Ligation of the caudal mesenteric artery during resection and anastomosis of the colorectal junction for annular adenocarcinoma in two dogs

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An 8-year-old terrier cross and a 10-year-old German Shorthaired Pointer presented to the University Veterinary Centre, Sydney, for investigation of long-standing tenesmus and dyschezia. Both patients had an annular adenocarcinoma at the colorectal junction. Exploratory laparotomy was performed and the affected large intestinal segment was removed by resection and anastomosis. In both dogs, the caudal mesenteric artery was intimately associated with the mass, necessitating its ligation and transection. Postoperatively, there was no evidence of anastomosis breakdown in either case and both animals recovered well from surgery. The dogs were euthanased 8 and 10 months, respectively, after surgery because of clinical signs relating to metastatic disease.

Keywords caudal mesenteric artery; colectomy; colorectal adenocarcinoma; ischaemia

Abbreviations NSAIDs, non-steroidal anti-inflammatory drugs; PDS, polydiaxanone

Surgery of the terminal colon is a relatively uncommon procedure in the dog. In contrast to cats, in which colectomy is routinely performed for treatment of megacolon, resection and anastomosis of the terminal colon has been rarely reported in dogs. The indications for this procedure may include treatment for neoplasia, strictures and trauma-related injury. Healing of any anastomosis relies on an adequate blood supply, minimal tension at the site, proper surgical technique (apposition of intestinal layers, in particular the submucosa) and appropriate postoperative nutrition. With respect to the colorectal junction, blood supply is a particularly important factor given that the large intestine has a segmental vascular pattern that makes it susceptible to ischaemic injury if part of the vascular supply is damaged.

Although there is no supporting published evidence, the current recommendation on resection and anastomosis of the terminal colon is to ligate individual vasa recta to preserve the blood supply from the cranial rectal artery. The caudal mesenteric artery provides most of the blood supply to the terminal colon and cranial rectum, which has led to a general belief among surgeons that caudal colectomy with ligation of the aforementioned arteries may be associated with an unacceptable risk of dehiscence in the dog; hence the procedure is largely discouraged (GBH, personal communication).

Cats undergoing total or subtotal colectomy for the treatment of refractory megacolon routinely have the caudal mesenteric artery ligated, and thereby the cranial rectal artery, without an observed increase in anastomotic failure. The question arises as to whether resection of the terminal colon in a dog, necessitating ligation of the caudal mesenteric artery, could be successful despite the published experimental literature.

The following report describes two cases of this surgical procedure at the University Veterinary Centre, Sydney, which was performed for palliative treatment of colorectal adenocarcinoma.

Dog 1

An 8-year-old, female spayed terrier cross was presented because of tenesmus and dyschezia of 6 months’ duration. The clinical signs had not resolved with medical management consisting of appropriate doses of amoxicillin–clavulanic acid, metronidazole and metoclopramide. Faecal floatation done by the referring veterinarian was negative for intestinal parasites.

A circumferential thickening of the rectal wall was palpable per rectum. Ultrasonographic examination showed diffuse thickening of the terminal 4 cm of the descending colon and cranial rectum with loss of layering. The medial iliac lymph nodes were normal in both size and echo-texture. An ultrasound-guided fine-needle aspiration biopsy was obtained and submitted for cytology, but was reported as non-diagnostic. Exploratory laparotomy was performed for further investigation.

Following a 12 h fast, the patient was premedicated using methadone (0.1 mg/kg IV), acetylpromazine (0.01 mg/kg IV) and glycopyrrolate (0.1 mg/kg SC). Anaesthesia was induced using alphaxalone (Alfaxan CD, 1.0 mg/kg IV) to effect and maintained with 2% isoflurane administered with 100% oxygen. Ticarcillin–clavulanic acid (50 mg/kg IV) was administered after induction. An intravenous infusion of morphine sulfate (0.1 mg/kg/h) was commenced and a morphine–bupivacaine epidural block was performed. A midline laparotomy extending from the xiphisternum to the pubis was performed. A circumferentially thickened area of descending colon, approximately 2 cm long, with an area of fibrosis and adhesion of the uterine stump were visualised. The oral colon was dilated. Adhesions between the mass and the uterine stump were separated by blunt
surgery was unremarkable. Meloxicam (0.1 mg/kg PO daily) was dispensed. The patient re-presented approximately 4 months after surgery with diarrhoea, haematochezia and tenesmus. No masses were palpable on rectal examination. The owner declined further investigation and opted for conservative management consisting of a bland diet and metronidazole (12 mg/kg PO twice daily for 21 days). Meloxicam was temporarily stopped and then restarted 7 days after resolution of gastrointestinal signs.

Six months after the surgery, the patient presented for a follow-up abdominal ultrasound. The owner had noted dyschezia of increasing frequency. Ultrasound examination revealed a focal thickening of the descending colonic wall with loss of layering. Nodules within the mesocolon and omentum and a small amount of free abdominal fluid were also present. Cytological evaluation of the fluid revealed low numbers of epithelial-like clusters of medium-to-large, rounded mononuclear cells with a high nuclear to cytoplasmic ratio and moderate anisokaryosis, consistent with a neoplastic effusion. Recurrence of the colorectal adenocarcinoma with peritoneal carcinomatosis was suspected.

