

## Palliative use of a stent for colonic obstruction caused by adenocarcinoma in two cats

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**Case Description**—Two adult male castrated cats were evaluated because of a history of constipation, tenesmus, or intermittent vomiting.

**Clinical Findings**—Radiography and ultrasonography revealed luminal narrowing in the colon of 1 cat and a colonic mass in the other. A histopathologic diagnosis of colonic adenocarcinoma was made in both cats.

**Treatment and Outcome**—Under fluoroscopic guidance, a self-expanding metallic stent was advanced over a wire and across the area of colonic stenosis and deployed. One cat had progressive weight loss but maintained a normal appetite, energy, and a high quality of life. Fecal continence was maintained, and tenesmus was rarely observed. The cat was euthanized because of tumor metastasis 274 days after the colonic stent was placed. The other cat retained fecal continence, and the owners reported subjective improvement in the severity of tenesmus, compared with that prior to stent placement. The cat was euthanized 19 days after stent placement because of perceived decreased quality of life.

**Clinical Relevance**—The use of self-expanding metallic stents for alleviation of colonic obstruction secondary to adenocarcinoma in cats appears to be effective. This technique provides a simple, quick, nonsurgical option for palliation in cats with advanced metastatic or systemic disease in which surgical resection may not be possible or warranted. (*J Am Vet Med Assoc* 2006;228:392–396)

An 11-year-old 9.5-kg (20.9-lb) castrated male cat was evaluated at the MJR-VHUP because of a 1-week history of constipation, tenesmus, and intermittent vomiting. The cat had been evaluated 6 weeks prior by the referring veterinarian for tenesmus and constipation. Abdominal radiography revealed that the colon was filled with feces. The cat responded well to supportive treatment that included a warm-water enema followed by administration of a commercial capsule formulation of dioctyl sodium sulfosuccinate (10.5 mg/kg [4.77 mg/lb], PO, q 24 h) for 5 days, then every other day as a stool softener. The diet was also switched from a commercially available senior diet to dry and canned formulations of a prescription diet.<sup>a</sup> Clinical signs resolved until 1 week prior to reevaluation.

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tion, when the tenesmus returned. During examination by the referring veterinarian, the owners reported that the cat had vomited intermittently after episodes of tenesmus. Abdominal radiography revealed that the colon was filled with feces, and after receiving an unspecified amount of fluids SC, the cat was referred to MJR-VHUP for additional diagnostic evaluation and treatment.

Upon physical examination, the cat was obese (body condition score, 7/9), well hydrated, and uncomfortable during palpation of the caudal portion of the abdomen. Results of a CBC and serum biochemical panel were unremarkable. Abdominal radiography revealed that the ascending colon was filled with feces and that a section of luminal narrowing was present in the gas-filled distal portion of the descending colon (Figure 1). Thoracic radiography revealed a diffuse nodular pulmonary pattern. The nodules ranged in size from 5 to 15 mm. Abdominal ultrasonography revealed irregular borders in both kidneys and diffuse thickening of the terminal portion of the colon. The colonic walls in this location measured 5 mm in thickness (mean  $\pm$  SD colonic wall thickness in healthy cats, 1.5  $\pm$  2.0 mm<sup>1</sup>), and the normal intestinal layering was not evident. Ultrasound-guided fine-needle aspirates of the colonic wall were performed during sedation with diazepam (0.5 mg/kg [0.23 mg/lb], IV), butorphanol (0.5 mg/kg, IV), and propofol (6.8 mg/kg [3.1 mg/lb], IV). Cytologic examination of smears prepared from the aspirates did not reveal a diagnosis. A positive contrast enema was performed with 40 mL of diluted iohexol<sup>b</sup> (50:50 with saline [0.9% NaCl] solution) injected via a 14-F balloon catheter inserted and inflated in the rectum. Fluoroscopic images revealed a 2-cm-long circumferential narrowing of the descending colon at the level of sixth lumbar vertebra with an irregular mucosal-contrast interface.

