

Intraoperative Consults

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Ureteral injury, bladder injury, urethral injury, laceration

Common Case Presentation

You are holding the urology consult pager and get paged “Doctor, can you please come to OR 2 for an intraoperative consult? Dr. Smith is concerned about an injury to the bladder/ureter/urethra.”

I. Receiving the call and initial thoughts

a. Background

1. What medical history is pertinent? What previous surgeries has the patient had?

In most cases urologic injury is not life-threatening. Take the time to review the patient's history and imaging. A brief conversation with the operating surgeon, review of the chart and conversation with the patient's family may be appropriate. Be gracious and never accusatory, use passive terms.

2. What imaging is available for review?

In the event of prior surgeries or pathology, review the imaging to try to visualize any anomalies or unusual anatomy of the GU tract.

3. Any recent trauma or any prior therapies (radiation/chemotherapy)?

These interventions may affect the surgical field or integrity of the tissues and may change your approach.

b. Current case details:

1. Is the patient stable?

If patient is unstable – urological injuries can often be managed without reconstruction or with a temporizing drain.^{1,2,3,4} In a stable patient, all efforts should be made to evaluate, stage and address the injury at presentation.

2. What is the current surgery and incision used? What position is the patient in?

The case and approach will help you focus on the relevant organ. If surgery is being performed with an approach you are not comfortable or familiar with – consider asking for

help from a colleague or switching to an approach you are familiar with. If you are not familiar with the incision – take time to familiarize yourself with anatomy, extend incision if needed.

If the patient is not in lithotomy, you'll need to decide if that is necessary for access.

Flexible cystoscopy can often be performed in lieu of rigid cystoscopy in lithotomy, to allow for ureteral cannulation or visualization within the bladder. Ask if the patient is on a fluoroscopic compatible bed - this may help with on-table IVP or imaging to place a stent.

3. How did the injury occur?

It is important to differentiate injury by sharp dissection, retraction injury or thermal energy injury. Ask what device was used at the time, as each energy source will have a different radius of thermal damage. Bipolar energy is believed to have the shortest length of thermal spread, with harmonic and ligasure device the next shortest, and monopolar energy the longest radius of thermal damage.

4. What trays/instruments are available?

Optimize the field by requesting instruments, retractors, wires and scopes familiar to you.

5. Is the catheter prepped in?

For a non-urologic case, usually the catheter is placed before prepping and draping and is not in the sterile field. If there is concern for a bladder injury, ask the circulator to gather irrigation tubing and a 3L bag of saline.

II. Differential diagnosis

a. Ureteral injury

1. The ureter can be injured below or above the pelvic brim. The location and length of the ureteral injury will determine your options for reconstruction
2. In a transvaginal approach, the ureter can be injured posterior to or superior to the trigone on either side

b. Bladder injury

1. The bladder can be injured on the intraperitoneal surface or in either extraperitoneal space, in the retropubic Space of Retzius, or in the posterior extraperitoneal space below the trigone. One unusual circumstance is bladder involvement in a direct inguinal hernia
2. During vaginal surgery, the bladder can be injured where it is in contact with the anterior vagina or above the level of the cervix

c. Urethral injury

1. The urethra may be at risk in perineal cases, either for colorectal malignancy, or with acute infectious presentation
2. The urethra may be at risk whenever the anterior vaginal wall is involved in the procedure

III. Evaluation

a. Once scrubbed in

1. Ask the surgeon to walk through what has been so far and where and when he/she encountered an issue.
 2. Get oriented to the field before taking any steps. Consider placing different retractor and wearing a headlamp and loops for deep pelvic visualization if case appropriate.
 3. If the injury is readily apparent, determine the mechanism of injury (sharp vs. thermal) and if there is involvement of malignant or otherwise unhealthy tissue. When there has been a fistula or chronic inflammation, the granulation tissue at the edges should be trimmed back to healthier tissue for a better repair.
 4. Stage the injury
 5. Always look for associated injuries to other GU organs
- b. Conversion to an approach and patient position you are familiar with.
- Continue in the same approach if you feel confident with assessing the injury and managing it via the same approach. However, if the repair will be too complex or challenging, do not hesitate to discuss converting to your preferred approach. The primary surgeon may need to complete his or her current steps before that is undertaken. This is often true about laparoscopic injuries – convert to open or robotic if you are not confident of repairing the injury laparoscopically.

