CANADIAN UNDERGRADUATE UROLOGY CURRICULUM

Genitourinary Trauma

A Message from CanUUC

This educational material is intended to supplement medical student knowledge on urological health and medical practices. We are committed to promoting inclusion across all our materials. We acknowledge that some language used within this content may include terminology from source materials and research studies, which has been maintained to reflect the scientific context in which information was gathered.

Wherever possible, we aim to use language that is respectful of all individuals, recognizing

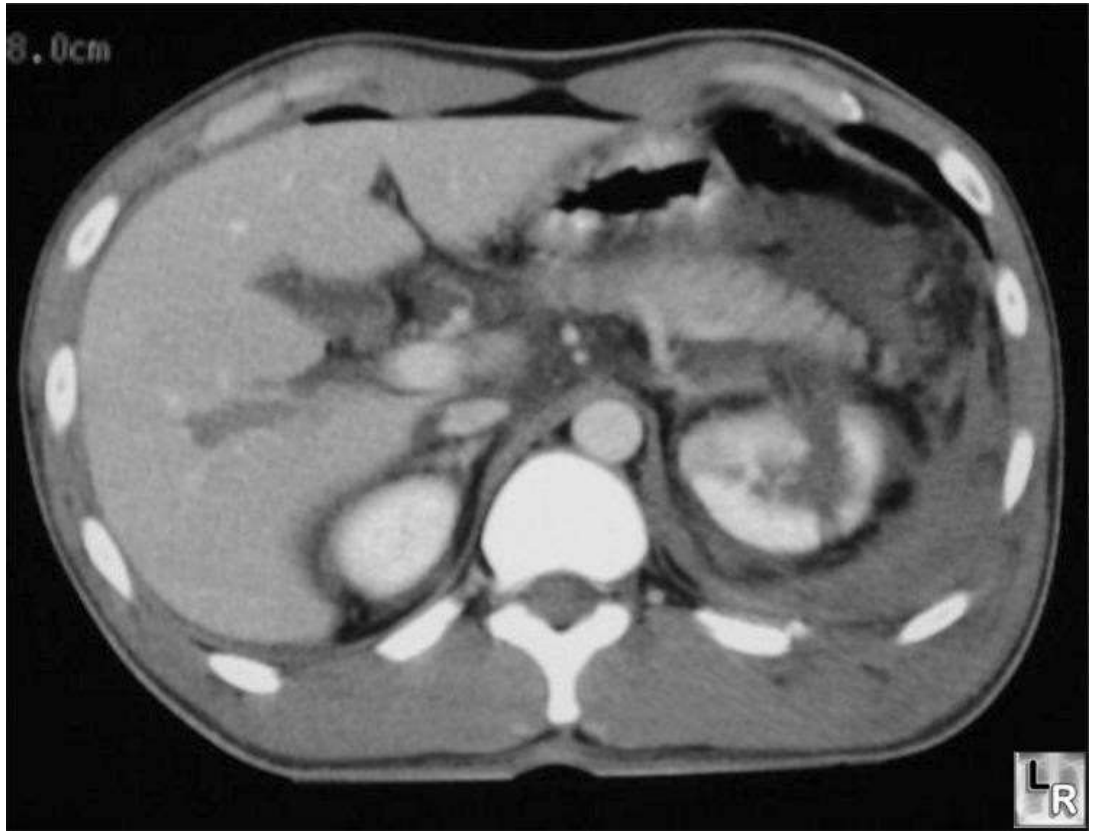
Learning Objectives

- Recognize hematuria as the cardinal symptom of urinary tract trauma.
- Outline the investigations required and basic management of a patient presenting with hematuria in the trauma setting

GU Trauma – Overview

1) Renal Trauma
2) Ureter Trauma
3) Bladder Trauma
4) Urethral Trauma
5) External Genitalia Trauma

Renal Trauma



Renal Trauma Mechanisms

Blunt Trauma (90%)

Trauma (10%)

- MVC, falls
- May cause contusions, laceration, avulsion
- Usually conservative treatment

Penetrating

- "Blast effect" - radiating current of energy
- Adjacent tissue necrosis
- Often are associated injuries
- Selective observation vs operative treatment

