Dealing with Urologic Issues Complicating the Re-do Abdomen

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Injury/Disease Demographics

- Iatrogenic lower urologic tract injuries are relatively uncommon, occurring in 0.2-1% of all gynecologic and pelvic procedures.
- Bladder injuries occur more frequently than ureteral injuries.
- Common types of ureteral injuries include: ligation, partial laceration, transection, crush and loss of blood supply, as well as thermal spread.
- The majority of ureteral injuries (75%) occur during uncomplicated pelvic procedures in patients with normal anatomy.

Clinical Presentation

- The potential for injury to the lower urologic tract is based on:
    - type and number of previous abdominal operations
    - indications for current operation
    - severity and recurrence of underlying disease process
    - previous interventions, specifically radiotherapy
- Sources of anatomic distortion should be sought (i.e. masses or malignancy, congenital abnormalities, hernias, neurogenic bladder) particularly in patients with evidence of hydroureteronephrosis.
- Gross hematuria or invasion of bladder on imaging warrants preoperative evaluation of the GU system.
- Unrecognized injuries at the time of operation, may present without specific symptoms and signs (see **Postoperative Management/Complications**).

Evaluation/Diagnostics/Imaging

- A detailed history should be undertaken with a focus on risk factors that may increase difficulty of a planned operation.
- Physical exam may be normal.
- Radiographic imaging is performed in selected patients based upon the risk factors noted above.
    - CT urography with a delayed phase at 12 minutes following IV contrast injection is optimal to allow for opacification of the ureters

Indications for Operative Intervention

- Operative intervention should be performed *immediately* if a ureteral or bladder injury is identified during surgery.
- For patients in whom injury recognition is delayed, indications for operation are based on the type and location of injury:

- Ureteral injury – antegrade (stent) or retrograde (percutaneous nephrostomy tubes) drainage of the collecting system, with or without percutaneous drainage of potentially infected collections, followed by delayed definitive repair.
- Intraperitoneal bladder injury – should be repaired surgically at the time of recognition.

Pre-operative Preparation

- Routine preoperative ureteral stent placement is not currently advocated.
  - Although preoperative stent insertion may help identify injury intraoperatively, they are not proven to prevent injury.
- For cases deemed to be technically challenging, ureteral stenting may be performed at the discretion of operating surgeon in consultation with urology.
- Preoperative decompression of the bladder via Foley catheterization may decrease the risk for injury during laparoscopic procedures.

Operative Techniques/ Intraoperative Considerations

Prevention and Management of Bladder Injury

- Bladder injuries during laparoscopy usually occur at the time of initial placement of the Veress needle or a trocar.
  - Critical to assess location of bladder in relation to port placement.
- Distended bladder or distorted anatomy due to adhesions or presence of abdominal wall hernias may predispose to higher risk of injury.
- Bladder injuries recognized intraoperatively:
  - Repair immediately using absorbable suture.
  - Consider possibility of ureteral injury.
  - If previous radiation, protect repair with an omental pedicle.
  - Consider placement of perivesical drain (typically removed within 48 hours).
  - Bladder rest with a Foley and adequate drainage is critical for 1 week. Consideration should be given to performing a cystogram prior to discontinuing the Foley catheter to ensure adequacy of repair and absence of a leak.

Prevention and Management of Ureteral Injury

- Intraoperative hemorrhage is a known risk factor for ureteral injury.
- Most important step to prevent ureteral injury is to identify the ureter throughout its entire course in the area of operation.
  - Avoid skeletonizing the ureter as this may result in devascularization.

- Identification of a ureteral injury is typically based on index of suspicion intraoperatively or direct visualization of injury (i.e. urine leak).
- 80-90% of injuries involve the pelvic ureter.
- Administration of indigo carmine (1 ampule = 40mg/5mL) or methylene blue (50mg IV), with or without IV furosemide, may help confirm presence of injury
    - Extravasation of dye may be seen at 10-15 minutes
- Confirmed injuries should be repaired immediately.
- Key principles of repair include:
    - adequate debridement
    - spatulated repair with mucosal apposition
    - tension-free repair over a stent
    - coverage and external drainage
- Level of injury, extent of ureteral injury, and quality of surrounding tissue ultimately will determine repair options.
    - Proximal ureter
        - Injuries of the uteteropelvic junction are best managed with limited debridment and primary spatulated end-to-end anastomosis, with or without a stent
    - Mid-ureter
        - Similar management as proximal ureteral injuries - ureteroureterostomy
    - Distal ureter
        - Injuries to the lower third of the ureter or below the internal iliac artery are best managed with reimplantation into the bladder with routine stenting
        - Two procedures that allow direct anastomosis to the bladder without tension
            - Psoas hitch
                - Bladder mobilized cephalad and lateral to side of injury and sutured to the psoas
                - Ureter reimplanted ensuring no angulation at site of entry
            - Boari flap
                - If psoas hitch cannot be performed without tension
                - Flap of bladder is rotated cephalad and tubularized followed by reimplantation of ureter into tubularized flap
                - Higher complication rate

Postoperative Management/ Complications

- Intraoperative drains are typically removed within 48 hours or when output is less than 100cc/day *unless* concern for leak is present.
- Drain creatinine should be sent in cases of suspected urine leak.
- Operatively placed stents may be removed in 2-6 weeks in conjunction with retrograde pyelogram.
- Follow-up imaging (US or CT urogram) ordered on individualized basis post-stent removal to rule out stricture
- Injuries involving the bladder trigone require longer duration of bladder drainage (10-14 days) in conjunction with confirmatory cystogram to ensure healing.

Delayed bladder injury

- May present days to weeks after surgery.
- Decreased or absent urine output, hematuria, difficulty voiding.
- Diagnosis via CT or standard cystography with post-drainage film.
- *Extraperitoneal injuries* managed conservatively with Foley insertion and bladder drainage.
- *Intraperitoneal injuries*, in general, require operative repair.

Delayed ureteral injury

- May present with:
    - prolonged ileus and/or nonspecific abdominal or flank pain.
    - azotemia (elevated BUN) or worsening renal function.
    - ascites or increased drain output (test for creatinine).
- Potential sequelae of missed injury include fistulas, strictures, and renal dysfunction.
- Critical to define location and extent of injury via contrast-enhanced CT abdomen/pelvis with excretory phase.
- Retrograde insertion of ureteral stent is best option.
- If not possible, proceed to antegrade insertion of percutaneous nephrostomy drain.
- Consideration should also be given to insertion of a percutaneous drain to drain extraluminal collections.
- Repair should be delayed.

Considerations for Special Populations

- Laparoscopic surgery
    - Ensure decompression of bladder prior to attempts at entry
    - If Veress needle is used to establish initial pneumoperitoneum, consider placing in supraumblilical location or Palmer's point

Suggested Readings

1. Zinman LN, Vanni AJ. Surgical Management of Urologic Trauma and Iatrogenic Injuries. *Surg Clin North Am*. 2016 Jun;96(3):425-39. doi: 10.1016/j.suc.2016.02.002.
2. Engel O, Rink M, Fisch M. Management of iatrogenic ureteral injury and techniques for ureteral reconstruction. *Curr Opin Urol*. 2015 Jul;25(4):331-5. doi: 10.1097/MOU.0000000000000175.
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