IV. Management

a. Ureteral injury⁵

1. Epidemiology

Up to 64% of ureter injuries are undiagnosed and over 90% of ureteral injuries are distal.⁶

2. Evaluation

i. In the event of suspected ureteral injury:

1. Cystoscopy can be performed to visualize adequate efflux from both ureters.
2. Retrograde ureteral dye injection (via cystoscopy)
3. Excretory urography (IV dye injection)
 - a. Excretory dye (indigo carmine, methylene blue, fluorescein) IV instillation of methylene blue or fluorescein can aid in visualizing efflux.
 - b. Methylene blue takes a variable amount of time, up to 10-20 minutes, to be excreted through the kidneys. Fluorescein, now used for robotic illumination of vasculature and ureters (with Firefly feature), can be administered IV and is quickly excreted and visible as a yellow-green hue even without Firefly
 - c. Intraoperative IVP: use renografin or omniplauq 2 ml/Kg IV push and perform X-ray 10 mins later⁷

4. Dissection and direct visualization of the ureter

- ii. By **cystoscopy**, if no efflux of urine, or dye-tinted fluid, is observed, there may be a suture ligated around the ureter. Work with the surgeon to try to identify the

tethering or potential suture that can be released, and observe the ureteral orifice again after releasing the suture

1. If efflux is observed, confirming resolution of the occlusion, place a ureteral stent as a precaution to allow it to heal with less chance of edema or stricture
2. If no efflux is observed after maneuvers to release the occlusion, consider performing a retrograde pyelogram with fluoroscopy to demonstrate the occlusion or any extravasation
3. If extravasation is demonstrated, with passage of contrast proximal to the level of injury, a ureteral stent should be placed
4. If extravasation is demonstrated, with no passage of contrast above the level, options are to convert to a pelvic approach for a primary repair or recommend percutaneous nephrostomy placement with antegrade attempt (usually by Interventional Radiology), to be undertaken once current case is completed
5. If there was a suspected clipping or transection of the ureter, the case will need to convert to a pelvic approach, either laparoscopic/robotic or open, to determine the level and repair options.

6. See [Figure 1](#)

3. Staging

- i. Grade 1 – hematoma only
- ii. Grade 2 – laceration <50% of circumference
- iii. Grade 3 – laceration > 50% of circumference
- iv. Grade 4 – complete tear < 2 cm devascularized
- v. Grade 5 – complete tear > 2 cm devascularized

4. Grade 1-2 injuries

- a. Conservative management: If there is evidence for grade 1-2 injury, ureteral contusion or skeletonization with minor laceration, often placing a J-J ureteral stent is best management. Even in the event of a focal laceration by a sharp mechanism (and not thermal), it may heal over a stent adequately

5. Grade 2-3 injuries

- a. Mobilize the ureter proximal and distal to the injury
- b. If by a sharp mechanism, a partial transection can be repaired primarily with interrupted 4-0 or 5-0 absorbable suture. Attempt to close the repair in a transverse orientation to lower the risk of narrowing the ureteral lumen
- c. If mechanism was thermal, it is advisable to excise the damaged segment, spatulate widely and perform a tension-free uretero-ureterostomy over a stent
- d. Primary closure over a ureteral stent. Leave foley x 48 hours to prevent reflux. Leave stent in for at least 3-4 weeks and follow up in 3-6 months with an CT urogram or renogram after stent removal⁸

6. Grade 4-5 injuries

- a. If patient is unstable – place a ureteral stent or temporarily divert by exteriorizing

the ureters^{4,9} or ligating the ureters and having IR place nephrostomy tubes.

b. If patient is stable, general reconstructive principles include

1. Debridement of ureteral ends to fresh tissue
2. Spatulation of ureteral ends
3. Placement of internal stent
4. Watertight closure with absorbable suture
5. Placement of external drain
6. Isolation of injury with peritoneum or omentum

c. Distal ureteral injury reconstructive options: Psoas hitch, boari flap, refluxing or nonrefluxing anastomosis

d. Mid ureteral injury reconstructive options: Psoas hitch, boari flap, ureteroureterostomy, transureteroureterostomy

e. Upper ureter reconstructive options: ureteroureterostomy, transureteroureterostomy, ureterocalicostomy, downward nephropexy with boari flap or psoas hitch, bowel interposition/ ileal ureter, autotransplant, nephrectomy

b. Bladder Injury⁵

1. Evaluation

- a. Filling the bladder with saline or dyed saline (using methylene blue or fluorescein injected into irrigation fluid) can be helpful. Either an assistant can instill via the foley with a catheter-tip syringe, or irrigation tubing with a bag of irrigation fluid can be attached to the foley and then regulated to instill or pause as needed
- b. Flexible or rigid cystoscopic evaluation can be helpful but difficult to perform due to patient position and sterile field
- c. Check for concomitant ureteral injuries

