# Nephroureteral Obstructions

## The Use of Stents and Ureteral Bypass Systems for Renal Decompression

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**KEYWORDS**

• Interventional radiology • Interventional urology • Stent
• Subcutaneous ureteral bypass • Nephroureterolithiasis • Ureteral obstruction

**KEY POINTS**

- The treatment of benign nephroureteral obstructions is challenging and often involves a combination of medical and surgical/interventional therapeutic options.
- Historical surgical treatments of nephroureteral obstructions have demonstrated varying results; however, newer interventional radiology therapies, such as stent and subcutaneous ureteral bypass system placement, are being used more commonly.
- The indications for the placement of stents and subcutaneous ureteral bypass systems still need to be fully elucidated, but early results are showing promise.

### INTRODUCTION

Canine and feline nephroureteral obstruction is a complex disease process that can be challenging to treat. Although the availability of various imaging modalities allows for a straightforward diagnosis to be made in most cases, the decision-making process for when a case should be taken to surgery, as well as the optimal treatment modality that should be used for renal decompression, remains controversial. In the following discussion, an overview of the perioperative management of cases with nephroureterolithiasis and nephroureteral obstruction is reviewed, with a focus on the use of renal decompressive procedures, such as ureteral stenting and subcutaneous ureteral bypass (SUB) system placement.

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The authors teach laboratories where some of the instrumentation discussed in this article are utilized.

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### *Diagnosis*

To effectively diagnose, treat, and manage patients with benign upper urinary tract obstructions, it is important to try and identify the underlying causes for these obstructions. The diagnosis of nephroliths and ureteroliths has increased over the last few decades because of advancements in diagnostic imaging and client and clinician education. In cats, nephroliths and ureteroliths are most commonly composed of calcium oxalate[1–3]; however, other stone types, including dried solidified blood calculi and struvite stones,[1,4] are also found. It is also important to note that in many cases of feline ureteral obstruction discrete calculi may not be identified. In these cases, it is likely that ureteritis, scarring from previous inflammation, and/or cellular or crystalline debris may be the cause of obstruction. Identifying the underlying cause for ureteral obstruction will help to guide the optimal treatment plan as well as long-term medical management after renal decompression has been performed.

A serum biochemistry profile should be performed in any dog or cat suspected of having an upper urinary tract obstruction. Most cats with ureteroliths have been shown to be azotemic,[3,5] even when unilateral ureteral obstruction is present. This finding emphasizes the fact that a large percentage of cats have preexisting chronic kidney disease (often times from a previous obstruction of the contralateral kidney) before diagnosis of obstruction. Evaluating the severity of azotemia, in addition to electrolytes, such as potassium, can help to guide whether patients should be taken to surgery on an emergency basis. The severity of azotemia (in conjunction with diagnostic imaging) also provides information regarding the degree of underlying chronic kidney disease that is present, a variable that may guide an owner's decision to pursue surgical intervention. The decision to pursue surgical intervention is not always straightforward, especially in nonazotemic patients that may appear clinically healthy. With the discovery of newer biomarkers of early kidney injury and dysfunction that are much more sensitive than creatinine, earlier diagnosis of and intervention for ureteral obstruction may become possible.[6,7]

The complete blood count often demonstrates anemia in cats with ureteral obstruction; in some cases, this may indicate the presence of longer-standing chronic kidney disease.[3,5] Additionally, the presence of an inflammatory leukogram may suggest an underlying infection associated with the presence of a stone or as the sole cause for the obstruction (ie, ureteritis).

Urinalysis and urine culture should be performed in all patients affected with nephroureterolithiasis. Assessment of urine pH may be useful in differentiating between stone types. Sediment evaluation can help to identify the presence of bacteria and pyuria. In dogs, struvite stones are most commonly associated with urease-producing bacteria (ie, *Staphylococcus, Proteus, Klebsiella*). The presence of these bacteria should raise the clinician's suspicion for the presence of a struvite stone. If a partial ureteral obstruction is present (and the ureteral stone is, therefore, bathed in urine), it is possible that medical management could be used as the sole treatment; however, concurrent ureteral stent placement may be necessary (see later discussion). In the authors' experience, sterile pyuria is found commonly in patients with ureteral obstruction, likely due to the inflammatory processes that are initiated soon after development of ureteral obstruction. Nonetheless, a urine culture should be performed in all patients with ureteral obstruction. In patients with complete ureteral obstruction, or in anuric patients, a sample of renal pelvic urine can be taken for culture if patients are undergoing surgical decompression.

Abdominal ultrasound should be performed in all cases of suspected nephroureteral obstruction. Ultrasound is the primary imaging method used for diagnosis of ureteral