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Soft Tissue Surgery Case Challenges for Advanced Practitioners Mini Series

Session 1: Emergency Surgery of the Urinary Tract

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In these notes I am going to give you my opinion on how I managed the cases that I am presenting to you during this webinar. There is a lot of additional information in the literature about pathophysiology, risk factors etc., which you are recommended to read.

Presentation of Obstructive Urinary Tract Disease

The majority of cases have a classic presentation of straining to urinate and failing to produce urine. In cats it is harder for owners to detect problems. Owners may be unaware of time spent in the litter tray, and outdoor cats usually do not strain indoors and if they do it will be later in presentation. In these cats, owners may mistake the dysuria for poor toileting habits or spraying, and not recognise the problem as dysuria. Therefore cats often present much later in the course of obstruction, and it is more common for me to see cats that are collapsed, hyperkalaemic and bradycardic than dogs.

It is also important to recognise that dysuria is not the only presenting complaint in obstructed animals. The cat in the presentation with a rectal prolapse was found when the owners returned from holiday and was not obstructed, and it would have been easy to overlook the uroliths. However, rectal prolapse in an adult cat is very unusual and suggests a problem that is causing marked straining. I have also seen rectal prolapse in a cat that had a cystostomy tube that was straining, presumably due to a catheter induced urinary tract infection.

It is important to consider the underlying cause of uroliths, which are the most common cause of obstructive urinary tract disease, and the most common reason we will treat urinary tract disease as an emergency. Common scenarios to consider are:

- Is the animal hypercalcaemic? Look for reasons such as hyperparathyroidism, anal sac apocrine gland adenocarcinoma, lymphoma
- Is the urolith radiolucent? Consider urate uroliths secondary to portosystemic shunt, especially in small breeds prone to PSS such as Yorkshire terriers. However, don't dismiss PSS in older dogs, as some dogs only have urinary tract signs, without any evidence of neurological signs and having successfully undergone anaesthesia, and may present later e.g. at 5 years old.
- Does the animal have a UTI that could have led to struvite formation?
- Is the dog a predisposed breed for a particular urolith? The classic example is the urate uroliths in Dalmatians but there are many others. try the app below which will suggest the most likely urolith in your case and make recommendations:
    - Go to App Store on your i-Phone
    - Click on search button
    - Look for MN Urolith app
    - Click on GET
    - Type in your Apple password
    - The MUC app will download on your iPhone
    - To open click on icon 
    - When you use the app for the first time you will need to log in. For log in use the same email and password that you normally use for the MUC website. You only have to sign in once and the app will recognise you.

Prior to treating obstructive urinary tract disease, it is also important to have a long-term plan. If this is the first episode of obstruction, then it is reasonable to unblock a cat with a non-urolith obstruction and start medical management. However, if the cat presents having had multiple obstructive episodes secondary to lower urinary tract disease, then consideration must be given to perineal urethrostomy after stabilization. I usually offer surgery if there are three consecutive obstructive episodes in quick succession (i.e. the cat reblocks within days to a week of being treated) or three times within a year. Cats that block for the second time after four years are less likely to need surgery, as they may never block again, so I am less aggressive with offering surgery, as it will significantly increase the risk of developing UTIs. In dogs, I do not consider urethrostomy for uroliths in dogs without a breed-specific predisposition for developing uroliths. However, if a dog with a breed-specific predisposition (and these dogs are normally Dalmatians) obstructs for a second time, then I will discuss

scrotal urethrostomy. Again it depends upon how much time there has been between episodes, the age of the dog and if an attempt has been made to reduce urolith formation with diet and medication. In a young dog that has reobstructed quickly or repeatedly, it is a viable option, but I wouldn't consider it in a dog that had two obstructive episodes years apart. One of the reasons for this is that urethrostomy will not stop urolith formation, just obstructive episodes if they pass into the urethra, and dogs may need to have repeated cystotomy anyway. Furthermore, the fact that I see very few dogs with obstructive disease that cannot easily be relieved by flushing suggests that this surgery is not often indicated. Most dogs with urethral obstruction can undergo flushing of uroliths to the bladder followed by cystotomy.