2. Staging

- a. Grade 1: hematoma (contusion, intramural hematoma), laceration (partial thickness)
- b. Grade 2: laceration (extraperitoneal, <2 cm)
- c. Grade 3: laceration (extraperitoneal, > 2cm, or intraperitoneal <2 cm)
- d. Grade 4: laceration (intraperitoneal, >2 cm)
- e. Grade 5: laceration (intra or extraperitoneal, extending into bladder neck, ureteral orifice or trigone)
- f. Advance one grade for multiple lesions up to grade 3

3. Repair

- a. Mobilize adequately for a clean and tension-free anastomosis. With multiple injuries, free the bladder from anterior and lateral attachments completely. Posterior or trigone area injuries may be approached via an anterior cystotomy for adequate visualization
- b. Identify and avoid ureters
- c. With a simple laceration, primary repair is straightforward, in 2 layer closure with running absorbable 2-0 suture. As above, any granulation or inflammatory tissue

should be excised to anastomose healthy tissue

- d. If a large segment of bladder has been excised with the primary surgery, more complex reconstruction may be necessary. This can be more likely to occur with severe inflammation, eg. fistula to bowel, or malignancy, either gynecologic or colorectal. A unique circumstance may be obstetric involvement of the bladder, either by placenta percreta or during a complex cesarean section delivery. Depending on the magnitude of the primary surgery, it is often preferred to attempt primary closure of the bladder, even if capacity seems significantly reduced. Postoperative bladder capacity and function can be evaluated after the bladder heals
- e. Lambert closure, interposition of omental flap, peritoneal flap or perivesical fat in patients with poor tissue healing
- f. When bladder is found to be involved in a direct inguinal hernia, the first step should be to decompress the bladder with a foley catheter. If the hernia does not drain with the urethral catheter, cystoscopic cannulation of the herniated portion and decompression by aspiration can be performed. Once the bladder hernia is decompressed, it can often be reduced without resection or additional maneuvers
- g. The anastomosis should be tested by instilling 180-240cc minimum in the bladder. A larger caliber urethral catheter, at least 20Fr, should be placed to maximum drainage
- h. If tissues are healthy, divert with a foley catheter 14 days and perform a voiding trial thereafter. If tissues are higher risk, due to prior surgery, extent of inflammation, radiation, poor nutrition, etc., divert with a foley catheter for up to 3 weeks and obtain a cystogram prior to catheter removal
- i. Consider an intra-abdominal drain
- j. Transvaginal repair of the bladder is feasible if the consulting surgeon is comfortable with this approach. Using deep vaginal retractors (Heaney, Nichols, Jackson, etc.) and a head lamp is useful. If you are not able to visualize the injury or are not comfortable with the approach, performing the repair with an approach you are comfortable with is recommended.

c. Urethral injury

1. Evaluation

- a. Difficult urethral foley placement is the most common reason for intraoperative urology consultation
 - 1. see [Figure 2](#)
- b. Always de-active an artificial urinary sphincter prior to foley placement and place 12 or 14 Fr catheter for no more than 3 days to prevent prosthetic erosion. Then place suprapubic tube if prolonged drainage needed.
- c. Blind dilation over a wire or with filiform and followers is not recommended
- d. For intraoperative urethral injuries, evaluation is as below:

1. Retrograde urethrogram
 2. Flexible cystoscopy
 3. Suprapubic tube placement with delayed assessment
2. Staging
 - a. Grade 1: urethral contusion, blood at meatus, retrograde normal
 - b. Grade 2: elongation of the urethra without extravasation on urethrography
 - c. Grade 3: Extravasation of contrast on urethrography at injury site
 - d. Grade 4: extravasation of contrast on urethrography at injury site without bladder visualization, < 2cm
 - e. Grade 5: Complete transection with > or = 2 cm separation, extravasation into prostate or vagina
 3. Repair
 - a. Principles of urethral reconstruction apply
 1. Contusions may be managed conservatively with catheter drainage
 2. Partial transection may be repaired primarily
 3. Attempt Heineke-Mikulicz closure technique widen lumen and reduce risk of stricture
 4. Anterior closure may need graft (buccal, lingual) to avoid chordee. Example of an anterior urethral injury ([Figure 3](#))
 - b. Perineal colorectal cases, such as abdomino-perineal resection, may involve the posterior aspect of the prostate capsule in male patients. The prostate can be resected partially and the capsule reapproximated or the defect cauterized, with careful attention to hemostasis and proximity to the external sphincter
 - c. A urethral foley will be required for 7-14 days and consider a retrograde urethrogram to confirm complete healing in the setting of higher risk features
 - d. Most urethral injuries to the posterior urethral wall can be repaired primarily, with a foley catheter left short term

