



Emergency Department Management of Urologic Trauma

The lecturer will review the current medical literature and will discuss the best recent reports. Current controversies in the management and diagnosis of common urologic problems will be explored.

- Describe trends in the recent medical literature.
- Discuss controversies in the diagnosis and management of common urologic problems.

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FACULTY

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ADVANCES IN THE MANAGEMENT OF GENITOURINARY TRAUMA

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OBJECTIVES

- A. Outline a clinically relevant classification of GU injury.
- B. Review the risk factors for GU trauma.
- C. Provide a rational approach for the diagnostic evaluation.
- D. List the treatment options for each injury.

EPIDEMIOLOGY

10% of all ED injuries

COVERT ENTITY → requires a high index of suspicion!

Easily overlooked in the presence of other more dramatic injuries

Mechanism(s) of injury:

- Blunt multisystem injury
- Rapid deceleration
- Penetrating torso injury

CLASSIFICATION

For purposes of injury staging and diagnostic evaluation, the genitourinary (GU) system can be divided into the *lower tract* (bladder, urethra, external genitalia) and *upper tract* (kidneys, ureters).

A. Lower Urinary Tract

Urethra

- Posterior urethra = proximal to the urogenital diaphragm
- Anterior urethra = distal to the urogenital diaphragm

Bladder

- Intraperitoneal perforation
- Extraperitoneal perforation

External Genitalia

- Scrotal/Testicular

Penile

B. Upper Urinary Tract

Renal

- Blunt renal trauma
- Penetrating renal trauma

Ureter

PHYSICAL EXAMINATION

Injury to the GU tract is usually NOT evident during the primary and secondary survey. When attention is focused on obvious injuries, GU trauma can be easily overlooked. A high index of suspicion is essential.

HEMATURIA is the important sign of GU injury. *Gross hematuria* may be seen with either upper or lower tract injury, and this alone should prompt thorough diagnostic evaluation. *Microscopic hematuria* (3-5 RBC/hpf) should be interpreted in the context of the patient's injuries and hemodynamic status. Remember that the presence/degree of hematuria can be influenced by sampling technique and crystalloid resuscitation. Visualization of *initial bladder effluent* is essential.

Signs of lower tract injury:

- Lower abdominal and/or suprapubic tenderness
- Pain on pelvic compression, pelvic instability
- Blood at the urethral meatus
- Blood at the vaginal introitus
- Perineal ecchymosis, hematoma (late finding)
- Abnormal prostate exam
- Gross hematuria

Signs of upper tract injury - ADULTS ONLY

- Gross hematuria
- Microhematuria with shock (≤ 90 systolic)
- Abdominal/flank/back tenderness or ecchymosis

Signs of upper urinary tract - CHILDREN

- Less musculature for organ protection
- Congenital upper tract abnormalities
- Longer support of ongoing hemorrhage without hypotension
- ANY AMOUNT OF HEMATURIA DICTATES INVESTIGATION

DIAGNOSTIC EVALUATION: GENERAL PRINCIPLES

Always study the GU system in a RETROGRADE fashion...ie, urethra before the bladder, before the kidneys and ureters:

Retrograde Uretrogram

Cystogram

CT Scan Or IVP With Nephrotomography

LOWER URINARY TRACT INJURIES

A. Urethral Trauma

Injury of the urethra is relatively uncommon. Urethral injury is usually seen in patients with:

- Pelvic fractures
- Direct blunt trauma (eg: straddle injury)
- Penetrating trauma

Remember that failure to recognize urethral injury can lead to (1) further iatrogenic damage, eg: during Foley catheter placement, and (2) significant delayed complications, eg: impotence, strictures, incontinence. For staging purposes, the urethra can be divided at the level of the urogenital diaphragm into the ANTERIOR SEGMENT (penile urethral) and POSTERIOR SEGMENT (membranous and prostatic urethra).

