Case Series

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Resolution of urethral obstruction using temporary urethral stents in two female cats

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Abstract

Case summary The management of urethral obstructions is well documented in male cats but is less established for females. These cases describe two female cats that presented with non-dissolvable urocystoliths. Urocystoliths were removed by laser lithotripsy and basket retrieval. Following urolith removal, urethral obstruction occurred in both cats. Both cats were successfully managed using temporary urethral stents in lieu of indwelling urethral catheters permitting outpatient, spontaneous recovery of the urethra.

Relevance and novel information Use of temporary urethral stents has not been described in cats. These novel stents are constructed from materials available in most veterinary facilities, placed without advanced imaging and reside entirely within the urethra and vestibule. Temporary stents are used to bypass urethral disease, facilitating outpatient recovery, and are easily removed when no longer needed. For these reasons, temporary stents are a cost-efficient alternative to permanent stents or indwelling urinary catheters attached to closed urine-collection systems.

Keywords: Urethral obstruction; urethral stent; temporary stent; urocystoliths; urolithiasis; laser lithotripsy; cystoscopy

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Introduction

Urethral obstruction (UO) is a common result of lower urinary tract disease in cats.[1,2] Neutered male cats with urethral plugs, uroliths or idiopathic disease are predisposed to UO.[1–5] There is minimal information regarding female cats with UOs, including cases following laser lithotripsy and basket retrieval of uroliths. The following report describes two cases of UO following minimally invasive urolith removal that were successfully managed with a novel temporary urethral stent.

Case description

Case 1

A 10-year-old spayed female domestic shorthair cat weighing 5.6 kg was referred for non-surgical removal of uroliths. Radiography confirmed two radiopaque urocystoliths (Figure 1).

The patient was placed under general anesthesia for cystoscopy and urolith removal. A cystoscope (MINI multipurpose rigid telescope 67030BA; Karl Storz) was inserted into the urethra and guided into the urinary bladder. Difficulty in passing the cystoscope required a greater anesthetic depth and additional pain control. Two uroliths were fragmented using a Holmium:YAG laser (193 pulses, 0.1 kJ delivered over 6 mins). A stone-extracting basket (NCircle tipless stone extractor; Cook Medical) was used to remove the fragments (Figure 2). Double-contrast cystography confirmed complete urolith

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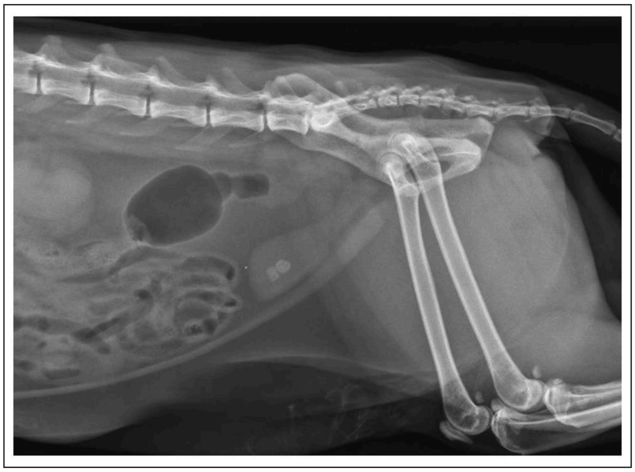

Figure 1 Lateral abdominal radiograph of a 10-year-old spayed female domestic shorthair cat showing two mineral opacities located in the urinary bladder

removal. The patient recovered from anesthesia uneventfully and was discharged the same day with amoxicillin/clavulanate (22 mg/kg q12h) for 2 days and gabapentin (9 mg/kg q8h) for 4 days. Urocystoliths were composed of 100% potassium magnesium pyrophosphate.

