URETERAL INJURIES

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LEARNING OBJECTIVES

• Identify patient at risk for injuries
• Awareness of methods to avoid injuries
• Awareness of *intraoperative* diagnosis of inadvertent surgery
• Increase knowledge of management of injuries

CONFLICT OF INTEREST

• No dependent parents
• No alimony
• One set of children – “in work force”
• Eligible for retirement - BUT
THINK

ECTOPIC

URETERAL INJURY

INCIDENCE

• 0.4 to 2.5% of PTS undergoing gyn surgery
• Only about 1/3 are recognized at time of surgery
• Unrecognized injuries result in loss of kidney in about 25% of cases
**URETERAL INJURY AND PROCEDURE**

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>PERCENT INJURIES</th>
</tr>
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<tbody>
<tr>
<td>TAH</td>
<td>0.5-1.0</td>
</tr>
<tr>
<td>TVH</td>
<td>0.1</td>
</tr>
<tr>
<td>Radical hyst.</td>
<td>1.0-2.0</td>
</tr>
<tr>
<td>Adnexectomy</td>
<td>0.1</td>
</tr>
<tr>
<td>Laparoscopy</td>
<td>unknown</td>
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</tbody>
</table>

**CAUSES GU FISTULAS (208 PATIENTS)**

- Gyn surgery*  82%
- Obstetrical   8%
- XRT           6%
- Trauma/fulgeration  4%

*74% surgery for benign disease

Lee: Obstet Gynecol 9/88

**URETERAL INJURIES IN FINLAND**

- 62,379 hysterectomies – 142 ureteral injuries
- TAH – 0.4/1,000 procedures
- Supracervical hyst. 0.3/1,000 procedures
- TVH – 0.2/1,000 procedures
- LAVH – 13.9/1,000 procedures
- Ureteral injuries are most common LAVH injuries and are increasing

LAPAROSCOPY AND URETERAL INJURIES

• 12 patients – urology service
• Indications: myoma (6), endometriosis (3), tubal ligation (2), PID (1)
• Time of recognition: 3 to 33 days
• Mechanism: cautery (7), laser (1), staples (4)
• Sites of injury: pelvic brim (8), U-V junction (4)

Oh: Obstet Gynecol, 03/2000

OTHER REPORTED LAPAROSCOPIC INJURIES

• Laser/cautery for endometriosis
• LUNA procedure
• Linear stapler or cautery for uterine vessels during LAVH

INJURY RATES AND B9 GYN SURG

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>RATE/1000 SURGERIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>VH</td>
<td>0.2</td>
</tr>
<tr>
<td>SAH</td>
<td>0.5</td>
</tr>
<tr>
<td>TAH</td>
<td>1.3</td>
</tr>
<tr>
<td>LH or LAVH</td>
<td>7.8</td>
</tr>
</tbody>
</table>

### Recent Etiologies of Ureteral Injuries

- Gyn surgery: 44%
- Traumatic injury: 24%
  - GSW or MVA
- Ureteroscopy: 18%


### Conditions Associated with Ureteral Injuries

- Inadequate incision
- Inadequate retraction
- Poor lighting
- Visibility limited by bleeding
- Digression from standard techniques (i.e. operative laparoscopy)

### Conditions Associated During Abdominal Surgery

- Obesity
- Large adherent pelvic mass
- Ureteral anomalies
- Intraligamentary leiomyomas
- Prior pelvic surgery
- Paracervical tissue induration
  - A) Infection
  - B) Cancer*
- Prior pelvic XRT*
CONDITIONS ASSOCIATED DURING VAGINAL SURGERY

• Uterine prolapse – remember the “knee”

• Anterior repair – ureters are about 1 cm from sutures

• Aggressive, “lateral plication” of U-S ligaments
  
  Ibeanu (LSU): OB/GYN 1:2009

AVOIDING URETERAL INJURIES - TRANSABDOMINAL

• Operate in spaces

• “The sidewall is your friend”

• Avoid large clamps and massive ligatures when attempting hemostasis in cardinal ligament area

• Avoid excessive use of cautery

• Widely mobilize bladder
AVOIDING URETERAL INJURIES - TVH

- Separately isolate bladder pillars
- Develop vesicouterine space – countertraction beneath bladder
- Use small pedicles for cardinal and U-S ligament ligation.
- ↔ Palpate
- Culdoplasty sutures through U-S ligaments – never lateral
AVOIDING URETERAL INJURIES - LAVH

- IP ligament area – use “windows” prior to cautery or stapling
- Clamp uterine vessels from below??
- Harmonic scalpel??

GYN SURG: PROPHY. CATH.