Differentials for Dysuria Urinary Tract Obstruction

Bladder/urethra
- Urolithiasis
- Neoplasia (transitional cell or squamous cell carcinoma)
- Inflammation e.g. granulomatous inflammation
- Infection
- Bladder polypoid disease

Prostatic disease
- Benign prostatic hyperplasia
- Prostatitis
- Prostatic abscess
- Prostatic/paraprostatic cyst
- Neoplasia

Vaginal
- Neoplasia – most are benign, rarely cause urethral obstruction
- Vaginitis

Penile
- Inflammation
- Trauma
- Neoplasia

Gastrointestinal causes of dyschezia e.g. colitis

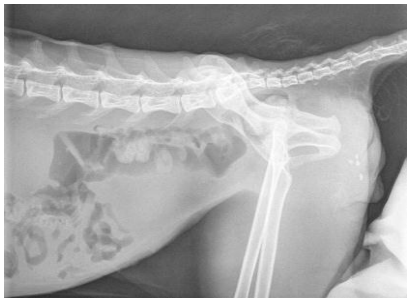
Is the Animal Obstructed?

This may sound obvious, but I see some unusual presentations of obstruction. The classic obstruction is easy to diagnose – appropriate history, large firm bladder, cannot express with firm bladder manipulation, and cannot pass a urinary catheter.

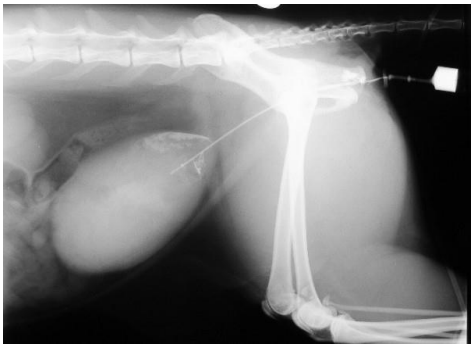
There are some confusing scenarios:

- Dogs and cats can be intermittently completely obstructed or they are partially obstructed. These animals can pass small streams or drips of urine. The owners therefore are not aware that they are not emptying the bladder and they may present later. On examination the bladder may be of normal size, but if obstructed the bladder is usually very firm and painful to palpate, and it cannot be expressed at all; or is difficult to express; or the stream of urine produced is narrow or dripping, weak and often intermittent. It is important to recognise these animals are obstructed so they can be appropriately treated.
- The animal can be catheterized with difficulty but the catheter reaches the bladder eventually and the bladder is emptied successfully. The animal then immediately reobstructs when the catheter is removed and the bladder has refilled. This may be due to:
    - Passage of the catheter past a urolith. In large dogs, a 6F catheter will pass with just a small amount of effort past some obstructions. This can be assessed by plain radiography (opaque uroliths) or positive contrast urethrography (lucent uroliths).
    - Inflammatory or neoplastic disease causing obstruction during urination are often surprising easy to catheterize, especially with a small catheter. This can

be assessed by positive contrast urethrocystography (males) or vaginourethrocystography (females).



- The animal is catheterized easily or with difficulty and the bladder is emptied. The animal reobstructs within hours or days i.e. in a longer time than above. This can occur when a urolith is in the urethra causing obstruction but is not stuck firmly – it is pushed back into the bladder but then the same or another small urolith subsequently passes back into the urethra to cause obstruction.
- During catheterization of a male cat, the catheter is passed with difficulty past an initial obstruction, then passes some centimetres further and meets another obstruction. This may represent urethral laceration. It can be assessed by plain radiography with the catheter in place (note below the catheter has passed more dorsally than the passage of the normal catheter) or by positive contrast urethrography.



Laboratory Findings in Obstruction

Typical serum biochemistry findings are azotaemia and hyperkalaemia, depending upon the extent and time since obstruction. High PCV and proteins may reflect hypovolaemia. Haematology changes may reflect inflammatory or neoplastic changes.