The next day the cat presented with a UO and post-renal azotemia (creatinine 601 µmol/l [reference interval {RI} 44–177]; 6.8 mg/dl [RI 0.5–2.0]). The cat was stabilized with intravenous fluids and anesthetized to relieve the obstruction by placing a 3.5 F indwelling urethral catheter attached to a closed collection system. Serum concentration of creatinine normalized (133 µmol/l; 1.5 mg/dl) in 48 h. The indwelling catheter was removed on day 4; however, the cat remained unable to urinate. A contrast cystourethrogram revealed a normal urethra (Figure 3). A temporary urethral stent was placed to allow recovery without the requirement for hospitalization. The stent was constructed from the distal end of a

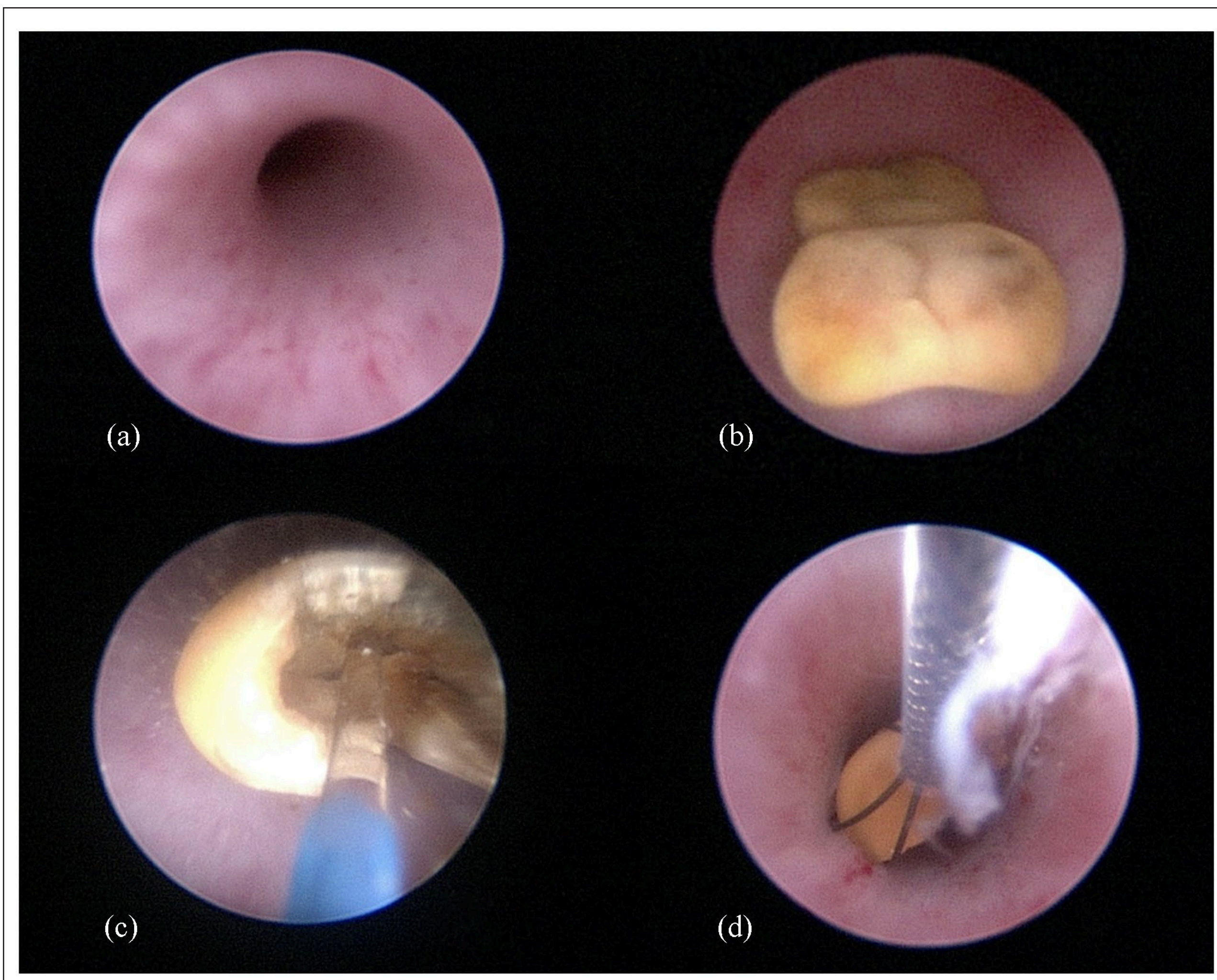

Figure 2 Cystoscopic images of a 10-year-old spayed female domestic shorthair cat: (a) normal-appearing urethral lumen and mucosal membrane; (b) two uroliths positioned in the gravity-dependent portion of the bladder; (c) laser lithotripsy fragmenting a urolith; and (d) basket removal of a fragmented urolith in the urethra

