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PRACTICAL UROLOGY TECHNIQUES

Retrograde urohydropropulsion

1. Decompress urinary bladder	Uroliths cannot be flushed back into an over distended urinary bladder. Use a 22g-1.5 inch needle attached to IV extension tubing, 3-way stopcock and large volume syringe to remove urine. By using the 3-way stopcock, the urinary bladder will not have to be repunctured to empty a full syringe of urine.
2. Lubricate around the urethroliths	Fill one 12ml syringe with 5mls of saline and another 12ml syringe with 5mls of sterile water-soluble lubricant. Attach these 2 syringes with a 3-way stopcock. Mix the contents of both syringes by emptying one syringe into the other several times. After inserting a urethral catheter, inject 3 to 8 mls of mixture to lubricate around the urolith.
3. Insert catheter	Use a large bore flexible catheter. Do not insert the catheter such that the tip is proximal to urethroliths.
4. Occlude pelvic urethra	Insert a gloved hand into the rectum. Press ventrally on the pelvis to occlude the pelvic urethra.
5. Occlude distal urethra	With a moistened gauze sponge, compress the distal urethra around the catheter using your thumb and first finger to seal the distal urethral opening.
6. Force fluid through catheter forcefully	Fill a large syringe with sterile isotonic solution (e.g. saline, LRS, etc.). The normal bladder holds approximately 3 to 5 mls per pound of the patient's weight. With the syringe attached to the catheter, turn it upside down, so that the plunger is on the tabletop. Hold the syringe by the barrel. Empty the syringe forcefully by using your body weight to depress the syringe plunger.
7. Relieve occlusion of pelvic urethra	Once the urethra becomes dilated, relieve the pressure occluding the pelvic urethra; continue flushing fluid through the urethra to force the urethrolith into the urinary bladder.

Nonsurgical stone removal: voiding urohydropropulsion

Until recently, most uroliths in the urinary bladder were either medically dissolved or surgically removed. However, at the University of Minnesota, we developed a new technique to remove urocystoliths, called voiding urohydropropulsion (table 1). By taking advantage of the effect of gravity on urolith position in the urinary bladder and dilation of the urethral lumen during the voiding phase of micturition, this simple technique allows uroliths to be rapidly flushed out of the urinary tract.

Over the past 5 years, voiding urohydropropulsion has been used to remove uroliths in over 100 dogs. We have found voiding urohydropropulsion to be an effective and safe method to remove small to moderately sized urocystoliths of any mineral composition. What follows are answers to the questions that we believe are most important to effectively perform voiding urohydropropulsion in your patient.

How can i determine what size of urolith can be voided?

Proper selection of patients for voiding urohydropropulsion will enhance removal of urocystoliths. The relationship of the size, shape, and surface contour of urocystoliths to the luminal diameter of the urethra are important factors. Uroliths that are larger than the smallest diameter of any portion of the distended urethral lumen are unlikely to be voided. In our clinical experience, diameters of the largest uroliths expelled from the urinary bladder were 7 mm from a 7.4 kg female dog, 5 mm from a 9 kg male dog, 5 mm from a 4.6 kg female cat, and 1 mm from a 6.6 kg male cat. It is logical to hypothesize that uroliths greater than 1 mm in diameter could be voided from a male cat with a perineal urethrostomy. As a guideline, we assume that smooth uroliths, less than 5 mm in diameter can be removed by voiding urohydropropulsion in any dog weighing more than 18 pounds.

How much fluid or urine should be in the bladder for voiding urohydropropulsion to be effective?
Assuring successful voiding urohydropropulsion requires that urinary bladders be maximally distended with urine or sterile isotonic solutions (Ringers solution, normal saline, other isotonic intravenous solutions). Maximal bladder distention allows the urinary bladder to be rapidly and forcefully compressed, creating sufficient intravesicular pressure to evacuate uroliths. For most dogs, we fill the urinary bladder with an 8 french, flexible rubber catheter inserted in the urethra. We achieve maximal distention by palpating the urinary bladder during filling. Sometimes we continue to fill the bladder until fluid begins to leak around the catheter. When this occurs, we often have to pinch the vulva or prepuce between our thumb and forefinger to occlude the distal urethra to maintain maximal bladder distention even after the catheter has been removed from the urethra.