A urine sample will need to be obtained for complete urinalysis and culture. Remember that struvites often form in the presence of infected urine, and the UTI may be the cause of urolith formation. Samples can be obtained if the animal has cystocentesis to resolve marked obstruction, or from a urinary catheter after obstruction is relieved.

Treatment of Hyperkalaemia

I tend to find that cats are more likely to present with hyperkalaemia than dogs, which probably reflects the fact that dysuria and obstruction are more likely to be noted in dogs that toilet in front of their owners. Many of these animals will also be azotaemic. Most cases of hyperkalaemia and azotaemia, even if they are marked, will resolve with fluid therapy and it is very rare for me to resort to medical therapy. Generally the biggest difficulty in managing these cases is finding a way to empty the bladder when undertaking the fluid therapy.

The main clinical effect of hyperkalaemia is bradycardia. This can easily be detected on physical examination. However, this needs to be countered by the effects of hypovolaemia on heart rate, which is typically tachycardia, so hyperkalaemic animals may not be bradycardic on presentation but may become so over time. Typical ECG changes are:

- Flattened P waves
- Widened QRS complexes
- Peaked T waves

Medical treatment for hyperkalaemia includes:

- Calcium gluconate to improve cardiac rhythm. It will not have an effect on the serum potassium levels, but will antagonize its effects on the heart.
    - 0.5-1.0 ml/kg 10% calcium gluconate given slow iv, effects will last for 20-30 minutes.
- Insulin and glucose. Insulin drives potassium into cells to reduce the serum potassium. Glucose is given to avoid hypoglycemia. This method requires a fluid pump and monitoring.
    - Insulin 0.25-0.5 IU/kg regular insulin PLUS
    - 1-2g 25% glucose/IU insulin
- Glucose alone to promote endogenous insulin production
    - 1-2ml/kg 50% dextrose

Typically I will start treating with boluses of crystalloid fluid therapy. If an animal is bradycardic, watching the ECG is a good way to assess that the hyperkalaemia is resolving, as the ECG changes will normalize and heart rate will climb. Unfortunately the technical challenge this poses is high volumes of urine production into an already full bladder. I am happy to perform cystocentesis to reduce bladder size but with some caveats:

- It must be done carefully as a taut bladder can tear/rupture.
- If the urethra remains obstructed after cystocentesis, when the bladder refills leakage will occur from even a small needle hole, and without resolution of the obstruction uroabdomen will quickly develop. Therefore I consider cystocentesis to be a short-term answer to the problem of preventing bladder rupture whilst correcting hyperkalaemia, or prior to referring an animal, rather than something that can be relied upon for days. It may need to be repeated once or twice.

What is more challenging is how to manage the bladder if the obstruction cannot be relieved or if a urethral tear (in cats) has occurred. If a catheter has been passed alongside an obstructed urolith, I am happy to leave it in situ for a number of hours whilst the animal is stabilized or awaiting a theatre slot. In the past, if I couldn't get a catheter past an obstruction or relieve it, definitive surgery was usually performed assuming the animal was stable, and typically would be urethrotomy/urethrostomy +/- cystotomy in male dogs or perineal urethrostomy in male cats. I have also performed temporary tube cystostomy pending definitive surgery, but in my hands a PU doesn't take much longer than a mini-laparotomy for cystostomy, so I tend to perform PU rather than put a C-tube in cats. An exception may be urethral tear, where definitive surgery may require transpubic or prepubic urethrostomy, which are much longer surgeries to perform. Performing C-tube placement prior to definitive surgery has a number of disadvantages. First, it is more expensive, as the animal will have two surgical procedures. Second, there are some complications associated with C-tube placement, although these are much less common for tubes that are used in the short-term to those that are used longer term. In male dogs with urethral obstruction, they are likely to require cystotomy (unless there is a single obstructing urolith) and so placing a C-tube prior to definitive surgery means that two bladder surgeries are performed. I would rather therefore have an obstructed male dog referred after fluid therapy and cystocentesis (once or twice only) than to have had a C-tube placed at the referring vets. I also find that retrohydropropulsion is almost always successful in my hands, and most obstructed males I see that have had a failed attempt at retrohydropropulsion prior to referral can be unblocked during a second retrohydropropulsion.

