Use of a nitinol stent to palliate a colorectal neoplastic obstruction in a dog

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Case Description—A 12-year-old castrated male Labrador Retriever was evaluated for clinical signs associated with colorectal obstruction.

Clinical Findings—The dog had a 2-week history of tenesmus and hematochezia. On rectal examination, an annular colorectal mass was palpable extending orad into the pelvic canal. The original diagnosis of the colorectal mass was a mucosal adenoma. The dog was maintained on a low-residue diet and fecal softeners for a period of 13 months after initial diagnosis. At that time, medical management was no longer effective.

Treatment and Outcome—Placement of a colonic stent was chosen to palliate the clinical signs associated with colorectal obstruction. By use of fluoroscopic and colonoscopic guidance, a nitinol stent was placed intraluminally to open the obstructed region. Placement of the stent resulted in improvement of clinical signs, although tenesmus and obstipation occurred periodically after stent placement. At 212 days after stent placement, the patient had extensive improvement in clinical signs with minimal complications; however, clinical signs became severe at 238 days after stent placement, and the dog was euthanized. Histologic evaluation of the rectal tumor from samples obtained during necropsy revealed that the tumor had undergone malignant transformation to a carcinoma in situ.

Clinical Relevance—A stent was successfully placed in the colon and rectum to relieve obstruction associated with a tumor originally diagnosed as a benign neoplasm. Placement of colorectal stents may be an option for the palliation of colorectal obstruction secondary to neoplastic disease; however, clinical signs may persist, and continuation of medical management may be necessary. (*J Am Vet Med Assoc* 2011;239:222–227)

A 12-year-old 32.4-kg (71.3-lb) castrated male Labrador Retriever was evaluated at the Colorado State University Veterinary Teaching Hospital because of a 2-week history of tenesmus and hematochezia. The owner also reported that the dog had some difficulty rising and was reluctant to jump into the car. Mild hind limb muscle atrophy and discomfort on palpation of the vertebral column and coxofemoral joint areas were noted on physical examination and were attributed to coxofemoral joint arthritis or lumbosacral disease; however, diagnostic tests to confirm this were not performed. On rectal examination, an annular mass was palpable approximately 7 cm orad to the anorectal junction. The most orad extent of the mass was not palpable, and sublumbar lymphadenopathy was not noted. The dog had a body condition score of 5 of 9, and all other physical examination variables were within reference range limits.

On the basis of rectal examination findings, a colorectal neoplasm was suspected, and staging diagnostic tests were recommended to the dog's owner. Results of a CBC and serum biochemical analysis revealed no abnormalities. Thoracic radiography revealed no sign of metastatic

ic disease. Colonoscopy with subsequent biopsy to obtain specimens of the mass and colon was recommended. The dog was premedicated for anesthesia with morphine (0.6 mg/kg [0.27 mg/lb], SC) and atropine (0.02 mg/kg [0.009 mg/lb], SC), and anesthesia was induced with propofol (3 mg/kg [1.4 mg/lb], IV) and midazolam (0.2 mg/kg [0.09 mg/lb], IV). General anesthesia was maintained with isoflurane in oxygen. During colonoscopy, the mass was viewed approximately 7 cm orad to the anorectal junction and extended orad for 3 cm to the most orad extent of the rectum. The mass was noted to be annular, irregularly shaped, multilobulated, and highly vascularized. Multiple 2.8-mm biopsy specimens of the mass and colon were obtained by use of standard endoscopic biopsy forceps.

The dog was sent home the next day; the dog was to receive carprofen (2.2 mg/kg [1 mg/lb], PO, q 12 h) and tramadol (2.3 mg/kg [1.05 mg/lb], PO, q 12 h) for pain management. Histologic findings were consistent with a mucosal adenoma with secondary colitis. The tumor was described as being well differentiated with no evidence of invasiveness into the submucosa. Abdominal ultrasonography and surgical resection of the mass via a colorectal resection and anastomosis were recommended to the owner. At that time, the owner elected not to have these procedures performed.