Subtotal colectomy was discussed but not seriously considered by the owners because of the radiographic evidence of probable pulmonary metastatic disease. At the time of referral, the cat was clinically affected only by the secondary mechanical obstruction caused by the colonic lesion and the owners reported the activity level and appetite to be excellent. For these reasons, palliative stenting to alleviate the colonic obstruction was considered and ultimately performed.

The cat was premedicated with midazolam (0.18 mg/kg [0.8 mg/lb], IV) and hydromorphone (0.18 mg/kg, IV), anesthesia was induced with propofol (3 mg/kg [1.4 mg/lb], IV), and general anesthesia was maintained with isoflurane in oxygen. Colonoscopy revealed a circumferential lesion in the terminal colon consisting of irregular

MJR-VHUP Matthew J. Ryan Veterinary Hospital  
at the University of Pennsylvania

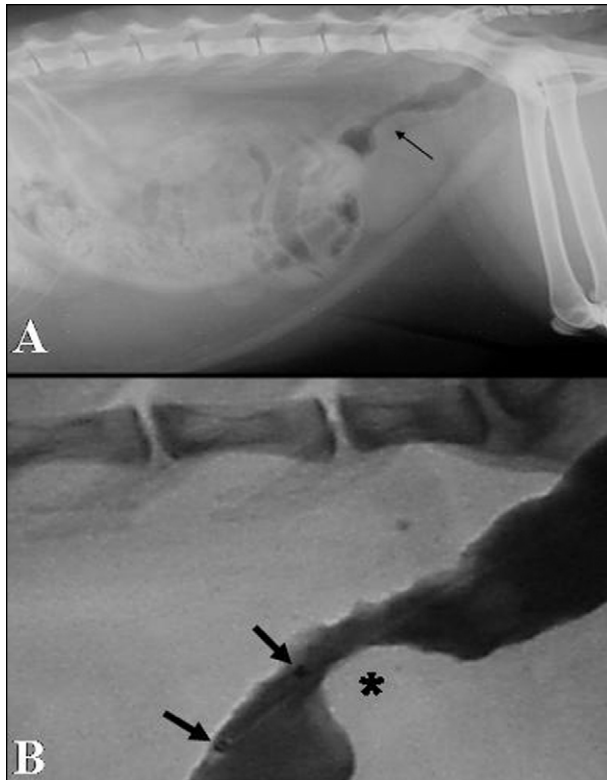


Figure 1—Lateral radiographic (A) and positive-contrast fluoroscopic (B) views of a cat with intestinal adenocarcinoma causing colonic obstruction. A—Notice the feces-filled ascending colon with a section of luminal narrowing (arrow) in the distal portion of the descending colon. B—Notice the luminal stenosis (asterisk). A marking catheter with radiopaque markers (arrows) is positioned across the lesion.

and friable colonic mucosal epithelium (Figure 2). The lesion was approximately 2 to 3 cm in length and caused a substantial reduction in luminal diameter. Endoscopic biopsy specimens of the tissue were obtained that revealed complete loss of colonic mucosa and irregular infiltrative glands lined by pleomorphic basophilic cells with numerous mitoses; a final histopathologic diagnosis of colonic adenocarcinoma was made.

The leading end of the endoscope was used to push the fecal material as orad as possible within the colon. A 0.035-inch angled hydrophilic guide wire<sup>c</sup> was inserted per rectum and gently advanced orad under direct fluoroscopic guidance. A catheter<sup>d</sup> with 2 radiopaque marks 20 mm apart was advanced over the wire to facilitate advancement of the catheter and wire combination across the stenotic region and into the transverse colon (Figure 1). The marks were used to calculate the radiographic magnification so the colonic width and stenosis length could be extrapolated. These measurements were used to select an appropriately sized stent that was approximately 10% larger in diameter than the measured distended portion of the colon and that extended at least 2 cm longer orally and aborally than the lesion. The marker catheter was removed over the wire, and the wire was left in place. Under fluoroscopic guidance, a 20 × 80-mm-long self-expanding metallic stent<sup>e</sup> was advanced over the wire and across the area of stenosis and then deployed (Figure 3). The

