

NEPHROTOMY FOR UROLITHIASIS

Case Report
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Signalment: “Schatzi”, 10 year old MN Pomeranian

History: Schatzi was presented for multiple cystoliths and bilateral nephroliths. Mild azotemia (BUN 51 mg/dl, creatinine 2.5 mg/dl) with urine specific gravity of 1.020 was present on referral lab work. Urine pH was 6.0, and a urine culture was negative.

Clinical Exam: Schatzi’s clinical exam was unremarkable.

Diagnostic Imaging:

Radiography: Large radio-opaque calculi were present bilaterally in the renal pelvises and in the urinary bladder.

Ultrasonography: Abdominal ultrasound confirmed the presence of bilateral nephroliths in the renal pelvises (right larger than left) and multiple cystoliths with diameters large enough to cause urethral obstruction. There was no pyelectasia or ureteral dilatation.



Figure 1

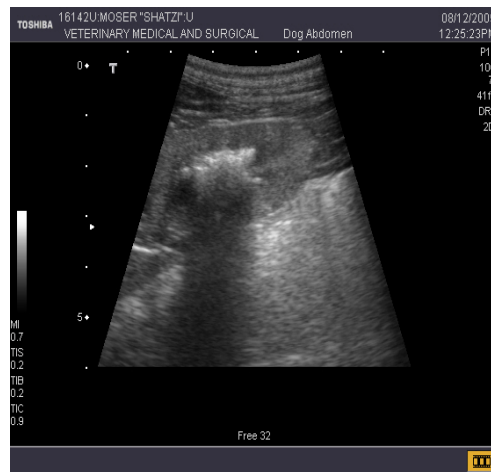


Figure 2

Diagnosis: Bilateral nephroliths and multiple cystoliths.

Treatment/Management: Schatzi was hospitalized and placed on IV fluids for diuresis. A PT/PTT (within normal limits) and cross-match were performed. Although improved, mild azotemia was still present on the pre-anesthetic chemistry (BUN 28 mg/dl, creatinine 1.8 mg/dl). After discussion with the owners, cystotomy and unilateral right nephrotomy were elected. The anesthetic technique was selected to minimize the negative cardiovascular and renal effects of general anesthesia, and a dopamine CRI was administered during surgery to maintain blood pressure. Routine exploratory laparotomy and cystotomy with multiple cystolith removal were without complication. Both kidneys were small and irregularly shaped. The right kidney was bluntly dissected free from the retroperitoneum along its convex edge. The ureter, renal artery and renal vein were isolated with blunt dissection. A tourniquet of 3-0 silk was placed around the renal vessels. A sharp incision was made along the convex border, extending 2/3 the length of the kidney and down to the renal pelvis. A single, large, irregular nephrolith was identified in the renal pelvis and was removed with DeBakey forceps. The renal pelvis was lavaged with sterile saline. The kidney halves were apposed with gentle digital pressure and the renal capsule was closed in simple continuous pattern with 4-0 PDS. Renal ischemia was limited to 10 minutes. Despite occlusion of the vessels, there was hemorrhage significant enough to necessitate a transfusion of packed red blood cells.

Post-operative care: A mannitol CRI (1 mg/kg/min) was administered following surgery to promote diuresis. Urine output remained within normal limits. BUN was 28 mg/dl, and creatinine was 1.8 mg/dl the day following surgery. The uroliths were submitted for mineral analysis and culture and were identified as calcium oxalate without infection. A canned diet of Purina NF was recommended to help prevent calcium oxalate stone formation and to treat suspected chronic kidney disease. Monitoring of the remaining nephrolith via serial radiography or ultrasonography, as well as monitoring of azotemia and urine cultures, was recommended every 6 months.