The development of pigtail catheters for cystostomy tube placement has made a huge impact on managing animals that I cannot unblock. In particular it allows a longer period of fluid therapy to stabilize the animal prior to definitive surgery, but it means that PU does not need to be performed as an emergency out of hours, but can be performed during a routine surgery list.

Pigtail catheter:
http://infinitimedical.com/products/drainage-catheters/

Urethral Catheter:
http://infinitimedical.com/products/feline-urinary-catheter/
Boothroyd@infinitymedical.com

Investigating Obstruction

Attempting to pass a urinary catheter will give an idea if obstruction is present. I often start with a smaller catheter than I would use if unobstructed, to avoid damaging the urethral wall in case of partial urolith obstruction or inflammatory/ neoplastic disease. Most cases of acute obstruction are due to uroliths. Cases of inflammatory or neoplastic disease often have a history of dysuria prior to obstruction, but this is not always true.

I find radiography most useful, especially in dogs, given that most obstructive disease is due to uroliths. Ultrasound will not detect all uroliths in the urethra, especially in the pelvic canal or os penis, but can be useful for perineal uroliths (which are less common than those obstructing the distal urethra), radiolucent uroliths, inflammatory/neoplastic disease of the bladder/urethra and for assessing kidneys and ureters.

Radiographs should be taken with the legs caudally to assess the kidneys, bladder and tip of the penis, and the legs cranially to assess the caudal penis and perineum. Particularly in large dogs, uroliths can be missed if superimposed on the limbs. Be careful to note where the fabellae lie, as they are occasionally mistaken for uroliths. If there are no uroliths present, consider radiolucent uroliths or inflammatory/ neoplastic disease as differentials, and perform a positive contrast urethrogram.

Retrohydropropulsion in Male Dogs

This is a technique that has improved success with experience. I encourage vets to refer dogs for another attempt at retrohydropropusion rather than performing urethrotomy for urethral obstruction, as I have only failed retrohydropropulsion in a couple of dogs so far. It takes a number of personnel to perform it and can take a long time (half an hour or more). I perform it on the x-ray table so that it can be performed after radiographic investigation, and so that radiographs +/- contrast studies can be performed to assess progress and complete the investigation.

- An assistant protrudes the penis from the prepuce and holds it at the base caudal to the os penis. If you have difficulty passing the catheter past this point, ask the assistant to ease off the pressure, as they can prevent a catheter passing when the urethra is not even obstructed.
- Place the largest dog urinary catheter that will fit into the penis using copious lubrication. A tight fit stops fluid leaking back from the penis. Pass the catheter right up to the obstruction. Be careful not to pass the catheter past the obstruction (this is uncommon).
- Clamp the penis a few centimetres caudal to the tip of the penis (see picture), so that the clamp sits right up next to the catheter in the urethra. This stops the urethra expanding on the distal side of the obstruction, which would allow leakage of fluid during retrohydropropulsion. If leakage does occur, you should reposition the clamp. Sometimes you will need an additional person to clamp the penis closed as well (it is important to still keep the clamp in place), and this is most effective if their hand adopts the same position as the clamp rather than just gripping around the whole penis, as the latter doesn't seem to effectively stop leakage. My experience is that

just clamping with a hand is much less effective than a clamp. I use a tongue clamp from Veterinary Instrumentation:

http://www.veterinary-instrumentation.co.uk/product.php?productid=5455&cat=54&page=1

