

MASTERS OF DISGUISE

Diagnosis of feline urethral obstruction is straightforward, but the difficulty lies in recognition of the problem at home, as cats are masters of hiding illness.

MANAGEMENT STRATEGIES

Managing Feline Urethral Obstruction

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Feline urethral obstruction (UO) is a common presenting emergency in veterinary medicine. Prognosis for survival with proper, timely treatment is 90% to 95%, and recurrence rates are estimated to be 15% to 40%.¹ UO is secondary to feline lower urinary tract disease (FLUTD), a clinical entity with a variety of etiologies. Feline idiopathic cystitis (FIC) accounts for 53% of FLUTD cases, followed by urolithiasis (29%) and urethral plugs (18%).² Urethral plugs may consist of crystals (e.g., magnesium phosphate, calcium oxalate), cellular matter, mucus/mucoid matter, or other accumulations. Urinary tract infection (UTI) is

an uncommon cause of FLUTD. Predisposing factors for feline UO are listed in **BOX 1**.^{1,3}

Cats are masters at hiding illness. As a result, the early signs of UO may go unnoticed and the problem may not be recognized until hours or days after it begins. Clinical signs of UO include periuria, pollakiuria, stranguria, dysuria, and oliguria. Microscopic or macroscopic hematuria may be noted. As UO advances, clinical signs include vomiting, lethargy, and collapse. The hallmark clinical sign of UO is a painful, firm, full to overdistended urinary bladder with little to no urine passing from the urethra. Clinical parameters may include normo- to hyperthermia and bradycardia or tachycardia with or without arrhythmias.

BOX 1 Factors Predisposing to Feline Urethral Obstruction

SEX: Male or neutered male

AGE: 2 to 4 years

BODY SIZE: Obesity, higher body condition score

BREED: Higher in non-pedigree cats; no breed predisposition

LIFESTYLE: Indoor, multicat household

OTHER: Inter-cat issues; decreased water intake

DIAGNOSTIC TESTING

Diagnostic testing in UO patients is critical to identifying complications. **TABLE 1** lists diagnostic tests for UO patients in order of priority. Urgent tests include blood gas and serum electrolyte measurements and electrocardiography (ECG). Results of these tests allow targeted stabilization of possible life-threatening metabolic and electrolyte disturbances. Radiographic imaging to detect the presence of obstructing urethroliths guides the approach to urinary catheter placement and bladder decompression (**FIGURE 1**).

**TABLE 1** Priority of Diagnostic Tests in Patients With Urinary Obstruction

PRIORITY	TEST	IDENTIFY AND TREAT
Urgent	Blood gases Serum electrolytes Na ⁺ , Cl ⁻ , HCO ⁻	Metabolic acidosis (common in urinary obstruction patients)
Urgent	Serum electrolytes K ⁺ , iCa ⁺⁺	Hyperkalemia, hypocalcemia
Urgent	Electrocardiography	Cardiac arrhythmias pertaining to electrolyte disturbances
High priority	Radiography	Uroliths, obstructing urethroliths; nephroliths and ureteroliths may also be seen
Priority	Blood urea nitrogen, creatinine, symmetric dimethylarginine	Acute kidney injury secondary to obstruction
Important	Urinalysis ± urine culture	Crystalluria, pyuria, bacteriuria
Important	Complete blood count	Anemia, leukocytosis, neutrophilia
Important	Clinical chemistry	Concurrent disease
Important	Ultrasonography (if available)	Urinary tract changes

Determining the renal status of the patient is a priority, as severe kidney injury may affect prognosis and client decisions. Other diagnostic tests provide valuable information for ongoing patient care but are not critical to early stabilization.

PATIENT STABILIZATION

The approach to stabilization varies with each case. The establishment of a tailored list of priorities is essential, with the goal being to achieve all in a timely fashion.

