Case Report

jfms OPEN REPORTS

Journal of Feline Medicine and Surgery Open Reports
1–4

DOI: 10.1177/2055116919850646
journals.sagepub.com/home/jfmsopenreports

This paper was handled and processed by the American Editorial Office (AAFP) for publication in *JFMS Open Reports*

SAGE

Laparoscopic resection of bilateral perinephric pseudocyst in a pediatric feline patient

Margaret Amparo Placer and Cindy McManis

Abstract

Case summary A 6-month-old male domestic shorthair cat presenting with abdominal distension and an acute history of renal azotemia was diagnosed with bilateral perinephric pseudocysts and International Renal Interest Society (IRIS) grade 3 acute kidney injury. Ultrasound-guided drainage of the cysts was performed initially; bilateral subtotal resection of the perinephric pseudocysts was later performed using laparoscopy as a more long-term solution. There was no regrowth or reformation of the perinephric pseudocysts 1 year after the procedure, and the cat remained in IRIS stage 2 chronic kidney disease 1 year postoperatively.

Relevance and novel information Compared with traditional surgical approaches, laparoscopic resection of perinephric pseudocysts provides a less invasive approach. Bilateral perinephric pseudocyst in a pediatric feline patient (and associated treatment) has not previously been documented in the literature.

Keywords: Perinephric; pseudocyst; laparoscopic; kidney; laparoscopy

Accepted: 21 April 2019

Introduction

The term perinephric pseudocyst (PNP) refers to a perirenal fibrous sac not lined by epithelium. There are four categories of classification based on fluid content: urine, lymph, blood or transudate.[1] Uriniferous PNPs result from efflux of extravasation of urine between the capsule and renal parenchyma, often associated with trauma. Lymphatic fluid may accumulate due to inflammation or obstruction of the hilar lymphatics. Hematoma formation may be associated with blood dyscrasias, neoplasia, ruptured aneurysm and/or with renal congestion following renal transplantation.

The fourth category, in which a transudate accumulates, is of unknown etiology. PNPs associated with chronic kidney disease (CKD) often fall into this category.[1] Serous fluid may accumulate around the kidneys extrarenal or subcapsular fashion. A subcapsular presentation is most common, with cyst attachments predominantly located at the hilus or pole of the kidney.[2,3] Conventional treatment modalities include surgical excision of the renal capsule and ultrasound-guided drainage. Bilateral laparoscopic fenestration has been reported in one geriatric cat; humane euthanasia was elected 8 months postoperatively owing to the patient's overall deterioration.[4]

This is the first description of bilateral subtotal laparoscopic capsulectomy for the treatment of PNPs in a pediatric patient. Currently, the youngest documented case of bilateral PNPs involved a 4-year-old cat.[2] A retrospective study and review of the literature by Ochoa et al reported a range of presentation age of 5–19 years, with a median age of 16 years and mean age of 14.5 years.[3]

Case description

A 6-month-old male neutered domestic shorthair cat weighing 2.5 kg was referred for imaging and evaluation owing to a 1 week history of abdominal distension and pain on abdominal palpation. Muscle atrophy at the hips

Just Cats Veterinary Services, The Woodlands, Houston, TX, USA

Corresponding author:
Margaret Amparo Placer DVM, 130 S. Canal Street. #520
Chicago, IL 60606, USA
Email: maggieplacer@gmail.com

