Trans-Urethral Resection of Bladder Tumor

Emma Bryant, Gabrielle Yankelevich

Introduction:

Transurethral resection of bladder tumor is a minimally invasive strategy to remove lesions of the bladder wall. It is both a therapeutic and diagnostic tool. A resectoscope is utilized to complete the resection; this tool uses electricity to both coagulate tissue and resect it. It consists of a sheath, lens, and working element (monopolar or bipolar electrode) as explained further below. Conventionally, bladder tumor resection is performed using a monopolar resectoscope. The current, generated by the diathermy machine, passes from the electrode through the patient's body to terminate at an electrode on the skin (grounding pad). This approach requires non-ionizing conduction fluid, such as glycine or sorbitol.

Ideally the irrigation solution is iso-osmotic, but by design it will contain less sodium and chloride ions than the patient's bloodstream does. This leads to a risk of post-operative Trans- Urethral Resection (TUR) syndrome. This is a serious complication due to excessive absorption of irrigation solution, causing hyponatremia which can lead seizures and death. To prevent TUR syndrome, limit resections to 1 hour. Water can also be used for irrigation, but it is both hypotonic and hypo-osmotic, so the patient's serum sodium and osmolality will drop rapidly.

In high-resource settings, bipolar resectoscopes are more commonly utilized to mitigate this risk. A bipolar working element uses both efferent and afferent currents, so an external electrode (grounding pad) is not necessary. Saline irrigation is used for bipolar resections.

Monopolar resectoscope and its attachments: camera (within plastic sheath), fiber-optic light cable (Gray), electrical cable (Black) and handpiece for manipulating the electrode.

A surgeon loading the resectoscope's electrode. It is imperative that you understand and can troubleshoot all components of the resectoscope, to allow the operation to progress smoothly and to prevent harm to the patient.

Detail of the resectoscope's electrode, at full extension advancing beyond the lens of the scope.

Risks of trans-urethral bladder tumor resection include transient postoperative bleeding and urinary retention. Post-operative urinary tract infection risk is significantly reduced with prophylactic antibiotics and pre-operative antibiotics. Additionally, both intra- and extraperitoneal bladder perforations can occur. The most common iatrogenic cause of perforation is "obturator jerk," which is a spasm of the leg in response to electrostimulation of the obturator nerve by the resectoscope. Further, perforations can also result from thin bladder walls in female patients, advanced age, and those who have had previous resections.

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Proper staging of a bladder tumor includes CT scan of the chest, abdomen and pelvis, with the bladder distended with saline to show the size and location of the tumor. In this case, the surgeon should be aware that a portion of the tumor involves the intra-peritoneal bladder; perforation here would require surgical repair.

Trans-urethral resection of bladder tumor proceeds in the following steps:

- Administration of general anesthetic with paralysis (can consider spinal anesthesia)
- Insert either a bipolar or monopolar resectoscope
- Resect the tumor and obtain hemostasis.
- Collect tumor chips and send them for pathological analysis.

Steps:

1. Place patient in modified dorsal lithotomy position and have anesthesia administer general anesthetic with paralytic or spinal anesthesia. Spinal anesthesia allows monitoring of the patient for confusion, which may herald the onset of TUR syndrome.
2. For monopolar resectoscopes, remember to place a grounding pad and utilize 10% dextrose or glycine irrigation. For bipolar resectoscopes, utilize saline irrigation. A large refillable sterile container for the irrigation allows the operation to continue without having to stop to refill.
3. The patient should receive single-dose antimicrobial prophylaxis prior to the procedure. Prepare and drape the genitals using betadine or chlorhexidine. The American Urological Association guidelines for antimicrobial prophylaxis according to patient sex and surgical history can be found here.
4. Visually inspect the lower abdomen and urethra. Perform a bimanual examination to assess for pelvic masses.
5. If you have a smaller cystoscope, perform a cystoscopy using a 30 and 70-degree cystoscope lens if possible to maximize visualization of traditionally difficult areas of the bladder, such as the bladder neck and anterior bladder wall.
6. Dilate the distal urethra using a urethral sound if necessary to insert the resectoscope. Note the size of the resectoscope sheath (usually 26F) and serially dilate only the meatus and most distal urethra, from 18F up to the size required, using lubrication.