flexible, 5 F urinary catheter (Kendall urethral catheter; Covidien). Stent length (11 cm) was determined by measuring the path of the urethra on radiographs from the vestibule to 1 cm proximal to the trigone. A 20G hypodermic needle was inserted below the cut surface and through the walls of the stent to create a path to pass a suture (Figure 4). A non-absorbable 3.0 suture was passed into the hollow end of the hypodermic needle and out the other side. The needle was removed, leaving the suture in place. The ends of the suture were tied to create a 2 mm loop that was used to anchor the stent down the urethra and inside the vestibule.

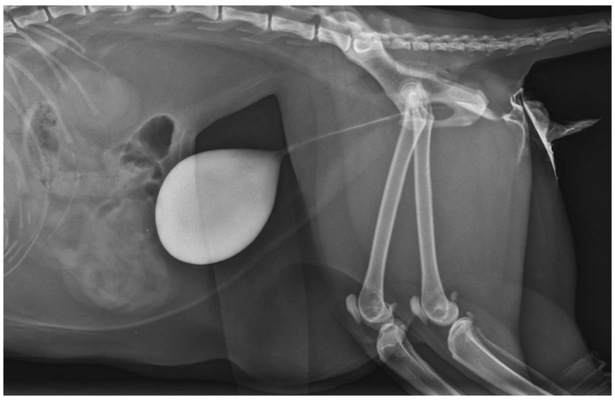

Figure 3 Contrast cystourethrogram in the evaluation of urethral obstruction following cystoscopic-guided laser lithotripsy and basket removal of uroliths

Under general anesthesia, the stent was passed halfway down the urethra. A non-absorbable suture attached to a cutting needle was passed through the perineal skin, into the vestibule and out the external vestibular opening. The suture was then passed through the center of the anchoring loop at the end of the stent. The anchoring loop was secured to the inside wall of the vestibule by passing the needle back through the external opening of the vestibule, then through the inner lateral wall and finally exiting through the skin near the suture's original

