URETHRAL OBSTRUCTION IN DOGS

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The aim of this article is to provide a practical starting point for the veterinary team to recognise this condition and to give some useful tips for diagnosis and treatment

Signalment

Signalment of patients with urethral obstruction can vary with the cause, but the most common causes in dogs include uroliths and urethral or bladder neck neoplasia. Rarer causes of obstruction include prostatic disease, trauma and stricture[1]. Male dogs are much more predisposed to obstructive urolithiasis, compared to females, due to their long, narrow urethra[1]. In addition, neuter status can influence predisposition to cystine uroliths. In one study, 70 per cent of cystine uroliths submitted to one laboratory were from intact male dogs[2]. The authors of a follow-up study suggest that this could represent an inherited androgen-dependent cystinuria (Type III)[3].

Many breeds of dog have a predisposition to certain types of uroliths, so these should be strongly considered as a differential diagnosis in a dog presenting with suspicious clinical signs. Table 1 summarises some common breed predispositions. Urate uroliths are common in dogs with portosystemic shunts (PSS) so breeds (such as Yorkshire Terriers) predisposed to PSS may present with urate urolithiasis, sometimes with no other clinical signs[1]. Scottish terriers, Shetland sheepdogs, wirehaired fox terriers, and West Highland white terriers have been reported to have a higher prevalence of lower urinary tract neoplasia than other breeds[1].

Presenting clinical signs

Urethral obstruction can be partial or complete. Signs of partial obstruction include:

- dribbling urine;
- stranguria;
- pollakiuria;
- haematuria;
- abdominal pain;
- licking of genitals.

Signs of partial urethral obstruction can be similar to those exhibited with cystitis, but remember that cystitis is relatively uncommon in male dogs, so early investigations should be initiated in these patients in favour of empirical treatment.

Type of urolith	Common predisposed breeds
Calcium oxalate	miniature schnauzer, bichon frisé, Lhasa apso, Yorkshire terrier, miniature poodle, other small breed dogs
Struvite	small breed dogs, females more than males
Cystine	English bulldog, Newfoundland, dachshund, other bulldogs,
Urate	Dalmation, black Russian terrier, bulldogs

Table 1: Common types of urolith and predisposed breeds.

In female dogs, although cystitis is more common, repeated signs of cystitis should warrant further investigation in case of an underlying cause that could result in urethral obstruction, such as uroliths or neoplasia.

Emergency stabilisation of complete obstruction

Complete urethral obstruction is a medical emergency and dogs will strain unproductively, with marked abdominal pain and a large, firm bladder, and they may develop inappetence, vomiting, and lethargy. Small drips of urine may be seen, but this should not be taken as a sign that the patient is not fully obstructed. In addition to the urinary system signs, physical examination may reveal tachycardia or bradyarrhythmia or signs of hypovolaemic shock if the obstruction has been prolonged. Rectal examination is important to palpate for any pelvic mass lesion, such as an enlarged prostate or neoplastic mass.

A minimum database should include:

- **complete blood count** – to assess for dehydration, anaemia, markers of infection;
- **urea and creatinine** – if elevated, can indicate post-renal azotaemia;
- **electrolytes** – potassium levels increase with urine retention post urethral obstruction;
- **glucose** – ketoacidosis can mimic collapse and hypovolaemia and produces hyperkalaemia;
- **blood gas analysis** – assess degree of acidaemia;
- **urinalysis and urine culture** – to look for evidence of infection, crystals.

Emergency stabilisation of complete urethral obstruction should follow three steps:

1. Evaluate haemodynamic status and provide analgesia;
2. Correct metabolic derangements; and,
3. Urinary diversion.

Intravenous access should be established early, and analgesia would normally be in the form of an opioid such as methadone. Non-steroidal anti-inflammatories and corticosteroids should be avoided since the kidneys are already compromised. Fluid resuscitation with crystalloids such as 0.9 per cent saline or lactated Ringer's (Hartmann's) should be initiated. Although Hartmann's contains potassium, the quantity is low enough that it should not be detrimental to a hyperkalaemic patient. Specific treatment for hyperkalaemia should be started if it measures greater than 6.5 mmol/L or if the electrocardiogram (ECG) is abnormal.

Diversion of urine must be done as soon as possible and may require sedation or general anaesthesia (GA). Options include:

- urethral catheter ideally;
- if urethral catheter is not possible, retrograde urohydropulsion (GA);
- intermittent cystocentesis;
- cystostomy tube.

Diagnostic imaging

Radiography is a readily accessible and very useful way of assessing the urethra, bladder and kidneys. Abdominal ultrasound is more useful for assessment of bladder masses, the prostate, and kidney architecture, but it can be difficult to image the entire urethra using this modality. In some dogs with obstructive urethroliths, plain radiographs are sufficient to visualise all of the stones because they are radiopaque. Generally speaking, calcium-containing uroliths will be radiopaque, as will struvites. Cystine and urate uroliths are reported to be radiolucent, but this can be variable depending on the size of these stones and whether they are mixed with other minerals[1].

