Avoiding and Managing Urologic Injury

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Objectives

• Review diagnosis and management of urologic injury
• Review indications for stenting, cystoscopy, and ureteral repair
• Show ureterolysis
• Show closure of cystotomy

Importance of the Ureter

• 19% of unplanned consults to Gyn Onc were for inability to identify the ureter
• Incidence of injury during LH (2004-14):
  – Overall: 0.3 - 1%
  – Bladder injury: 0.05 - 1.8%
  – Ureteric injury: 0.02-1.5%

Aviki EM Gynecol Oncol 137(1):93-97, 2015
Walters M, Urogynecology and reconstructive pelvic surgery, Elsevier, 2015
Factors Affecting Incidence

<table>
<thead>
<tr>
<th>Route</th>
<th>Rate of injury (per 1000 hysts)</th>
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<tbody>
<tr>
<td></td>
<td>Bladder</td>
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<tr>
<td>Abdominal</td>
<td>5.8</td>
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<td>Vaginal</td>
<td>5.1</td>
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<td>Laparoscopic</td>
<td>7.3</td>
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<td>Robotic-Assisted</td>
<td>16.5</td>
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- Procedural Factors: Malignancy, Prolapse, Incontinence procedures, Laparoscopic approach

Factors Affecting Incidence

- Patient Factors
  - Prior pelvic surgery
  - Endometriosis
  - Urinary tract anomalies (pelvic kidney, duplicated ureter)
  - Prior pelvic irradiation
  - Obesity
  - Large pelvic mass
  - Fibroids, especially when located in broad ligament or near cervix
  - Large uterus (>250 gm)


Good news: We have improved

- Learning curve reaches significance at 30 cases


Review anatomy related to identification and dissection of the ureter and bladder
Anatomy of the Ureter

Ovarian vessels are tortuous & ALWAYS close to the ureter - must differentiate!

Can always find at the pelvic brim - make the incision higher if you are struggling!
Types of Urinary Tract Injury

- Bladder:
  - Cystotomy
  - Devascularization or denervation
  - Accidental placement of intravesical suture or staple
- Ureter:
  - Crush injury
  - Kinked or ligated with suture or staple
  - Lacerated or transected during sharp or blunt dissection
  - Thermal injury
  - Devascularization or denervation
Types of Urinary Tract Injury

Identify the ureter

- **Remember the course of the ureter**
- Open the retroperitoneum in a safe, lateral location – remember the “triangle”
- Always safe to go lateral and cephalad
- Higher is better
- Adherent to the medial leaf of the peritoneum
- Use more suction, less (no) irrigation
Right Pelvic Sidewall

IP ligament
URETER
External Iliac A
Internal Iliac A
Ureter, Under the Uterine Artery

Uterosacral Ligament

Uterine Artery

Ureter
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The Triangle (Right Side)
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Identify the ureter

- Lyse adhesions as needed to identify the course of the ureter
- Important at the level of the IP
- Important at the level of the uterines
- At the level of the IP, stay lateral! Lateral is safe
- Open the retroperitoneum in a safe, lateral location – remember the “triangle”

Prevent Injury at the Pelvic Brim
Finding the Ureter

Prevent Injury at the Uterine Artery and Pelvic Sidewall
Prevent Injury at the Uterine Artery and Pelvic Sidewall

- Do NOT go below the Koh ring
- Have strategies to deal with bleeding
  - Seal vessel without tension
  - Hemostatic agents
  - Ligate uterine artery at its origin
- Isolate the ureter in difficult cases

Prevent Injury at the Vaginal Cuff

- Surgical Technique
  - Always identify ureters and bladder!
  - Be aware of thermal spread
    - Traditional bipolar – 2 to 22 mm
    - Harmonic scalpel – 0 to 3 mm (depends on application time and device setting)
    - Ligasure device – 1.8 to 4.4 mm
  - Cephalad displacement of uterus (“If you’re not sweating, you’re not pushing hard enough!”)
  - Skeletonize uterine vessels
  - Dissect bladder off upper vagina

Use a ring to push the ureters away - always!