If a urolith is obstructing the urethra, is voiding urohydropropulsion likely to be effective?
Voiding urohydropropulsion is NOT likely to be effective in patients with uroliths lodged in the urethra at the time of diagnosis.

Can voiding urohydropropulsion be performed successfully in the male dog?
The success of voiding urohydropropulsion is not dependent on whether patients are male or female, but whether uroliths are sufficiently size to pass through urethral lumens. Because the diameter of the urethra in male dogs is smaller than female dogs and because the os penis in male dogs restricts expansion of the urethral lumen, larger uroliths can be voided from female dogs when compared to male dogs of equal size.

What should i do if uroliths become lodged in the urethra during voiding urohydropropulsion?
If uroliths are too large to easily pass through the urethral lumen, they may become lodged in the urethra during voiding urohydropropulsion. For most patients, when this occurs, uroliths are easily flushed back into the urinary bladder by retrograde urohydropropulsion. However, if the urinary bladder is still distended with the fluid, retrograde urohydropropulsion may be difficult. Excessive intravesicular pressure that is created as the bladder is filled with fluid to perform voiding urohydropropulsion, forces uroliths to move distally along the urethra. Therefore, successful retrograde urohydropropulsion of uroliths may first require that the bladder be emptied by decompressive cystocentesis.

If i have never performed voiding urohydropropulsion, how do i get started?
To help minimize the anxiety associated with a new technique, perform voiding urohydropropulsion on a dog that you have scheduled for cystotomy. For your first attempt, select a patient, that in all probability, is likely to result in a successful outcome. In other words, choose a medium size, female dog with relatively smooth uroliths equal to or less than 5mm in diameter. The patient is sedated just as if a cystotomy is going to be performed. However, first try voiding urohydropropulsion. If you have difficulty catheterizing the urethra, feel uncomfortable maximally distending the urinary bladder with fluid or are unsuccessful at removing all uroliths, the patient is already prepared for surgery. In fact, even if you rupture the urinary bladder, which is not likely, you are prepared to surgically repair the tear.

UROLOGY

Performing voiding urohydropropulsion

1. Anesthetize the patient	They type of anesthesia selected may vary based on the likelihood of success and gender of the patient. Consider reversible short acting anesthetics (e.g. Propofol) for patients with very small uroliths that are easily removed. Patients likely to go to surgery/ lithotripsy should be placed under inhalation anesthesia. Consider epidural anesthesia to facilitate relaxation of the urethra in male dogs.
2. Attach a 3-way stopcock to the end of the urinary catheter	The 3-way stopcock facilitates control of the volume of fluid entering the bladder and containment of fluid once the bladder is filled.
3. Fill the urinary bladder	Sterile physiologic solutions (LRS, normal saline) are injected through a transurethral catheter to distend the bladder. If fluid is expelled prematurely around the catheter prior to adequate bladder filling, the vulva and/or urethra can be gently occluded using your thumb and first finger. Placement of additional fluid may not be needed.
4. Position the patient such that the spine is approximately vertical	Repositioning the patient allows uroliths to accumulate at the neck of the bladder facilitating their expulsion. Anatomically, the urethra does not become vertical until the caudal spine is 20 to 25 degrees anterior of vertical, but this may not be clinically important.
5. Agitate the bladder	Agitating the urinary bladder left and right is performed to dislodge uroliths loosely adhered to the bladder mucosa.
6. Express the urinary bladder	Apply steady digital pressure to the urinary bladder to induce micturition. Once voiding begins, the bladder is more vigorously compressed. Compress the urinary bladder dorsally and cranially (toward the back and head of the patient). Movement of the urinary bladder caudally toward the pelvic canal may cause the urethra to kink preventing maximal urethral dilation.
7. Repeat steps 2 through 6	The bladder is flushed repeatedly until no uroliths are expelled.
8. Medical Imaging	Radiography provides an appropriate method of assessing successful expulsion of uroliths. To enhance detection of remaining small uroliths consider a double-contrast cystography (only the lateral view is needed).