A urethral dilator with a curved tip being used to dilate only the urethral meatus to allow the resectoscope sheath to pass.

7. Insert the resectoscope sheath in the bladder with either a blind or visual obturator. Removal of the obturator should cause return of fluid. This indicates proper placement of the sheath within the bladder. If the scope does not pass through the penile or bulbar urethra, the patient may have a urethral stricture. Insert the scope to visualize the area of blockage.

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Resectoscope sheath with a blind obturator, attached to the irrigation tubing.

Insert the sheath and obturator into the urethral meatus, maintaining traction on the penis to keep the urethra straight. Keep your thumb on the obturator so there is no chance it will be dislodged, to prevent the unprotected edges of the sheath from damaging the urethral mucosa.

The sheath and obturator should pass without resistance into the bladder. When the tip of the sheath is within the bladder, it should move inwards and outwards with gentle pressure, and urine or irrigation fluid from the bladder should flow freely out.

8. Exchange the obturator for a resectoscope with monopolar or bipolar working element. Visualize the trigone, ureteral orifices, and tumors.

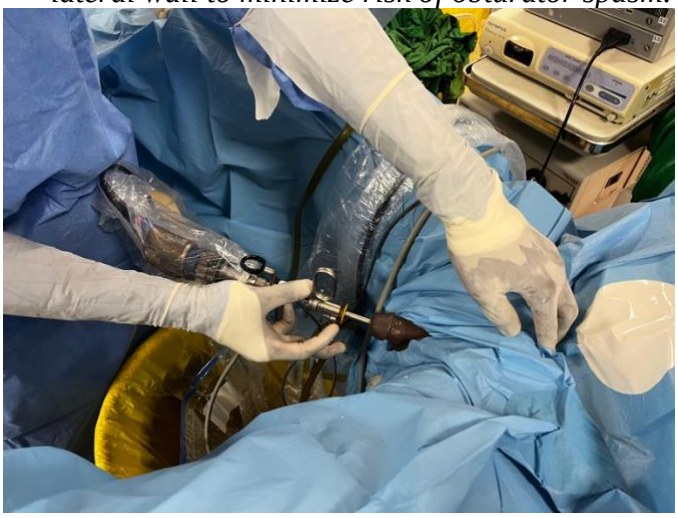
Small bladder tumor and extensive bladder trabeculation (hypertrophy of the detrusor muscles due to obstruction.)

9. Resect any small tumors at the base.

The electrode is used at a controlled depth to resect the bladder tissue at the base of the tumor.
Source: doi: 10.3389/frai.2024.1375482

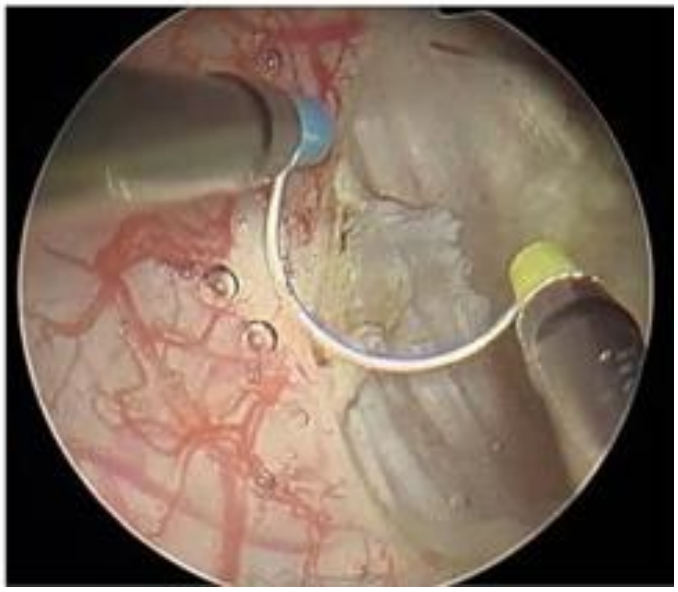
10. Divide large tumors into sectors and begin to resect the first section in layers. Start at the periphery of the tumor and swipe until the base is