Analgesia

A necessity for UO patients, analgesia is often neglected in the rush to treat the obstruction and related complications. Provision of analgesia should be an

immediate and ongoing priority. The PLATTER algorithm can guide the use of analgesic care (**BOX 2**).⁴ Validated pain scales such as the Glasgow Composite Measure Pain Scale–Feline (aprvt.com) and the Feline Grimace Scale (felinegrimacescale.com) minimize subjectivity and provide consistency in evaluation.

A multimodal approach to analgesia is essential, using analgesics from several drug classes. Analgesic options are presented in **TABLE 2**. Nonsteroidal anti-inflammatory drugs (NSAIDs) should be used with caution. Use in patients that are dehydrated, have confirmed kidney disease, or have unknown kidney function should be avoided until the patient is rehydrated and/or resolution of azotemia is confirmed. While NSAIDs may not show a direct benefit in preventing recurrence of UO in FIC patients,^{5,6} they



FIGURE 1. Radiographic imaging facilitates the identification of obstructing urethroliths. A 12-year-old spayed, domestic longhaired cat presented with a history of stranguria and dysuria that had progressed to oliguria. An obstructing urethrolith can be seen (**arrow**).

BOX 2 PLATTER Algorithm for the Continuum of Analgesia

- **Plan:** Perform a patient-specific pain assessment and formulate a treatment plan.
- **Anticipate:** While existing needs are treated, identify future needs and administer preventive analgesia.
- **Treat:** Provide appropriate treatment commensurate with the type, severity, and duration of expected or existing pain.
- **Evaluate:** Evaluate the patient's response to analgesics using a validated pain scoring tool.
- **Return:** As the patient's needs change, formulate a new plan.

should be considered as a beneficial component of multimodal analgesia.

Fluid Therapy

The goals of fluid therapy for UO patients include support of intravascular volume, dilution of serum potassium, and correction of metabolic derangements. Patients presented with cardiovascular collapse should receive shock doses of crystalloid solutions (50 to 55 mL/kg IV)⁷ in bolus fractions to restore vascular volume.¹ The first bolus of 25% of the calculated shock dose should be administered over 15 to 20 minutes, followed by reassessment of the patient's perfusion parameters. Additional boluses of fluids can be administered in 25% increments. If the patient is not responding after 50% of the calculated shock dose has been administered, colloids may be required.⁷

Once intravascular fluid volume is stabilized, fluid rates should be based on replacement of interstitial dehydration amounts plus maintenance fluid at 2 to 3 mL/kg/h.¹ Anecdotally, higher rates of 10 to 20 mL/kg may be chosen in an effort to “flush out” the urinary tract and reduce hyperkalemia and/or in anticipation of postobstructive diuresis (POD).^{8,9}

Balanced electrolyte solutions such as lactated Ringer's solution and Plasma-Lyte (Baxter, baxter.com) contain low levels of potassium (4 to 5 mEq/L) and are safe for use in hyperkalemic UO patients.^{7,8} They do not negatively affect the rate of normalization of serum

potassium, and, as most UO cats have metabolic acidosis, their alkalinizing effect can be beneficial in restoring pH in the first 12 hours of fluid therapy.^{1,8,9} In contrast, 0.9% NaCl is acidifying and may compromise attempts to restore acid-base balance.⁸

POD with urine production in excess of 2 mL/kg/h occurs within 4 to 6 hours after relief of obstruction in as many as 46% to 74% of patients.^{10,11} It is a result of the accumulation of osmotically active substances in the blood. Pressure necrosis, medullary washout, and antidiuretic hormone resistance may also contribute to POD. Monitoring of fluid input/output and changes in body weight assists in early identification of POD. Fluid therapy is tailored to ongoing fluid losses. Since POD can lead to kaliuresis, monitoring of serum potassium is recommended, and potassium should be supplemented if required.

Hyperkalemia Management

Hyperkalemia is a potentially life-threatening complication of UO. It may be evident early in patient assessment, based on the presence of arrhythmias, bradycardia, or tachycardia.