Clinical signs of hematochezia and tenesmus waxed and waned during the next 10 months. The dog was fed a low-residue diet,^a and its owner intermittently administered lactulose (7 mL, PO, q 8 h) as a fecal softener. Tenesmus and hematochezia began to worsen at the end of the

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10-month period, and the dog was again evaluated at the Colorado State University Veterinary Teaching Hospital. On physical examination, the dog's weight had decreased from the first visit to 31.2 kg (68.6 lb), and the dog was noted to have generalized muscle wasting and a body condition score of 3 of 9. On rectal examination, the previously palpated rectal mass was noticeably larger, extending more aborad than was previously noted; the mass was now palpable 3 cm orad to the anorectal junction. A slight neutrophilia (11,400 cells/ μ L; reference range, 2,600 to 11,000 cells/ μ L) was noted on a CBC, and the dog was mildly anemic (PCV of 37%; reference range, 40% to 55%). No abnormalities were noted on serum biochemical analysis.

Colonoscopy was again performed (Figure 1). The mass was now found to be extending aborad to 3 cm orad to the anorectal junction. Additionally, the mass was noted to be annular for a segment of 5 cm (3 to 8 cm orad to the anorectal junction); the mass continued orad on the dorsal surface of the colon for a length of 2 cm and width of 1 cm. The length of colon now affected by tumor was 7 cm. A partial digital debulking of the tumor was performed, and samples from the procedure were sent for histologic examination. No criteria of malignancy were noted on the second histologic examination, further suggesting a benign mass. Abdominal ultrasonography and surgical options were again discussed with the owner, who elected not to perform further diagnostic tests or treatment; colorectal stenting was discussed as a palliative option for relief of clinical signs secondary to colorectal obstruction. The dog was discharged from the hospital after colonoscopy, and the owner considered the potential treatment options. Although the dog continued to receive oral administration of lactulose, substantial tenesmus and hematochezia continued during the next 2 months. At that time, the dog's owner elected to pursue palliative colorectal stenting.

The dog was admitted to the Colorado State University Veterinary Teaching Hospital, and food was withheld for 36 hours, during which time the dog was administered several enemas. Further hematologic analyses, abdominal ultrasonography, and thoracic radiography were declined by the owner. The dog was premedicated for anesthesia the next day with methadone (1 mg/kg [0.45 mg/lb], SC) and glycopyrrolate

(0.02 mg/kg, SC), and anesthesia was induced with propofol (2 mg/kg [0.9 mg/lb], IV). General anesthesia was maintained with isoflurane in oxygen. The dog was transported to the fluoroscopy suite and positioned in right lateral recumbency.

Recommendations for colonic stent sizing have been made for cats, and sizing in this dog was extrapolated from these data.¹ A colonoscopy was performed to document the location of the colorectal mass and to obtain an additional biopsy specimen. The mass extended farther aborad than previously noted, to within 2 cm of the anorectal junction (total estimated length = 8 cm). A 0.035-inch hydrophilic guidewire^b was advanced into the colon and past the mass under fluoroscopic guidance. A marker catheter,^c with radiopaque marks 10 mm apart, was passed parallel to the colonoscope over the guidewire, and the guidewire was subsequently removed. The marks on the catheter were used to account for radiographic magnification. A combination of colonoscopy and fluoroscopy was used to determine the length of the mass in the colon and rectum. The colonoscope was advanced to a point 2 cm orad to the mass, and the location of the colonoscope was viewed with fluoroscopy. The marker catheter was used to measure the length of the colorectal mass, which was confirmed to be 8 cm. The goal was to place the stent 2 cm orad to the mass; as the mass extended to within 2 cm of the anorectal junction, the distal end of the stent was to be placed a few millimeters orad to the anorectal junction. An anatomic location of the seventh lumbar vertebral body was noted as a point of reference for the location of the orad extent of the stent placement. The stent chosen was a 30 $\times$ 110-mm-long, uncovered, self-expanding nitinol stent.^d

The colonoscope was removed from the rectum. The guidewire was again advanced into the colon and past the mass under fluoroscopic guidance. The stent was advanced over the guidewire to a point 2 cm orad to the mass and deployed. One centimeter of stent was protruding from the anus after deployment of the stent, and this was gently pushed orad to a location 5 mm orad to the anorectal junction as the stent continued to radially dilate. A post-stent-placement fluoroscopic examination revealed proper stent placement (Figure 2). A post-stent-

Figure 1—Colonoscopic images of a colorectal tumor resulting in colorectal obstruction in a 12-year-old castrated male Labrador Retriever. A—Notice the complete obstruction of the colon at the aborad aspect of the tumor. B—Image of the orad extent of the annular component of the tumor (mid-tumor location). C—Image of the dorsal-only extension of the tumor at its most orad extent.