reached. At this point, make a swipe at the edge of the tumor. This marks the depth to which all subsequent sections should be limited. The extracted tissue from the swipe should include the muscularis propria, but take special care to avoid extending through it entirely. *TIP: This maneuver can be modified with tumor location. For example, lesions on the anterior wall of the bladder may require minimal bladder filling with increased suprapubic pressure for extraction. The lower abdomen should be compressed with the nondominant hand in this case. Additionally, the resection loop should be parallel to the mucosa for tumors located on the lateral wall to minimize risk of obturator spasm.*



Here, the scope is inverted so that its angled tip can view the anterior bladder. Overfilling the bladder pushes its anterior part away from the scope, so minimal bladder filling and frequent emptying are useful for accessing this area. Suprapubic pressure with the nondominant hand brings the anterior bladder closer to the resectoscope as well.

11. If operating without continuous irrigation flow, empty the bladder every five swipes to ensure proper volume and thickness.
12. Maintain hemostasis at each segment site before advancing. To verify hemostasis, empty the bladder and ensure that no active bleeding is appreciated.



Appropriate depth of resection. Note that the resectoscope is turned so that the electrode is parallel to the surface of the bladder being resected.
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13. Resect the remaining segments.
14. Use a bladder evacuator (Ellik or similar) or 60cc catheter-tip (Toomey) syringe to collect the tumor chips. If there are only a few chips, they can be retrieved with the resectoscope loop itself. The chips, as well as additional deep and marginal segments, should be sent for pathologic examination.

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A bladder evacuator attaches to the resectoscope sheath after the resectoscope has been removed. It contains a one-way valve that allows you to squeeze, inserting fluid without returning collected specimens to the bladder, and release, drawing fluid into the reservoir. It will not work if the tip of the sheath is pressed against the bladder wall; the surgeon can reposition it, including inserting and withdrawing it as necessary, with the non-dominant hand. As shown here, the fluid is very bloody- if this situation persists, you should reinsert the resectoscope and try to find and control the bleeding.

A 60mL catheter tip (Toomey) syringe, shown here with a cap over the tip, can be useful if you do not have a bladder evacuator, or if you need to remove clots. Source: Marmasphan, CC BY-SA 4.0 via Wikimedia Commons

Pitfalls

- For large-scale resections, place a 20- or 22-Fr catheter, which can be removed between postoperative day 1-7 depending on the depth/extent of the resection. For less experienced surgeons, or with extensive bleeding, a three-way catheter with continuous irrigation is appropriate. Smaller resections do not require a catheter and the patient can go home. If the patient is discharged without a catheter, the patient should void prior to discharge.

A 3-way catheter, with irrigation entering through the top of the picture and drainage going out to the patient's left. Source: Sarang, Public domain, via Wikimedia Commons

- There is a significant risk for bladder perforation during this operation. Visible perivesical adipose tissue following resection, inadequate filling at maximum flow, and expanded abdomen are findings suspicious for perforation.
- For minor damage: If discovered intraoperatively, the procedure can be completed quickly. Patients should recover with an indwelling catheter for 3-5 days.
- For severe damage: the procedure should be halted and an on table cystogram should immediately be performed to diagnose a perforation and differentiate between extraperitoneal and intraperitoneal injury. For extraperitoneal damage, resection should proceed under low pressure with minimal irrigation to reduce fluid extravasation and a foley should be placed. Surgical repair should be considered according to patient status and extent of injury; however, most extraperitoneal perforations will resolve with catheter drainage

only. In contrast, intraperitoneal injury requires immediately stopping the procedure and performing an exploratory laparotomy to fix the perforation.

- Postoperative bleeding is possible and is especially important to consider in large resections. It can occur immediately following the operation, most likely due to incomplete hemostasis, or in the subsequent days. Patients with bleeding inadequately managed intraoperatively should be admitted overnight for observation. In either case, catheter drainage and continuous irrigation are indicated.
- Urinary retention can occur for several days postoperatively and should resolve spontaneously. Persistence of retention may require administration of an alpha blocker and further work-up.

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