospital at the University of Pennsylvania, or the Animal Cancer Center at Colorado State University between 1995 and 2012 were reviewed. Histologic samples obtained by means of colonoscopic biopsy, surgical resection, or necropsy were reviewed by a single pathologist when available, but cases were not excluded if material for histologic analysis was not available.

Medical records review

For each dog enrolled in the study, information extracted from the medical record included history; signalment; initial clinical signs (including duration); results of physical examination (including results of digital rectal examination); results of CBCs, serum biochemical analyses, and urinalysis; and results of diagnostic imaging, including thoracic and abdominal radiography and abdominal ultrasonography. Pertinent details were retrieved from the colonoscopy report in the medical record, including bowel preparation technique, complications of bowel preparation (if applicable), complications of the colonoscopy procedure (if applicable), and colonoscopy results including size and number of any lesions. Lesion size recorded in the medical record was a subjective estimate made by the endoscopist. For the subset of lesions of epithelial origin, circumferential lesion location (ie, emanating from the left, right, dorsal, or ventral aspect of the rectum), orad or aborad lesion location (colorectal junction, proximal rectum, midrectum, or distal rectum), and lesion type (pedunculated, cauliflower-like, sessile, diffuse, or annular-circumferential) were also recorded. Because of the indistinct border between the rectum and colon, localization in reference to the colorectal junction represented a clinical judgment rather than an exact measurement. Type of surgical procedure performed when applicable was recorded; however, surgical complications and outcome were not recorded.

Histologic review

When available, histologic sections obtained from masses identified during colonoscopy, from biopsy specimens obtained at the time of surgery or necropsy, or both were reviewed by a single board-certified pathologist (JRP). In some cases, prepared slides were sent for analysis by the home institution, and in some cases, the original blocks were sent and slides

were subsequently prepared from those blocks. Histologic reports generated by the pathologist at the home institution at the time of original treatment and included in the medical record were not considered. All tissue specimens were fixed in neutral-buffered 10% formalin at the time of initial collection, routinely processed, embedded in paraffin, cut at a thickness of 3 to 5 μm, and stained with H&E. The pathologist reviewed all specimens without knowledge of any clinical information or the prior histologic diagnosis. No immunohistochemical staining was performed.

Lesions of epithelial origin were classified as hyperplasia, benign polyp (adenoma), carcinoma in situ, or adenocarcinoma. Additionally, with use of the published scheme for human patients described by the American Joint Committee on Cancer,[17] tumor grade was assigned as follows: T0 (no malignancy), Tis (carcinoma in situ), T1 (invasion of submucosa), T2 (invasion of muscularis), T3 (invasion through muscularis to serosa), or T4 (invasion of other tissues). A tumor grade was reported only for biopsy samples collected surgically or at necropsy because biopsy samples collected during colonoscopy did not include submucosa, making it impossible to judge penetration beyond the mucosa into deeper tissue layers. Extent of differentiation (ie, well, intermediately, or poorly differentiated or anaplastic) was also reported.

Statistical analysis

Descriptive statistics for age and body weight are reported as mean and SD after use of the Shapiro-Wilk test to evaluate distributions of data. The following analyses were performed for the subset of lesions of epithelial origin only. Lesion size versus histologic diagnosis was compared with the exact Wilcoxon-Mann-Whitney test. Lesion size versus tumor grade was compared with the exact Jonckheere-Terpstra test. Presence or absence of multiple lesions was compared with histologic diagnosis by means of the Fisher exact test and was compared with tumor grade with an exact Wilcoxon-Mann-Whitney test. Circumferential lesion location, orad-aborad lesion location, and lesion type were compared with histologic diagnosis by means of an exact χ^2 test of homogeneity, and an exact Kruskal-Wallis test was used to compare these variables with tumor grade. Lesion type was also dichotomized into pedunculated, cauliflower, or sessile lesions versus annular or diffuse lesions and compared with histologic diagnosis by use of a Fisher exact test. All analyses were performed with a commercially available software package.[a] Values of $P < 0.05$ were considered significant.

Results

Animals

Eighty-two dogs met the study selection criteria. Mean ± SD age at the time of initial examination was 99 ± 38 months (median, 96 months; range, 10 to 236 months). Mean ± SD body weight at the time of enrollment was 26.2 ± 11.6 kg (57.6 ± 25.5 lb; median, 26.9 kg [59.2 lb]; range, 4.4 to 48.6 kg [9.7 to 107 lb]). There were 7 sexually intact males, 40 castrated males, and 35 spayed females. There were 16 mixed-breed dogs. The remaining 66 dogs represented a variety of breeds, including German Shepherd Dog (n = 7); Golden

[a]StatXact 10, Cytel Software Corp, Cambridge, Mass.