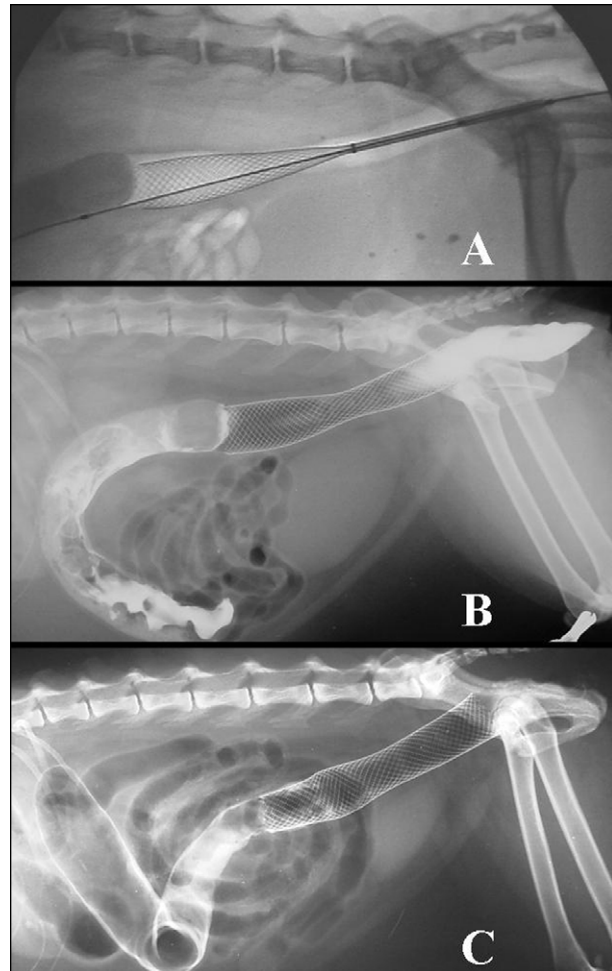


Figure 2—Lateral abdominal radiographic views of a cat undergoing placement of a stent across a region of colonic obstruction caused by an adenocarcinoma. A—Deployment of the stent across the lesion. B—Twenty-four hours after stent placement. C—Forty-eight hours after stent placement; notice alleviation of the colonic obstruction.

delivery system was removed over the wire and replaced with a 4-F Berenstein-type catheter. The guide wire was removed, and 10 mL of a hypertonic contrast agent<sup>f</sup> was injected through the catheter and into the dry fecal material to help draw fluid into the feces. The cat recovered from general anesthesia without complications. Total procedural time including colonoscopy, biopsy, and stent deployment was 35 minutes.

Mild tenesmus was noticed during the first 24 hours after surgery, but the magnitude was similar to that observed before surgery. Radiography performed 24 hours after surgery revealed that the fecal mass was entering the stent (Figure 3). An additional 20 mL of hypertonic contrast<sup>f</sup> agent mixed with 3 mL of a water-soluble lubricant was injected per rectum. Approximately 30 hours after stent placement, the cat passed a large amount of loose fecal material. Radiography performed at 48 hours revealed that the stent had increased the stenotic colonic luminal diameter by approximately 3 times and the colon was relatively devoid of formed fecal matter.

The cat was discharged from the hospital the following day with a 7-day course of broad-spectrum

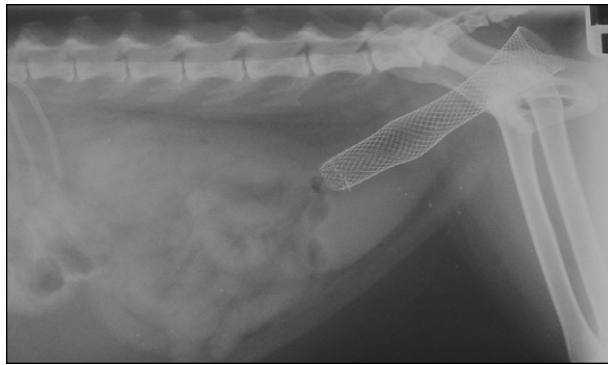


Figure 3—Lateral abdominal radiographic view of the same cat as in Figure 2, obtained approximately 6 months after stent placement. Notice the slight aboral migration and slight fraying of the oral segment of the stent, compared with Figure 2.