Discussion: The decision to perform a nephrotomy for renolith removal is complex. No dissolution protocol is available for calcium oxalate uroliths, and options for removal are limited to nephrotomy or extracorporeal shock-wave lithotripsy. In many patients, nephroliths are of no clinical importance; in fact, a recent study in cats suggests that nephroliths do not contribute to the morbidity of renal disease.¹ Recurrence following nephrolith removal is also a concern; it has been reported that greater than 50% of dogs developed recurrence of calcium oxalate nephroliths within 3 years of removal.² Nephrotomy itself is a procedure that requires significant technical skill and carries risk of morbidity and mortality. However, it is generally accepted that nephrolith removal is indicated in cases of ureteral or renal pelvic obstruction, large calculus causing compression of renal parenchyma, recurrent or uncontrollable infection, or progressive deterioration of renal function.² In Schatzi's case, nephrotomy was elected due to the large size of the renoliths (potentially causing compression of the renal parenchyma and pain), the presence of bilateral disease, and concern that the nephroliths may migrate into the ureter causing obstruction and secondary renal damage. It was unclear whether the presence of bilateral renoliths was contributing to the azotemia through intermittent renal pelvic obstruction. The right kidney was selected for nephrotomy because gross evidence of chronic kidney disease was present bilaterally (small and irregular kidneys) and because the right nephrolith was larger.

The effect of nephrotomy on renal function has been investigated, although a definitive relationship is still unclear. Nephrotomy may negatively impact renal function by direct surgical trauma, ischemia, and secondary inflammation resulting in edema and eventual fibrosis. While initial studies in dogs with normal kidney function indicated a decrease in GFR of up to 40% in nephrotomized kidneys,² additional studies have shown little to no change in GFR in both cats and dogs with normal kidneys.³⁻⁶ However, there is no information available regarding nephrotomy in dogs or cats with pre-existing renal dysfunction. The possibility of exacerbating existing renal insufficiency must therefore be considered prior to proceeding with nephrotomy.

Pharmacologic means of protecting kidneys from decreased renal blood flow and secondary effects of inflammation may be helpful in decreasing the morbidity of nephrotomy. Studies in rats and in dogs suggest mannitol exerts protective effects following renal ischemic insult.³ Mannitol increases osmotic pressure within the renal tubules, reducing endothelial cell edema and preventing tubular obstruction, and maintains renal blood flow and glomerular filtration by increasing renal arteriole dilation. Additionally, balanced anesthetic techniques and the use of vasopressors during surgery may be protective by maintaining adequate renal blood flow throughout anesthesia.

Follow-up care is dictated in part by urolith analysis. A urine culture and sensitivity, with appropriate antibiotic therapy, should always be performed. For calcium oxalate stones, calcium levels and fasted triglyceride levels should be assessed, as hyperlipidemia and hyper- or hypocalcemia can be risk factors for formation of calcium oxalate stones.⁷ Prevention of recurrence should be attempted with dietary management. Increased moisture in the diet is the most important factor, with a goal of urine specific gravity less than 1.025 in dogs.⁷ Diets marketed for calcium oxalate stone prevention are generally high moisture, low in fat and non-acidifying. For recurrence despite appropriate diet, additional treatments to consider include potassium citrate (which forms soluble salts with calcium) and thiazide diuretics (which inhibit proximal tubular reabsorption of calcium).

If a nephrolith is not removed, monitoring should involve serial radiography or ultrasonography to evaluate growth, compression of renal parenchyma, and obstruction. Regular urine cultures and blood chemistries should also be performed. Although rechecks are often recommended every 6 months, significant persistent loss of renal function has been documented in cats in as little as 2 weeks following ureteral obstruction.⁷

Summary: Research suggests that nephrotomy can be performed with little to no negative effect on kidney function if surgical technique and anesthetic management are appropriate. In suitable candidates, removal of nephroliths may improve renal function and should be considered. Nephrolith removal should be followed with dietary and medical therapy to prevent recurrence.

References:

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Figures:

- 1) Ventrodorsal abdominal radiograph with bilateral radio-opaque nephroliths and large cystoliths.
- 2) Ultrasonographic image of the right kidney with large nephrolith in the renal pelvis.