Surgical treatment of right-sided renal lymphoma with invasion of the caudal vena cava

An eight-year-old, male castrated basset hound presenting with a three-month history of lethargy was examined. Diagnostic tests including radiography and ultrasonography showed a right-sided renal mass. A $^{99m}$Tc diethylenetriamine penta-acetic acid scan demonstrated that this kidney was non-functional. At surgery, invasion of the caudal vena cava was found, and the renal segment of the vena cava and the right kidney were resected. The left renal vein was anastomosed to the more proximal vena cava using a polytetrafluoroethylene graft, and the dog recovered well. Two days postsurgery, the dog suffered an acute episode of aspiration pneumonia and was euthanased. The renal mass was diagnosed as lymphoma on histopathology.

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the basis that the right kidney was non-functional. A decision was made to carry out a right-sided nephrectomy.

Electrocardiography, capnography, direct arterial blood pressure and pulse oximetry monitoring were performed throughout anaesthesia. Fentanyl (Fentanyl citrate; Marsam Pharmaceuticals) was given by continuous infusion intravenously (approximately 10 mg/kg/hour), and crystalloids and hetastarch (6% Hetastarch; Gensia Laboratories) were administered as needed.

The superficial abdominal vasculature was very prominent. Following a ventral laparotomy, the abdomen was explored. The right kidney was found to be enlarged (approximately 20 × 10 × 8 cm) and irregular. Extensive attachments to the dorsal and dorsolateral abdominal wall, and invasion of the renal segment of the cava, was found (Fig 1). The vena cava in this segment was filled with a solid mass that invaded and replaced the caval wall over approximately 270° of its circumference. The left kidney appeared slightly enlarged with prominent and enlarged capsular vessels. No mass was palpated within the left renal vein. The extent of flow within the left renal vein could not be determined. The venous vasculature in the caudal half of the abdomen was very prominent, with multiple tortuous abnormal venous vessels present in the dorsocaudal abdomen.

A decision was made to graft the left renal vein to the vena cava cranial to the obstruction, and resect the right kidney and associated segment of the vena cava, and mass. Heparin (Heparin; Celsus) was administered at 30 iu/kg intravenously, and repeated one hour later. Using a tangential vascular clamp, an end-to-side anastomosis was performed between the vena cava and a 5 mm diameter polytetrafluoroethylene (PTFE) graft (Impra; Tempe) using 5-0 polypropylene in a simple continuous pattern. The free end of the graft was clamped and the vascular clamp on the vena cava released. An end-to-end anastomosis was then performed between the PTFE graft and the left renal vein, in a simple continuous pattern using 5-0 polypropylene. A 30 mm vascular thoraco-abdominal stapler (TA30V; US Surgical) was used to ligate the caudal vena cava 2 cm cranial and 2 cm caudal to the area invaded by solid tissue. Following extensive meticulous dissection, the right kidney and associated segment of the caudal vena cava was removed (Fig 2). The abdomen was closed routinely. Heparin administration was continued at 100 iu subcutaneously four times daily.

Postoperatively, urine output was maintained above 1.5 ml/kg/hour using crystalloids, hetastarch and dopamine (Dopamine; Abbott Hospital Products), as required. The activated partial thromboplastin time measured 12 hours postoperatively was 28-3 seconds (control 10-5 to 15-6 seconds) and 24-9 seconds at 36 hours postoperatively. After 24 hours, aspirin (Bayer Aspirin; Bayer US) therapy was initiated (5 mg/kg every other day orally). The activated clotting time was monitored four times daily and was maintained between 125 and 150 seconds. The dog was bright and able to walk and was taking small amounts of food. Fentanyl, dopamine and hetastarch were discontinued by 36 hours following surgery. Creatinine was lower than the presurgery value at this time (170 mmol/litre).

Forty-three hours following surgery, the dog suddenly became dyspnoeic and was coughing up blood-tinged fluid. The dog was transferred to an oxygen cage and the heparin was antagonised using protamine (Protamine; Eli Lilly). Thoracic radiographs revealed a severe alveolar interstitial lung pattern in the left cranial and right middle lung lobes, consistent with bronchopneumonia and/or pulmonary oedema or interstitial bleeding. The dog stabilised, but suffered a sudden respiratory and subsequent cardiac arrest three hours later. Resuscitation was successful, but two further cardiopulmonary arrests occurred over the following two hours and the owners elected for euthanasia.
Pathology
On histological examination, the right kidney was comprised of a highly cellular mass of discrete, round, 12 to 14 μm cells with scant cytoplasm, which effaced and compressed normal parenchyma. Immunohistochemical stains, using monoclonal antibodies for CD 3 (Dako; Carpinteria) (T cells) and CD 79a (Dako) (B cells), had positive reaction product with the CD 3 antibody. A diagnosis of renal lymphoma was made. Histopathological examination of the lung resulted in a diagnosis of severe diffuse bronchopneumonia, secondary to aspiration. There was no evidence of pulmonary thrombosis. No bacterial aetiological agents were identified. The PTFE graft was found to be intact and there was no evidence of thrombosis within the lumen.

