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## **Bladder/Urethral Stone(s) Surgical Philosophy**

One of the most frustrating aspects of surgery of the lower urinary tract for bladder and or urethral stones is the unexpected complication of leaving a stone behind. This will not be a discussion of the stone types seen in dogs or cats but a discussion of how to be sure that you retrieve all of the stones and debris present during your surgery. As a urinary tract surgeon we have a pledge to "leave no stone behind."

There are significant differences in how we approach a female that has many small bladder and/or urethral stones and the male that has similar issues. There are significant anatomical differences that dictate the surgical approach to stone removal.

There are also differences that have developed in the last 10 years in where we make our incisions in the urinary bladder wall. The ventral bladder incision has replaced the dorsal bladder incision for many reasons.

Finally, we have altered the technique that we used to close the bladder wall incisions. Single layer appositional patterns have replaced double layer closures (inversion or appositional with seromuscular inversion).

All of this information has developed in the last 10-15 years and many veterinarians are not yet aware of the changes that are being suggested.

Urethrotomy is rarely needed in the male dog that has urethral stones. Almost all urethral stones can be repelled into the bladder and removed through the cystotomy incision. Occasionally, a permanent urethrostomy will be needed in the male dog if significant urethral damage has occurred (rare) or if the animal has had repeated episodes of urethral obstruction and a semi permanent relief is sought. A permanent urethrostomy should be performed in the scrotal position (scrotal urethrostomy). Perineal urethrostomy in the male dog is very undesirable (urine scalding of rear legs). It is only used in rare situations. This technique is almost entirely confined to the feline.

**Situation:**

**Bladder stones in the male dog with several small urethral calculi located behind the os penis (most common) or at the ischial arch:**

This animal presents straining and possibly dripping a few drops of red tinged urine. Radiographs reveal a very large bladder that is severely distended. The presence of many small stones in the bladder may be seen (struvites, oxalates or silicates). If no stones are visualized and you believe they must be present then contrast and double contrast studies may be indicated (urates or cystine stones). The penile urethra that narrows as it enters the os penis is the clue to the over distended bladder. Is it packed with stones? **Bladder decompression** is the most important issue that is immediate. Stone removal and/or hydro propulsion from the urethra can wait. Placement of a bladder decompressing catheter is of utmost urgency. Depending on the size of the dog a 3 ½, 5, 8 or 10 Fr. polypropylene catheter can be passed. Rubber catheters and feeding tubes do not have the strength to get past packed stones. In most cases the smaller catheter can be teased by the obstructing stones into the bladder for decompression. You must be very cautious about flushing as you try to pass the catheter. You do not want to over distend the bladder or rupture it. If passing a catheter cannot be done a cystocentesis may relieve enough of the back pressure against the stones to allow the small polypropylene catheter to pass. I do not take this technique lightly and only do it if I cannot get the catheter to pass the urethral stones. If the bladder is tense enough it is possible to rupture it or at least to make a larger hole than desired and begin losing urine into the abdominal cavity. If you have decided that you are going to have to hydro propulse the stones into the bladder than you must be sure that the majority of urine has been removed from the bladder by cystocentesis. You do not want to worsen an already stretched bladder wall or rupture it with aggressive urethral flushing to hydro propulse stones. Once the catheter is in place attention must be given to the kidney and bladder. What is the kidney function? Do we have an elevated BUN and creatinine? Stone removal can wait. Keep the bladder small with catheter decompression. You do not want this damaged bladder wall to be overstretched again. Intramural hemorrhage at this point is already going to lead to bladder wall fibrosis and a decrease in contractility. Once stability is achieved (kidneys and bladder) stone removal can be contemplated.

The animal is anesthetized and clipped for posterior abdominal surgery. You should surgically prepare the abdomen as you routinely do. The preputial cavity should be repeatedly flushed with a DILUTE (1:40) povidone iodine or chlorhexidine solution. The preputial cavity and the tip of the penis will remain in the surgical field during the cystotomy procedure for extensive penile flushing so that we can insure that no urethral stones are inadvertently left behind.