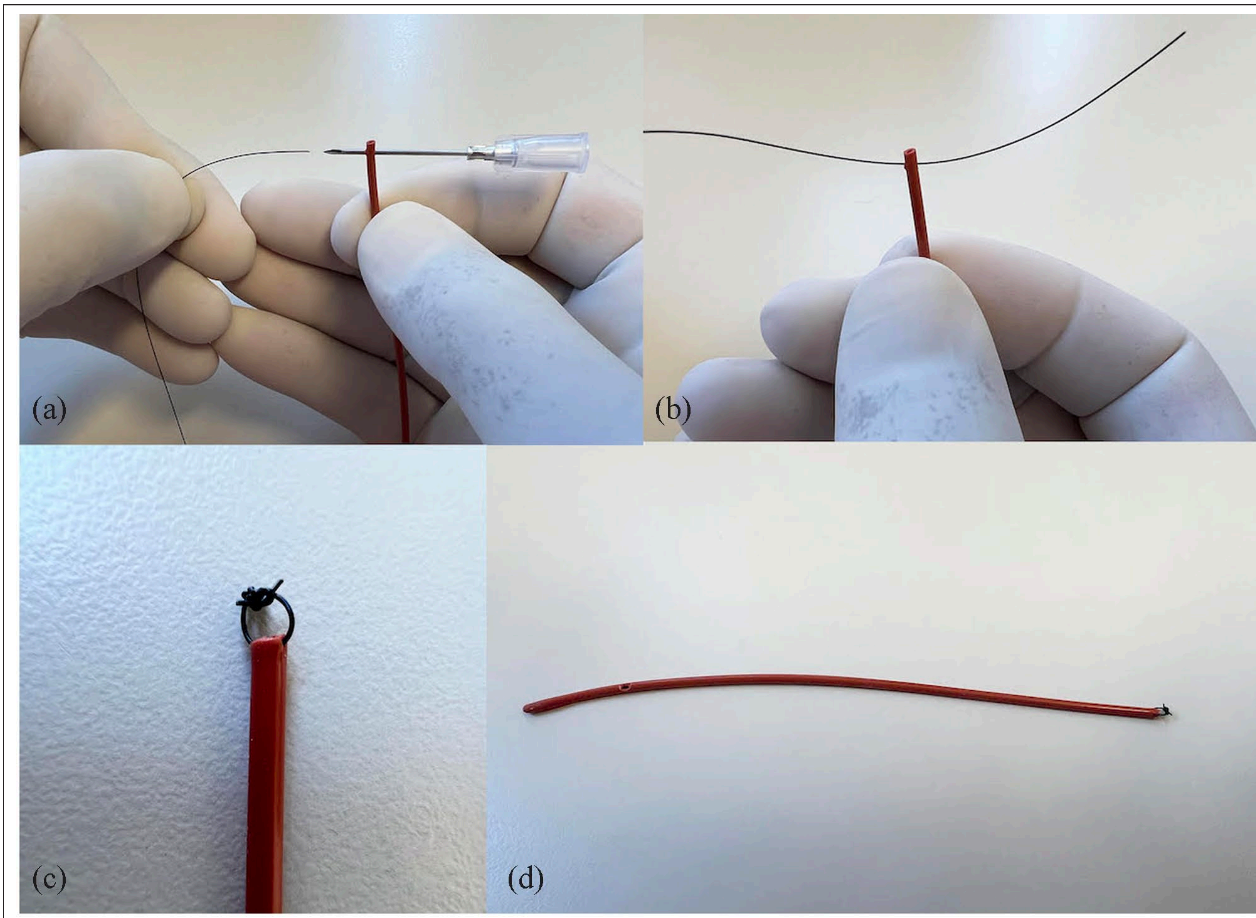

Figure 4 Construction of a temporary stent: (a) a hypodermic needle is inserted through the distal end of the stent and a suture is inserted into the end of the needle and out the other end; (b) the needle is retracted, leaving the suture in the needle's track; (c) the suture is tied to create a small loop at the distal end of the stent; and (d) the completed stent was 11 cm long with two drainage holes at one end and the anchoring loop at the other end

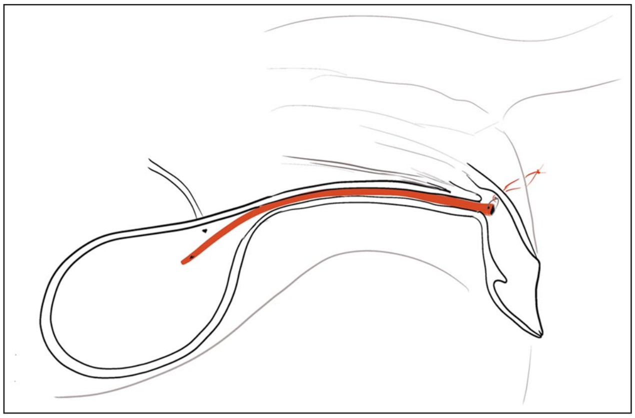

Figure 5 Illustration of temporary urethral stent placement in a female cat with the proximal tip of the stent located in the bladder. The distal end of the stent is anchored to the inside wall of the vestibule with a loop of suture loosely tied externally