Retriever and Labrador Retriever (6 each); Shetland Sheepdog (4); Airdale Terrier, West Highland White Terrier, Beagle, English Bulldog, and Pug (3 each); Australian Shepherd, Brittany Spaniel, Chihuahua, Cavalier King Charles Spaniel, Dachshund, Siberian Husky, and Keeshond (2 each); and Weimaraner, Bassett Hound, Border Collie, Boxer, Cardigan Welsh Corgi, Chesapeake Bay Retriever, Welsh Corgi, English Springer Spaniel, French Bulldog, Great Dane, Great Pyrenees, Newfoundland, Standard Poodle, and American Pit Bull Terrier (1 each).

Clinical and laboratory findings

Seventy-nine of 82 (96.3%) dogs had at least 1 clinical sign associated with the rectal mass. Clinical signs included hematochezia (76/82 [92.7%]), tenesmus (47/82 [57.3%]), dyschezia (18/82 [22.0%]), and mucus in the stool (13/82 [15.9%]). In those dogs with clinical signs, the median duration of those clinical signs was 5 months (range, 0.25 to 72 months). All dogs had a digital rectal examination performed, and a mass was palpable in 71 of the 82 (86.6%) dogs. In 3 (3.7%) dogs, the colon was described as having irregular mucosa on palpation but no discrete mass was palpated, and in 8 (9.8%) dogs, no abnormalities were evident on digital palpation. In 49 of 71 (69.0%) dogs with a digitally palpable rectal mass, median estimated maximal diameter of the mass was 2.5 cm (range, 0.5 to 8 cm). Results of CBC, serum biochemical analysis, and urinalysis were variable and were not considered of relevance to the primary diagnosis; thus, they are not reported.

Diagnostic imaging findings

Thoracic radiographs were available for review for 66 of the 82 (80.5%) dogs and lacked evidence of metastatic disease in 64 of 66 (97.0%) dogs. One dog with an adenocarcinoma (T1 grade) had a bilateral diffuse miliary interstitial pattern in all lung lobes that was suggestive of diffuse metastatic neoplasia or lymphoma. In a dog with an adenocarcinoma in situ (Tis grade), a solitary small pulmonary nodule suspected to represent an inflammatory or neoplastic process was present in the right middle lung lobe. In both patients with evidence of metastatic disease, the owners elected to proceed with diagnostic evaluation and surgical treatment of the rectal masses without further investigation of the pulmonary abnormalities. In 19 of 82 (23.2%) dogs, abdominal radiography was performed, but it did not reveal any abnormal findings in 18 of the 19. In 1 dog, a mass (of unknown histologic diagnosis) emanating from the ventral aspect of the sixth lumbar vertebra that extended to the second coccygeal vertebra and resulted in ventral deviation of the colon was suspected to be an enlarged sublumbar lymph node. Fifty-eight of 82 (70.7%) dogs underwent abdominal ultrasonography. Abnormalities recorded included sublumbar lymphadenopathy (16/58 [27.6%]), colonic wall thickening (9/58 [15.5%]), and a colorectal mass in the region of the colorectal junction (9/58 [15.5%]).

Colonoscopy findings and complications

All 82 dogs in the study had a colonoscopy performed. In 31 of 72 dogs, the colonoscopy was performed on a different day from the subsequent surgery, whereas in 41 of 72 dogs, the colonoscopy was performed on the same day. Bowel preparation consisted of the use of osmotic bowel-cleansing agents (47/82 [57.3%]) and at least 1 enema (53/82 [64.6%]). In 32 of the 53 dogs that received at least 1 enema, the enemas were the only form of bowel

preparation used and no bowel-cleansing agents were administered. In some cases, bowel preparation was not documented in the medical record, and thus, it is plausible that the reported frequency of bowel cleanser and enema use was underestimated. Polyethylene glycol—based agents[b] were used in 18 of 47 dogs, whereas sodium phosphate monobasic monohydrate—based products[c,d] were used in 29 of 47 dogs. Complications that were attributed to the colonoscopy or bowel preparation occurred in 3 of 82 (3.7%) dogs; however, all were considered minor in nature. One dog developed self-limiting dyspnea, and 1 dog developed self-limiting diarrhea following oral administration of a polyethylene glycol–based product.[b] Both of these dogs recovered uneventfully and underwent their colonoscopy procedures the following day. A third dog developed an increase in respiratory rate, fever, and arrhythmia following colonoscopy and a surgical rectal mucosal resection performed during a single anesthetic episode. This dog had received an oral sodium phosphate monobasic monohydrate—based product[c] and warm water enemas.