- An assistant places a finger (or 2) in the rectum and palpates the urethra ventrally. If the urolith is in the perineal (this is less common than in the distal urethra), be careful to place the finger more proximal (cranial) to the urolith. Compress the urethra ventrally.
- Using a 3-way tap and syringes of saline, fill the urinary catheter until the assistant can feel fluid pushing firmly in the urethra against their finger in the rectum. They should be struggling to hold back the fluid. It is important to check there is no leakage from the penis or the urethra will not be distended enough.
- At this stage the urethra should be sufficiently distended that the urethra wall will have moved away from the urolith and it will hopefully be possible to flush the urolith proximally.
- You will need to give a very forced flush of saline at the same time as the assistant lifts their finger off the urethra in the rectum.
- Make sure that the 20ml syringe you are using is full and use the 3-way tap to attach it to the catheter (the 3-way tap stops you losing full filling of the urethra). Make sure all attachments to the catheter are tight to stop them flying off as you do the firm injection. Check the penis assistant (if used) is clamping particularly tightly). Do a countdown 3-2-1 and push hard on the syringe to flush the full 20ml into the catheter – the assistant will release pressure in the rectum at the same time.
- If successful, the urolith will have been flushed to the bladder. The assistant performing rectal examination may even feel a large urolith move past in the urethra.
- Try to advance the catheter. If the obstruction is obviously present, repeat retrohydropropulsion. Consider using a saline/lubrication mix is saline alone is not effective.
- If the obstruction appears to have been resolved, take a radiograph to confirm a radio-opaque urolith is no longer in the urethra. A positive contrast retrograde urethrogram will be needed to confirm resolution of a radiolucent urolith.
- Once obstruction is relieved, perform cystotomy. Failure to perform cystotomy will undoubtedly lead to reconstruction, as uroliths tend to move back to the urethra. If I am performing retrohydropropulsion late at night or if another surgical emergency precludes immediate surgery, I will place a urinary catheter after successful retrohydropropulsion and perform cystotomy the next day.

Relieving Obstruction in Male Cats

It is not typical for male cats to present with uroliths obstructing the penile urethra. Most cases have debris from the bladder that may be gritty or smooth. Some obstructions are easily relieved with flushing, others are much more difficult.

Cats tend to have more advanced obstruction than dogs and are more likely to have electrolyte disturbance and azotemia. It is important to give fluid therapy and ensure bradycardia has resolved to avoid death at the time of sedation.

I will try initial catheterisation under combinations of midazolam and ketamine, but will convert to anaesthesia if I haven't resolved the obstruction when maximum sedation protocols have been used.

It is vitally important that the penis is fully extended caudally during catheterization, as it has an S-bend to it, and forceful attempts at catheterization will lead to urethral tear/ rupture, which is very problematic to subsequently resolve. If the obstruction is mild, it can be achieved by an assistant holding the penis caudally extended. However, most cats I treat have a difficult obstruction and as soon as a catheter is introduced into the urethra, it pushes the penis cranially and it reforms the S-shape. I therefore have an assistant extrude the penis and I clamp the preputial mucosa (not the penis) just before it joins the penile mucosa at the preputial fornix, as I find this keeps the penis maximally extruded. Clearly sedation must be adequate to allow this.

A reasonably stiff catheter with an end hole is required to relieve a difficult obstruction. A Slippery Sam catheter is only useful for those obstructions that resolve with a quick flush of saline, as they are too soft. I find intravenous cannulae (minus the stylet) useful as they are short and come in a variety of diameters. It is also useful to try a selection of different stiffness and diameter catheters to relieve an obstruction, as some may be more successful than others.

Copious lubrication is applied to the catheter and it is placed into the penile urethra. Saline or a saline/lubricant mix is used to attempt forced flushing. Any cranial movement of the catheter against an obstruction must be gentle to avoid inadvertent tearing of the urethral wall.

If I cannot resolve an obstruction, I may consider cystocentesis (or a pigtail catheter into the bladder), then attempt again 12 hours later. In some cats, obstruction can be easier to relieve when the mucosa is well hydrated, and it is always worth a second attempt before resorting to perineal urethrostomy.