Renal Trauma: clues, signs, symptoms

- **Hematuria**
- **Flank Pain**
- Sudden deceleration/fall
- Flank bruising
- Broken ribs (11th and 12th)
- Lower chest/upper abdomen trauma

Renal Trauma without Hematuria

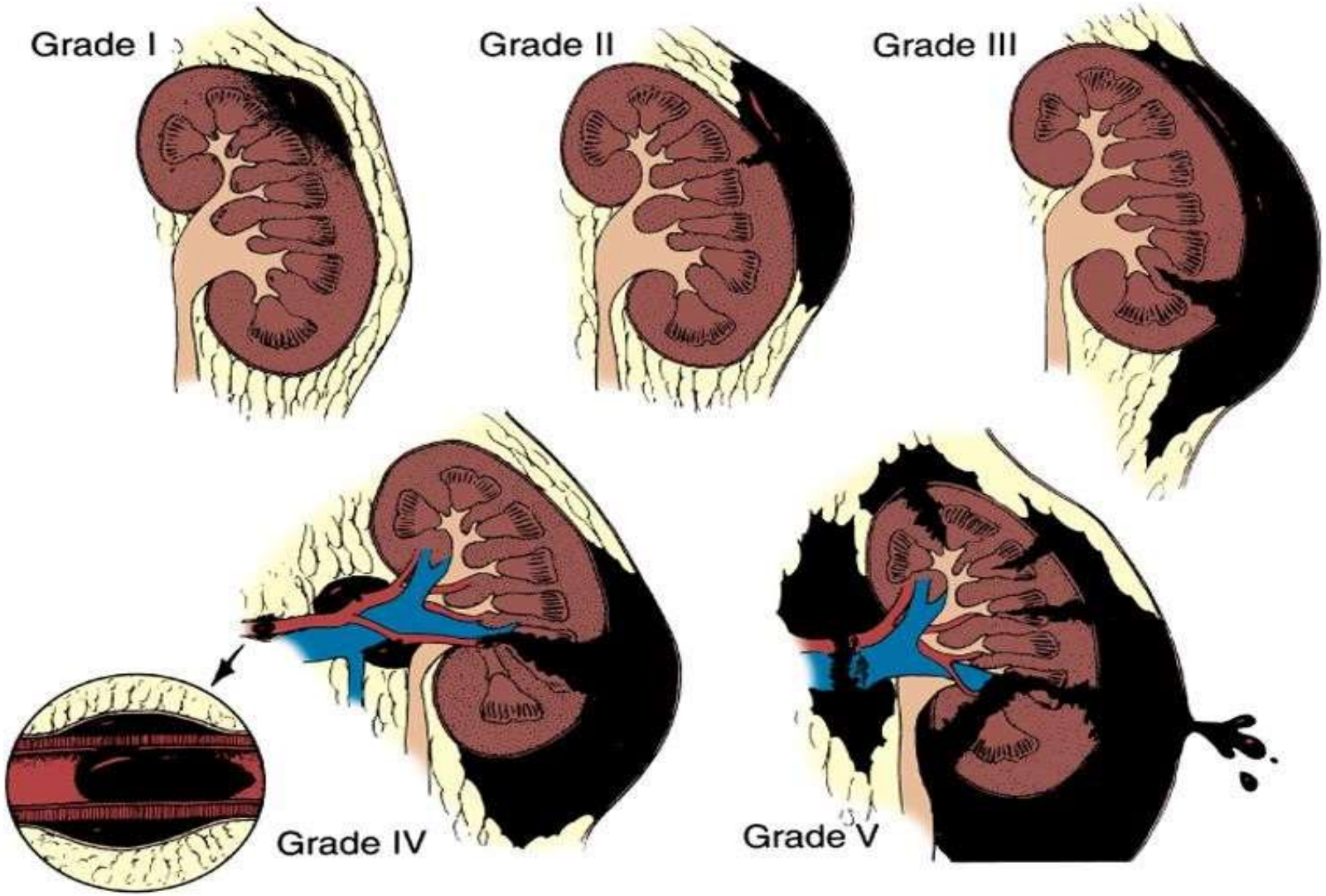
- Injury to the kidney (ie: hematoma, small lacerations) that does not enter into the urine-collecting system.
- Avulsion of vascular pedicle
- Complete avulsion of uteropelvic junction (UPJ)
- Obstruction of ureter with clot