ECG patterns alter with worsening hyperkalemia. With mild potassium elevations (5.5 to 6.5 mEq/L), classic early changes include tall T waves with a prolonged QRS complex. Mild elevations in potassium usually resolve in response to dilutional fluid therapy (10 to 20 mL/kg/h).¹

TABLE 2 Analgesic Drugs for Consideration in the Treatment and Management of Pain Secondary to Urethral Obstruction

DRUG	CLASS	DOSE	DISADVANTAGES AND SIDE EFFECTS
Buprenorphine	Opioid Partial μ agonist	0.01–0.03 mg/kg transmucosal, IM, IV q4–12h	■ Dysphoria, unusual behaviors, mydriasis, hyperthermia
Buprenorphine, sustained release		80–120 μ g/kg SC q72h	
Butorphanol	Opioid K agonist/ μ antagonist	0.2–0.4 mg/kg IV, IM, SC q1–4h	■ Limited analgesia
Fentanyl	Opioid μ agonist/K agonist	5–10 μ g/kg IV, IM, SC q1–3h CRI 2–5 μ g/kg/hr IV	■ Respiratory depression, bradycardia, urinary retention, hyperthermia
Gabapentin	Calcium channel modulator	5–15 mg/kg PO q12h	■ Transient ataxia, transient sedation
Pregabalin		1–2 mg/kg PO q12h	
Meloxicam	COX-2-selective NSAID	0.1 mg/kg PO day 1, then 0.05 mg/kg q24h	■ Vomiting (rare) ■ Limit use in patients with kidney disease, unknown kidney function, and/or dehydration
Robenacoxib		1 mg/kg PO q24h for a total of 3 doses	

CRI=constant-rate infusion



Moderate hyperkalemia of 6 to 8 mmol/L requires immediate fluid therapy and treatment. Regular insulin administered at 0.1 to 0.25 IU/kg IV will drive an intracellular shift of potassium within 1 hour.¹² To reduce the risk of hypoglycemia, 10% to 20% dextrose should be given as a bolus of 0.5 g/kg. Intravenous fluids can be supplemented with 1% to 2% dextrose to maintain blood glucose levels.¹²

Serum potassium elevations in excess of 8 mmol/L are severe and require additional treatment to protect cardiac function. Calcium gluconate is administered slowly at 50 to 100 mg/kg IV, with continuous ECG monitoring. Calcium gluconate has a myocardial protective effect for 20 to 30 minutes.¹²

Hypocalcemia Management

Hypocalcemia may occur as a complication of UO related to reduced renal clearance of phosphorus.¹² Decreases in ionized calcium to below 1.6 mEq/L can lead to impaired cardiac electrical and mechanical function. Intravenous calcium gluconate may be indicated as described above.

BLADDER DECOMPRESSION AND RELIEF OF UO

Once the patient has been stabilized, bladder decompression and relief of the urinary obstruction are necessary. Decompressive cystocentesis is a valid approach to relieve bladder pressure and associated pain in the initial phases of treatment and has been evaluated as a safe alternative treatment for UO when finances do not permit urinary catheterization.¹³ In cases of UO

where decompressive cystocentesis was used, the risk of bladder tear or rupture and/or clinically significant abdominal effusion was determined to be low.^{13,14}

Relief of the UO and placement of a urinary catheter should not be attempted without heavy sedation or full general anesthesia.¹ Use of a coccygeal epidural can reduce sedative and anesthetic requirements and improve comfort levels during the recovery phase.¹⁵

Catheter Choice

Urinary catheters are available in a variety of materials, sizes, and configurations (**TABLE 3**). For initial unblocking, more rigid catheters such as olive tip catheters or polypropylene catheters are often selected, although the rigidity of these catheters may increase the risk of urethral trauma. As rigid catheters are not ideal as indwelling catheters, placement of a second, softer catheter is necessary after unblocking, which increases the risk of urethral trauma and irritation. Catheters made of polytetrafluoroethylene and polyurethane are more rigid at room temperatures and soften at body temperature. They are ideal for both unblocking and placement as an indwelling catheter.