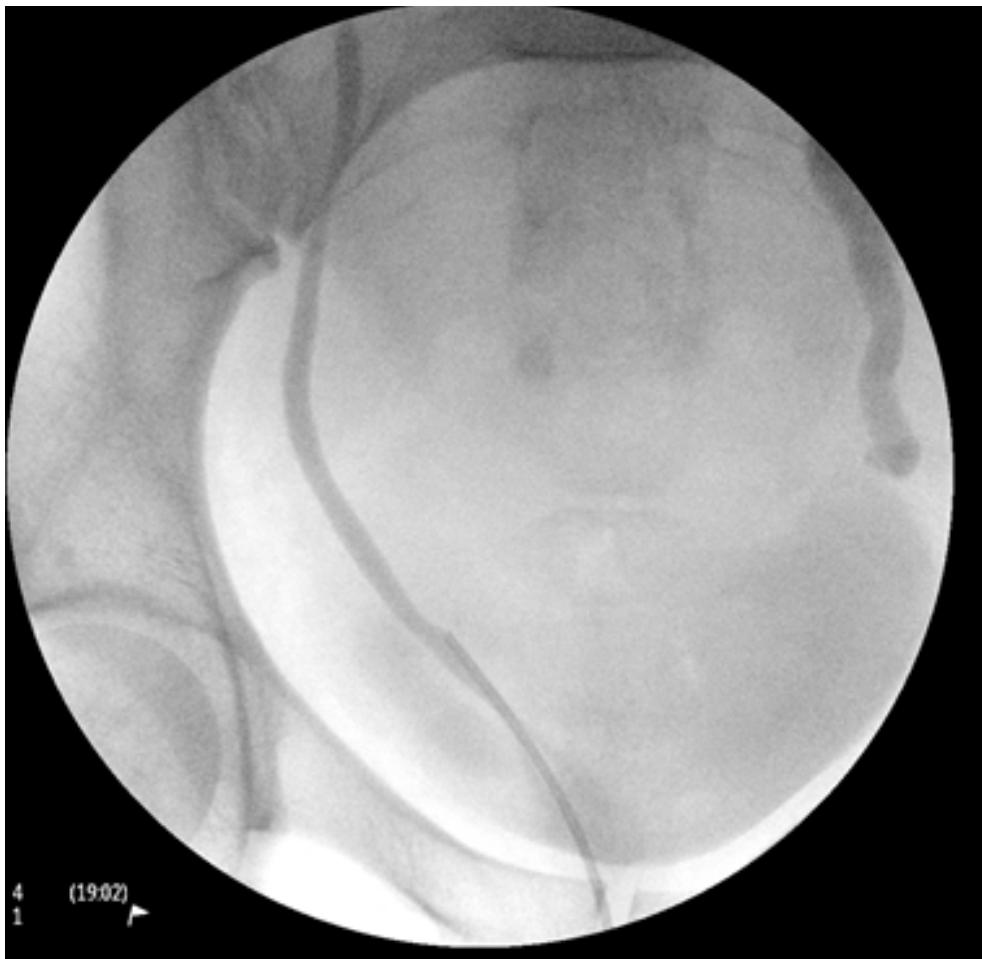
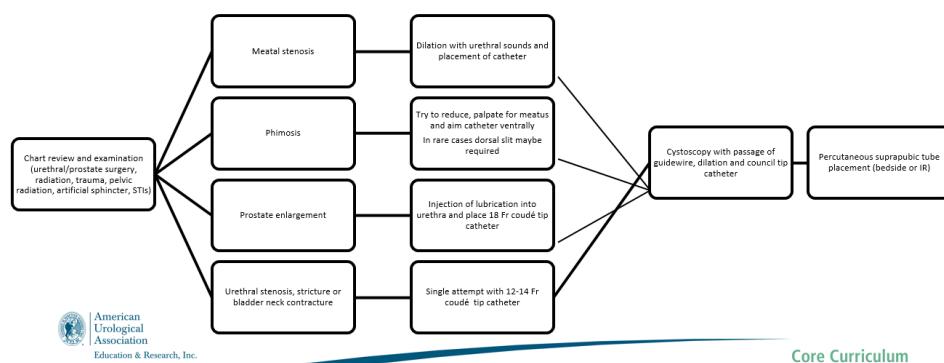


Figure 1: Intraoperative consult for a transected ureter during an emergency Cesarean section – note retained contrast and sharp cut off at the level of the suture. Always evaluate the bladder and contralateral ureter prior to proceeding with repair as done here.