The posterior abdomen is approached by reflecting the penis and prepuce to one side. The cranial preputial muscle and the cranial preputial artery and vein may or may not be transected. The abdominal incision is made on midline through the linea alba and it extends all the way to the pubic symphysis. You will take the incision as far cranial as you need to get good exposure to the bladder. The bladder is located and the ligament that attaches the bladder to the ventral midline is transected. Find the apex of the bladder and place a 3-0 stay suture through the wall (silk or nylon). Be sure the bite in the bladder wall is substantial, since it will be used to manipulate the bladder. **Note:** Many veterinarians retroflex the bladder out of the abdomen so that the incision can be made of the dorsal surface of the bladder. There is no sound reason to do this. Today we recommend that you make your bladder incision on the VENTRAL SURFACE of the bladder. The ureters enter the bladder on the dorsal surface and you can feel very comfortable that you will not involve them in your approach with a central bladder wall incision. I also believe it is much easier to palpate the urethral exit point in the trigone and it is much easier to gain access to the urethra with a catheter if that is needed (more common in females) if a ventral cystotomy incision is used. There are many positives for a ventral bladder wall incision and no negatives. The incision should run along the attachment of the ventral medial ligament (old ventral mesentery).

The stay suture is pulled cranial to stretch the bladder forward and it is stabilized to the drape. The bladder is packed off from the rest of the abdomen to “limit operative field contamination” and to “limit urine spillage into the abdomen.” As the ventral incision is made into

the lumen the excess urine is suctioned or sponged away. Two lateral stay sutures can be placed to open the incision so that the lumen can be examined and any obvious stones removed. **Note:** Rarely can you visualize the trigone area and the urethral exit. This is usually true with a ventral incision and is always true with a dorsal incision. We put our finger into the lumen to feel for unseen stones and may inadvertently easily push small milliary stones and/or crystal debris into the proximal urethra and not even realize what has happened. We conclude that the bladder is empty and close, not realizing that several small stones and/or crystal are still present in the proximal urethra outside of our feel.

In this situation that we are discussing our patient has urethral stones (os penis or ischial arch) that we have seen on our work up films. We now must work on cleaning the urethra of milliary stones, crystals and other debris that might be present. The key to success and the best chance of limiting the possibility of recurrence is to leave nothing behind.

Retract the prepuce and expose the tip of the penis. Grab the mucus membrane along the penis with a hemostat to keep it exposed and outside the prepuce. Take a 10 Fr. polypropylene urinary catheter and a 35 cc syringe. You will also need 500 mls. of saline. Pass the large polypropylene catheter into the tip of the penis as far as necessary to cover the side holes. This usually will be short of the os penis. Grip the tip of the penis around the catheter so that saline will not back flush as you flush saline into the urethra. Fill the syringe with saline and begin the flush VERY SLOWLY. Begin the flush very slowly so that you can be sure that the saline is moving through any stones that may be lodged behind the os penis or along the ischial arch. Once you see saline flowing into the bladder and coming out the bladder incision you can increase the pressure of the flush from the syringe. By the time you have reached the end of the 35 ml flush you should be almost blasting saline into the urethra. Any stones that were in the neck of the urethra will be the first to enter the bladder. Repeat the HIGH PRESSURE flush as many times as needed to be sure you have cleared the urethra. If you are counting stones from a radiograph image, be sure that you do not lose any into the suction apparatus being used for removal of saline. At some point you are going to want to test the urethra for clearance of stones. If the animal is large enough and you feel the 10 Fr. polypropylene catheter will pass through the os penis, advance it to the level of the proximal end of the penis. Carefully feel for stones catching the side holes of the catheter. If you feel anything you will need to flush more. You can now do the flush injection right in the area of the stone lodgment. The turbulence created in the area from the saline coming out of the side holes of the catheter and hitting the wall of the urethra will dislodge most all stones and crystal debris and flush them into the bladder. Rarely do I have to do a urethrotomy. **Note: I have never ruptured a urethra with this very aggressive flushing technique.** Flush until all stones are removed. The catheter can be advanced with intermittent flushing until it comes out the bladder incision. Withdraw the catheter to the original position and flush twice more. You can now feel confident you have removed all urethral debris. You will have used most of the 500 mls of saline. Please note that if the 10 Fr. catheter is too large to pass through the os penis to check for stone presence in the urethra you will have to try a 8 Fr., 5 Fr. or 3 ½ Fr. Use the largest catheter that you can get through the os penis since you want to maximize flow and turbulence with your flush.