It is important to visualise the whole urethra, so positioning male dogs in lateral recumbency with the legs in neutral and 'pulled forward' positions will help with this. Urethroliths will usually lodge at the base of the os penis or at the ishiatic arch so particular attention should be paid to these areas. It is also useful to review the entire abdomen since the dog may also have nephroliths, may have prostatic disease, or could have microhepatica if they have a portosystemic shunt. For dogs with radiolucent uroliths, a positive contrast retrograde urethrocystogram using iodinated contrast agents such as iohexol can help visualise them as filling defects in the column of contrast (see Figure 1). Older texts often refer to double-contrast studies where air or CO_2 is injected into the bladder after the positive contrast agent[4]. This can be useful to visualise more subtle abnormalities, particularly within the bladder wall. However, many clinicians no longer recommend this technique due to the risk of fatal air embolism and the improvement in the quality of ultrasound imaging available in recent times. Ensuring that the bladder is not overfilled during contrast studies is an important consideration, so contrast can either be removed via the urethral catheter (preferable), or by cystocentesis (if unable to pass a catheter).

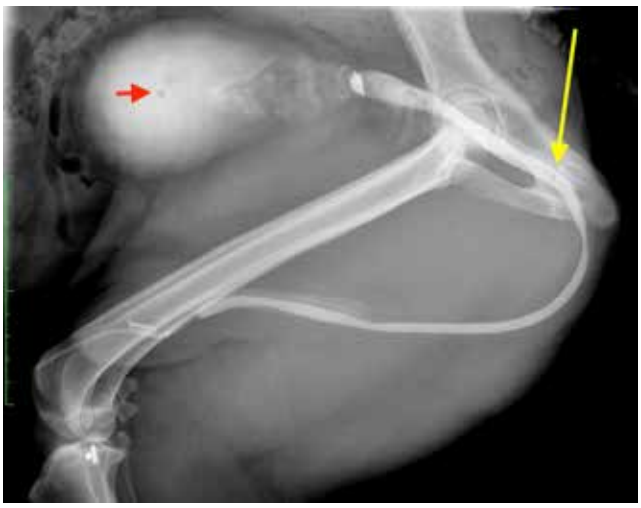


Figure 1: Radiograph showing retrograde urethrocystogram of male dog after retrograde urohydropulsion of the urethrolith into the bladder. The urolith can be seen as a filling defect in the contrast within the bladder (red arrow). An air bubble can be seen within the contrast column in the urethra at the level of the ischium (yellow arrow). This can be confused with a urolith, which is why it is important to prime the catheter with contrast prior to starting the study. The dog's pelvic limbs have been pulled forward to allow visualisation of the entire urethra.

Step-by-step guide to positive contrast retrograde urethrocystogram:

Male dog –

1. Ensure radiation safety rules are observed, including wearing of monitoring badges, lead gowns and thyroid protectors. Use an extension line so personnel can stand behind a protective screen.
2. Draw up 20 to 30 mls (less in very small dogs) of sterile iohexol or similar iodinated contrast agent and prime an appropriately-sized rigid urethral catheter to eliminate air bubbles.
3. Ensure the bladder is empty enough to receive the contrast.
4. After cleaning the prepuce, lubricate the catheter and introduce it into the penile urethra in a sterile manner so the side holes are just inside and use either tongue forceps or Doyenne atraumatic bowel clamps on the end of the penis to hold it in place and prevent backwards leakage of contrast.
5. Connect an extension line that is pre-filled with contrast between the catheter and syringe.
6. Inject contrast to dilate the urethra and take radiographs towards the end of instillation. Ensure the whole urethra can be visualised by bringing the legs forward.
7. Assess filling defects, obstruction to contrast flow, and any leakage of contrast from the urinary tract.

Female dog (vaginourethrocystogram) –

1. Similar procedure to male dogs but use a Foley catheter rather than a rigid catheter.
2. The catheter is pre-filled with contrast as above. After lubricating the tip, the catheter is introduced into the vestibule of the vagina and the balloon inflated to fill the vestibule. Doyenne forceps may need to be applied across the vulva to stop the catheter from falling out caudally.
3. Additional contrast agent may be required (can be diluted 1:1 to increase the volume) to allow filling of the vagina and urethra.

Urethrocystoscopy is another method for investigating urethral obstruction, although this may be limited by the ability to pass the endoscope past any obstruction. Very small dogs (under approximately 6.5kg to 10kg in males and under 2kg in females) may not be able to accommodate the width of the endoscope within their urethra. However, this modality provides direct visualisation of urethroliths or strictures, can be used for biopsy of any mass lesions, and can be used to treat some obstructions.