antimicrobials consisting of amoxicillin-clavulanic acid (13 mg/kg [6 mg/lb], PO, q 12 h) and metronidazole (13 mg/kg, PO, q 12 h). In addition, lifelong oral administration of a cyclooxygenase inhibitor (meloxicam, 0.05 mg/kg [0.02 mg/lb], PO, q 24 h) for anti-inflammatory and possible antineoplastic effects and oral administration of disaccharide laxative (lactulose, 0.15 g/kg [0.07 g/lb], PO, q 8 h) were prescribed. The cat's diet was switched to a canned formulation of a low-residue veterinary prescription diet.<sup>8</sup>

The cat had progressive weight loss but maintained a normal appetite, energy, and a high quality of life. Fecal continence was maintained, and tenesmus was rarely observed. The owners titrated the dose of lactulose at home to maintain soft stools. Radiography repeated every 4 to 6 weeks revealed gradual progression of the nodular pulmonary pattern and maintenance of a patent colonic lumen (Figure 4). On day 271, the owners noted increased lethargy and a swelling in the perianal region. Physical examination revealed severe extensive perianal cellulitis and abscessation associated with the left anal sac. Given the extent of the lesion and advanced nature of the disease, the owners chose euthanasia for the cat. The cat was euthanized 274 days after the colonic stent was placed. On postmortem examination, the lumen of the colon was still patent in the region of the stent. Histologic examination revealed multiorgan metastasis of the adenocarcinoma to the perianal skin, left anal sac, lungs, and right kidney. There was severe, multifocal to coalescing necrotizing cellulitis associated with the left perianal and anal sac region.

A 9-year-old 5.5-kg (12.1-lb) castrated male Siamese cat (cat 2) with a 10-day history of tenesmus was referred to MJR-VHUP for evaluation. The cat was evaluated 5 days prior by the referring veterinarian. Physical examination at that time revealed distention of the abdomen by fluid. Results of a serum biochemical panel, measurement of total thyroxine concentration, urinalysis, and bacteriologic culture of urine were within reference ranges, and a CBC revealed thrombocytosis (773,000 platelets/ $\mu$ L; reference range, 200,000 to 500,000 platelets/ $\mu$ L). Abdominal radiography and ultrasonography revealed feces that filled the colon, a large volume of peritoneal effusion, and a mass associated with the terminal portion of the colon. The omentum

appeared to be attached to the serosal surface of the colonic mass. After sedation and manual evacuation of the distal portion of the colon, referral to MJR-VHUP was recommended for further diagnostic and treatment options. The cat was evaluated 2 days later at MJR-VHUP. Results of the physical examination were unchanged. Radiographs of the thorax were unremarkable. Abdominal ultrasonography was repeated, and findings were similar with the exception of a small hypoechoic liver nodule. Abdominocentesis and analysis of the peritoneal effusion revealed a total protein concentration of 3.1 g/dL and a nucleated cell count of 3,700 cells/ $\mu$ L. Cytologic evaluation of smears of the effusion revealed aggregates of tightly cohesive, round to irregular epithelial cells with distinct cell borders and centrally located round to oval nuclei. The chromatin was coarsely stippled to rosey with 1 or 2 distinct bizarre-shaped nucleoli. The cytoplasm was scant to moderate in volume and deeply basophilic. The cells had moderate anisocytosis and anisokaryosis; rarely, cells had nuclear and cellular molding. Findings were consistent with a carcinomatous effusion. A positive contrast enema performed with 15 mL of iohexol,<sup>b</sup> followed by radiography, revealed a 5-cm segment of narrowed descending colon with an irregular luminal-filling defect. The cat was premedicated with butorphanol (0.2 mg/kg [0.09 mg/lb], IV) and glycopyrolate (0.01 mg/kg [0.004 mg/lb], IV), anesthesia was induced with ketamine (3 mg/kg [1.4 mg/lb], IV) and diazepam (0.5 mg/kg [0.23 mg/lb], IV), and general anesthesia was maintained with isoflurane in oxygen. A lumbar epidural injection was performed to administer morphine (0.1 mg/kg [0.045 mg/lb], intrathecal) and bupivacaine (0.5 mg/kg, intrathecal). Colonoscopy revealed a circumferential lesion in the terminal portion of the colon consisting of irregular colonic mucosal epithelium. The lumen of the colon was approximately 50% occluded. Evaluation of endoscopically obtained biopsy specimens revealed adenocarcinoma. A 20  $\times$  70-mm stent<sup>c</sup> was placed by use of the same technique as described. Procedural time including colonoscopy and biopsy was 30 minutes. The cat passed a large volume of soft feces within 12 hours after stent placement and was discharged with recommendations for treatment with lactulose (0.15 g/kg, PO, q 8 h), meloxicam (0.05 mg/kg, PO, q 24 h), and spironolactone (1.1 mg/kg [0.5 mg/lb], PO, q 12 h). Despite reestablishment of integrity of the colonic lumen, the cat continued to produce a large volume of peritoneal effusion because of the abdominal tumors. The cat retained fecal continence, and the owners reported subjective improvement in the severity of tenesmus, compared with that prior to stent placement. The cat was euthanized 19 days after stent placement because of perceived decreased quality of life. A postmortem examination was not performed.