**Note:** In the male dog most flushing will come from the tip of the penis into the bladder. Rarely will you have to flush from the bladder out. The key to success when you think you have flushed enough is to flush some more. Flush with pressure. This is the only way that you can move stones and/or crystal debris from the male urethra.

### **Situation:**

#### **Female dog/cat that has milliary bladder stones.**

The surgical approach to the bladder in the female is exactly the same. Do a ventral midline abdominal approach and a ventral cystotomy. Stay away from those ureters on the dorsal side. Stay

suture placement in the apex is the same. The only real difference is the flushing technique. The urethral exit in the female is in the vaginal vault and is very difficult to catheterize from the vaginal side. Approach the female urethra for flushing from the urinary bladder. This technique is more complicated and precise. After all visible stones have been removed from the bladder you must flush the whole urethra as aggressively as we just described for the male. You may have pushed small stones and/or crystal debris into the proximal urethral neck through the trigone. Advance the tip of the 10 Fr. polypropylene catheter into the proximal urethra a short distance. Flush with a 20 ml saline volume. The flush solution will back flow into the bladder and may bring back a small stone or two or crystal debris that was in the proximal urethra. Advance the catheter another cm or so. Repeat the flush. Again the flush will come back into the bladder. Another stone? Advance the catheter again another cm or two. Repeat the flush again. The saline may come back into the bladder or it may go the other direction out of the urethra and the vagina. Your technician can verify that the table is wet under the drape. If the saline comes back into the bladder with this flush repeat this advancement process until the saline goes out the urethra and vagina. Find the spot where if you draw the catheter back a cm the flush will come back into the bladder and if you advance it a cm it will go out the vaginal urethra. Sometimes if you are lucky you will find the spot and saline will go both ways with the flush. Now repeat the flush-back, then forward. Repeat the flush-back, then forward. Keep repeating until you feel comfortable that all debris has been flushed from the female urethra. Then flush some more.

Occasionally a fairly large stone will enter the female urethra and lodge next to the urethralis muscle just inside the urethral opening into the vagina. These are very difficult if not impossible to dislodge with flushing. It is rarely possible to catheterize the vaginal urethral opening and back-flush the stone. The most effective method in removing a stone in this position is to advance a 6 inch alligator forceps from the bladder incision into the urethra until you feel the stone. Open the forceps and grab it and draw it back into the bladder. If you cannot move it you begin crushing it so that it can be flushed from the urethra. This is done blindly and by feel. Be calm and do not get excessively aggressive. Work patiently and you will have success.

### **Key to success: FLUSH, FLUSH, AND FLUSH SOMEMORE**

#### **Bladder Closure:**

Inverting suture patterns on the bladder should not be used anymore. They are technically very difficult to do well, especially on a bladder with a thick wall or on a very small bladder. Appositional patterns have been shown to provide just as much strength and are not prone to leakage. Serosal contact is not needed for a fluid tight seal as was previously thought. Good tissue apposition with mild tissue pressure is important and can be easily achieved with an appositional pattern. Some veterinarians do double layer appositional closure. We have found the single layer appositional with a simple interrupted pattern to be very effective. A non-absorbable suture material such as 3-0, 2-0, and even 0 PDS is very appropriate (match suture size to bladder size). Remember that inflamed bladders can easily allow smaller materials to tear through. Large bites help alleviate this issue. Large simple interrupted sutures that do not enter the lumen give good bladder wall security. With larger bites more tissue pressure occurs between sutures so that a fluid tight seal is achieved. THIS IS TECHNICALLY SO MUCH EASIER TO DO AND THE RESULTS ARE EXCELLENT. Some veterinarians do a similar closure but with a continuous pattern.

#### **Stone culture and identification:**

The role of bacteria in stone biology cannot be overemphasized. Crushing and culturing the center of a stone will always give you the organism if antibiotic therapy has compromised your

ability to get the organism identified from urine or bladder wall. We culture urine, bladder wall and stone to maximize our ability to get an organism identified.

With the development of diet alteration to help prevent stone recurrence it is important that correct stone identification be carried out. Two laboratories are available to us:

1. Urolithiasis Laboratory, Inc.  
P.O. Box 25375  
Houston, TX 77265-9950  
800-235-4868
  
2. University of Minnesota
  
3. Animal Reference Pathology (ARUP)  
500 Chipeta Way  
Salt Lake City, UT 84108  
800-426-2099