Canine Scrotal Urethrostomy

When faced with urethral obstruction that cannot be relieved, options available are urethrotomy or urethrostomy. A urethrotomy is preferred unless the animal has a clinical need for urethrostomy, e.g. the dog has had obstructive episodes in the past and the goal is to avoid future urethrotomy. In the clinical case example in the lecture, there were multiple uroliths lodged within the urethra adjacent to the os penis, where urethrotomy would not have been possible (the groove is only a few millimetres wide caudally and the os penis is complete cranially), and furthermore he had had one previous urethrotomy and had reobstructed within a year. However, the cases in which I perform urethrotomy are more likely to have the urolith trapped just caudal to the os penis and therefore can be accessed via prescrotal urethrotomy. I have never personally needed to perform perineal urethrotomy in a dog as I find uroliths that obstruct here can always be relieved, although there are reports of this procedure, and it is apparently a technical challenge given the amount of haemorrhage that will occur due to the thickness of the corpus spongiosum, and the depth of the urethra, making suturing to the skin difficult.

If possible I pass a urinary catheter until the obstructed urolith or if it passes alongside it, I will allow it to do so. It is very helpful to have a guide for the position of the urethra as it can't be palpated through the penile tissue, and sometimes uroliths are not easily palpable. Urethrotomy is performed prescrotally and urethrostomy at the site of the scrotum, so entire dogs are castrated. This site aims for the narrowest depth of corpus spongiosum to minimise haemorrhage, and avoids urine scald during posturing for urination. I also perform scrotal ablation as the urethra needs to be sutured to skin to form a new stoma and the scrotum would be in the way and lead to urine scald. Be careful not to over-resect skin as there must not be tension on the skin when suturing it to urethral mucosa.

The corpus spongiosum must be incised in order to access the urethra. In small dogs the bleeding associated with this is acceptable, assuming it is done careful on the midline. In larger dogs the bleeding can be immense and make surgery difficult to perform. Haemorrhage can be reduced by intermittent irrigation with cold saline or adrenaline. Use of the urethral catheter helps minimise incision of this tissue and allows a straight incision into the urethra. I make an initial incision with a new sharp scalpel blade, and continue the incision using tenotomy scissors, as it is easier to make an accurate straight incision than with a blade, especially if there is no catheter.

For urethrotomy I just make the incision large enough to remove the catheter. I leave the surgical site open to allow healing by second intention, as it is easier than suturing, and suturing has been associated with scar formation. There will be marked haemorrhage during urination for several days and for the first 24 hours bleeding may be continuous from the surgical site. It is rare for there to be enough hemorrhage to warrant transfusion. Haemorrhage during urination may occur for 1-2 weeks.

For urethrostomy, the incision must be long enough to allow it to reduce in size by half and still allow passage of uroliths. In a Dalmatian I would consider 3-4cm. If the stoma is too small, uroliths will not pass and obstruction will occur. I use small suture material i.e. 1.5 metric, which gives a good balance between being small enough for the needle to not cause too much damage to mucosa and large enough to see comfortably if surgical magnification if not used. The urethra does not need stronger/larger sutures as it does not have high tensile strength. I use a monofilament permanent suture to minimise reaction in the tissues that could over-reduce stoma size e.g. Monosof, Ethilon. It is important to avoid a cutting needle as the sharp edges faces the cut edge of mucosa and it is more likely that it will tear the mucosa on passing. A reverse cutting needle is acceptable as the cut faces away from the cut edge of mucosa but care must be taken that it does not cut mucosa. I prefer a tapercut needle although it is not usually possible to find this on permanent suture material and so a reverse cutting needle is a compromise (and hence another reason for using small gauge suture). Either simple continuous or simple interrupted sutures are used. I find that simple continuous sutures reduce haemorrhage better but it can be more difficult to get good tissue apposition. I will use simple interrupted sutures if I am struggling with tissue apposition or if I need to place some key sutures to obtain a good stoma shape. I place only skin to mucosa sutures, as I have not generally dissected enough to create much deep dead space. It is also to place sutures deep to the urethral mucosa without penetrating corpus spongiosum that leads to more haemorrhage. However sometimes I will close dead space if it exists lateral to the corpus spongiosum. Usually spongiosum and urethral mucosal haemorrhage is well controlled by sutures.