- Ureteral catheterization – 469/3071 gyn PTS
- 0.62% (2 of 322) had injuries with pre-op cath
- 0.10% (2 of 2016) had injuries with NO pre-op cath
- P = NS


DISADVANTAGES PREOPERATIVE URETERAL CATHETERS

- Palpating against them can damage ureter
- With severe scarring (endometriosis) – difficult to palpate
- Preoperative PT selection is difficult
- Can be inserted during procedure
- Indications: double collecting system, prior ureteral surgery
- Illuminated for LAVH??
PREVENTION – CYSTOSCOPY – META - ANALYSIS

• Major gyn surgery – 8 studies reported routine cystoscopy and 22 studies did not
• 4 fold increase in bladder or ureteral injuries when cystoscopy not used
• “Routine cystoscopy would discover 90% of unsuspected ureteral injuries”


INTRAOPERATIVE UNIVERSAL CYSTOSCOPY

• Cystoscopy at time of hysterectomy for B9 disease – 839 PTS
• Bladder injury – 2.9%
• Ureteral injury – 1.8%
• Injury detection rate 97.4% (Only one PT presented with P.O. injury)

Ibeanu: Obstet Gynecol 1:2009

SOLVING THE BARRIER PROBLEM

• Credentialing problems
• SAFETY issue
• “Cystoscopy for lower UI injury at time of gyn surgery”
• “Cry wolf”

Brubaker: Obstet Gynecol 1/2009
**SINS**

“The venial sin is injury to the ureter; the mortal sin is failure of recognition.”

Higgins, JAMA, 1967

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**URETERAL INJURY – INTRAOP. RECOGNITION**

- Inject indigo carmine or M. blue into ureter – proximal compression – observe distally
- Cystotomy – 5 ml indigo carmine IV and observe ureteral orifices
- No blue efflux – insert 6-8 ureteral catheter
- Intraoperative IVP is a poor choice
IMPROVE ABILITY TO VISUALIZE EFFLUX

• Use zero to 30° scope from above
• Use 70° scope transurethral
• Along with indigo carmine, give fluid bolus and mannitol or lasix
• 10% dextrose in bladder
INABILITY TO PASS CATHETER
• Ureterotomy
• 6 to 8 F – passed caudad and cephalad
• 4-0 PGA to close defect
• Drain
MANAGING LAPAROSCOPIC INJURIES
• Usually associated with staple or cautery use
• If not an expert laparoscopist – use open technique
• Cautery injury – usually requires resection of a portion of the ureter

CRUSH OR LIGATURE INJURY (<30 MIN)

<table>
<thead>
<tr>
<th>Small injury</th>
<th>Large injury</th>
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<tbody>
<tr>
<td>IVIC - Extravasation</td>
<td>Resect</td>
</tr>
<tr>
<td>No extravasation</td>
<td>6-8 F ureteral catheter for 7 to 10 days plus Retroperitoneal drain</td>
</tr>
</tbody>
</table>
PRINCIPLES OF REPAIR
OF URETER
• Below midpelvis (within 6-8 cm of U-V junction) – ureteroneocystostomy
• Above midpelvis – ureteroureterostomy
• Suture – 4-0 chromic or PGA

PRINCIPLES OF REPAIR
OF URETER
• Ureteral catheter
• Suture catheter to ureter – use 4-0 chromic
• Retroperitoneal drain
• Omental wrap
URETERONEO CYCTOSTOMY – TUNNEL?

• Adult system different
• Severe hydronephrosis:
  Tunnel - 50%: NO tunnel – 13%
• Chronic UTI:
  Tunnel – 62%: NO tunnel – 27%

URETERONESYSTOSTOMY (CONTINUED)

• Disadvantages of tunnel
  Requires relatively long ureter
  Procedure time is increased
  May lead to more scar formation

Wheless, 1986
# Extensive Injuries Above Midpelvis

- Transureteroureterostomy
- Mobil. of kidney/ureter
- Ureteroileocystoplasty
- Cutaneous ureterostomy

# Unrecognized Ureteral Injury – SX and Signs

- Flank pain
- Chills, fever
- Abdominal distension (paralytic ileus)
- Mass – pseudocystic urinoma
- “Incontinence” – passage of urine through vagina (occasionally – skin or rectum)
- Mean time for U-V fistula – 5-14 d

# Office Diagnosis

- “Leaking is worse when I stand or walk”
- Speculum (or tampon tests)
- IV indigo carmine and sterile milk via Foley
- Pooling – dark blue, suspect ureterovaginal fistula
- Pooling – white, suspect VVF
- Pooling – powder blue, suspect BOTH
OTHER DIAGNOSTIC TESTS

• Serum creatinine – with obstruction this may increase by only 0.8 mg/dl (Stanhope)
• IVP
• Retrograde studies
• TVS – look for mass or “ascites”
• If “free fluid,” consider aspiration and obtain creatinine of fluid.

REPAIR OF URETERAL INJURIES TIMING

• Controversial – depends on patient condition
• In general, if recognized after 72 hours, delay repair until edema and local inflammation has subsided – usually 6-8 weeks.
• Distal injuries have been repaired successfully at 10-14 days in select patients as reported by Beland (1977) and Witters (1986)
• Laparoscopy??
ALTERNATIVES TO EARLY REPAIR

• Percutaneous nephrostomy
• Retrograde stent placement
• Combination of both
• About 15% of U-V fistulas will heal spontaneously with stent
• Consider use of drain in select cases
SELECTED REFERENCES