Table 1 Laboratory values for the patient – SI and US units

	4 days prior to presentation	At presentation	1 day following presentation	One month postoperatively	Six months postoperatively	One year postoperatively
BUN RI: 15.0–33.0 mg/dl; 5.35–11.78 mmol/l	>140 mg/dl; 49.98 mmol/l	117 mg/dl; 41.77 mmol/l	129 mg/dl; 46.05 mmol/l	54 mg/dl; 19.28 mmol/l	37 mg/dl; 13.21 mmol/l	39 mg/dl; 13.92 mmol/l
Creatinine RI: 0.6–1.6 mg/dl; 53.04–141.44 mmol/l	4.2 mg/dl; 371.28 mmol/l	3.6 mg/dl; 318.24 mmol/l	3.9 mg/dl; 344.76 mmol/l	1.1 mg/dl; 97.24 mmol/l	1.9 mg/dl; 167.96 mmol/l	2.2 mg/dl; 194.48 mmol/l
Phosphorus RI: 2.6–7.5 mg/dl; 0.84–2.42 mmol/l	14.2 mg/dl; 4.59 mmol/l	–	9.4 mg/dl; 3.04 mmol/l	8.7 mg/dl; 2.81 mmol/l	5.9 mg/dl; 1.91 mmol/l	5.2 mg/dl; 1.68 mmol/l
Calcium RI: 7.8–11.9 mg/dl; 1.95–2.98 mmol/l	10.5 mg/dl; 2.63 mmol/l	–	10.7 mg/dl; 2.67 mmol/l	10.6 mg/dl; 2.65 mmol/l	10.3 mg/dl; 2.58 mmol/l	10.4 mg/dl; 2.6 mmol/l
Potassium RI: 3.7–5.9 mmol/l	–	5	4.4	5.4	4.5	4.6
Hematocrit (%)	–	29.7	–	26.2	31.5	34.7
Total solids RI: 6.3–8.8 g/dl; 63–88 g/l	6.7 g/dl; 76 g/l	7 g/dl; 70 g/l	6.4 g/dl; 64 g/l	–	–	6.7 g/dl; 67 g/l
Glucose RI: 70–153 mg/dl; 3.89–8.49 mmol/l	91 mg/dl; 5.05 mmol/l	103 mg/dl; 5.72 mmol/l	102 mg/dl; 5.66 mmol/l	90 mg/dl; 5 mmol/l	169 mg/dl; 9.38 mmol/l	203 mg/dl; 11.27 mmol/l
Alanine aminotransferase RI: 0–115 U/l	74	66	39	68	85	148
Alkaline phosphatase RI: 0–192 U/l	59	58	55	141	75	26
WBC RI: 3.9–19 K/ µmol	–	13,040	–	–	–	5780
Monocyte RI: 0.15–1.70 K/µl	Elevated per referring veterinarian	0.68	–	0.55	0.45	0.35
USG	1.016	1.018	–	1.024	1.015	1.018

BUN = blood urea nitrogen; RI = reference interval; WBC = white blood cell; USG = urine specific gravity

was also noted. The cat presented from a rescue facility and patient history was limited; however, no known toxin exposure or trauma was noted in the month prior to presentation. Elevated blood urea nitrogen (BUN) and creatinine, hyperphosphatemia and monocytosis were noted by the referring veterinarian 4 days prior to presentation at our facility (see Table 1).

On physical examination the kidneys were large and distorted, and the cat was moderately dehydrated. Hematology and biochemistry panels confirmed elevated BUN and creatinine, hyperphosphatemia and revealed a mild leukocytosis for the feline species (see Table 1). The urine specific gravity was 1.018 with moderate protein and an inactive urine sediment; urine culture was negative for bacterial growth. A diagnosis of grade 3 non-oliguric acute kidney injury was made and the cat was started on intravenous fluids (lactated Ringer's solution) at a rate of 4 ml/kg/h. A renal diet and/or a phosphate binding agent were not introduced at this time to avoid food aversion.

Abdominal radiographs followed by ultrasonography revealed large fluid-filled sacs surrounding both kidneys, consistent with bilateral PNPs. The cat was sedated with butorphanol 10 mg/ml 0.2 mg/kg intramuscularly (IM), ketamine 100 mg/ml 2 mg/kg IM and dexmedetomidine 0.5 mg/ml 0.1 mg/kg IM prior to each therapeutic aspiration and drainage of the PNPs. Both kidneys were hyperechoic with poor corticomedullary distinction and located within hypoechoic subcapsular fluid. Therapeutic ultrasound-guided aspiration of the PNPs was performed on presentation; 195 ml fluid was drained from the right cyst and 42 ml from the left.

The creatinine concentration of the fluid from the left and right pseudocysts was 11 mg/dl (838.75 µmol/l)

and 8.6 mg/dl (655.75 µmol/l), respectively, vs 3.6 mg/dl (318.24 µmol/l) in the serum. The total protein content of the fluid collected was 0 g/dl (<2.5 g/dl), and the color was pale straw to light yellow. The fluid contained low cellularity, comprised predominantly of macrophages and neutrophils, with low numbers of small lymphocytes. Overall, the presence of a transudate was supported; however, the creatinine of the cystic fluid was more than twice the serum concentration, suggestive of a uriniferous fluid. No growth was detected on culture of the PNP fluid. Owing to the cat's discomfort with increasing PNP distension/refilling, therapeutic PNP cystocentesis under IM sedation was necessary every 48 h prior to surgery (performed twice prior to the day of surgery). Sedation was not reversed to allow continued, lingering pain control between drainage (q48h) until surgical intervention could be performed. On the day of surgery, 50 ml of fluid was drained from each cyst immediately prior to surgery.