Cystotomy after Urethrotomy/Urethrostomy

It is typical that dogs requiring urethrotomy or urethrostomy also require cystotomy for urolith removal. This is done after to allow flushing of the urethra. When dogs are in dorsal recumbency, uroliths tend to fall by gravity into the trigone and proximal urethra. This explains why 14% of dogs and 20% cats had uroliths left behind after cystotomy in one study. If I have relieved obstruction with retrohydropropulsion, I leave the urinary catheter in place during preparation for cystotomy, and remove it after the final scrub so that I can replace it with a sterile catheter during surgery to allow flushing. It is very frustrating if the catheter is removed prematurely and the urolith reobstructs, as retrohydropropulsion is difficult to do, although if

necessary at least the urolith is not quite as obstructed as on presentation. If there are multiple uroliths that are small enough to enter the urethra, I make a ventral incision in the caudal bladder that usually includes the trigone and sometimes the urethra. It is important to stay on the midline to avoid the ureters, although they are dorsally located so a true midline incision should avoid them. I do not perform dorsal cystotomy as I need it to be near the trigone, which would not be possible due to ureter location. Whilst an incision into the proximal urethra is possible, I try to avoid it, as suturing it may lead to narrowing. It is also difficult to perform if it is within the pelvic canal, and cannot be performed in dogs with large prostates. The goal is to be able to have a clear view of uroliths being flushed into the trigone so cystotomy alone should be sufficient. If a dog has large uroliths only that are too big to enter the urethra, I perform a mid body cystotomy as it is easier to close.

I remove all uroliths from the bladder initially. Some can become adherent to the bladder mucosa, especially calcium oxalate uroliths as they are rough, and so a larger cystotomy may be required to access them. When the bladder is empty, I start to perform urethral flushing. I place swabs around the cystotomy to collect uroliths (rather than allowing them to fall into the abdominal cavity) and start with forced flushing with the catheter within the pelvic urethra. This will flush out many stones within the proximal urethra. I then sequentially move the catheter closer to the penis and continue episodes of forced flushing to flush out all residual uroliths. It is important to have visualization of the trigone during flushing. If you flush and then look, you will miss the uroliths that get flushed to the trigone and then immediately fall back to the urethra. If you have to operate alone, place stay sutures along the cystotomy incision attached by a short length to mosquito forceps and hang the forceps over the lateral edges of the dog. The stay suture in the bladder apex can be tied around the abdominal retractors cranially if no assistant is available. It can help to block the urethra via the cystotomy incision with a curette at the end of a flush to stop them disappearing. I usually like to have had 3-4 negative flushes before accepting that the urethra is empty.

Flushing can be performed via urethrotomy or urethrostomy incisions (after suturing is complete for urethrostomy), but gentle handling is required. Typically urethral catheters are not left in situ in either urethrotomy or urethrostomy, unless there is another clinical need.

Radiographs should be repeated to ensure that all uroliths are removed, and is especially recommended for any vets not used to flushing the urethra.

Feline Perineal Urethrostomy

I prefer to have cats in sternal recumbency for this procedure, as it is how I have done most cases and I have most experience with this position. Some authors advocate dorsal recumbency and I have cats in this position if I may need to convert to transpubic or prepubic urethrostomy – typically if I am operating on a known urethral tear.

If the cat is not currently obstructed I place a urinary catheter as it helps guide a straight urethral incision.