Figure 2—Lateral fluoroscopic and radiographic views of the caudal portion of the abdomen and pelvis of the same dog as in Figure 1 that underwent nitinol stent placement to palliate neoplastic colorectal obstruction. A—Fluoroscopic image of the colon and rectum before stent placement. B—Fluoroscopic image to evaluate stent location immediately after placement in the colon and rectum. C—Radiographic image obtained 5 days after stent placement. The stent is dilated, and luminal patency had been maintained. D—Radiographic image obtained 190 days after stent placement. Notice that luminal patency has continued.

placement colonoscopic examination revealed opening of the stent with subsequent intraluminal patency. The duration of the entire procedure (colonoscopy and stent placement) was 80 minutes. The duration of the stent-placement procedure alone was 55 minutes. The third histologic examination revealed a well-differentiated colorectal adenoma with colitis.

The dog recovered well from anesthesia and was discharged later the same day. The dog was to receive lactulose (7 mL, PO, q 8 h) and tramadol (3.5 mg/kg [1.6 mg/lb, PO, q 8 h]); a recommendation for a low-residue diet was made. The dog had moderate to severe tenesmus with hematochezia and watery diarrhea for approximately 5 days following stent placement. Abdominal radiography was performed and revealed increased dilation of the stent across the obstruction (Figure 2). The lactulose dose was adjusted and sulfasalazine (16.67 mg/kg [7.6 mg/lb], PO, q 8 h) administration was started. Over the

next 2 weeks, the tenesmus and hematochezia mostly resolved, but severe watery diarrhea continued. As a result, metronidazole (10 mg/kg [4.5 mg/lb], PO, q 8 h) and a probiotic product^c were administered.

For the next 6 weeks, the dog had continued moderate to severe episodes of watery diarrhea. The dog was then brought to the referring veterinarian because of lethargy and difficulty rising. Evaluation revealed hind limb weakness, hind limb muscle wasting, and signs of discomfort in the lumbosacral area. The dog started treatment with prednisone (0.75 mg/kg [0.34 mg/lb], PO, q 24 h), tramadol (3.5 mg/kg, PO, q 12 h), and enrofloxacin (7.5 mg/kg [3.4 mg/lb], PO, q 24 h). There was no improvement in clinical signs, and 1 week later, the dog was returned to the referring veterinarian because of severe tenesmus and hematochezia. Abdominal radiography revealed marked colonic distention with impacted fecal material from the most proximal aspect of the stent

extending orad to the ascending colon. Attempts to relieve the dog's obstipation with multiple enemas and IV administration of fluids were unsuccessful, and the dog was referred to the Colorado State University Veterinary Teaching Hospital for further evaluation. Physical examination revealed mild dehydration on the basis of moderately tacky mucous membranes and decreased skin turgor, signs of abdominal discomfort elicited on palpation, decreased body weight and hind limb muscle mass, and intermittent hind limb knuckling with decreased conscious proprioception. Abdominal radiography revealed marked colonic distention with impacted fecal material from the most proximal aspect of the stent extending orad to the ascending colon. Mild increases in serum activity of liver enzymes (alanine aminotransferase, 209 U/L [reference range, 10 to 120 U/L]; alkaline phosphatase, 279 U/L [reference range, 0 to 140 U/L]) were noted on serum biochemical analysis. A CBC revealed neutrophilia of 18,800 cells/ μ L (reference range, 3,500 to 12,000 cells/ μ L) and evidence of anemia with a PCV of 29% (reference range, 37% to 55%). High serum liver enzyme activities could have been a result of the administration of prednisone; anemia was likely secondary to hematochezia. Thoracic radiography revealed no visible evidence of pulmonary disease. Fluid therapy for 12 hours did not improve the marked obstipation, and the dog was anesthetized to perform manual deobstipation. The dog was premedicated with hydromorphone (0.1 mg/kg [0.045 mg/lb], IV), and anesthesia was induced with propofol (2 mg/kg, IV). General anesthesia was maintained with isoflurane in oxygen. During the procedure, rectal examination revealed that there was tumor ingrowth through the stent, but the lumen was adequately patent and the dog was successfully deobstipated. The dog was discharged and was to receive the following treatment: tramadol (1.5 mg/kg [0.7 mg/lb], PO, q 8 h), prednisone (0.75 mg/kg, PO, q 24 h), gabapentin (3.3 mg/kg [1.5 mg/lb], PO, q 8 h), lactulose (7 mL, PO, q 8 h), psyllium^f (3.4 g [1 tsp], PO, q 12 h), cisapride (0.2 mg/kg [0.09 mg/lb], PO, q 8 h), enrofloxacin (7.5 mg/kg, PO, q 24 h), and metronidazole (16.67 mg/kg, PO, q 12 h). Prednisone administration was stopped after the dose was tapered over time.