A single rectal mass was seen in 76 of 82 (92.7%) dogs, and multiple masses were seen in the remaining 6 (7.3%). Of the 6 dogs with ≥ 1 mass, 5 had 2 masses and 1 had 4 masses. Lesion location was recorded in 64 dogs with single masses or multiple masses restricted to a single area, with lesions located in the distal rectum in 31 of the 64, in the midrectum in 18, in the proximal rectum in 5, and at the colorectal junction in 10. In 2 of the dogs with 2 mass lesions in different locations, lesions were located in the distal rectum and midrectum in one dog and at the proximal rectum and colorectal junction in the other. In all 6 dogs with multiple masses, all masses were judged to be located aborad to the colorectal junction, with no lesions present entirely within the ascending, transverse, or descending colon.

In 52 of 82 (63.4%) dogs, an estimate of the size of the largest mass was made from colonoscopic images. Median estimated maximal diameter was 2.1 cm (range 0.4 to 8 cm). For the 53 dogs for which circumferential lesion location was recorded, masses were emanating from the ventral aspect of the rectum in 21, from the dorsal aspect in 18, from the left side in 8, and from the right side in 6. Lesion type was recorded for 20 lesions, with 10 of the 20 lesions described as cauliflower-like or sessile, 5 described as pedunculated, 4 described as annular, and 1 described as diffuse.

For the population of dogs with epithelial tumors, neither histologic diagnosis nor tumor grade was found to be significantly associated with the colonoscopic estimate of lesion size, presence or absence of multiple lesions, circumferential lesion location, or orad-aborad lesion location. When lesion type was dichotomized into pedunculated, sessile, or cauliflower-like versus annular or diffuse lesions, histologic diagnosis (adenocarcinoma vs polyp [adenoma]) was significantly ($P = 0.025$) associated with lesion type, with annular or diffuse lesions more likely to be classified as adenocarcinomas. Furthermore, there was a significant ($P = 0.01$) association between lesion type and tumor grade, with annular and diffuse lesions being more likely to be a higher tumor grade, compared with pedunculated, cauliflower-like, and sessile lesions.

[b]GoLYTELY, Braintree Laboratories, Braintree, Mass.
[c]Osmoprep, Salix Pharmaceuticals, Raleigh, NC.
[d]Visicol, Salix Pharmaceuticals, Raleigh, NC.

Surgical procedures

A variety of surgical procedures was used to resect rectal masses in 68 of the 82 (82.9%) dogs. Mucosal eversion was performed in 33 of the 68 dogs, rectal pull-through was performed in 25, a celiotomy was performed in 7, and a dorsal perineal approach, pelvic split technique, and endoscopic debulking with a snare were performed in 1 each. In the remaining 14 dogs, either surgical resection was not performed or details of the technique used were not documented in the medical record.

Histologic review

Colonoscopic and surgical biopsy samples from 24 and 64 dogs, respectively, were available for review. For 16 dogs, both colonoscopic and surgical biopsy samples were available for review (Supplemental Table S1, available at: http://avmajournals.avma.org/doi/suppl/10.2460/javma.250.4.424). For 10 dogs, no colonoscopic or surgical biopsy samples were available for review.

For the 24 dogs for which histologic slides or blocks from colonoscopic biopsy samples were available for review, results of histologic examination was consistent with a diagnosis of epithelial proliferation in 17 (ie, benign polyp or adenoma in 13 and adenocarcinoma or adenocarcinoma in situ in 4), with a diagnosis of colitis in 4, with a diagnosis of lymphoma in 2, and with a diagnosis of mucosal hyperplasia in 1. Thirteen of the 17 epithelial tumors were classified as well differentiated, 2 were classified as intermediately differentiated, 1 was classified as poorly differentiated, and 1 was classified as anaplastic. Colonoscopic biopsy samples generally did not include any submucosa. Therefore, penetration beyond the mucosa by neoplastic cells could not be assessed, and a tumor grade was not reported.