Do's and Don'ts of Basket Retrieval of Uroliths

DO	DON'T
Use baskets to orient elongated stones to facilitate their removal	Forcibly remove stones too large to pass through the urethra
Consider basket retrieval as an alternative to VU in patients with urinary bladders to fragile to manually express	Lacerate urethral mucosa by forcibly pulling sharp stones too large to pass through the urethra
Use baskets to position urocystoliths in the urethra to facilitate efficient lithotripsy	

Forceps biopsy of the lower urinary tract

Differentiation of potentially reversible disease from progressive irreversible disease is the single most important factor in the management of persistent or recurrent lower urinary tract signs. Biopsy of the urinary bladder and urethra is helpful to make this distinction in the living patient. Many options are available to obtain tissue for microscopic evaluation. If structures to be biopsied can be palpated, they are accessible for aspiration with a needle and syringe. If larger, architecturally intact samples are desired, they can be obtained by catheter biopsy (Osborne 1995), cystoscopy and pinch biopsy (Senior 1995), or celiotomy and core resection. A practical alternative to these procedures is use of flexible endoscopy forceps to retrieve tissue samples from the lower urinary tract.

Materials needed for biopsy

Flexible endoscope forceps (not the endoscope) is inserted into the urethra to obtain tissue samples. Several types of grasping units on the end of the forceps are available. We have had the best results using forceps with a fenestrated oval cup and central needle. The fenestrated cup minimizes tissue crushing and the central needle helps anchor the grasping unit to the mucosa that is to be sampled.
No other special equipment is required. However, additional routine supplies would include those needed to assist catheterization in the female dog (e.g. otoscope) and the desired fixative for histologic processing of the sample (e.g. 10% buffered formalin).

Performing forceps biopsy

Obtaining tissue samples using the endoscopy forceps is similar to methods used to obtain gastrointestinal mucosal with an endoscope. Since the endoscope is not inserted into the urethra, other methods, such as palpation or radiography, are needed to localize the lesion and direct the biopsy forceps.

1. Allow the patient to void urine prior to biopsy. If micturition is difficult due to partial of complete obstruction, urine can be removed by transurethral catheterization or decompressive cystocentesis. An empty bladder will facilitate patient comfort and cooperation.
2. Sedate or anesthetize the patient. For many dogs general anesthesia is not needed. However, mild tranquilization may facilitate urethral catheterization, palpation of the urethra and bladder, and will minimize patient discomfort and anxiety. In lieu of generalized sedation, local anesthesia can be achieved by applying water soluble lubricants containing lidocaine to the vaginal mucosa and/or urethra.a To anesthetize urethral mucosa, the same lubricant can be applied to the biopsy forceps prior to urethral insertion or it can be diluted and injected into the urethral lumen through a catheter. It has been our experience that most cats usually require general sedation to manipulate and catheterize their urethra.
3. Identify the site for biopsy by palpation, catheterization and/or radiography.
4. With the grasping unit at the end of the forceps closed, insert the flexible endoscopy forceps (not the endoscope) into the urethra.
5. Advance the forceps until the grasping unit is near the area to be biopsied. The tip of the grasping unit can be positioned by abdominal palpation, rectal palpation, radiography or ultrasonography. For most urethral lesions, the biopsy site is easily determined during insertion and advancement of the forceps through the urethral lumen; increased friction and force is often required to advance the forceps at the biopsy site. The biopsy site can also be located by using previous radiograms to determine how far the forceps must be inserted into the urethral lumen to reach the lesion. For diffuse urothelial lesions the apex of the bladder can be sampled by advancing the forceps to the most cranial portion of the bladder. Positioning the forceps fluoroscopically, immediately following contrast urethrocystography is also an effective method of positioning the biopsy instrument adjacent to the lesion.
6. After the biopsy forceps is properly positioned, open the grasping unit and slightly advance the forceps against the lesion.
7. Close the grasping unit. With the grasping unit closed, the forceps and tissue sample are retracted from the urinary tract.
8. The biopsy sample can be removed from the forceps by lifting the sample from the cup of the grasping unit with a 22 or 25 gauge needle. The sample should then be transferred to formalin for histologic processing.
9. Impression smears for immediate cytologic evaluation can be made prior to placing the sample in formalin. Tissue samples are first lightly blotted on filter paper or dry gauze pads to remove surface blood. Then impressions are be made on glass slides and stained prior to microscopic evaluation.
10. Several samples should be retrieved to insure complete representation of the area in question.