entry. Pulling the ends of the suture guided the stent inside the vestibule and further down the urethra. The ends of the suture were loosely tied over the skin, securing the stent in place (Figure 5).[6] With the stent traversing the entire urethra, urinary incontinence was unavoidable. Pain medication previously prescribed was continued, and the stent appeared to be well tolerated. The temporary stent remained in place for 4 days, until the patient urinated the stent out of the urethra. The external suture was cut, to detach the stent. Normal micturition was observed, and the cat was subsequently discharged. A follow-up telephone call 1 week later confirmed that the cat displayed no further urinary discomfort and had made a complete recovery.

Case 2

A 9-year-old spayed female Birman cat weighing 4.3 kg presented for non-surgical urocystolith removal. The patient was anesthetized. The cystoscope was inserted into the urethra and guided into the bladder. Two uroliths were fragmented with a Holmium:YAG laser (108 pulses, 0.09 kJ delivered over 4 mins). Larger urolith fragments were removed using a stone-extracting basket. The remaining fragments were removed by voiding urohydropropulsion. Double-contrast cystography confirmed complete removal of the urocystoliths. The cat was discharged the same day with a 2-day course of marbofloxacin (5 mg/kg q24h) and a 4-day course of buprenorphine (0.015 mg/kg q8h–q12h transmucosally). Urocystoliths were composed of 100% ammonium urate.

The patient presented 2 days later with UO and postrenal azotemia (creatinine 513 µmol/l [RI 44–177]; 5.8 mg/dl [RI 0.5–2.0]). The patient was anesthetized, and a flexible 5 F indwelling urethral catheter was placed and attached to a closed collection system. The patient was hospitalized and prazosin (1.0 mg q24h) was prescribed.

Figure 6 Completed temporary stent placement showing the externally fixated stay suture (lateral to the vulva) connected internally to the anchoring loop of the stent

The serum concentration of creatinine normalized (141 µmol/l; 1.6 mg/dl) on day 3 and the urethral catheter was removed. However, the cat voided ineffectively, consistent with re-obstruction. A contrast cystourethrogram revealed that the urethra was normal. Based on continuing UO, a temporary urethral stent was placed.

The temporary stent was constructed from the last 10 cm of a soft 5 F feeding tube (Covidien) and secured down the urethra as in case 1 (Figure 6). The patient was discharged with the stent in place for continued care and monitoring at home. The cat was diapered to manage urinary incontinence. The previously described pain medication was continued, and the stent appeared to be well tolerated. The patient presented 6 days later for stent removal. A topical anesthetic was applied to the lining of the vestibule. A hemostat was attached to the distal end of the stent. The stay suture was snipped and the stent was pulled out. Four hours later, the cat urinated normally and was discharged. A follow-up telephone call 1 week later confirmed that the cat displayed no further urinary discomfort and had made a complete recovery.

Discussion

UOs were successfully managed in two cats using a novel temporary stent. The obstructions occurred following cystoscopic laser lithotripsy. Since medical imaging following urolith removal did not identify residual urolith fragments, it was hypothesized that the obstructions were the result of iatrogenic trauma, mural swelling and urethral spasms. There are several theories for the origin of these obstructions. Anesthesia may not have achieved sufficient relaxation of the urethra during cystoscopy.[7] Manipulating the cystoscope during periods of waning urethral relaxation could have induced urethral trauma with subsequent inflammation and swelling. In addition to advancing the cystoscope through the urethra multiple times, once in the bladder, the cystoscope was rotated 180° along its longitudinal axis. The cystoscope is rotated because its optics are designed with a fixed 30° upward deflection. To improve visualization of uroliths in the dependent portion of the urinary bladder, the cystoscope is rotated so that the optical deflection is directed downward in the direction of the uroliths.[8] Rotating the scope can bind and twist the urethral lining, inciting trauma and inflammation. Lastly, as urolith fragments are retrieved from the bladder, they can abrade the urethral lining when traversing the lumen. This list of potential causes is not exhaustive, but are the contributing factors of highest suspicion.