For the 64 dogs for which histologic blocks of samples obtained during surgical resection were available for review, results of histologic examination were consistent with a diagnosis of a epithelial proliferation in 58 (ie, benign polyp or adenoma in 41 and adenocarcinoma or adenocarcinoma in situ in 17), with a diagnosis of plasmacytoma in 3, and with a diagnosis of lymphoma, mucosal hyperplasia, and leiomyoma in 1 each. For the 17 dogs in which an adenocarcinoma or adenocarcinoma in situ was diagnosed, the tumor grade was Tis in 8, T1 in 3, T2 in 5, and T3 in 1. Thirty-four of the 58 lesions of epithelial origin were classified as well differentiated, 21 were classified as intermediately differentiated, and 3 were classified as poorly differentiated; none were classified as anaplastic.

For the 16 dogs for which both colonoscopic and surgical biopsy samples from the same lesions were available for review, histologic diagnoses were concordant for 11 and discordant for 5. In a 14-year-old 12.6-kg (27.7-lb) neutered male mixed-breed dog, the histologic diagnosis of a colonoscopic biopsy sample was consistent with hyperplasia, whereas the diagnosis for a surgical biopsy sample was consistent with a benign polyp (adenoma). In an 8.5-year-old 6.6-kg (14.5-lb) spayed female Dachshund, the histologic diagnosis of a colonoscopic biopsy sample was colitis, but a diagnosis of mucosal hyperplasia was made on the basis of results of histologic examination of surgical biopsy samples. In 2 dogs, colitis was diagnosed on the basis of results of histologic examination of colonoscopic biopsy specimens, whereas adenocarcinoma was diagnosed following

examination of surgical biopsy samples. In the remaining dog with discordant results, adenocarcinoma was diagnosed on the basis of results of histologic examination of colonoscopic biopsy samples and lymphoma was subsequently diagnosed on the basis of results of histologic evaluation of surgical biopsy specimens. In 9 dogs with benign polyps (adenoma), results of histologic examination of colonoscopic and surgical biopsy samples were in agreement; however, in 4 of these dogs, the neoplasms were classified as less differentiated following histologic examination of surgical biopsy samples than they had been following examination of colonoscopic samples. Specifically, extent of differentiation changed from well differentiated to intermediately differentiated in 3 dogs and from intermediately differentiated to poorly differentiated in 1 dog.

Discussion

Results of the present multicenter retrospective case series conducted over a 17-year period (1995 through 2012) evaluating colonoscopic and histologic features in a large cohort of dogs with rectal masses suggested that multiple rectal masses are uncommon in dogs. In addition, secondary lesions orad to the colorectal junction were not found in this study. Colonoscopy was associated with few complications; however, for several patients, biopsy samples obtained via colonoscopy were classified as more differentiated than were samples obtained via surgical biopsy, potentially underdiagnosing malignancy.

Rectal tumors frequently represent a challenging diagnostic and treatment conundrum to soft tissue surgeons because of the inherent inaccessibility of the lesions and the need to preserve colorectal function and fecal continence. Colonoscopy has traditionally been considered a valuable preoperative diagnostic tool for evaluation of dogs with rectal masses to characterize the location and nature of the lesion, assess for multiplicity of lesions, and harvest biopsy samples to aid in clinical decision making. Few studies have documented the complications and results associated with colonoscopic evaluation of dogs with rectal masses.

In the present study, the complication rate from the colonoscopic procedure was only 3.7% (3/82 dogs), and in a much larger study[16] of dogs undergoing colonoscopy for a variety of causes (not limited to rectal masses), a complication rate of 8.5% was reported, with most complications described as minor. Colonoscopy would therefore appear to be a generally safe procedure and not commonly associated with serious morbidity, although rare life-threatening complications have occurred, including fatal aspiration of polyethylene glycol—based solution,[b] colonic perforation, and excessive bleeding after biopsy.[16] Perhaps the more important reason for questioning the need for complete colonoscopic examination in dogs with rectal masses is avoidance of the additional hospitalization and cost incurred for some of the bowel-cleansing protocols, the requirement for general anesthesia, and the added technician time for assisting with the procedure and cleaning the endoscopy equipment. Colonoscopies were performed on a different day from surgery in 31 of 72 (43.1%) dogs in the present study; this practice has been recommended to prevent liquid colonic contents from contaminating the surgical site during the procedure. Staggering the colonoscopy and surgical procedures, however, resulted in additional duration of hospitalization, anesthesia, and cost to the owner that could potentially be avoided.