## Discussion

Feline gastrointestinal adenocarcinoma represents 20% to 35% of gastrointestinal neoplasms in cats.<sup>2</sup> It is the most common nonhematopoietic neoplasm of the intestinal tract of cats<sup>2</sup> and the most common neoplasm of the colon.<sup>3</sup> Histologic subtypes have been described as tubular, undifferentiated, and mucinous.<sup>4</sup>

As many as 76% of cats with colonic adenocarcinoma have evidence of metastases at the time of diagnosis.<sup>3,4</sup> Sites of metastasis include regional lymph nodes, peritoneum, liver, spleen, bone, and lungs.<sup>3,5</sup> Median survival time varies with the extent of disease and the treatment modalities.<sup>3</sup> Surgical resection is the most common method of treatment for focal intestinal adenocarcinomas. In 1 report<sup>3</sup> of 16 colonic adenocarcinomas in cats, increased survival time associated with subtotal colectomy versus more conservative surgical resection was reported. That study<sup>3</sup> also revealed significantly decreased survival time in cats with metastatic disease at the time of surgery (median duration of survival, 49 days), compared with cats without metastatic disease (259 days). Doxorubicin chemotherapy after surgery increased the median survival time, compared with cats that did not receive chemotherapy, although the groups were not stratified regarding the presence or absence of metastasis.<sup>3</sup>

In humans, colonic carcinoma is a common tumor.<sup>6</sup> Conventional treatment includes surgical resection with or without chemotherapy.<sup>7</sup> Approximately 10% to 30% of humans with colonic tumors have clinical signs secondary to acute intestinal obstruction.<sup>8</sup> At the time of diagnosis, many affected humans are in poor condition<sup>7</sup> and postoperative morbidity and mortality rates are better in those in whom the resection and anastomosis can be performed on an elective basis.<sup>7,9,10</sup> Historically, initial surgery consisted of resection of the primary tumor and a temporary colostomy, followed by reanastomosis performed at a later date.<sup>7</sup> More recently, self-expanding stents have been utilized to relieve the obstruction and improve the status of the patient prior to a single definitive surgical treatment. Stents are also used as a palliative modality in patients with advanced terminal disease or in patients unable to undergo surgery.<sup>11</sup> A recent review<sup>12</sup> revealed a technical success rate of 92% and a clinical success rate of 88% in 598 patients who received colonic stents for malignant obstructions. Complications rates were < 10%, and major complications included stent migration (10%), reobstruction (10%), and perforation (4%). Perforation was seen most commonly in patients in whom dilation of the stenotic lesion was performed prior to stent placement.<sup>12</sup> Stent migration seems to occur more frequently when covered stents are used, compared with uncovered stents.<sup>13</sup> None of these complications were detected in the 2 cats of the present report, although minor stent repositioning and slight aboral displacement did occur as the stents gradually expanded to their full diameter.