Absence of hematuria **does not rule out injury**; may

American Association of Trauma Surgery

- **Grade I** – Contusion (normal imaging); subcapsular hematoma
- **Grade II** – Non-expanding perirenal hematoma; <1cm cortical laceration
- **Grade III** – >1cm cortical laceration (no collecting system injury)
- **Grade IV** – > 1cm laceration extending into medulla and collecting system; Artery or vein injury (controlled hemorrhage)

Renal Trauma Grading System



Evaluation of Renal Trauma

Urinalysis

- Positive in 95% of renal trauma
- Degree does not reflect severity - can be negative even if major pedicle injury

https://oxfordurgentclinic.com/what-does-a-urinalysis-test-for/

Renal Trauma: Imaging

Plain Film:

- Rib fracture
- Loss of psoas shadow
- Scoliosis - psoas spasm

CT Abdomen with contrast:

- ***Single Best study***
- Detects hematomas, lacerations, pedicle injuries, urine leaks & devascularized segments
- Best to have CT contrast with arterial and delayed (excretory) phases

Renal Trauma: Indications for Imaging

Penetrating trauma

- **Always** needs imaging

Blunt Trauma (ie: gross blood, low pressure, high-speed crash):

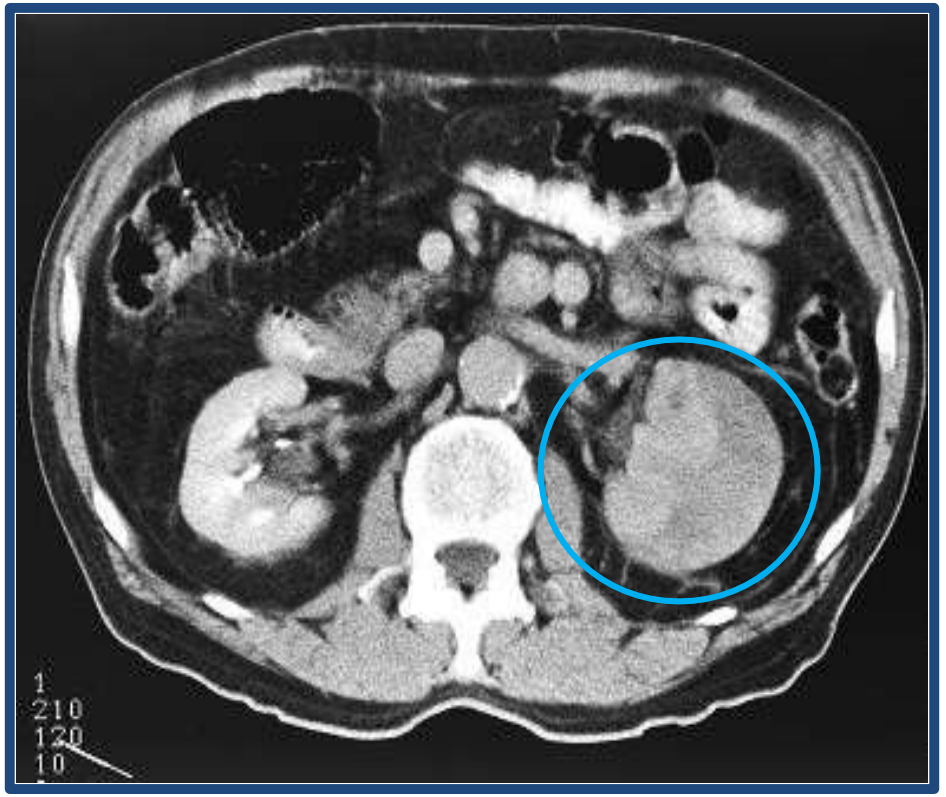
Adults

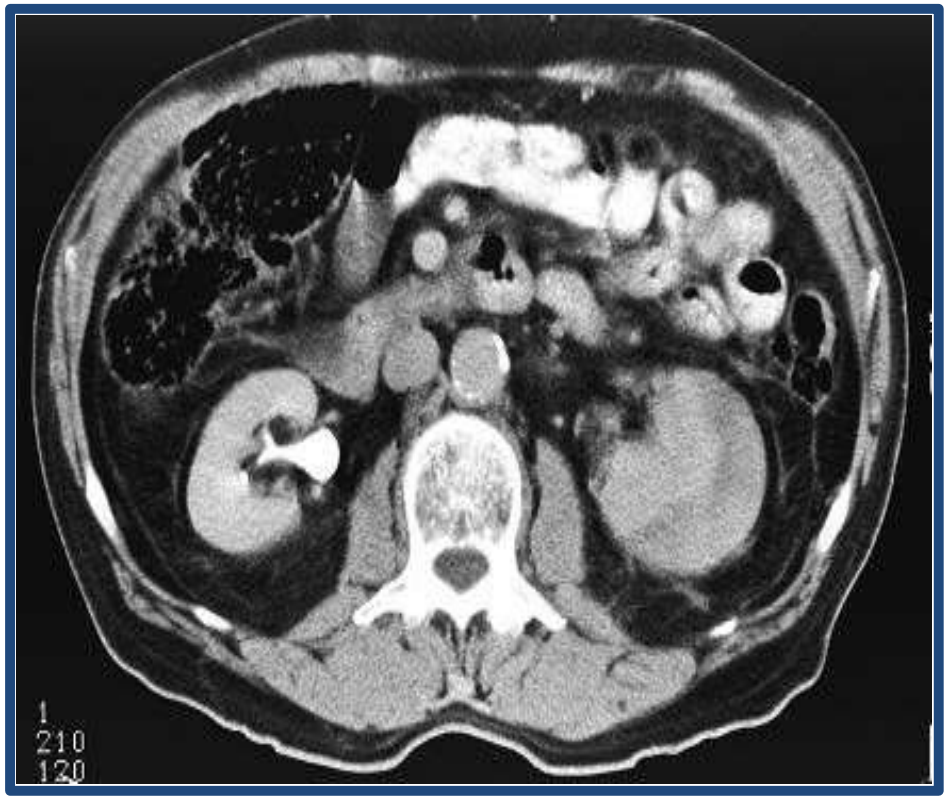
- Macroscopic (gross) hematuria
- Microscopic hematuria and hypotension (<90mmHg)
- Rapid deceleration injury

Pediatrics

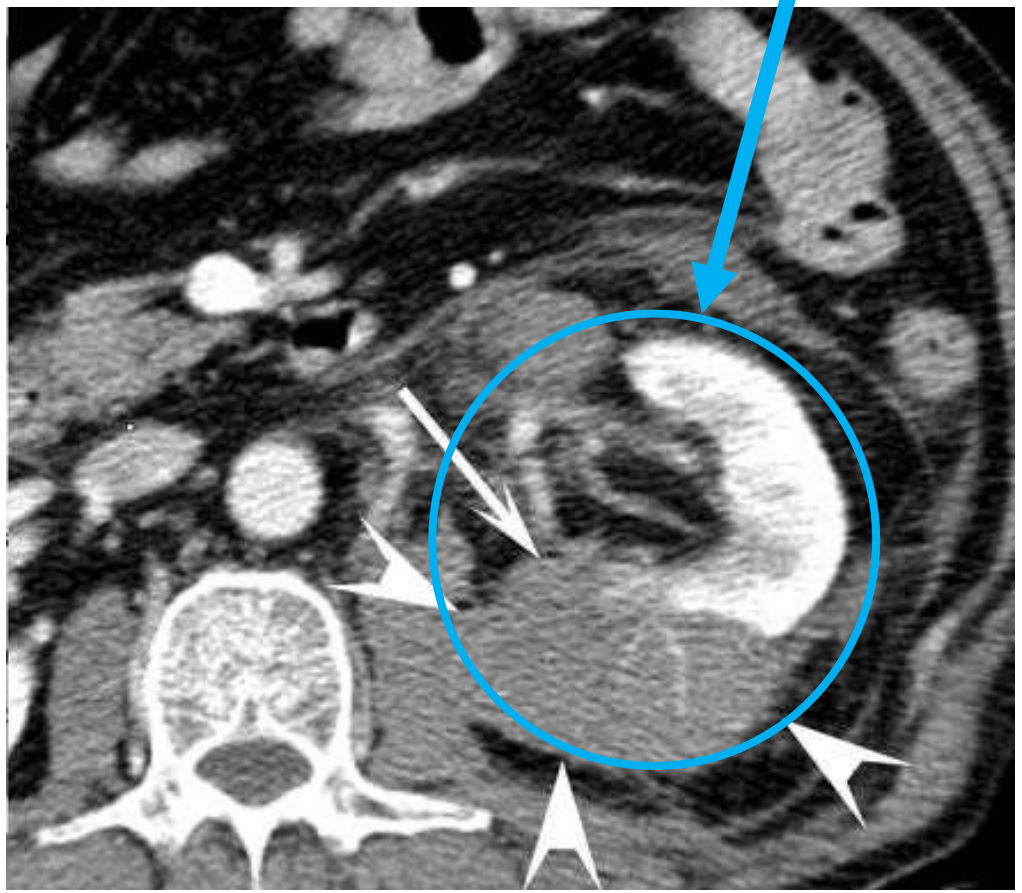
- All trauma with gross *or* microscopic