DISCUSSION

Extension of tumour into the renal segment of the caudal vena cava can occur from three possible sources: the vessel wall itself, the adrenal gland or the kidney. Primary vessel wall tumours are very rare in dogs (de Martin and others 1983, King 1991, LeGrange and others 2000). The most common reason for neoplastic invasion of the caudal vena cava is invasion by malignant adrenocortical tumours, occurring in about 22 per cent of such cases (Scavelli and others 1986, Emms and others 1987, Poffenbarger and others 1988, Voorhout and others 1990, Yamaoka and others 1994). Caudal vena caval angiography tends to slightly overestimate vascular involvement (Gilson and others 1994). However, given that a renal mass was suspected in the present case, there was little reason to suspect vascular invasion.

There are no reports in the literature discussing the medical treatment of unilateral renal lymphoma in dogs. Crow (1985) suggests that, in dogs, chemotherapy will only achieve a partial remission, with temporary reduction in the severity of clinical signs being the result. Surgery would therefore appear to be the preferred option for the treatment of unilateral renal lymphoma in the dog.

There were three options for the surgical management of tumour involvement of the caudal vena cava in this case: (1) resection of the involved segment and ligation of the left renal vein; (2) resection of the involved segment with reconstruction of the renal segment of the caudal vena cava; or (3) resection of the involved segment with anastomosis of the left renal vein to the more proximal segment of the caudal vena cava. In dogs and humans, the first option can be performed and left renal function preserved (Lespinaise 1947, Duckett and others 1973, Clayman and others 1980, Lord 1982). An extensive collateral system, based on persistence of vestigial vessels of the embryonic cardinal veins, can compensate for acute obstruction of the caudal vena cava and left renal vein (Duckett and others 1973). However, various degrees of left renal dysfunction ranging from a few hours to up to 10 weeks, occasionally requiring dialysis, and also leg oedema, were seen in approximately 60 per cent of patients in those reports (Lespinaise 1947, Clark 1961, Duckett and others 1973, Clayman and others 1980, Lord 1982).

Ligation of the caudal vena cava is best tolerated in chronic diseases where an adequate collateral circulation has developed (Huget and others 1995). In this case, there was no flow through the caudal vena cava caudal to the left kidney, but it was unclear whether or not blood from the left renal vein was entering the more cranial segment of the vena cava. To avoid transient compromise of left renal function, the left renal vein was anastomosed to a more cranial segment of the caudal vena cava.

Prosthetic or autogenous materials can be used for vascular grafting. Prosthetic materials include polyethylene terephthalate (Dacron) and PTFE (Teflon or Gore-Tex) (Nishihi 1995). Autogenous materials include veins, pericardium, peritoneum and small intestine (Lantz and others 1990, Poy and others 1998, White and Burton 1998). PTFE was chosen because of good results obtained in both humans and dogs when used for reconstruction of the caudal vena cava (Cochran and others 1984, Oksada and others 1996) and also because it obviated the need for a further surgical approach. PTFE can still be thrombogenic in a low flow situation, which is why the dog was medicated with heparin and then aspirin.

Aspiration pneumonia probably resulted in the death of the dog. The total anaesthetic time was prolonged (six hours). This has been suggested to predispose to regurgitation and subsequent aspiration (Lumb and Jones 1984). Silent (inapparent) aspiration occurs in approximately 8 per cent of human patients (Blitt and others...
1970). The incidence in dogs is not known; however, it is known that gastrooesophageal reflux occurs in approximately 30 per cent of dogs undergoing intra-abdominal surgery (Galatos and Raptopoulos 1995a,b). It was also possible that the production of blood on coughing noted postoperatively may have been due to a relative overdosage of heparin and aspirin (despite the use of appropriate doses and clotting function times having remained in the desired range), and that this bleeding may have exacerbated any pneumonia present. This was the reason for the administration of protamine in this case.

References


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