Six weeks later, at 190 days after stent placement, the dog had only mild intermittent tenesmus, but hind limb weakness with lumbosacral discomfort was still apparent. In addition to lactulose, psyllium, and cisapride (0.3 mg/kg [0.14 mg/lb], PO, q 8 h), the dog was receiving carprofen (2.2 mg/kg, PO, q 12 h), gabapentin (3.3 mg/kg, PO, q 8 h), and acupuncture treatments. Abdominal radiography revealed no stent migration or breakage and no overt evidence of obstipation (Figure 2). At 212 days after stent placement, the dog was continuing to do well. At 238 days after stent placement, the dog again had severe clinical signs of obstipation 1 week after the owner independently discontinued the cisapride administration.

At that time, the dog's owner elected that the dog be euthanized. On postmortem examination, no external abnormalities were found. The large intestine was resected en bloc from the ileocecal junction to the anal mucocutaneous junction. A longitudinal full-thickness transection was performed throughout the length of the large intestine and rectum, thereby exposing the luminal aspect of the

colon, rectum, and stent. The nitinol mesh of the stent was strongly adhered to the underlying mucosa and was invaded lumenally by multiple nodular, variably sized masses ranging in size from 5 to 10 mm in diameter. Additionally, multiple small, pale to tan nodules measuring from 1 to 3 mm in diameter were present within the mucosa aborad to the distal aspect of the stent. Full-thickness tissues were obtained from the affected areas as well as orad and aborad to the stent for histologic examination. The remainder of the gross necropsy findings were unremarkable, with no evidence of metastatic disease within the dog's abdominal or thoracic cavities.

Postmortem histologic examination of the proliferative tissue underlying the stent revealed a mass markedly expanding and replacing the mucosa diffusely with cuboidal to columnar epithelial cells arranged into numerous papillary projections and fronds supported by moderate fibrovascular stroma. The neoplastic cells had variably distinct cell borders, moderate amounts of basophilic cytoplasm, centrally placed round to oval nuclei with stippled chromatin, and indistinct nucleoli. Moderate anisocytosis and anisokaryosis were present, and numerous neoplastic cells had intracytoplasmic vacuoles. Intermixed within the neoplastic cells as well as within the surrounding mucosa and submucosa were moderate numbers of lymphocytes, plasma cells, and neutrophils. The neoplastic mass itself was confined to the mucosa without any evidence of infiltration into the submucosa or muscularis.

Tissue sections obtained orad and aborad to the stent revealed multifocal areas of mucosal loss and necrosis. Marked numbers of lymphocytes, plasma cells, and neutrophils were present within the mucosa and submucosa with extension into the muscularis. Moderate amounts of granulation tissue and foci of hemorrhage were also present. No neoplastic cells were identified within the sections evaluated. A final histologic examination of the mass revealed that it had undergone malignant transformation to a carcinoma in situ.

Discussion

To the authors' knowledge, placement of a colorectal stent to relieve a colorectal obstruction in a dog has not been reported. Colorectal neoplasia is an uncommon diagnosis in dogs. Most reports on colorectal neoplasia describe the clinical characteristics and outcomes of dogs with adenocarcinoma; however, adenomatous polyps and carcinoma in situ are also regularly diagnosed.²⁻⁷ Of 170 dogs with colorectal neoplasia documented in 6 retrospective studies,³⁻⁸ 100 (59%) had an adenocarcinoma, 33 (19%) had adenomatous polyps, and 25 (15%) had a carcinoma in situ. Other reported colorectal tumors in the remaining 12 dogs included lymphoma, leiomyoma, leiomyosarcoma, plasmacytoma, mast cell tumor, and inflammatory pseudopolyps.^{4,8} Similar to colorectal neoplasia in humans, colorectal tumors in dogs can undergo malignant transformation as was found in 1 previous report⁷; 2 dogs with adenomatous polyps developed carcinoma in situ, and 1 dog with adenomatous polyps and 2 dogs with carcinoma in situ developed invasive carcinoma.⁷