Retrograde urohydropulsion of urethral stones

Over 85 per cent of urethroliths can be moved into the bladder using retrograde urohydropulsion[5]. Exceptions include uroliths that have been present for a long time, which are embedded firmly into the urethral mucosa. Often a urethral catheter can be passed beyond stones like this, so passage of a urethral catheter should not be taken as confirmation that an obstruction is relieved.

Step-by-step guide to retrograde urohydropulsion in male dogs:

1. Perform this procedure in the radiography room to be able to immediately check for movement of the urethroliths.
2. Draw up 20ml of sterile saline 0.9 per cent and prime

a rigid urethral catheter to eliminate air bubbles. Make sure the catheter is the largest size that the urethra can accommodate.
3. Ensure the bladder is empty enough to receive the saline.
4. Introduce the lubricated catheter into the penile urethra in a sterile manner to the level of the obstruction and hold the catheter in position within the urethra by gently pinching the end of the penis with a sterile gauze. Do not try to push the stones using the catheter as you may cause a urethral tear.
5. Initially try flushing the urethra to see if the uroliths will move. If successful, the catheter should advance into the bladder, but always check with radiographs/contrast study.
6. If unsuccessful, an assistant inserts a gloved, lubricated finger into the rectum and pressure is applied ventrally to occlude the urethra.
7. A small volume of saline (2 to 5ml) is injected with the finger in place and then the finger is released. Check if the catheter advances further.
8. Repeat until the catheter advances into the bladder and check with radiographs/contrast study.
9. A mix of sterile water-based lubricant and saline can be used if needed.

If retrograde urohydropulsion is unsuccessful, options include:

- **Urethrotomy with or without cystotomy.** This can be used to remove urethroliths that are adhered to the urethral mucosa and will not budge. This is technically quite challenging and should be performed by an experienced surgeon. A cystotomy is usually required as well to remove cystoliths.
- **Permanent urethrostomy.** This is the creation of a permanent opening in the urethra and is a salvage option for dogs with recurrent urethral obstruction distal to the site of the urethrostomy. This is usually performed at the level of the scrotum in male dogs because most urethrolith obstructions occur at the base of the os penis. The scrotal urethra is much wider than the penile urethra, allowing larger uroliths to pass.
- **Transabdominal cystostomy tube.** This is usually used as a palliative measure for obstructive neoplasia such as urothelial carcinoma of the bladder neck, which cannot be easily surgically excised. Urethral stenting can provide an alternative method of temporarily re-establishing urethral patency, but can have complications such as urinary incontinence and stranguria. A cystostomy tube can also be considered in the case of obstructive urethroliths in order to attempt further retrograde urohydropulsion after initiation of anti-inflammatory treatment, although this is rarely needed[6].

Non-surgical options to treat urethral obstruction with uroliths

Non-surgical management of urethral obstruction is encouraged as much as possible due to the reduction in trauma to the urinary tract, reduced risk of recurrent uroliths (due to absence of suture material in the bladder) and reduced risk of urethral stricture[7]. However, in reality, access to advanced non-surgical, minimally-invasive techniques, such as intracorporeal laser lithotripsy, is currently limited in many countries. Basket retrieval via urethroscopy is not considered wise in the case of obstructive urethroliths due to the risk of re-obstruction[7].

The type of uroliths present strongly influences the ability to medically manage dogs with urethral obstruction. If urethroliths can be retropulsed into the bladder then medical dissolution should be attempted if the stones are highly likely to be struvites[7]. Struvite uroliths in dogs are often associated with urease-producing bacterial infection and alkaline urine. They can usually be successfully treated with appropriate antibiotics and urinary acidification through dietary modification.

Urate uroliths non-associated with liver disease, or cystine uroliths can also potentially be addressed medically[7]. However, owners must be counselled about the possibility of recurrent urethral obstruction through this process, with many owners opting for removal of the stones rather than risking repeat obstruction. Calcium oxalate uroliths cannot be dissolved medically once formed and so obstructive calcium oxalate uroliths should be removed[7].

Surgical options for urethral obstruction after successful retrograde urohydropulsion of uroliths

- **Open cystotomy.** This is the mainstay of surgical treatment for urethroliths that can be retropulsed into the bladder. Normograde and retrograde catheterisation should be performed during surgery to ensure all uroliths are removed.
- **Percutaneous cystolithotomy (PCCL).** This is a minimally-invasive surgical technique which minimises the size of the abdominal and bladder incisions and requires use of a cystoscope. A recent study found similar results between PCCL and open cystotomy, with complete removal of uroliths in 98 per cent of patients in both groups[8].