In cats with a UO, urinary catheter sizes should be no larger than 3.5 to 5 Fr. Smaller urethral catheters (3.5 Fr) may be associated with decreased risk of recurrent obstruction 24 hours after catheter removal.¹⁶ Indwelling urinary catheters are generally left in place for 1 to 3 days, although no conclusive data exist to specify duration.¹ Factors to consider include patient stability, resolution of biochemical abnormalities, POD, and gross and microscopic character of urine.

TABLE 3 Urinary Catheter Selection for Relief of Urethral Obstruction

CATHETER	PROS	CONS
Stainless steel olive tip	<ul style="list-style-type: none"> Most rigid, with variable-size olive-shaped tip for relief of obstruction 	<ul style="list-style-type: none"> Higher risk of urethral trauma Not designed for indwelling use
Polypropylene (tomcat)	<ul style="list-style-type: none"> Most rigid, relieves obstruction Open-ended and side-hole options 	<ul style="list-style-type: none"> Higher risk of urethral trauma More reactive/irritating than polyvinyl Not recommended for indwelling use
Polyvinyl (red rubber)	<ul style="list-style-type: none"> Softer for indwelling 	<ul style="list-style-type: none"> Side holes not ideal for relief of obstruction
Polytetrafluoroethylene ("slippery Sam")	<ul style="list-style-type: none"> Firmer at room temperature for unblocking, softens at body temperature for indwelling Less reactive than polypropylene and polyvinyl 	<ul style="list-style-type: none"> Higher cost
Polyurethane (tomcat small urinary catheter)	<ul style="list-style-type: none"> Firmer at room temperature for unblocking, softens at body temperature for indwelling Less reactive than polypropylene and polyvinyl Product may include flushing stylet 	<ul style="list-style-type: none"> Higher cost

Collection System

A closed collection system facilitates monitoring of catheter patency, measurement of urine output, and early identification of POD. It may reduce urine soiling and scalding. Anecdotally, clinicians may prefer open systems based on concerns about the comfort level of the patient and obstruction of urine flow with a closed system. Closed urinary catheter systems are recommended as the standard of care.¹⁷

Complications

UTI is uncommon in UO patients.¹⁸ The use of an indwelling urinary catheter presents a low risk for acquired UTI.¹⁸ Empiric use of antibiotics is not warranted at the time of presentation or during treatment.¹⁷ Urine culture after 24 hours of catheterization or at the time of catheter removal has been recommended.^{1,18} However, in the absence of clinical signs associated with cystitis, the identification of pyuria in urine sediment or bacteriuria by urine culture does not necessarily warrant treatment.¹⁷

Detrusor atony can occur as a result of bladder overstretch during a prolonged, untreated UO. Recovery of normal detrusor function is promoted by keeping the bladder small during the days after relief of the obstruction. Indwelling urinary catheters or manual bladder expression may suffice. Parasympathomimetic drugs such as bethanechol increase smooth muscle contractility and may further support detrusor recovery.¹² Side effects of bethanechol include vomiting and diarrhea; this drug should not be used in patients with active UO or high risk of recurrent UO.

POSTOBSTRUCTION SUPPORTIVE CARE

Analgesia

Multimodal analgesia (**TABLE 2**) should be continued based on patient reassessment (**BOX 2**) in the clinic and after discharge of the patient from the hospital.

Muscle Relaxant/ Antispasmodic Medications

The feline urethra is composed of smooth muscle along the proximal quarter to third of its length and skeletal muscle distally. Only proximal portions of the feline urethra are responsive to smooth muscle relaxants. Prazosin (alpha-1 adrenergic antagonist) can cause

urethral smooth muscle relaxation, has a rapid onset of action, and is the antispasmodic of choice. Potential side effects include hypotension, lethargy, ptialism, diarrhea, anorexia, and malodorous stool.¹⁹ Phenoxybenzamine is a less effective alpha-1 adrenergic antagonist sometimes used for UO. It requires up to a week to take effect.¹ Acepromazine may be used to reduce proximal urethral pressures, acting also as a sedative; however, the risks of hypotension are significantly higher than with prazosin or phenoxybenzamine.

