Obstruction of the canine urethra can occur anywhere from the neck of the bladder to the tip of the penis. Many causes of urethral obstruction exist and can be divided into two categories: intraluminal (e.g., calculi) and intramural/extraluminal (e.g., neoplasia, granulomatous urethritis, prostatic disease, perineal hernia, stricture). Functional causes of urethral obstruction due to reflex dyssynergia (detrusor-urethral dyssynergia [DUD]) must also be ruled out. The most common cause is calculi that become lodged at the base of the os penis in male dogs. Urethral obstructions can be partial or complete. Clinical consequences of the obstruction become more severe and life threatening as the degree and duration of the obstruction increases. As such, dogs with complete urethral obstruction must be treated as a true emergency.

**DIAGNOSTIC CRITERIA**

**Historical Information**

**Gender Predisposition:** More common in male dogs. Intact male dogs have a higher tendency to become obstructed secondary to prostatic disease (benign prostatic hypertrophy, prostatitis/prostatic abscess. Note: prostatic tumors do not discriminate and can be seen in neutered males). Male dogs demonstrate a higher tendency of forming calcium oxalate stones; female dogs more commonly form struvite stones.

**Age Predisposition:** Uroliths can be seen in any age of dog but are most frequently observed in middle-aged dogs. Stone formation in dogs less than 1 year of age may be supportive of a portosystemic shunt (urate) or chronic urinary tract infection (UTI) (struvite). Tumors of the urinary tract or surrounding structures, prostatic diseases, and perineal hernias are more common in older dogs.

**Breed Predisposition:**

- Struvite: miniature schnauzer, bichon frise, shih tzu, mixed breeds, cocker spaniel.
- Calcium oxalate: miniature schnauzer, Lhasa apso, Yorkshire terrier, miniature poodle, shih tzu, bichon frise.
- Urate: dalmatian, English bulldog.

**Shetland sheepdogs, West Highland white terriers, and Scottish terriers have a higher incidence of urinary bladder tumors.**

**Owner Observations:** Clinical signs of lower urinary tract inflammation (hematuria, pollakiuria, stranguria) are common in dogs with bladder or urethral calculi. Small stones may lodge in the urethra of male dogs and cause partial (thin urine stream) or complete (no urine stream) urinary obstruction. Dogs may posture to urinate for prolonged periods of time and produce only occasional drops of urine. Dogs with prostatic enlargement or intrapelvic neoplasia may have thin, ribbon-like stools and tenesmus. Owners may notice weight loss in dogs with prostatic carcinoma. Perineal swellings may be noted in dogs with perineal hernias. If obstruction leads to postrenal azotemia, systemic signs (e.g., lethargy, vomiting, anorexia) may exist. As azotemia worsens, coma, seizures, or death may occur.

**Physical Examination Findings**

- Abdominal palpation reveals an enlarged, firm, painful bladder following complete obstruction.
- Reduced velocity and diameter of the urine stream (partial obstruction) or no urine flow (complete obstruction) during voiding.
- Hematuria.
- Deep palpation of the perineum and of the penis just behind the os penis may allow identification of calculi or in the pelvic urethra per rectal examination.
- Rectal examination may reveal prostatic enlargement, intrapelvic masses, perineal hernia, or calculi.
- Although rare, the author has seen on two occasions urethral prolapse in male dogs from chronic straining.
- Signs of uremia (lethargy, inappetence/anorexia, vomiting) may develop as duration of obstruction increases (greater than 24 hours).
- Signs of severe uremia: weakness, hypothermia, bradycardia (with moderate hyperkalemia), rapid shallow respiration, stupor/coma, seizures (may occur terminally), tachycardia (from severe hyperkalemia causing ventricular dysrhythmias).
Hyperkalemia will occur with prolonged obstructions. Serum phosphorus levels may also be quite high.

Electrolytes: Hyperkalemia will occur with prolonged obstructions; may reach life-threatening levels. Also may see hypernatremia/hyperchloremia from dehydration. Hyponatremia/hypochloremia may also be noted when obstruction is associated with loss of gastrointestinal fluid from vomiting. Metabolic acidosis is also common.

Urinalysis: Hematuria/proteinuria are frequently seen in urine of obstructed dogs due to bladder mucosal injury. Pyuria/bacteriuria indicates infection (bladder or prostate). Crystals may mimic calculi present. Atypical epithelial cells may be seen in dogs with neoplasia.

Urine culture: Positive bacterial growth in dogs with UTI or prostatitis.

Other Diagnostic Tests
- Caudal survey abdominal radiographs to include the kidneys, ureters, bladder, pelvic urethra, and penis. Urethral obstruction should be performed to identify radiodense calculi, prostatic enlargement, bladder masses, and other caudal abdominal/pelvic masses.
- Positive-contrast urethrography is the most sensitive method of detecting intraluminal and intramural lesions of the urethra. It is easily performed in the male dog to identify radiolucent calculi, strictures, urethral tears, masses, or infiltrative urethral disease. Performed using aseptic technique, 1ml/lb of contrast agent (Renografin® [Fort Dodge Animal Health], Hypaque® [Intrapharm Laboratories], Omnipaque® [Nycomed]) is injected through a Foley catheter inserted and inflated at the tip of the penis. If possible, the bladder is emptied first; however, this is often not possible in an obstructed dog. Patients may require sedation and decompressive cystocentesis.

