Lower Urinary Tract Injury and Gynecologic Surgery

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LUTI

- Urethra
- Bladder
- Pelvic Ureter

- Surgical Anatomy
- Prevention
- Recognition
- Evaluation / Treatment
KEY POINTS - LUTI

• Increased risk
  – Complicated Difficult surgery
  – Prolonged operating time
  – High blood loss (>1,000 ml)

• Intraoperative Recognition and Treatment is optimal

• Post operative drainage is crucial (Catheters, stents)

• High index of suspicion in immediate post operative period

• LUTIs occur to ALL surgeons regardless of experience or technique (although, experience and technique are important for prevention)
Urethra Injury

- 3-5 cm length, to bladder trigone
- Hymen ---- anterior distal 1/3 vagina
- Dense endopelvic connective tissue
- INJURY is uncommon (<1% MUS)
- INJURY RESULTS in
  - Fistula (incontinence)
  - Mesh erosion (infection, incontinence, fistula)
- INJURY OCCURS from
  - Anterior repair
  - Vaginal cyst excisions
  - Midurethral sling placement
Bladder Injury

- Most common LUTI
- 0.6% VagHyst, 0.9% AbdHyst, 1% LSHyst
- MUS = 1-10% RP trocar perforations
- Post hysterectomy vesicovaginal fistula =
Cystotomy - Preventive Strategies

• Cesarean Delivery-
  – Multiple priors- develop bladder reflection from lateral to medial (start plane of dissection away from scar and work to midline)
  – Back fill bladder

• Vaginal Hysterectomy-
  – Make incision on cervicovaginal line.
  – Sharp dissection, look for fatty, slick glistening vesicouterine plane
  – Counter traction
  – Elevate bladder

• Abdominal Hysterectomy-
  – Find the foggy, avascular vesico vaginal space, on the pearly white
  – Counter traction on bladder
  – Mobilize below cervix 1-2 cm
  – NO sponge stick

• Laparoscopic / Robotic Hysterectomy-
  – Same as abdominal
  – Colpotomy rings
  – Avoid excessive thermal energy
Ureter

• Pelvic Ureter-
  – 25 cm +/- length
  – begins at pelvic brim crossing iliac artery beneath ovarian vessels
  – Blood supply from lateral pelvis

• INJURY at level of uterine vessels – cervical isthmus. MOST COMMON site
• INJURY at pelvic brim- ovarian vessels
• INJURY at lateral anterior vaginal fornix- cuff
Incidence-Ureteral Injury
Operative Laparoscopic Procedures

• 1990- Grainger, et al, Ureteral injuries at laparoscopy: Obstet Gynecol 75(5):839-43 1990 (pre-LAVH) 8 cases +5 new cases-most injuries were near USLs with electrosurgical energy

• 1992- Woodland, Ureter injury during laparoscopy-assisted vaginal hysterectomy with the endoscopic linear stapler: Am J Obstet Gynecol; 167(3):756-7 1992 reported 2 misadventures with stapling device

• 1997/1999- Harkki-Siren & Kurki, A nationwide analysis of laparoscopic complications: Obstet Gynecol; 89(1): 108-12 1997 Finland 70,607 Gyn L/S cases; 1990-1994 10 fold increase in major complication rate (10.1/1,000) of which were ureteral injuries. Major complications of laparoscopy: a follow-up study: Obstet Gynecol; 94(1): 94-8 1999 32,205 Gyn L/S cases 1% ureteral injury rate (stable), most at LAVH
Ureteral Injury at Hysterectomy
Highest with Minimally Invasive Laparoscopy

- The Impact of Minimally Invasive Surgery on Major Iatrogenic Ureteral Injury and Subsequent Ureteral Repair During Hysterectomy: A National Analysis of Risk Factors and Outcomes.

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**OBJECTIVE:** To identify risk factors for ureteral injury during hysterectomy and to assess outcomes of concurrent minimally invasive vs converted to open repairs.