Patient care following biopsy

Following bladder biopsy, hematuria and dysuria may be more pronounced. In most cases, bleeding quickly stabilizes (hours to a day) without treatment. Administration of antibiotics is indicated because the integrity of the mucosal surface of the lower urinary tract is damaged by this procedure, further altering normal host defenses. Infections diagnosed during initial evaluation should be eradicated prior to biopsy. Eliminating infection prior to biopsy will minimize hematuria and dysuria associated with sampling of inflamed tissues and also the potential of extending the infection into the biopsy site and adjacent tissues. In the absence of prior infection, we routinely administer antibiotics orally for the next 3 to 5 days.

Limitations of forceps biopsy

Standard flexible biopsy forceps are no larger in diameter than an 8 french catheter. As a general rule, you should be able to insert the biopsy forceps into the urethral lumen of most male dogs greater than 4 kilograms, and into the urethral lumen of most, if not all, female cats and dogs. The lumen of the penile urethra of male cats is usually too small to accommodate insertion of standard flexible biopsy forceps. However, the urethra of male cats following perineal urethrostomies usually is large enough to accommodate insertion of standard biopsy forceps.

It is possible that a thin or weakened bladder wall could be perforated by this procedure. For this reason we do not recommend biopsy of the lower urinary tract at sites proximal to partial or complete obstruction because increases in intravesicular pressure may result in extravasation of urine into the abdominal cavity. If a tissue sample proximal to a urinary obstruction is desired, constant bladder evacuation by means of indwelling urethral catheterization or antepubic percutaneous catheterization (Stone 1992) of the urinary bladder should be considered. Minimizing intravesicular pressure should allow small perforations of the bladder wall to spontaneously heal. Although forceps biopsy is ideal for obtaining samples from the urethra, trigone, and apex of the urinary bladder, directing the flexible forceps to obtain samples from the lateral wall of the urinary bladder requires patience and skill. Use of biopsy forceps with a central needle may help secure samples from this location.

Simple urethral stent construction and placement

A simple alternative to placement of self-expanding expensive stents is placement of a soft urinary catheter. We place an opened catheter into the urethra and bury the distal tip into the vestibule or prepuce so that it is covered and the dog cannot remove the catheter. Following catheter placement, the dog is likely to be incontinent and will need to be diapered.

Equipment:

8Fr soft red rubber catheter
5Fr firm Polypropylene catheter
3-0 non absorbable suture material with needle attached (2)
Sterile Lubricant
Otoscope of other device to place urinary catheter into the urethra
20 gauge needle

Set up:

1. From a radiograph measure the needed length of the catheter (usually from the cranial 7th lumbar vertebra to the middle of the vestibule).
2. Cut the 8 Fr catheter from the closed end.
3. Near the cut end of the catheter, insert the 20gauge needle.
4. Feed the suture through the needle, remove the needle and make a very small loop at the end of the catheter using the suture.
5. Use the suture or string to make a safety loop about 15 to 20 cm long through that goes through the small suture loop at the end of the catheter.
6. Place sterile lube on the outside of the polypropylene catheter. Insert the discarded end of the red catheter over the tip of the polypropylene catheter, and then insert the remaining red catheter with the suture over the polypropylene catheter.

Anesthetize the Dog

1. Use general anesthesia to allow the urethral the completely relax.
2. A coccygeal or lumbar epidural will improve urethral relaxation.

Place an Anchor Suture in the Vestibule of the Dog.

1. Using needle holders, pass the needle (with suture attached) through the fornix of the labia and exit on the side.
2. About 1cm ventral and below, pass the suture from the outside and into the vestibule.
3. Remove the needle from the suture.

Securing the Catheter in the Urethra

1. Pass one end of the anchor suture through the small loop on red rubber catheter.
2. Using an Otoscope, pass the red catheter through the urethral opening using the polypropylene catheter as a guide.
3. Hold the discarded end of the catheter firmly while the polypropylene catheter is disengaged from the red rubber catheter stent.
4. Secure the red rubber catheter stint in place by completing a surgical knot using the end of the anchor suture.

The advantages of this stent is that it can be placed quickly and removed quickly without anesthesia. It is a fraction of the cost of routine nitinol stents that that cannot be removed.

The disadvantages of this procedure is that with the stent in place the dog will be incontinent (females are incontinent with the nitinol stent). Therefore the dog will need to be in a diaper while in the house. The catheter is also a risk factor for infection.

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