No important complications directly related to the stents were detected in either cat during stent placement or during the follow-up period. Both cats had tenesmus during the 24 hours after stent placement, but the severity was similar to that observed prior to surgery. Epidurally administered morphine and bupivacaine in the second cat seemed to decrease tenesmus, and subjective improvement was evident, compared with the first cat. The perineal and anal sac abscessation in the first cat did not appear to be related to the stent. Anal sac abscessation may have developed secondary to prolonged soft stool consistency that hindered normal expression of anal sac secretions. Periodic expression of the anal sacs

may be needed to decrease the incidence of anal sac disease in cats undergoing this procedure. There was also histologic evidence of tumor metastasis in this area, which may have predisposed the cat to the resulting infection. Spironolactone was prescribed in the second cat for possible palliation of the malignant effusion. Although diuretic administration is less successful in cases in which salt retention is not a primary pathophysiologic mechanism of the ascites, a proportion of human patients benefit from diuretic administration.<sup>14</sup> The procedural time, including colonoscopy, biopsy, and stent placement, was < 40 minutes in both cats; this is considerably shorter than the time required for colectomy.

Traditional chemotherapy was declined by the owners of both cats, and it is unknown whether chemotherapy would have improved survival time in these cats. An orally administered cyclooxygenase inhibitor was used in both cats for possible palliation of the effects of neoplasia. Cyclooxygenase-2 expression has been detected in intestinal adenocarcinoma in dogs,<sup>15</sup> but a recent study<sup>16</sup> failed to identify cyclooxygenase-2 expression in intestinal adenocarcinoma in cats.

The use of self-expanding metallic stents for alleviation of colonic obstruction secondary to adenocarcinoma in cats appears to be effective. This technique provides a simple, quick, nonsurgical option for palliation in patients with advanced metastatic or systemic disease in which surgical resection may not be possible or warranted.

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- a. Prescription Diet Feline w/d, Hill's Pet Nutrition Inc, Topeka Kan.
  - b. Iohexol (Omnipaque), Amersham Health, Princeton, NJ.
  - c. Weasel wire, Infiniti Medical, Haverford, Pa.
  - d. Marker catheter, Infiniti Medical, Haverford, Pa.
  - e. Wallstent, Boston Scientific Corp, Natick, Mass.
  - f. Meglumine diatrizoate (Hypaque 60), Amersham Health, Princeton, NJ.
  - g. Eukanuba Feline Low Residue, The Iams Co, Dayton, Ohio.
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## Selected abstract for JAVMA readers from the American Journal of Veterinary Research

Evaluation of association between body size and large intestinal transit time in healthy dogs  
David C. Hernot et al

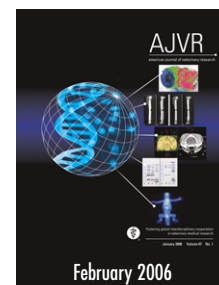
**Objective**—To compare large intestinal transit time (LITT) in dogs of various body sizes and determine whether fecal quality was correlated with LITT.

**Animals**—6 Miniature Poodles, 6 Standard Schnauzers, 6 Giant Schnauzers, and 6 Great Danes.

**Procedure**—LITT was calculated as the difference between total (TTT) and orocecal transit time (OCTT). Minimum and mean OCTTs were determined by use of the sulfasalazine-sulfapyridine method. Minimum TTT was estimated by use of chromium and ferric oxide as color markers, and mean TTT was calculated from the recovery from feces of ingested colored plastic beads. Fecal moisture content was determined and fecal consistency was scored during the same period.

**Results**—Large-breed dogs had higher fecal moisture content and more watery fecal consistency. No association between body size and OCTT was detected, but there was a positive correlation between body size and mean TTT. Mean LITT increased significantly with body size, from  $9.1 \pm 1.1$  hours in Miniature Poodles to  $39.4 \pm 1.6$  hours for Giant Schnauzers. Significant correlations were detected among mean LITT, mean TTT, and fecal scores, whereas no correlation was observed between fecal moisture content and TTT or LITT.

**Conclusions and Clinical Relevance**—LITT was correlated with fecal consistency in dogs of various body sizes. Mean LITT can be predicted from values for mean TTT in healthy dogs. (*Am J Vet Res* 2006;67:342–347)



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