**METHODS:** We queried the American College of Surgeons-National Surgical Quality Improvement Program database between 2005 and 2013 to identify abdominal hysterectomy (AH), minimally invasive hysterectomy (MIH), or vaginal hysterectomy. Ureteral injury was identified based on intraoperative or delayed management. Multivariate logistic regression was performed to assess the effect of hysterectomy approach on risk of ureteral injury while controlling for covariates. For patients with ureteral injury during MIH, we compared 30-day outcomes following minimally invasive vs converted open repairs.

**RESULTS:**
There were 302 iatrogenic ureteral injuries from 96,538 hysterectomies, with 0.18%, 0.48%, and 0.04% from AH, MIH, and vaginal hysterectomy, respectively. Patients who underwent MIH were younger and had decreased comorbidities compared to patients who underwent AH (all P < .001). MIH resulted in lower overall complications (6.6% vs 14.8%, P < .001) but higher ureteral injury rate (0.48% vs 0.18%, P < .001) compared to AH. On multivariate analysis, the minimally invasive approach was associated with increased risk of ureteral injury (odds ratio 4.2, P < .001). Patients undergoing minimally invasive ureteral repairs (89%) during MIH had shorter operating room time and length of stay but similar overall perioperative complications compared to those with converted open repairs (11%).

**CONCLUSION:**
Using a large national series, we show that the minimally invasive approach for hysterectomy is an independent risk factor for iatrogenic ureteral injuries. During MIH, concurrent minimally invasive ureteral repairs resulted in comparable 30-day outcomes compared to converted to open repairs.
Location of ureters in relation to the uterine cervix by CT*

- 52 women – pelvic CT – no pathology
- Age and body mass compared to distances
- Result: At most dorsal reflection of the ureter, the average distance from ureter to cervical margin was 2.3 +/- 0.8cm (range 0.1 – 5.3 cm)
- 12% had one ureter within 0.5cm to cervix margin
- Only slightly more proximal to cervical margin in heavier women (insignificant)

Conditions Associated with Ureteral Injury

- Myomas
- Endometriosis
- Adnexal mass
- Cancer
- Ovarian remnant syndrome
- Mullerian abnormalities
- Diverticulosis
- Radiation therapy
- Pelvic organ prolapse
- Pregnancy
- Prior surgery-ureteral re-implants
- Pelvic infection
Ureteral Injury
Preventive Strategies

• Preoperative ureteral stents/catheters
  – DOES NOT DECREASE CHANCE OF INJURY, however, may aid in dissection and identification of injury
  – Lighted stents, indocyanine green, Firefly Fluorescence Endoscopic system, etc
REDUCING RISK OF INJURY

• ABDOMINAL / LAPAROSCOPIC HYSTERECTOMY
  – OPEN RETROPERITONEAL SPACE and identify ureter-MAKE WINDOW BENEATH MEDIAL PERITONEUM to isolate ovarian vessels
  – MOBILIZE BLADDER > 1cm from vaginal cuff
  – SKELETONIZE UTERINE VESSELS
  – CLAMP PLACEMENT at right angle to isthmus
  – CLAMP INSIDE PREVIOUS PEDICLE
  – ENERGY SOURCES--- LATERAL THERMAL SPREAD (3-8mm)
REDUCING RISK OF INJURY

• **VAGINAL HYSTERECTOMY**
  – DEVELOP VESICOUTERINE SPACE
  – ELEVATE BLADDER
  – PALPATE URETERS
  – CLAMP PLACEMENT (small purchases, “hug” the cervix)
    • REMEMBER: the ureters are located at the lateral vaginal apices and traction on cervix draws them into operative field
INTRAOPERATIVE MANAGEMENT OF LUTIs
Bladder Injury
INTRAOPERATIVE IDENTIFICATION

• Where is the injury? How large? (trigone, base, dome) Extensive electrosurgical energy?
• Cystoscopy and direct visualization of defect
• MUS trocar (RP and TO) - remove and redo
• Repair and drain (Foley x 3-14 days)
• Trigone – GET HELP (ureteral stents, prolonged drainage)
• +/- cystogram with Foley removal
Is Cystoscopy mandatory for all hysterectomies? (Universal Cystoscopy)