Given the limited effect of antispasmodics on the feline urethra, their need as a treatment for UO has been called into question. Controlled studies have failed to demonstrate a benefit of their use.¹ Although a 2013 study failed to find a difference in the incidence of recurrent UO and severity of lower urinary tract signs among cats receiving prazosin and those receiving placebo,¹⁹ larger studies are still needed.

Antianxiety Medications

During the postobstruction recovery phase and following discharge, antianxiety medications may be indicated. Patients diagnosed with FIC sometimes benefit from short- or long-term use of antianxiety medications such as alprazolam or amitriptyline. The use of these medications should not replace appropriate dietary and/or environmental modifications.

Nutritional Therapy

Urinary prescription diets play a role in the management of UO secondary to urolithiasis. Some of these diets promote elimination of crystalluria, dissolution of struvite uroliths, and/or the prevention of subsequent urolith formation. At least one of these diets has also been shown to reduce recurrence of several clinical signs associated with FIC.²⁰

Surgical Intervention

In the case of life-threatening urolith UO, surgical removal of the uroliths may be indicated. However, if patients can be safely unobstructed and stabilized, dietary dissolution of existing sterile struvite stones is a less invasive and less costly treatment option.^{21,22} Urolith size should be reassessed 2 weeks after diet initiation to determine if dietary dissolution is possible. A 50% or greater reduction in the stone size indicates likely success for dietary dissolution.²²



Environmental Management

Meeting the environmental needs of cats and providing the appropriate number and distribution of resources is key to reducing anxiety and often appropriate in the treatment of FLUTD.^{23,24} The American Association of Feline Practitioners/International Society of Feline Medicine guidelines on environmental needs in cats²³ and guidelines to diagnosing and resolving house-soiling behavior in cats²⁴ are excellent resources for advising clients. In cases of FIC, multimodal environmental modification has been demonstrated to reduce lower urinary tract signs and signs of anxiety in potentially reducing the risk of FIC-related UO.²⁵

CONCLUSION

Feline UO is a common emergency. Diagnosis of UO in cats is straightforward, but the difficulty lies in recognition of the problem at home. Client education is key to prevention as well as prompt treatment. Diagnostic testing facilitates identification of complicating metabolic and electrolyte disturbances, and treatment is aimed at providing analgesia and stabilization of the patient prior to attempts at UO relief. Lifelong care in the form of diet and environmental modification is likely necessary. **TVP**

References

- Cooper ES. Controversies in the management of feline urethral obstruction. *J Vet Emerg Crit Care* 2015;25(1):130-137.
- Gerber B, Eichenberger S, Reusch CE. Guarded long-term prognosis in male cats with urethral obstruction. *J Feline Med Surg* 2008;10(1):16-23.
- Jukes A, Lui M, Morton JM, et al. Associations between increased body condition score, bodyweight, age and breed with urethral obstruction in male castrated cats. *Vet J* 2019;244:7-12.
- Epstein ME, Rodan I, Griffenhagen G, et al. 2015 AAHA/AAFP pain management guidelines for dogs and cats. *J Feline Med Surg* 2015;17(3):251-272.
- Dorsch R, Zellner F, Schulz B, et al. Evaluation of meloxicam for the treatment of obstructive feline idiopathic cystitis. *J Feline Med Surg* 2016;18(11):925-933.
- Nivy R, Segev G, Rimer D, et al. A prospective randomized study of efficacy of 2 treatment protocols in preventing recurrence of clinical signs in 51 male cats with obstructive idiopathic cystitis. *J Vet Intern Med* 2019;33(5):2117-2123.
- Davis H, Jensen T, Johnson A, et al. 2013 AAHA/AAFP fluid therapy guidelines for dogs and cats. *JAAHA* 2013;49(3):149-159.
- Drobatz KJ, Cole SG. The influence of crystalloid type on acid-base and electrolyte status of cats with urethral obstruction. *J Vet Emerg Crit Care* 2008;18(4):355-361.
- Cunha MG, Freitas GC, Carregaro AB, et al. Renal and cardiorespiratory effects of treatment with lactated Ringer's solution or physiologic saline (0.9% NaCl) solution in cats with experimentally induced urethral obstruction. *Am J Vet Res* 2010;71(7):840-846.
- Francis BJ, Wells RJ, Rao S, Hackett TB. Retrospective study to characterize post-obstructive diuresis in cats with urethral obstruction. *J Feline Med Surg* 2010;12(8):606-608.