Imaging must be repeated after surgery; in one study, 42 per cent of dogs that had appropriate post-operative imaging following cystotomy had residual uroliths. There was a low rate of post-operative imaging performed in that paper[4]. A more recent study found that if cystoscopy/urethroscopy or positive-contrast radiographs are always performed, the rate of retained uroliths is very low[9].

Uroliths should always be submitted for mineral analysis and culture and susceptibility testing. Some clinicians also take a small sample of bladder mucosa from the edge of the incision for submission for culture and susceptibility testing.

Post-operative care

Whether or not to leave an indwelling urethral catheter post-surgery is dependent on the likelihood of early reobstruction post-surgery. In most cases of urolith-related obstruction where a simple cystotomy is done, or if a permanent urethrostomy is performed, the author would not leave an indwelling urethral catheter in place. However, with revision surgery or where the bladder is extremely fragile and at risk of leakage, leaving a Foley catheter in place for five to 10 days may help avoid this post-operative complication.

Appropriate analgesia in the form of tapering opioids and an NSAID ± paracetamol can be used in stable patients without azotaemia. Antibiotics should only be given post-operatively if an active urine sediment examination has been identified or there has been a positive culture on a urine sample collected by cystocentesis. Owners should be warned of the high likelihood of haematuria and stranguria for a period of up to two weeks post-operatively.

Conclusion

Management of urethral obstruction remains a regular part of general and emergency small animal veterinary practice. Prompt recognition of complete obstruction and understanding of the consequences can lead to successful outcomes. Using appropriate imaging techniques both pre- and post-operatively can make a huge difference to the success of surgical removal of uroliths. Finally, if the correct technique is used, most obstructive urethroliths can be flushed into the bladder using retrograde urohydropulsion, avoiding the need for more complex surgery such as urethrotomy.

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READER QUESTIONS AND ANSWERS

1. WHICH OF THE FOLLOWING IS A COMMON CLINICAL SIGN OF COMPLETE URETHRAL OBSTRUCTION IN A DOG?

A. Increased urine production with a soft, small bladder
B. Unproductive straining to urinate with a large, firm bladder
C. Painless urination with increased appetite
D. Pollakiuria with a small, easily expressed bladder and no evidence of urinary retention

2. A MALE DOG PRESENTS WITH COMPLETE URETHRAL OBSTRUCTION, BRADYARRHYTHMIA AND MARKED AZOTAEMIA. BLOOD TESTING REVEALS A POTASSIUM CONCENTRATION OF 5.8MMOL/L. WHICH FINDING WOULD INDICATE THE NEED FOR SPECIFIC TREATMENT FOR HYPERKALAEMIA?

A. The markedly elevated creatinine concentration
B. An abnormal electrocardiogram trace
C. The high potassium concentration of 5.8mmol/L
D. Failure to pass a urethral catheter on the first attempt

3. A DOG IS SUSPECTED OF HAVING URETHRAL OBSTRUCTION CAUSED BY RADIOLUCENT UROLITHS. WHICH DIAGNOSTIC IMAGING TECHNIQUE IS RECOMMENDED TO HELP IDENTIFY THESE STONES?

A. Plain abdominal radiography alone
B. Abdominal ultrasound as the definitive method for visualising the entire urethra
C. Positive-contrast retrograde urethrocystography using an iodinated contrast agent
D. Double-contrast cystography using air as the preferred contrast technique

4. DURING MANAGEMENT OF A MALE DOG WITH OBSTRUCTIVE URETHROLITHIASIS, A URETHRAL CATHETER IS SUCCESSFULLY PASSED BEYOND THE OBSTRUCTING STONES. WHICH STATEMENT BEST REFLECTS THE RECOMMENDED INTERPRETATION AND NEXT STEP?

A. Successful catheter passage confirms that the obstruction has been completely relieved.
B. The stones should be pushed directly into the bladder using the catheter tip.
C. Catheter passage does not confirm relief of obstruction; stone movement should be assessed using radiography or a contrast study.
D. Immediate urethrostomy is indicated in every case where catheterisation has been required.

5. A DOG UNDERGOES OPEN CYSTOTOMY FOLLOWING SUCCESSFUL RETROGRADE UROHYDROPULSION OF URETHROLITHS. WHICH APPROACH IS RECOMMENDED TO MINIMISE THE RISK OF RETAINED UROLITHS?

A. Rely on visual inspection of the bladder during surgery and perform further imaging only if clinical signs recur
B. Leave an indwelling urethral catheter in every patient for 10 days to ensure all stones pass
C. Count the stones on pre-operative radiographs and if the number removed is equal, this means all stones have been removed.
D. Perform normograde and retrograde catheterisation during surgery and repeat appropriate post-operative imaging to assess for retained uroliths

ANSWERS: 1B; 2B; 3C; 4C; 5D.