• NO
• YES-Prolapse surgery
• YES-Incontinence surgery
• YES-High Risk surgery
Cystoscopy
CYSTOTOMY REPAIR

• DOME
  – Small <3mm Foley catheter
  – >3mm - One layer delayed absorbable suture
• TWO LAYER  delayed absorbable suture
Ureteral Injury

INTRAOPERATIVE IDENTIFICATION

• FINDING = Ureteral jet absent, sluggish
• TYPE OF PROCEDURE
  – High USL vault suspension= remove sutures
  – Fluid challenge , furosemide

• STENT OR URETERAL CATHETER PLACEMENT
• RETROGRADE PYELOGRAM
LUTIs- Delayed Post-op Recognition

• Symptoms
  – Bladder
    • Hematuria
    • abdominal pain- ileus, peritonitis, fever
    • voiding dysfunction
    • watery wound leak, high drain output
    • fistula
  – Ureter
    • Flank pain
    • anuria
    • Asymptomatic
    • Fever
    • fistula
SUSPECTED URETERAL INJURY
POST-OP (DELAYED) EVALUATION

BLADDER
Ultrasound- renal, pelvic, bladder (low suspicion)
Cystogram
CT cystogram

URETER
• CT intravenous pyelogram
• Intravenous pyelogram (IVP)
• Retrograde pyelogram (cystoscopic)
Long-term consequences of ureteral injury

• Stricture
• Fistula
• Obstruction
• Kidney damage
TREATMENT OF INJURY- UNRECOGNIZED

TIMING OF REPAIR
Damage recognized 2-3 days from surgery
and
No frank inflammation
and
Patient is surgically stable
then
IMMEDIATE REPAIR INDICATED
TREATMENT OF INJURY- UNRECOGNIZED

TIMING OF REPAIR

If greater than 3-5 days out

Then

Place percutaneous nephrostomy and repair 8-12 weeks later
Ureteral Injury

• Types- kinking, ligation, crush, laceration, transection, thermal, ischemic
Ureteral Repair

- Stent only for minor injury only
- Stent - Minor thermal
- < ½ diameter, otherwise repair and drain
TREATMENT OF RECOGNIZED INJURY IN OPERATING ROOM

If cut or extensively damaged:
- Ureteroneocystostomy within 5 cm of ureterovesicle junction
- Psoas hitch to relieve tension (as needed)
- Boari flap
- Ureteroureterostomy if damage > 5 cm from UrVJ
TREATMENT OF RECOGNIZED INJURY IN OPERATING ROOM
(>5 cm from UrVJ)

Ureteroureterostomy
FISTULAS

• URETHROVAGINAL FISTULA-rare
• VESICOVAGINAL FISTULA-most common
• URETEROVAGINAL FISTULA- normal voiding, continued vaginal leaking
Fistula diagnosis

- HISTORY-continuous urinary incontinence, watery vaginal discharge after hysterectomy
- PHYSICAL EXAM- Fluid in vagina, direct visualization of fistula, if not...........
- TAMPON /DYE TEST- Methylene blue in bladder, place tampon /sponges vaginally, observe, inspect
- Where is the dye stain?
Ureterovaginal fistula-diagnosis

- Oral phenazopyridine 2 hr before
- Empty bladder (cath) and instill methylene blue in bladder
- Place vaginal tampon / sponges
- Observe- tampon orange?
- Equivocal test may require imaging
Fistula Repair

- Small fistula may heal with Foley catheter, or ureteral stent + time. (<3mm).
- Delay repair 12 weeks +/- until mature fistula
- Repair- trans vaginal, abdominal
- Repair VVF-
  - Flap slitting
  - Latzko partial colpocleisis
Vesicoureteral Fistula

• Ureteroneocystostomy (reimplant ureter)
Summary
Urinary Tract Injury
Final Points
• Adhere to good surgical technique
• Be aware of potential hazards (healthy paranoia)
• Confirm integrity of bladder and ureter
  – Communicate with patient, family, and colleagues
• Don’t panic
  – Discuss
  – Defer with colleague if not sure