- Fröhlich L, Hartmann K, Sautter-Louis C, Dorsch R. Postobstructive diuresis in cats with naturally occurring lower urinary tract obstruction: incidence, severity and association with laboratory parameters on admission. *J Feline Med Surg* 2016;18(1):809-817.
- Little S. *The Cat: Clinical Medicine and Management*. St. Louis, MO: Elsevier Saunders; 2011.
- Cooper ES, Owens TJ, Chew DJ, Buffington CAT. A protocol for managing urethral obstruction in male cats without urethral catheterization. *JAVMA* 2010;237(11):1261-1266.
- Gerken KK, Cooper ES, Butler AL, Chew DJ. Association of abdominal effusion with a single decompressive cystocentesis prior to catheterization in male cats with urethral obstruction. *J Vet Emerg Crit Care* 2020;30(1):11-17.
- O'Hearn AK, Wright BD. Coccygeal epidural with local anesthetic for catheterization and pain management in the treatment of feline urethral obstruction. *J Vet Emerg Crit Care* 2011;21(1):50-52.
- Hetrick PF, Davidow EB. Initial treatment factors associated with feline urethral obstruction recurrence rate: 192 cases (2004-2010). *JAVMA* 2013;243(4):512-519.
- Weese JS, Blondeau J, Boothe D, et al. International Society for Companion Animal Infectious Diseases (ISCAID) guidelines for the diagnosis and management of bacterial urinary tract infections in dogs and cats. *Vet J* 2019;247:8-25.
- Cooper ES, Lasley E, Daniels JB, Chew DJ. Incidence of bacteriuria at presentation and resulting from urinary catheterization in feline urethral obstruction. *J Vet Emerg Crit Care* 2019;29(5):472-477.
- Reineke EL, Thomas EK, Syring RS, et al. The effect of prazosin on outcome in feline urethral obstruction. *J Vet Emerg Crit Care* 2017;27(4):387-396.
- Kruger JM, Lulich JP, MacLeay J. Comparison of foods with differing nutritional profiles for long-term management of acute nonobstructive idiopathic cystitis in cats. *JAVMA* 2015;247(5):508-517.
- Lulich JP, Kruger JM, Macleay JM, et al. Efficacy of two commercially available, low-magnesium, urine-acidifying dry foods for the dissolution of struvite uroliths in cats. *JAVMA* 2013;243(8):1147-1153.
- Lulich JP, Berent AC, Adams LG, et al. ACVIM small animal consensus recommendations on the treatment and prevention of uroliths in dogs and cats. *J Vet Intern Med* 2016;30(5):1564-1574.
- Ellis SLH, Rodan I, Carney HC, et al. AAFCO and ISFM feline environmental needs guidelines. *J Feline Med Surg* 2013;15(3):219-230.
- Carney HC, Sadek TP, Curtis TM, et al. AAFCO and ISFM guidelines for diagnosing and solving house-soiling behavior in cats. *J Feline Med Surg* 2014;16(7):579-598.
- Buffington CAT, Westropp JL, Chew DJ, Bolus RR. Clinical evaluation of multimodal environmental modification (MEMO) in the management of cats with idiopathic cystitis. *J Feline Med Surg* 2006;8(4):261-268.



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