Laparoscopic fenestration of the PNPs was elected. The cat was premedicated with butorphanol 10 mg/ml 0.37 mg/kg IM, midazolam 5 mg/ml 0.19 mg/kg IM and oxymorphone 1 mg/ml 0.47 mg/kg IM 50 mins prior to induction. Butorphanol was used in an effort to prevent/antagonize the dysphoric, sedative and respiratory effects that some cats experience with full agonist while, in theory, sparing the analgesic effects. Oxymorphone was chosen for increased pain control. The cat was then induced with propofol 10 mg/ml 9.4 mg/kg intravenously. Postoperative pain control included placement of a fentanyl 12 µg patch at the inside of the left rear leg immediately following the procedure, and subcutaneous morphine 15 mg/ml 0.7 mg/kg 20 mins and 3 h postoperatively.

The cat was placed in dorsal recumbency and the surgical site was prepped. A ventral midline stab incision was made caudal to the umbilicus and a Veress needle was inserted. The abdomen was then insufflated with CO_2 to a maximal pressure of 13 mmHg using a mechanical insufflator (Endoflator; Karl Storz Endoscopy). A trocar-cannula was placed using a 3.5 mm Karl Storz 30114GK Lightweight Trocar + Cannula W/Silicone Valve, and a 3 mm, 0°, 14 cm laparoscope (Hopkins; Karl Storz Endoscopy) was inserted at the location of the Veress needle. A second cannula was placed caudal to the umbilicus, and the palpation probe (Karl Storz 26167TS Palpation Probe With CM Markings 3 mm × 20 cm) was used to isolate the PNPs. A third cannula was placed through the left lateral body wall at the level of the left kidney. The left PNP was grasped and elevated with laparoscopic forceps (Karl Storz 30322 MDS Clickline Blakesley Dissecting and Biopsy Forceps). The PNP was then fenestrated and cauterized with laparoscopic scissors (Karl Storz 30321MWS Clickline Scissors). The right PNP was grasped, elevated and fenestrated in a similar manner. The dissected aspects of each capsule were placed lateral to the bladder and were retrieved prior to closure. The kidneys were not removed from their retroperitoneal attachments. As much of the ventral aspect of the pseudocyts as possible was resected bilaterally, creating a 3–4 cm fenestration at each site. The cannula sites were closed with two layers of cruciate sutures in the body wall and skin utilizing 4-0 polydioxanone suture (PDS II; Ethicon).

Histopathologic analysis of the capsular tissue was consistent with steatitis/fasciitis with mild granulomatous fibrosis also noted. Submitted tissue was negative for corona viral antigen utilizing immunohistochemistry, as feline infectious peritonitis may be associated with CKD and PNP development.[3,5,6]

Outcome

The cat was hospitalized 3 days postoperatively. Aluminum hydroxide powder was introduced (35 mg/kg with food q12h) as a phosphate binder once appetite returned postoperatively. A renal diet was deferred owing to the patient's age and growth requirements. The cat was re-examined at 1 month, 6 months and 1 year postoperatively. BUN and phosphorus remained elevated on all occasions. Creatinine was elevated at 6 months and 1 year postoperatively. Creatinine was consistent with grade 3 acute kidney injury initially; 1 month postoperatively the patient was in stage 1 CKD. Biochemistry values were consistent with stage 2 CKD 6 months and 1 year postoperatively.[6] Repeated abdominal ultrasound at subsequent visits revealed no evidence of cystic structures in the region of the kidneys, and no free fluid was noted in the abdomen.

Discussion

Laparoscopic fenestration is a viable treatment option for patients with PNPs. In this case, laparoscopic resection decreased abdominal distension and severity of renal azotemia. Advantages of laparoscopic surgery for the treatment of PNPs include (assumed) less pain and a more rapid return to normal activity vs laparotomy.[7–9] In the future, placement of all ports along the midline may be considered to avoid pain associated with penetration of the body wall. This may be difficult to achieve as feline patients are generally smaller than canine patients, but it remains an option for larger cats. Aspiration of the PNPs prior to fenestration is recommended as it allows the capsule wall to be more easily manipulated.

Potential complications of this technique include iatrogenic damage to the renal parenchyma during initial penetration of the capsule. This may occur with laparoscopic scissors or harmonic scalpel. A vessel-sealing device utilizing cautery or a harmonic scalpel is recommended to minimize hemorrhage.[10] Iatrogenic damage is possible with laparotomy, although palpation of the kidney should decrease inadvertent contact. Risk associated

with trauma from repeated fine-needle aspiration/drainage is in theory less likely, especially if ultrasonography is used.