Early histologic examination of the mass of the dog of the present report revealed an adenoma. Three biopsies of the mass at different stages of treatment were performed during colonoscopy, as the gross appearance of the tumor was not consistent with previous descriptions^{4,7} of benign rectal tumors in dogs. These tumors are generally raised, sessile lesions without massive colorectal involvement, whereas this tumor was extensive (8 cm in length) and annular in appearance.^{4,7} The biological behavior of the tumor in the dog of this report supports the histopathologic diagnosis of a benign tumor, as no signs of metastatic disease were noted for greater than 18 months after the original diagnosis. However, as seen in a previous study,⁷ this tumor underwent malignant transformation from an adenoma to a carcinoma *in situ*.

Dogs with colorectal neoplasia are generally evaluated for a triad of clinical signs including hematochezia (82% to 100% of affected dogs), tenesmus (35% to 100% of affected dogs), and dyschezia (12% to 100% of affected dogs).⁴⁻⁷ Similarly, in the dog of the present report, hematochezia and tenesmus were reported as the initial clinical signs. Despite medical management, tenesmus worsened over a period of approximately a year to the point that definitive or palliative options needed to be considered to allow for a good quality of life. It should be noted that the inflammatory state of the colon (colitis noted on histologic examination) associated with the tumor was not specifically addressed medically prior to stent placement.

After analysis of hematologic findings and staging diagnostic tests, the performance of colonoscopy is critical to evaluate the colon and rectum for extent of disease and the presence of other lesions. In the dog of the present report, colonoscopy was also used to obtain biopsy specimens prior to stent placement and to calculate the extent of the tumor to properly size and position the stent. Colonoscopy is often used during the placement of colonic stents in humans as a means of directing a guidewire or stent placement (either through the working channel or parallel to the colonoscope).⁹⁻¹¹

Surgical resection is the treatment of choice for nonlymphomatous colorectal neoplasia. Recommended surgical margins vary between 1 and 8 cm, depending on the tumor type.¹²⁻¹⁵ Several different surgical procedures, including local excision by mucosal eversion (partial and full thickness), cryosurgery, transrectal stapling, transanal rectal pull-through, combined abdominal-transanal rectal amputation, bilateral pubic and ischial osteotomy for colorectal resection and anastomosis, and colostomy, have been described.^{4,6,8,12-15} Because of the extent and location of the mass of the dog of the present report, the patient's owner elected not to have us attempt a large colorectal resection or colostomy; palliation of the clinical signs by placement of a colorectal stent was instead chosen.

For companion animals, 2 cats have undergone colonic stent placement to relieve obstruction secondary to colonic adenocarcinoma.¹ In those 2 cats, colonic obstruction was relieved after stent placement, and both cats maintained fecal continence. Adverse effects from the stent were not noticed in either cat (tenesmus after stent placement was similar to before stent place-

ment), and the survival time of 1 cat was encouraging at 274 days after stent placement. The other cat was euthanized 19 days after stent placement because of a perceived poor quality of life. The lengths of colon affected by adenocarcinoma were 2 to 3 cm and 5 cm, respectively, in those cats, and the authors reported that colonic stenting provided an effective palliative option for those 2 cats.¹

Colorectal stenting is an accepted procedure for the treatment of benign and malignant obstructions in humans. Stents are used in humans for 2 major indications: as a palliative means of relieving clinical signs or as a bridge to surgery, which allows for patient stabilization prior to an elective procedure.¹⁶⁻¹⁹ The use of stenting in a palliative setting allows patients with severe comorbidities or metastatic disease to avoid a major surgical procedure such as colorectal resection and the formation of a stoma.²⁰ Stoma formation is associated with a high rate of complications in humans, and the use of stents can often allow for the avoidance of surgery to relieve a colorectal obstruction on an emergent basis.^{20,21} Patients that undergo stenting as an emergency procedure to relieve a colorectal obstruction prior to elective surgery experience shorter hospital stays, lower severe complication rates, fewer unnecessary operations, and fewer colostomies.¹⁶

Technical success of colonic stenting (defined as an ability to pass a guidewire and proper stent placement) is generally high (90% to 100%) in humans.^{18,21} Clinical success (defined as colonic decompression within 72 to 96 hours after stent placement without endoscopic or surgical reintervention)^{18,21} is also regularly achieved; in a systematic review of several studies evaluating colonic stenting, a median rate of clinical success of 92% was reported.¹⁸ By these definitions, the dog of the present report achieved both technical and clinical success; however, clinical signs such as tenesmus and occasional obstipation persisted. Although the dog of this report had improvement in clinical signs during the 7 months immediately after stent placement, long-term clinical success as judged by complete elimination of clinical signs was not achieved.