Identify and manage urologic injury

- Direct visualization of cystotomy or ureteral injury
- Hematuria in foley bag
- Gas in foley bag
- Visualization of foley balloon in surgical field
- Extravasation of urine into surgical field
  - Retrograde bladder fill (diluted methylene blue, sterile milk)
  - Stent placement
  - IVP
  - Retrograde ureteral dye study
- Crush, delayed thermal injury, and partial obstructions are difficult to recognize

Hurt WG, Gynecologic and Obstetrical Surgery (Nichols DH ed), Baltimore, Mosby, 1993
Identify intraoperatively

- Cystoscopy
  - Evaluate bladder for perforation, bleeding, suture
  - Evaluate bilateral ureteral jet efflux
    - PO pyridium (100-200 mg in pre-op)
    - IV sodium fluorescein (1 mL of 10% fluorescein diluted in 9 mL saline; administer 1 mL diluted fluorescein IV)
    - Intravesical mannitol or glycine solution
    - IV indigo carmine
    - IV or Intravesical methylene blue
    - Can also give dose of IV Lasix +/- fluid bolus +/- reverse Trendelenburg

Benefit to early detection

- 15 patients with ureteral injuries
  - 7 patients detected by intraop cystoscopy or early postoperative ureteral jet US
  - 5 patients detected by signs or symptoms
  - 3 patients developed injury despite normal cysto/US
- Diagnosed earlier (1.7 vs. 19.9 days)
- OR of 10 for more conservative treatment - 1/7 early patients required preimplantation vs. 5/8 late diagnosis patients

Wu HH, JMIG 13:403, 2006
Intra-operative Recognition

• What if a clamp is placed across the ureter?
  • Remove clamp
  • Inspect for integrity
  • Stent (2-6 weeks)
  • Drain (7-10 days)
    • Output should be <50 cc/day
    • Check Cr prior to removal (should = serum)
    • Leave longer if necrosis or if devascularized
  • Close peritoneum

Wu HH, JMIG 13:403, 2006

Didn’t see it in the OR…

• Flank pain / CVA tenderness
• Unexplained fever
• Persistent ileus
• Lower abdominal mass (urinoma)
  • U:P Cr = 30-100:1
• Urine leakage from vagina
• Decreased urine output
• Unexplained hematuria

Postoperative Diagnosis of Urinary Tract Injury

- Imaging Studies
  - Cystoscopy
  - CT Cystogram – can sometimes miss subtle findings
  - Renal ultrasound – evaluate for hydronephrosis or retroperitoneal fluid collection
  - Retrograde pyelogram – gives more information on precise location of injury once injury is suspected or confirmed
  - CT Abd/Pelvis

Postoperative Management of Urinary Tract Injury

- Relieve obstruction
  - Retrograde stents
  - If unable to pass retrograde stents, try anterograde stents
  - May need percutaneous nephrostomy tubes
- Treat infection
- Stop urine leakage
  - Consider bladder catheter
Sequelae of Injury

- Ureteral obstruction
  - Can lead to hydronephrosis and kidney injury
- Genitourinary fistula
- Urinoma
- Hematoma, infection, abscess formation, ischemia, necrosis

Indications for urinary stents

- Stents can be placed prior to difficult procedures
- Make identification of ureter easier
- Have not shown reduction in injury
- May decrease unrecognized injury
- Lighted stent cannot be seen when field is illuminated during surgery
- Routine use is controversial:
  - Wood: 7/92 scented patients had oliguria/anuria compared with 0/400 unstinted patients
  - Merritt: Successfully placed in 313/397 patients in 5.4 minutes for experienced surgeons and 8.4 minutes for inexperienced surgeons; complications included UTI, AKI, Fistula (all <2%)

Wood EC, JAAGL 3(3):393, 1996
Indications for urinary stents

- Prophylactic ureteral stents
  - Universal use is not recommended
  - Cost-effective only if ureteral injury rate >3.2%
  - Can be considered in cases where ureteral identification is expected to be challenging:
    - Severe endometriosis
    - Large cervical fibroids
    - Prior pelvic radiation
    - Planned c-hysterectomy


Universal cystoscopy?