To relieve UOs, a novel temporary urethral stent was placed when short-term indwelling urethral catheters attached to closed collection systems were insufficient. The location of the stent and the lack of an attached collection bag decreased the likelihood of undue tension on the urethra and inadvertent removal of the stent. The cats could move freely when not tethered to a urine-collection system. Using a temporary stent allowed the cats to recover outside of the hospital setting, thus decreasing costs and patient stress. Indwelling catheters have a significant risk of bacterial infection.[9] Temporary stent location may decrease the risk for bacterial contamination as all parts of the stent are contained within the urogenital tract, avoiding fecal and environmental contamination.

Self-expanding metallic stents and balloon-expandable metallic stents have been used to treat UOs in cats and dogs.[10–14] Once deployed, these stents are not intended to be removed. In patients where UOs are expected to resolve, temporary stents would be a better choice to avoid long-term stent care.

Compared with permanent stents, temporary stents are less expensive, easily placed and easily removed. Because they are constructed from materials ubiquitous in most veterinary clinics, they can be assembled and placed by the veterinary team on demand, and without specialized training or advanced imaging. Both permanent and temporary stents increase the risk of urinary discomfort, infection and urinary incontinence. However, when temporary stents are associated with unacceptable or uncontrollable adverse effects, they can be quickly removed without lasting effects.

Based on this small case series, several other observations are worth noting. Functional UO can be a potential life-threatening complication of cystoscopy, laser lithotripsy and urolith fragment removal. To minimize cystoscopic irritation to the urethra, improved anesthetic protocols designed to sufficiently relax the urethra for the entire operation period are needed. Urethral irritation can also be minimized if feline cystoscopes are designed with narrower shaft diameters and zero-degree deflection optics. These design changes would ease urethral entry and minimize scope manipulation.

The use of temporary urethral stents can be considered for other urinary disorders for which indwelling catheters and permanent stents are currently used.[6] Temporary stents can maintain urethral patency while waiting for biopsy results of mucosal diseases causing urethral obstruction. Temporary stents can be placed in cats with urethral obstruction for which permanent stenting is cost prohibitive. Unlike expanding metallic stents, temporary stents can divert urine while permitting apposition and re-epithelialization of wound edges from a urethral tear to heal. One drawback of temporary stents is the increased risk of urinary incontinence, which may require diapering or confinement until the urethra recovers and the stent is removed. The challenge of anchoring a temporary stent inside the urethra in the absence of a vaginal vestibule makes this procedure problematic in male cats.

Conclusions

Temporary urethral stents successfully relieved UO, allowing the urethra time to spontaneously recover normal function in two female cats. The cause of the UOs was unknown, but they were likely caused by inflammation and swelling associated with cystoscopy and minimally invasive urocystolith removal. This novel strategy was a cost-efficient alternative to indwelling urethral catheterization or permanent urethral stent installation. Because temporary stents are constructed from readily available materials and inserted without specialized equipment, practitioners capable of catheterizing the urethra can insert them on demand.

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

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Ethical approval The work described in this manuscript involved the use of non-experimental (owned or unowned) animals. Established internationally recognised high standards ('best practice') of veterinary clinical care for the individual patient were always followed and/or this work involved the use of cadavers. Ethical approval from a committee was therefore not specifically required for publication in *JFMS Open Reports*. Although not required, where ethical approval was still obtained, it is stated in the manuscript.

Informed consent Informed consent (verbal or written) was obtained from the owner or legal custodian of all animal(s) described in this work (experimental or non-experimental animals, including cadavers) for all procedure(s) undertaken (prospective or retrospective studies). No animals or people are identifiable within this publication, and therefore additional informed consent for publication was not required.

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