Core Curriculum

Figure 2: Algorithm for management of difficult foley placement.

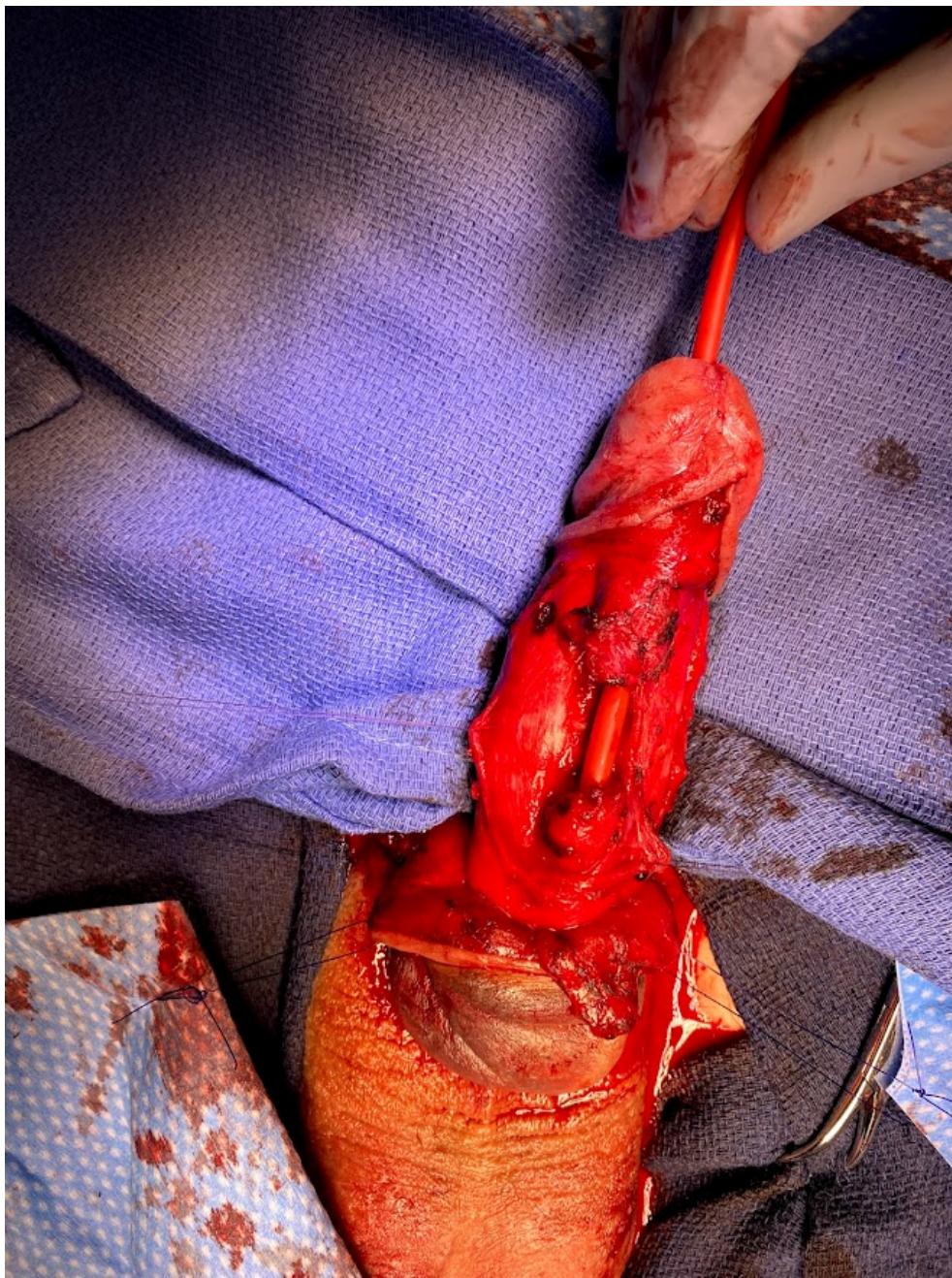


Figure 3: Intraoperative photograph of an anterior urethral injury from a biking accident repaired with buccal graft to prevent chordee.

See References: 10,11

Key Takeaways

- When responding to an intraoperative consult, always remember to be gracious and professional. Make yourself comfortable with the anatomy. Take time to optimize the equipment and environment.
- In a stable patient, stage and repair the injury
- In an unstable patient, drain and return another day

Presentations

Intraoperative Presentation 1

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