One critically important reason for intraluminal examination of the colon and rectum in dogs with rectal tumors is accurate characterization and localization of the lesion. Lesion appearance may also have prognostic importance. In human patients, the diagnosis of adenomatous polyps has historically been based on colonoscopic appearance, with pedunculated, sessile, and depressed lesions having differing prognoses.[18] More recently, critical evaluation of this method in human patients has cast doubt on the validity of direct colonoscopic evaluation given the substantial interobserver variability that has been documented.[19] Results of the present study may suggest that colonoscopic findings correlate somewhat with histologic diagnosis and tumor grade; although we base this on evaluation of a relatively small number of cases. Tumors that appeared annular or diffuse were more likely to be invasive carcinomas rather than benign polyps or adenomas and tended to have higher tumor grades. Previous studies[5,13] in dogs have also suggested a relationship between prognosis and lesion appearance, with 1 study[5] suggesting that patients with single pedunculated lesions had longer survival times, compared with survival times for dogs with cobblestone-like or annular masses. The authors of another study[13] noted that dogs with multiple or diffuse lesions had higher recurrence rates, compared with rates for dogs with single masses.[13] Nonetheless, larger, well-designed studies of dogs are needed to critically evaluate the relationship between colonoscopic features and prognosis.

Recent evidence in the veterinary literature suggests that some surgical procedures described for treatment of colorectal neoplasms, such as rectal pull-through, are associated with high morbidity rates[20] whereas others, such as mucosal eversion, are associated with good outcomes and few complications.[4,12] The choice of surgical approach in dogs is typically guided by lesion location and extent, which are usually evaluated by direct colonoscopic visualization. In some cases, several approaches may be possible, and alternatives to current high-morbidity procedures may become available in the future. The choice of procedure will always require accurate information regarding lesion location and extent.

A further justification for colonoscopic staging in patients with rectal masses is to evaluate for lesion multiplicity. Two studies of dogs with colorectal epithelial tumors reported 12% to 19% of dogs had multiple colorectal masses.[5,13] However, in the present study and in a previous study[5] of 33 dogs with colorectal carcinoma that underwent proctoscopy, no patients had multiple lesions orad to the colorectal junction. An additional case series[10] reported the presence of a descending colonic mass in 1 dog with a rectal tumor, but this situation appears to be rare. On the basis of our results and results of these prior reports, we suggest that complete bowel preparation followed by colonoscopy extending to the ileocecocolic junction is a relatively low-yield endeavor, provided that a thorough endoscopic examination of the complete length of the rectum and colorectal junction is performed to evaluate for multiplicity of masses in that region.

The value of intraluminal imaging in dogs with rectal neoplasms is clear. Orad lesions may be overlooked in instances when surgical excision of lesions visible within the most caudal aspect of the rectum is not combined with some form of intraluminal examination.[5] It remains unclear whether it is essential to endoscopically examine the entirety of the ascending, transverse, and descending colon in all dogs being examined because of a rectal mass. Other options for examination of the colorectal junction and the rectum in dogs exist

that may avoid the need for bowel preparation and an expensive and time-consuming colonoscopic procedure, and these options require further evaluation. A more localized intraluminal evaluation with proctoscopy[5,21] or transanal single port evaluation[22] may be a more appropriate diagnostic tool for selected cases. Proctoscopy or sigmoidoscopy has been performed for many years and can provide visualization of the rectum and a portion of the descending colon. Proctoscopy is not usually performed with insufflation, and therefore, visualization of the rectal mucosa may not be as clear as with colonoscopy. Transanal single-port evaluation uses a laparoscopic single-port device to evaluate the rectum with a rigid laparoscope after insufflation of the rectum. This has been used in human patients in association with transanal microsurgical techniques for lesion resection,[22] and we have used this in place of colonoscopy for evaluation of the rectum in some dogs. Nonendoscopic techniques such as CT pneumocolonography have also been investigated in dogs and may provide a so-called virtual colonoscopy platform, although performance of this technique requires a standard bowel preparation similar to that performed prior to colonoscopy.[23] This CT pneumocolonography technique has the advantage of additionally providing valuable staging information on locoregional lymph centers and possible metastatic spread of disease. Further studies of these other diagnostic modalities are suggested to optimize preoperative diagnostic information for this subset of patients.