I start with a generous skin incision around both the penis and the residual scrotal sac – the pelvic urethra will be sutured to the skin at the dorsal level of the scrotum. It helps to place an Allis clamp on the penile skin to mark the ventral aspect of skin in case there is rotation and you lose track of what is dorsal and ventral. I perform blunt and sharp dissection close to the penis until the ischiocavernosus muscles are located. I ligate them close to the penis and transect laterally (there is no lateral blood supply). Dissection is performed without over dissecting away from the urethra to avoid nerve damage. The bulbourethral glands can be hard to identify, but they are located lateral and slightly dorsal to the urethra approximately 5mm cranial to the ischiocavernosus muscles. They can sometimes be confused with or covered in fat. They are the landmarks for the cranial extent of the urethral incision. I do not cut any further cranial, even if it seems as though it is possible, as invariably this makes placement of the most cranial/dorsal sutures very difficult, and will risk urine leakage.

When dissection is complete I make a transverse incision along the dorsal urethra just cranial to the penis – this is easier if a catheter is in place. If there is no catheter, take care not to cut too deeply as it is easy to fully transect the urethra. When the mall urethral lumen is visible, tenotomy scissors are used to incise the dorsal urethra longitudinally to the bulbourethral glands. If there is too much haemorrhage to see the mucosa, apply ice-cold saline.

With an assistant retracting the penis caudally and the skin dorsally, place the first two sutures between the most dorsal aspect of skin (1mm to left and right sides of midline) and the most cranial extent of the urethral incision (slightly to the left and right respectively). I have tried starting with the more caudal sutures but actually it is then harder to reach the cranial part of the urethral incision as you lose the help of the penis being pulled caudally. Take care to recognise the cut edge of urethral mucosa – it is easy to inadvertently miss it and take only penile tissue as it retracts all along the cranial half of the urethral incision. This would lead to urine leaking under the skin and necrosis. Make sure the needle is as small as possible (so therefore suture should not be bigger than 1.5m) and avoid a standard cutting needle. Reverse cutting needles should be used with care to avoid urethral tearing, which is more likely in the cat than the dog, and more problematic as the urethral diameter we are working with is much smaller. Be careful to be at least 2mm from the cut edge but not too far or the sutures will meet on the midline. I usually leave a 3cm length of mucosa before transecting the penis to avoid urine scald.

If the urethral incision has been made to the bulbourethral glands, you will be able to pass a mosquito forceps to the hinges.

There is also a technique that uses the prepuce during PU, which some surgeons prefer.

There is no need to place a urethral catheter post-operatively. However if the cat develops a full bladder without straining, I would be concerned about atony secondary to prolonged obstruction. A well-lubricated Foley catheter can usually be placed conscious and bethanecol can be used. Similarly a catheter may be required in cats that appear to still be blocked after surgery, which is usually due to urethral spasm. This assumes a retrograde study was performed prior to surgery to ensure there wasn't another site of obstruction, a laceration or a stricture. Drugs to combat urethral spasm include prazocin, phenoxybenzamine and diazepam, but avoid long-term use of diazepam, as there are reports of fulminant hepatic necrosis.

Managing Feline Urethral Tear/Rupture

It is not always possible to know the full length of the laceration. Some are relatively short and a PU can still be performed, especially if the laceration is dorsal where the urethral incision would have been made. A short ventral laceration can be accommodated as long as the laceration is not approaching the bulbourethral glands. If a ventral laceration is too far cranial then it is difficult to create the stoma dorsally, but it might be possible to place the sutures, and then leave a urinary catheter (or a cystostomy tube) in place for urethral diversion. If a cystostomy tube is used it must be attached to a drainage bag to prevent any bladder filling as no urination can be allowed in case of urine leakage into periurethral tissues.

If the laceration continues cranial to the ischiocavernosus muscles and bulbourethral glands, it is more likely that PU cannot be accommodated. In this case I will now consider transpubic urethrostomy – this is well described:

Bernarde A, Viguier E. Transpelvic urethrostomy in 11 cats using an ischial ostectomy. Vet Surg. 2004 May-Jun;33(3):246-52.

If the laceration is too cranial to allow transpubic urethrostomy, prepubic urethrostomy can be performed, but is more likely to lead to urinary tract infections the more cranial the urethrostomy has to be performed.