Anterior Urethral Injury

Mechanism of injury:

- Straddle injury
- Fall
- Self-instrumentation
- Iatrogenic

Symptoms: pain, dysuria, urinary retention

Signs:

- BLOOD AT THE URETHRAL MEATUS
- Urethral and/or scrotal mass, hematoma
- NORMAL prostate exam

Diagnosis: retrograde urethrogram

Treatment: Foley catheter; suprapubic catheter

Posterior Urethral Injury

Mechanism of injury:

- Pelvic fracture
 - shearing force with disruption of puboprostatic ligament
 - complete in 90%, incomplete in 10%
- Instrumentation, eg: metal sounds, catheter guides
- TURP

Symptoms: LAP, suprapubic tenderness, urinary retention

Signs:

- BLOOD AT THE URETHRAL MEATUS
- Scrotal and/or perineal hematoma
- ABNORMAL prostate exam

Diagnosis: retrograde urethrogram

Treatment: surgical

Complications: urethral strictures, impotence, incontinence

PROCEDURE: Retrograde Urethrogram

Indications: anytime you suspect a urethral injury

Equipment:

- 60 cc syringe with adapter or Toomey syringe
- Foley catheter with balloon inflated in fossa navicularis

Technique:

1. Stretch the penis obliquely to eliminate urethral folding
2. Patient should only be rolled if pelvic fracture excluded
3. Inject 50-60 cc full-strength Conray
4. Take radiograph while you are injecting the last 10 cc
5. Look for extravasation with either
 - Contrast in the bladder (incomplete injury)
 - No contrast in the bladder (complete injury)

B. Bladder Trauma

Mechanism of injury:

- Pelvic fracture
 - Bladder rupture in 5-10% of pts. w/ pelvic fractures
 - Pelvic fractures in 88-92% of pts with bladder rupture
- Direct blow

Symptoms: lower abdominal pain, inability to urinate

Signs: SHOCK, suprapubic tenderness, \pm abnormal rectal examination

Diagnosis: retrograde cystogram

- Extraperitoneal rupture (EPR)
- Intraperitoneal rupture (IPR)

Treatment EPR:

- Foley catheter for 10-14 days

- Surgery if bladder neck involved

Treatment IPR: surgical repair

Complications: abscess, peritonitis,

PROCEDURE: Retrograde Cystogram

Indications:

- Unequivocal = gross hematuria
- Equivocal
 - pelvic fracture with microhematuria
 - pelvic fracture without hematuria
 - urethral injury

Comments:

- Never done in an anterograde fashion (IVP, CT)
- Always retrograde, so bladder filling can be controlled
- The bladder *must* be over distended

Technique:

1. Rule out urethral injury first!
2. Pass a 14F or 16F Foley catheter
3. KUB before injecting contrast (compare with post-void)
4. Instill 400 cc of CONRAY (in children age x 30 cc)
5. Clamp catheter
6. AP filled film, then drain the bladder completely
7. Post-void film (essential to see posterior extravasation)

UPPER URINARY TRACT INJURIES

A. Renal Trauma

Most common of all GU injuries

Congenital abnormalities predispose to injury

BLUNT RENAL TRAUMA vs. PENETRATING RENAL TRAUMA

Blunt Renal Trauma

80-85% of renal injuries

Associated intraperitoneal injuries in 20% of patients

Mechanism of injury:

- Rapid deceleration
- Direct blow

Symptoms: asymptomatic, abdominal and/or flank pain

Signs:

- Shock
- DEGREE OF HEMATURIA \neq DEGREE OF INJURY
- Contusions/ecchymosis to back, flank, abdomen
- Vertebral or transverse process fractures

Classification

- 85-95% of renal injuries are not clinically significant
 - contusions
 - subcapsular hematomas
 - all do well...managed expectantly
- Minor Laceration 6-15%
 - involving the superficial renal medulla
 - intact collecting system
- Major lacerations
 - deep renal medulla
 - into the collecting system
- Vascular injuries 1-2%
 - pedicle injury
 - usually associated with other significant injuries
 - management controversial
 - most kidneys NOT salvageable

Management Of Blunt Renal Trauma

Historically, patients with any amount of hematuria got an IVP. Recent studies have clearly demonstrated that this is neither necessary or cost-effective. In 1985 the Urologic community set out to define markers of significant renal injury (ie: which patient is at risk?), and an appropriate diagnostic approach to these patients. References, *Journal of Urology*:

133:	183-187,	1985
136:	370-371,	1986
136:	561-565,	1986
138:	99-101,	1987
138:	266-268,	1987
140:	16- 18,	1988
141:	1095-8,	1989
148:	266-267,	1992

The results of these studies defined the markers for significant renal injury:

- Gross hematuria
- Microscopic hematuria associated with shock in the field or ED
- Sudden deceleration injury
- Any degree of hematuria in children

What test should be used to evaluate the kidneys? This will depend on your practice setting and the availability of diagnostic modalities. The pros and cons of IVP and CT are reviewed below:

Bolus Infusion IVP With Nephrotomography

Advantages:

- Widely available
- Can be performed in the trauma room or OR

Disadvantages:

- Only defines 60-85% of injuries
- Less anatomic detail than CT

Procedure: First get a KUB. Then inject 2 cc/kg of contrast (up to 200cc). Radiography at 2, 5, 10 minutes.