Double-contrast cystography is used to define lesions of the bladder (e.g., transitional carcinoma). The bladder is emptied by urinary catheterization; air is injected through the catheter until the bladder is slightly firm; a lateral radiograph is taken; a contrast agent is injected; a second radiograph is taken. The author has achieved good results using a 1ml/lb dose of the contrast agent. A smaller dose, 1–2 ml for small dogs and 2–10 ml for larger dogs, has also been recommended, with the goal of accumulating a shallow (0.5 cm) pool of contrast media in the dependent portion of the bladder, thus facilitating visualization of lesions.

Ultrasoundography is highly sensitive for detecting lesions of the bladder and prostate; kidneys can also be examined for evidence of hydronephrosis. This technique does not give a high yield for evaluation of the urethra. Proximal urethral lesions may be identified.

ECG is a helpful and inexpensive way to parallel the magnitude of increase in serum potassium concentration if electrolytes are unable to be measured on an emergency basis, although there are many exceptions. Used to assess the deleterious effects of presumptive hyperkalemia on the ECG. Hypocalcemia and metabolic acidosis also contribute to the severity of the changes as well as the presence or absence of hyponatremia (Table 1).
- Calculi that are passed or retrieved should be sent for crystallographic analysis for quantitative and qualitative analysis.
- Cytology of washes of the urinary tract collected by urinary catheterization can be used to diagnose transitional cell carcinoma of the bladder neck and prostatic diseases.

Summary of Diagnostic Criteria
- Historical problem of difficulty or absence of urination.
- Physical examination reveals large, firm, painful bladder.
- ± radiographic evidence of calculi in urethra.
- ± mass in caudal abdomen/pelvic canal may be palpated or visualized on radiographs/ultrasound.

Differential Diagnosis

Urethral obstruction:
- Calculi.
- Stricture.
- Prostatic enlargement (e.g., benign prostatic hyperplasia, prostatitis, prostatic abscess, prostatic neoplasia).
- Neoplasia of bladder neck/trigone (e.g., transitional cell carcinoma).
- Granulomatous urethritis.
- Perineal hernia with retroflexion of bladder.
- Other neoplasia (e.g., urethra, pelvic canal, penile).
- Functional: reflex dyssynergia-DUD.

Signs of lower urinary tract disease:
- UTI: small bladder, pyuria on urinalysis, positive urine culture.
- Bladder calculi without obstruction: small bladder, calculi confined to bladder on radiographs.

Azotemia:
- Dehydration.
- Pre-renal and intrarenal failure.
- Addison’s disease.
TREATMENT RECOMMENDATIONS

If the **dog is stable** (i.e., no signs of uremia), treatment should be aimed at immediate establishment of a patent pathway for urine flow. This can be achieved by:

- **Urinary catheter alone.**
- **Retrograde hydropropulsion of calculi followed by placement of urinary catheter; usually requires heavy sedation or general anesthesia.**
- **If unable to relieve obstruction and dog is stable, immediate surgical intervention can be performed if indicated (e.g., calculi, perineal hernia, placement of cystostomy tube).**

If the **dog is showing systemic signs of uremia** due to the obstruction, treatment should occur as follows:

**Stabilize the patient first.** Initiate aggressive fluid therapy to combat the metabolic derangements associated with post-renal uremia (i.e., dehydration, acidosis, hyperkalemia, azotemia, and hypothermia). Fluids of choice are those that do not contain lactate or potassium (e.g., normal saline). Eliminating the physiologic effect of obstruction combined with a selected therapy for patients with life-threatening cardiotoxicity is appropriate for most patients. Severe hyperkalemia will be life-threatening due to cardiotoxic effects. Treatment for hyperkalemia with one or more of the following as indicated by response to therapy may be required.

- **Insulin:** Promotes the intracellular movement of potassium.
  - 0.5 units/kg of regular insulin.
  - Give 2 g dextrose (4 ml of 50% dextrose solution) for each unit of insulin.
  - Give 50% of insulin/dextrose dose IV; add the other half of the dose to the IV fluids immediately.

- **Calcium gluconate (10%):** Acts to protect the heart from the adverse effects of hyperkalemia; temporary measure only.
  - 0.5–1.0 mg/kg IV.
  - Potential serious side effects; monitor ECG closely during injection.

- **Sodium bicarbonate:** Promotes the intracellular movement of potassium (via exchange for hydrogen ions).
  - 0.5–1.0 mEq/kg IV slowly over 15 minutes.

- **Urethral catheterization.** If urethral calculi are the cause of the obstruction, **retrograde hydropropulsion followed by urethral catheterization** may be possible; if sedation is necessary, use non-cardiotoxic drugs (e.g., diazepam 0.5 mg/kg IV; oxymorphone 0.05–0.1 mg/kg SQ, IM, IV; morphine 0.1–0.5 mg/kg IM; butorphanol 0.2–0.4 mg/kg SQ, IM, IV).