Reported complications in humans with colorectal stenting have included colonic perforation, stent migration, tumor ingrowth with secondary obstruction, fistulation, and tenesmus.^{9,10,17,20} The episode of constipation that occurred approximately 3 months after stent placement may be attributable to the elimination of lactulose from the dog's treatment regimen in an effort to control the diarrhea. In a clinical report¹ of colonic stenting in 2 cats that survived nearly 7 months after stent placement, the cats continued to receive oral administration of lactulose and a low-residue diet⁸ to maintain soft feces. Although major complications (eg, colonic perforation and stent migration) were not noted, tenesmus and obstipation were noted periodically in the dog of the present report. Ultimately, the dog was euthanized because of continuation of clinical signs. There was no mechanical obstruction at the proximal aspect of the stent, but the colon was severely distended with soft fecal matter. This episode of obstipation occurred after disruption of medical management. The dog seemed to have a good response to cisapride in addition to the lactulose. It is

possible that the dog had poor colonic motility because of chronic obstruction from the mass.

Outcomes in dogs with malignant colorectal neoplasia have been described.^{4,6} Dogs with colorectal adenocarcinoma undergoing surgical excision or cryosurgery have a significantly longer mean survival time than dogs without surgical excision (surgical excision, 22 months; cryosurgery, 24 months; no surgery, 15 months).⁶ Further, survival times may be affected by the location and gross appearance of a tumor. Dogs with single pedunculated, polypoid masses and dogs with annular masses causing strictures had survival times of 32 and 1.6 months, respectively.⁶ Data on the outcomes of dogs with benign colorectal neoplasia are lacking; however, the prognosis is considered good when resection of the mass can be undertaken.¹⁵ Recurrence of adenomatous polyps is uncommon after resection, and clinical signs resolve in most dogs.^{4,7,22}

Long-term outcome factors of veterinary patients undergoing colorectal stent placement should be considered. First, long-term follow-up of veterinary patients with colonic stents is not available. Additionally, stent complications associated with long-term placement are unknown. Potential long-term complications related to the stent may have included tumor ingrowth through stent gaps resulting in obstruction, migration, and stent fracture.^{10,23} Second, as malignant transformation can occur with colorectal neoplasia, it is recommended that dogs with benign masses (such as was originally found in the dog of the present report) be evaluated periodically after stent placement with thoracic radiography, abdominal ultrasonography, and colonoscopy (including biopsy) to assess progression.^{4,7,22} Colonoscopy is also useful in the assessment of tumor ingrowth. Although migration of an uncovered stent (as was used in the dog of the present report) is less likely than with a covered stent, tumor ingrowth through uncovered stent gaps can result in reobstruction and a necessity for restenting.^{10,18,23} Lastly, marked improvement in clinical signs was not noted until 7 weeks after stent placement in the dog of the present report. Owners should be prepared for the possibility that dogs with placement of a colorectal stent for palliation may need to continue oral administration of medications indefinitely, and clinical signs may show slow improvement until the proper combination of medications and colorectal patency is achieved.

Colorectal stenting resulted in palliation of obstruction in the dog of this report with a large colorectal tumor for a period of nearly 8 months. Major complications were not noted, and the dog's quality of life improved substantially after stent placement; however, some clinical signs continued to develop intermittently, necessitating intervention. Caution should be exercised in the placement of colorectal stents, especially in dogs with benign tumors, as long-term outcome data in companion animals are lacking. Further investigation may reveal the overall clinical efficacy of this treatment modality.

- a. Iams Canine Low Residue, The Iams Co, Dayton, Ohio.
- b. Weasel Wire, Infiniti Medical, Haverford, Pa.
- c. Marker catheter, Infiniti Medical, Haverford, Pa.

- d. Vet Stent-Colorectal, Infiniti Medical, Haverford, Pa.
- e. Prostora, The Iams Co, Dayton, Ohio.
- f. Metamucil, Procter & Gamble, Cincinnati, Ohio.
- g. Eukanuba Feline Low Residue, The Iams Co, Dayton, Ohio.

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