The patient was euthanased 2 months later, 8 months after the surgery, because of persistent dyschezia, weight loss and anorexia. Necropsy was not performed.

**Dog 2**

A 10-year-old German Shorthaired Pointer was referred for evaluation of an annular adenocarcinoma of the terminal colon. The dog had been forming thin ribbon-like stools for the past 6 months and the clinical signs had recently progressed to tenesmus and haematochezia. Minor improvement in clinical signs was noted when the dog was treated with sulfasalazine (30 mg/kg PO twice daily) and Hills Canine z/d ultra®. The dog was also receiving thyrroxine (0.02 mg/kg PO twice daily). The lesion had been biopsied by the referring veterinarian 2 weeks prior to the referral presentation. Histopathology had confirmed the presence of a colonic adenocarcinoma. No pulmonary metastasis was noted on thoracic radiographs.

On abdominal palpation the mass could be identified as a firm, tubular, 3 to 4 cm lesion located along the midline of the caudal abdomen. The lesion was also palpable on rectal examination.

The patient was fasted for 12 h. Following premedication with acepromazine (0.01 mg/kg IV) and methadone (0.4 mg/kg IV), general anaesthesia was induced with alphaxalone (1.5 mg/kg IV) and maintained with isoflurane and 100% oxygen. Ticarcillin–clavulanic acid (50 mg/kg IV) was administered at this time. An intravenous morphine infusion and epidural regional anaesthesia were carried out as in dog 1. A ventral midline laparotomy was performed. The palpable lesion involved the terminal colon circumferentially and was adjacent to the caudal mesenteric artery. The caudal mesenteric, cranial rectal and left colic arteries were ligated and the lesion was removed with 2-cm margins. An end-to-end anastomosis was performed using simple interrupted approximating sutures of 4/0 PDS. Both internal iliac lymph nodes were removed; the right lymph node was grossly enlarged. The anastomotic site was omentalised and the abdomen was closed routinely following lavage with warm physiologic saline. Histopathological examination confirmed colonic adenocarcinoma with
metastasis to the iliac lymph nodes. Infiltration was evident throughout all layers of the colon, including the serosal layer.

The intravenous infusion of morphine sulfate (6 mg/h) was continued postoperatively. Ticarcillin–clavulanic acid (50 mg/kg IV) was administered every 8 h. The dog developed persistent tenesmus and haematochezia within the first 24 h. Faecal incontinence was present and led to perineal inflammation that was treated by topical application of castor oil and zinc cream. Straining was partially responsive to the application of lignocaine gel (Xylocaine gel®) to the anus. The faecal incontinence gradually improved over the subsequent 4 days.

A low residue canned dog food (Eukanuba™) was offered in small amounts, frequently, and oral amoxicillin–clavulanic acid (16.4 mg/kg twice daily) and tramadol hydrochloride (1.6 mg/kg twice daily) were introduced after the second day. The patient developed diffuse pitting oedema of both hindlimbs, beginning at the medial aspect of the femoral region and extending distally to the metatarsal area over the subsequent 24 h. This was managed using gentle massage and leash walking. The popliteal lymph nodes became enlarged, but reduced in size with time. The dog was discharged 7 days after surgery on oral amoxicillin–clavulanic acid, tramadol hydrochloride and codeine phosphate (1 mg/kg twice daily). The pitting oedema had resolved by the time of discharge.

The dog re-presented 7 months after the surgery. She had been producing well-formed stools without obvious tenesmus or dyschezia according to the owner. A 2-cm, round ‘golf ball’-like lesion was palpable on the dorsal aspect of the rectum. Abdominal ultrasound demonstrated enlargement of the lymph nodes in the caudal abdomen and pelvic canal. Thoracic radiography showed numerous round opacities within the pulmonary parenchyma consistent with metastatic disease. The patient was discharged on oral tramadol hydrochloride (1.6 mg/kg twice daily) and firocoxib (4.9 mg/kg once daily).

Ten months after the surgery, the dog was euthanased as a result of hindlimb paresis and intractable lumbar spinal pain. The owner had noted no reoccurrence of the diarrhoea, tenesmus or haematochezia since the surgery.

Discussion

Intestinal adenocarcinoma is uncommon in dogs and occurs mainly in the colon and rectum, appearing as pedunculated, nodular or annular masses. A study of 78 dogs with colorectal adenocarcinoma reported tenesmus, dyschezia and haematochezia in all patients; 63% had masses that were palpable on rectal examination. The large intestinal signs occurred secondary to the thickening, reduced luminal diameter and general irritation caused by the primary mass. This can be distressing and frustrating for both the patient and its owner and the dog’s quality of life is generally deemed to be poor. The results for the two dogs in the present report show that surgical resection of the affected area can alleviate the clinical signs, thereby improving the dog’s quality of life. Owners of both dogs were satisfied with the palliation achieved by colectomy, despite the initial postoperative complications and recurrence of the tumour in both patients. Both dogs had better survival times (8 and 10 months, respectively) than in the published reports. The mean survival time for annular colorectal adenocarcinoma has been reported as 1.6 months in 5 dogs.