- **Establish temporary pathway for urine flow.** Definitive surgical treatment of the underlying cause of the urethral obstruction needs to be delayed until the dog’s metabolic derangements have been corrected. The methods of providing a pathway for urine flow are:

  - **Urethral catheterization.** If urethral calculi are the cause of the obstruction, **retrograde hydropropulsion followed by urethral catheterization** may be possible; if sedation is necessary, use non-cardiotoxic drugs (e.g., diazepam 0.5 mg/kg IV; oxymorphone 0.05–0.1 mg/kg SQ, IM, IV; morphine 0.1–0.5 mg/kg IM; butorphanol 0.2–0.4 mg/kg SQ, IM, IV).

  - **Should hydropropulsion fail, or if the bladder is maximally distended, it may be necessary to perform cystocentesis to avoid overdistension and possible rupture of the bladder. Use a small-gauge needle for the procedure; about 2/3 of the volume should be removed to avoid traumatizing the bladder wall with the needle.**

**TABLE 1 Plasma Potassium Concentration and ECG Changes**

<table>
<thead>
<tr>
<th>Plasma K+ Concentration</th>
<th>ECG Changes</th>
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</thead>
<tbody>
<tr>
<td>5.5–6.5 mEq/L</td>
<td>May see appearance of tall, peaked T waves and slowing of heart rate.</td>
</tr>
<tr>
<td>6.5–8.5 mEq/L</td>
<td>Decrease is R wave amplitude, widening of the QRS complex, prolongation of the P-R interval, decrease in P wave amplitude, and prolongation of P wave duration.</td>
</tr>
<tr>
<td>&gt;7.5–8.5 mEq/L</td>
<td>P waves are no longer visible and there may be a derivation of the ST segment from baseline.</td>
</tr>
<tr>
<td>&gt;11 mEq/L</td>
<td>Ventricular fibrillation or ventricular asystole may be observed.</td>
</tr>
</tbody>
</table>

*It should be kept in mind that the presence and severity of electrocardiographic abnormalities do not always correlate with serum potassium concentrations, because of the concurrent effects of other electrolyte abnormalities, metabolic acidosis, and decreased tissue perfusion.

**CHECKPOINTS**

- Treatment has three major components:
  - Combating the metabolic derangements associated with postrenal uremia (dehydration, hypothermia, acidosis, hyperkalemia, and azotemia).
  - Restoring and maintaining a patent pathway for urine outflow.
  - Implementing specific treatment for the underlying cause of urine retention.
Repeated cystocentesis is not recommended for repeated decompression of the bladder due to the risk of bladder wall damage and potential rupture.

**Temporary cystostomy tube** placement is an effective way to provide continued bladder decompression in cases where a urethral catheter cannot be placed; it can be performed under sedation and local anesthesia. A Foley or mushroom-tipped catheter is placed transabdominally into the bladder until the dog can be taken to surgery for definitive surgery.

A **Stamey catheter** is a urinary catheter that can be introduced into the bladder percutaneously; no surgical incision is necessary. Limited to use with experienced practitioners.

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### Supportive Treatment

- Adequate analgesia using opiates such as butorphanol 0.1–0.4 mg/kg IV, SC, IM q2–4h; morphine 0.1–0.5 mg/kg IM q4h; oxymorphone 0.1–0.4 mg/kg IM q4h; or buprenorphine 0.3 mg/kg IM q12h as needed when appropriate.
- While awaiting culture results, initiate broad-spectrum antibiotic therapy such as cefazolin 22 mg/kg IV q6–8h or Clavamox® [Pfizer Animal Health] 14 mg/kg P.O. q12h.
- **Patient Monitoring**
  - Check urine production and hydration status frequently; adjust fluid administration rate accordingly.
  - Verify ability to urinate adequately or use urinary catheterization to combat urine retention. Indwelling catheterization with closed drainage is appropriate.
  - When ECG indicates life-threatening changes, continuous monitoring is needed initially to guide treatment and evaluate response.
  - Repeat BUN/creatinine and electrolytes to monitor azotemia.
- Lactate, or potassium-containing fluids.
- Avoid drugs that reduce blood pressure or induce cardiac dysrhythmia until dehydration or hyperkalemia are resolved.

### PROGNOSIS

Depends on a number of variables including the type and severity of the urethral obstruction.

#### Favorable Criteria

- Lack of azotemia or clinical signs of azotemia.
- Partial urethral obstruction.
- Short duration of obstruction.
- Correctable via surgical or medical management, i.e., acute obstruction due to urethral calculi.

#### Unfavorable Criteria

- Severe azotemia with clinical signs causing hyperkalemic cardiotoxicity.
- Conditions associated with non-treatable disease such as a chronic partial obstruction. Prognosis is guarded, but may be poor to grave if associated with severe hydronephrosis, neoplasia, or DUD.

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### Home Management

Variable depending on underlying cause and if permanent therapy is possible.

### Treatment Contraindications

- Frequent, intermittent cystocentesis of a distended, turgid, urinary bladder.

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**STANDARDS OF CARE: EMERGENCY AND CRITICAL CARE MEDICINE**