Ultimately, continuous accurate assessment of the cat's renal function before and after the procedure would only have been possible with measurement of the glomerular filtration rate (GFR); however, serial monitoring for azotemia allowed for adequate management and assessment of the cat's renal function. After ultrasound-guided drainage or surgical resection of PNPs, the underlying renal disease will often continue to progress, although improvements in GFR have been documented in individual cases of laparoscopic and open surgical fenestration.[5] The literature shows that survival of cats with CKD, with and without PNPs, correlates with levels of azotemia and proteinuria present at presentation, as well as plasma phosphorus concentration, but these studies generally included older patients.[2,11]

The association between renal disease and PNPs is well recognized, although the exact pathogenesis remains unclear. It has been hypothesized that severe interstitial fibrosis may impair lymphatic drainage or renal drainage of surrounding renal parenchyma and result in transudation; however, this has not been shown in dogs and feline research is lacking.[3] Congenital or familial diseases such as amyloidosis and polycystic kidney disease are more common in certain cat breeds including Abyssinian, Siamese, Oriental Shorthair, Persian and Himalayan. PNPs in a young cat may also result from acute kidney injury, infectious disease, or may be idiopathic. Renal biopsy was deferred owing to the severity of azotemia at time of presentation, lack of suspicion of a hereditary disease and lack of significant proteinuria.[6] As the cat in this report was a domestic shorthair, lacked pyuria/infectious organisms in the urine, and did not have a history of exposure to a known toxin or trauma, an idiopathic cause is suspected.

The primary advantage of surgical treatment is the lower incidence of fluid re-accumulation compared with percutaneous drainage. Although GFR was not measured in this case, serum biochemical parameters suggested that renal function improved postoperatively. Decreased muscle mass (associated with development) may have resulted in lower serum creatinine at presentation and at the 1 month postoperative evaluation; however, by 1 year of age adult reference intervals became applicable. Regarding phosphorus concentration, it is worth noting that presenting phosphorus concentration may have been elevated owing to the cat's age in addition to kidney injury, with declining concentrations resulting from maturation as well as intervention.

Conclusions

Laparoscopic subtotal resection of PNPs is a plausible method for the treatment of this condition, as it is a relatively short, minimally invasive procedure. Future studies of larger numbers of cases are required to evaluate the morbidity associated with this technique compared with traditional laparotomy.

Conflict of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding The authors received no financial support for the research, authorship, and/or publication of this article.

Informed consent Written informed consent was obtained from the owner of the animal described in this work for the procedures undertaken.

ORCID iD Margaret Amparo Placer https://orcid.org/0000-0003-2567-2420

References

1 Essman SC, Drost WT, Hoover JP, et al. **Imaging of a cat with perirenal pseudocysts**. *Vet Radiol Ultrasound* 2000; 41: 329–334.
2 Beck J, Bellenger C, Lamb W, et al. **Perirenal pseudocysts in 26 cats**. *Aust Vet J* 2000; 78: 166–171.
3 Ochoa VB, Dibartola SP, Chew DJ, et al. **Perinephric pseudocysts in the cat: a retrospective study and review of the literature**. *J Vet Intern Med* 1999; 13: 47–55.
4 Mouat EE, Mayhew PD, Weh JL, et al. **Bilateral laparoscopic subtotal perinephric pseudocyst resection in a cat**. *J Feline Med Surg* 2009; 11: 1015–1018.
5 Mccord K, Steyn P and Lunn K. **Unilateral improvement in glomerular filtration rate after permanent drainage of a perinephric pseudocyst in a cat**. *J Feline Med Surg* 2008; 10: 280–283.
6 Polzin DJ. **Chronic Kidney Disease**. In: Ettinger SJ and Feldman EC (eds). Textbook of veterinary internal medicine: diseases of the dog and the cat. 7th ed. St Louis, MO: Elsevier Saunders, 2010, pp 1990–2021.
7 Mayhew PD and Brown DC. **Prospective evaluation of two intracorporeally sutured prophylactic laparoscopic gastropexy techniques compared with laparoscopic-assisted gastropexy in dogs**. *Vet Surg* 2009; 38: 738–746.
8 Culp WTN, Mayhew PD and Brown DC. **The effect of laparoscopic versus open ovariectomy on postsurgical activity in small dogs**. *Vet Surg* 2009; 38: 811–817.
9 Devitt CM, Cox RE and Hailey JJ. **Duration, complications, stress, and pain of open ovariohysterectomy versus a simple method of laparoscopic-assisted ovariohysterectomy in dogs**. *J Am Vet Med Assoc* 2005; 227: 921–927.
10 Mayhew PD and Brown DC. **Comparison of three techniques for ovarian pedicle hemostasis during laparoscopic-assisted ovariohysterectomy**. *Vet Surg* 2007; 36: 541–547.
11 Geddes RF, Finch NC, Syme HM, et al. **The role of phosphorus in the pathophysiology of chronic kidney disease**. *J Vet Emerg Crit Care* 2013; 23: 122–133.