Surgical resection of intestinal tumours generally involves end-to-end anastomosis, although an alternative procedure is end-on-colostomy. The current literature strongly advises preservation of the caudal mesenteric artery during colonic resection and anastomosis to avoid severe ischaemic colitis that may lead to wound breakdown. The two clinical cases in this study are the first in which resection and anastomosis of the colon, including ligation of the caudal mesenteric artery, has been reported in the dog. Our observations show that healing of the colon following ligation of the caudal mesenteric artery is possible.

The descending colon and rectum are perfused by the middle colic artery, caudal mesenteric artery and, to a lesser extent, branches of the internal pudendal artery. The middle colic artery originates from the ileocolic vessel, which is a tributary of the cranial mesenteric artery. This vessel courses within the mesocolon distally while giving off vasa recti that embed in the descending colon. The caudal mesenteric artery arises from the abdominal aorta at the caudal level of the fifth lumbar vertebra. It courses caudoventrally in the mesocolon, where it divides into the left colic artery and the cranial rectal artery. Proximally, the left colic artery anastomoses with the middle colic artery to form a marginal artery. Distally, the cranial rectal artery anastomoses with the middle and caudal rectal arteries, both of which are branches of the internal pudendal artery. Goldsmid et al. evaluated the colorectal blood supply in dogs by means of visual, fluorescence and histological studies. They concluded that the cranial rectal artery was the primary vessel perfusing the distal colon and the majority of the rectum. The middle and caudal rectal arteries supplied only the caudal aspect of the rectum, suggesting that if the cranial rectal artery was ligated, blood supply to the terminal colon and cranial rectum would be compromised. Observations in anaesthetised dogs prior to euthanasia showed compromise of colonic blood flow for up to 8 h after ligation of the caudal mesenteric artery. They concluded that if the cranial rectal artery had to be ligated then the terminal colon and the majority of the rectum should be resected to minimise the risk of ischaemic necrosis.

The fact that the two dogs in the present report survived without evidence of anastomotic dehiscence suggests that the remaining blood supply to the colorectal anastomosis was adequate and presumably from tributaries of the internal pudendal artery and the middle colic artery. However, local angiogenesis arising as a result of the presence of a rapidly growing neoplasm may have contributed to the formation of an adequate collateral blood supply. Colorectal tumours in humans have been found to express COX-2 receptors, which is suspected to promote local angiogenesis. However, it also represents a target for chemotherapy. Reportedly less than half of canine rectal carcinomas express COX-2 receptors, but the use of non-steroidal anti-inflammatory drugs (NSAIDs) may still be indicated. NSAIDs were used for extended periods postoperatively in both of the present cases with minimal side-effects noted.

Tramadol hydrochloride was administered in both cases postoperatively. It is a μ opioid receptor agonist that provides analgesia, as well as reducing colonic motility. Its administration improved
patient comfort, as well as reducing the frequency of diarrhoea and straining. Alternatively codeine phosphate may be used.

Anastomoses of the large intestine undergoes a period of collagenolysis starting approximately 24 h after surgery and until day 4 collagenolysis continues to be greater than collagen synthesis. Consequently, this is the period in which dehiscence is most likely to occur. Adequate blood flow to the anastomotic site during this time is essential in order to facilitate synthesis of collagen and increase resistance to infection.

Although the medium-term outcome was good, perioperative complications including large-bowel diarrhoea, tenesmus and perineal dermatitis secondary to temporary faecal incontinence necessitated aggressive symptomatic treatment in both dogs. There are a number of possible reasons for this. Stimulation of the defecation reflex because of surgical inflammation was considered the most likely cause, although reaction to the ticarcillin–clavulanic acid or other drugs could not be ruled out. Alternatively, mild ischaemia may have led to colonic ulceration that resolved spontaneously as blood flow improved by means of collateral circulation. The diffuse bilateral hindlimb pitting oedema noted in dog 2 was assumed to be secondary to intrapelvic inflammation and subsequent lymphatic obstruction related to the removal of the left iliac lymph node. However, metastatic disease obstructing local lymphatics could not be ruled out.

It is interesting to note that the published literature does not specify preservation of the caudal mesenteric artery and thereby the cranial rectal artery in cats undergoing colectomy for megacolon. In the absence of detailed anatomical studies, it is presumed that adequate blood flow occurs via other vascular structures, including the middle and caudal rectal arteries. Nevertheless, some authors still recommend preservation of the cranial rectal artery in the cat. Studies quantifying the collateral blood supply of the feline colon and rectum would be helpful.

Summary

This case report has shown that colonic resection and anastomosis with ligation of the caudal mesenteric artery can be performed in dogs without dehiscence. The surgery provided temporary resolution of clinical signs and an increase in survival time when compared with the published literature. Owners should be informed of the possibility of short-term postoperative complications that may require aggressive medical management. A larger study is required to confirm whether the postoperative morbidity seen in the present dogs might be expected in all patients.

References


(Accepted for publication 21 August 2008)