- Prospective study of 471 hysterectomies in 3 centers
- 24 urinary tract injuries (5.3%): 8 ureteral, 17 bladder
- Ureteral injury associated with prolapse surgery (7.3% vs 1.2%, p = 0.03)
- Bladder injury associated with incontinence surgery (12.5% vs 3.1%, p = 0.005)
- Only 12.5% of ureteral injuries and 35.3% of bladder injuries were detected before cystoscopy

Vakili B, Am J Obstet Gynecol 192, 1599, 2005
Universal cystoscopy?

- Prospective study, 839 hysterectomy cases
- Peristalsis and dilation of ureter are insufficient to detect injury
- 97% of ureteral injuries were detected with universal cystoscopy
- Negative cystoscopy did not exclude all cases due to partial obstruction or burn

Ibeanu et al, Int Urogynecol J Pelvic Floor Dysfunct 2003

Universal cystoscopy?

- Retrospective study, 140 cases with and 109 cases without cysto after robot-assisted hysterectomy
- No difference in groups - zero in both groups
- Hard to show a benefit with a rare complication

Nguyen ML, JSLS 18(3), 2014
Universal cystoscopy?

- Retrospective study, 1982 hysterectomy patients 2009-10
- No intraoperative ureteral injuries detected whether cystoscopy was used or not
- 5 patients (0.25%) had a ureteral injury detected post-op
  - All were MIS cases
  - None had cystoscopy at time of surgery
- Recommended selective cystoscopy with low threshold - low volume surgeons, complex cases

Ibeanu et al., Int Urogynecol J Pelvic Floor Dysfunct 2003

Ureteral repair

- Most require stenting or advanced surgical repair
- Exception: kinking or ligation of ureter with suture
  - Remove suture
  - Assess integrity of ureter
  - If abnormal or if absent efflux on cystoscopy, patient will need stent placed

Ureteral repair

- Most occur in distal 4-5 cm of ureter: ureteroneocystostomy

Ureteral repair

- If just below pelvic brim: ureteroureterostomy or ureteroneocystostomy
- If above pelvic brim, do NOT do ureteroneocystostomy
Call for help if:

- Thermal urinary tract injury
- Injuries to the trigone
- Delayed diagnosis of injury
- Most ureteral injuries
  - Transection
  - Crush injury
  - Thermal damage
  - Absent or abnormal efflux

Ureterolysis
Repair of cystotomy

Bladder Dome:
<2 mm: expectant management
<1 cm: repair vs foley for 5-7 days
>1 cm: repair

2 layers absorbable suture
- 3-0 then 2-0 Vicryl, Monocryl or PDS
- Full thickness
- Interrupted or running
- Barbed suture is fine

Retrograde fill bladder to assess integrity of repair

Repair of cystotomy

- Can be repaired laparoscopically if:
  - Small injury
  - Adequate surgeon expertise
  - Adequate visualization
  - No involvement of trigone or bladder neck
Postoperative Care After Cystotomy

• Bladder decompression with foley catheter for 5-14 days depending on size and location of injury
  – Bladder reepithelializes within 3-4 days, regains normal strength by 21 days
• CT cystogram prior to catheter removal
• Consider voiding trial with foley removal (Fill with 300cc, must void 200 cc), or bladder scan

Prophylactic Antibiotics

• If diagnosed intraoperatively, no additional antibiotics indicated
  – If no surgical prophylaxis abx given (i.e. lsc BSO), give antibiotic to cover Gram negative and enterococci
• Antibiotics for patients who go home with a foley?
  • ACOG: limited evidence to support ciprofloxacin 250 mg from POD2 until Foley out
  • Cochrane: Antibiotics at time of catheterization yields less bacteriuria than prolonged use

Lusardi G, Cochrane Database Syst Rev 2013; :CD005428
References

References


• Schimpf MO, Gottenger EE, Wagner JR. Universal ureteral stent placement at hysterectomy to identify ureteral injury: a decision analysis. BJOG 2008; 115:1151.