The histologic assessment of epithelial neoplasms of the colon has been evaluated previously, and a continuum of disease from adenomatous polyp through to invasive carcinoma has been documented in several studies,[5,13] similar to findings for human patients. Ultimately, when colonoscopy is performed, biopsy of any lesion is typically recommended. Few reports have documented a comparison between colonoscopically harvested biopsy samples and those obtained through surgical resection, with interpretation by a single board-certified pathologist.[13] Disagreement of 30% was found in 1 study[13] and was mainly attributed to the superficial nature of colonoscopic biopsy samples and the inability to harvest associated submucosa or deeper tissue necessary to evaluate tumor invasion beyond the mucosa. Although 82 dogs underwent colonoscopy in the present study, not all 82 underwent colonoscopic biopsy, and both colonoscopic and surgical biopsy samples were available for review from fewer still. Nonetheless, analysis of paired colonoscopic and surgical biopsy samples from 16 dogs was possible and showed a discordance rate similar to that for the previous study,[13] with 5 of 16 dogs having discordant results. It is our impression that many colorectal carcinomas appear well differentiated when only superficial colonoscopically harvested biopsy samples are evaluated, and we suggest this may contribute to misdiagnosis.

Diagnosis and staging of rectal neoplasia is essential to optimize patient outcome. Staging in human patients with colorectal cancer is usually done on the basis of the tumor-node-metastasis system, which has been extensively described.[17,24] This staging system is dependent on detailed histologic evaluation of the primary lesion; diagnostic imaging results or, preferably, biopsy of the regional lymph node bed; and assessment for any distant lymph node or other organ metastases. Unfortunately, the necessary clinical evaluation to establish accurate tumor node metastasis status is often not performed in dogs, and thus, the magnitude of effect of tumor stage on outcome is unknown in dogs. A tumor grade for colonoscopic biopsy samples was not reported in the present study because the submucosa

was generally not present in samples obtained during colonoscopy, precluding assessment of invasiveness; however, we did report tumor grade for surgical biopsy samples. In most studies of human patients with rectal neoplasms, tumor grade has been found to be a stage-independent prognostic factor and, thus, is important to consider. In 4 of 12 dogs in the present study in which extent of tumor differentiation was determined for both colonoscopic and surgical biopsy samples, less differentiation was seen in the surgical biopsy sample, suggesting that colonoscopic biopsy samples may underestimate the extent of differentiation of rectal tumors in dogs. This observation has been made previously in dogs.[13] We suggest that biopsy samples collected with larger biopsy forceps or by means of wedge incision might have a higher sensitivity for correct reflection of tumor invasiveness in epithelial tumors of the rectum in dogs. Unfortunately, sensitivity calculations were not possible in the present study because of the small number of cases for which both colonoscopic and surgical biopsy samples were available. On the basis of our results, however, the sensitivity and positive predictive value for colonoscopic biopsy samples to reflect true tumor invasiveness are likely to be suboptimal. With the limitations of colonoscopic biopsy, it may be advisable to evaluate other modalities for assessment of tumor invasiveness in these patients. Advanced imaging modalities such as transrectal ultrasonography, CT virtual colonoscopy, and MRI-based techniques provide highly sensitive evaluation of tumor invasiveness, and each has advantages and disadvantages in human patients.[25,26] In veterinary patients, these modalities have not been used extensively to date. Greater attention should be paid to appropriate tumor grading and staging in these cases, especially in light of the fact that a high percentage of dogs with rectal carcinomas have regional and distant metastasis at necropsy, but few studies in the veterinary literature report the in vivo rate of metastasis.[11]

The present study had several notable limitations. Important data were missing from some cases. Colonoscopies and colonoscopic biopsies were performed in a nonstandardized fashion by a large group of endoscopists with various degrees of training. Despite the obvious disadvantage of not being able to obtain blocks for every biopsy sample for reevaluation and the resulting loss of some data, we thought that it was vital to have all histologic analyses reassessed by a single board-certified pathologist. We elected not to report outcomes of surgery in this study, as these have been reported elsewhere and reports of complications, outcomes, and recurrence are notoriously inaccurate when obtained from medical records or client questionnaires over a long period of time. Whereas colonoscopy remains key to surgical planning and disease staging, reassessment of current diagnostic modalities for evaluation of dogs with rectal masses is suggested, especially in light of newer diagnostic tools becoming more available.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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