The One-Shot IVP

Stevenson (J Trauma 1994) reviewed 239 unstable patients who had a preoperative "one-shot IVP." Results:

- 53 abnormal studies (26% false positive)
- 183 normal studies (8% false negative)

Because an IVP performed in the ED may cause delays in the unstable patient, this is best done in the OR! In the stable patient, staging with CT makes more sense.

Contrast-Enhanced CT

Advantages:

- Sensitivity and specificity approaches 100%
- Precise staging, defines fragment viability
- Defines size of perirenal hematomas
- Defines vascular injuries
- Identifies minor extravasation
- Identifies associated injuries

CAVEAT: The contrast material given during IVP or CT may interfere with the interpretation of the head CT (blood or contrast?). In patients with CHI, do CT done first.

Blunt Renal Trauma - Summary

- Major renal lacerations are the significant injuries
- Criteria for diagnostic evaluation include:
 - Gross hematuria
 - Microscopic hematuria with shock
 - Any amount of hematuria in the child
- CT scan the diagnostic study of choice, IVP the alternative

Blunt Renovascular Injuries

Traditionally, these have been considered an absolute criteria for immediate surgical repair. More recent data suggest that despite our best efforts, these injuries do not do well. Carroll (*J Trauma* 1990) reviewed the San Francisco experience 1977-1988. Of 1361 renal injuries, 15 involved the renal vascular pedicle. Results:

- 6 nephrectomies
- 1 post-operative death
- 9 repairs... 2 with complete functional recovery

The authors recommended attempted revascularization in:

- Patients with one kidney
- Patients with bilateral renal injury
- Non-ischemic partial injury

Penetrating Renal Injuries

15-20% of renal injuries

Mechanism of injury: GSW, stab wounds

Associated intraperitoneal injuries = 80%

SIGNIFICANT INJURIES OCCUR WITHOUT HEMATURIA

Diagnosis:

- Proximity determines whom to study
- CT diagnostic procedure of choice

C. Ureteral Trauma

Mechanism of injury: penetrating (blunt injury rare)

Symptoms: (usually delayed) fever, abdominal and flank pain

Signs are nonspecific

Diagnosis: CT vs IVP...both can miss!

Complications: abscess, ureteral stricture, fistula

Brandes (*J Trauma* 1994) reviewed 12 ureteral injuries:

- Hematuria absent in 45%
- IVP missed in 9/9
- 11/12 diagnosed intraoperatively

GENITOURINARY TRAUMA - MISCELLANEOUS

A. Scrotal Trauma

ALWAYS rule out testicular injury (violation of tunica albuginea)

Mechanism of injury: laceration, direct blow, avulsion

Diagnosis: color DOPPLER U/S

Treatment:

- Primary closure with/without a drain in the ED
- Closure in the operating room
- Skin grafting

Complications: infection, hydrocele

B. Penile Trauma

ALWAYS rule out urethral injury - may need a retrograde urethrogram

Mechanism of injury:

- Lacerations
- Direct blow
- Avulsion
- Human bite
- Rings

Symptoms: pain, inability to urinate

Signs: bleeding, penile hematoma

Diagnosis: retrograde urethrogram

Treatment: primary closure, Foley catheter, skin grafting

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RIVERWALK COMMENTS:

1. CONTRAST ALLERGY?
2. INTRA VS. EXTRA (HOW TO TELL)...NEED MORE EXAMPLES
3. CONTRAST AGENTS (NAME, DILUTION)
4. FOLLOW-UP FOR HEMATURIA...PMD VS. UROLOGY
5. CYSTOGRAM IN PATIENTS WITH (+) URETHROGRAM
6. TALK MORE ABOUT PEDICLE INJURY
7. CHILDREN (WHAT IS THE AGE CUTOFF)
8. MORE ON EXTERNAL GENITALIA
9. MORE IVP'S...SPECIFICS ON HOW TO DO AND TIMING OF X-RAYS
10. MORE ON MANAGEMENT (BLADDER, KIDNEY)