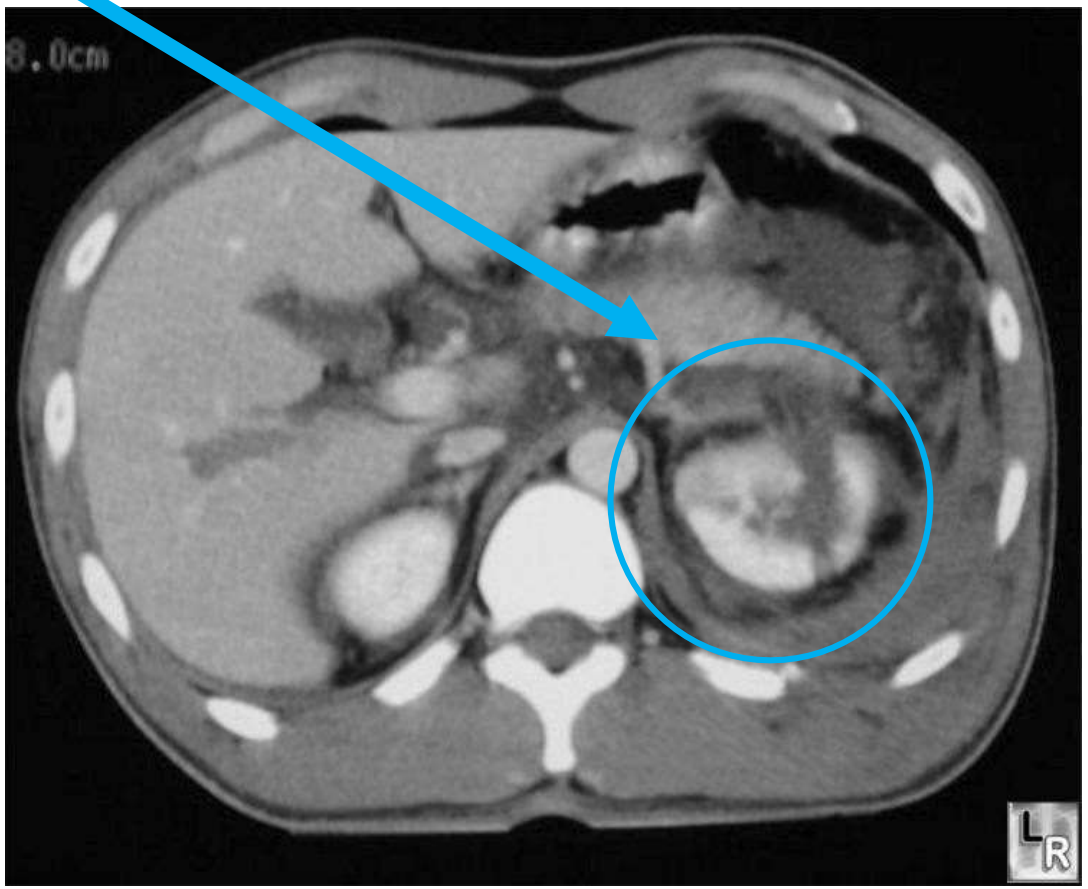
Renal Trauma - CT Abdomen: Grade I - Subcapsular Hematoma



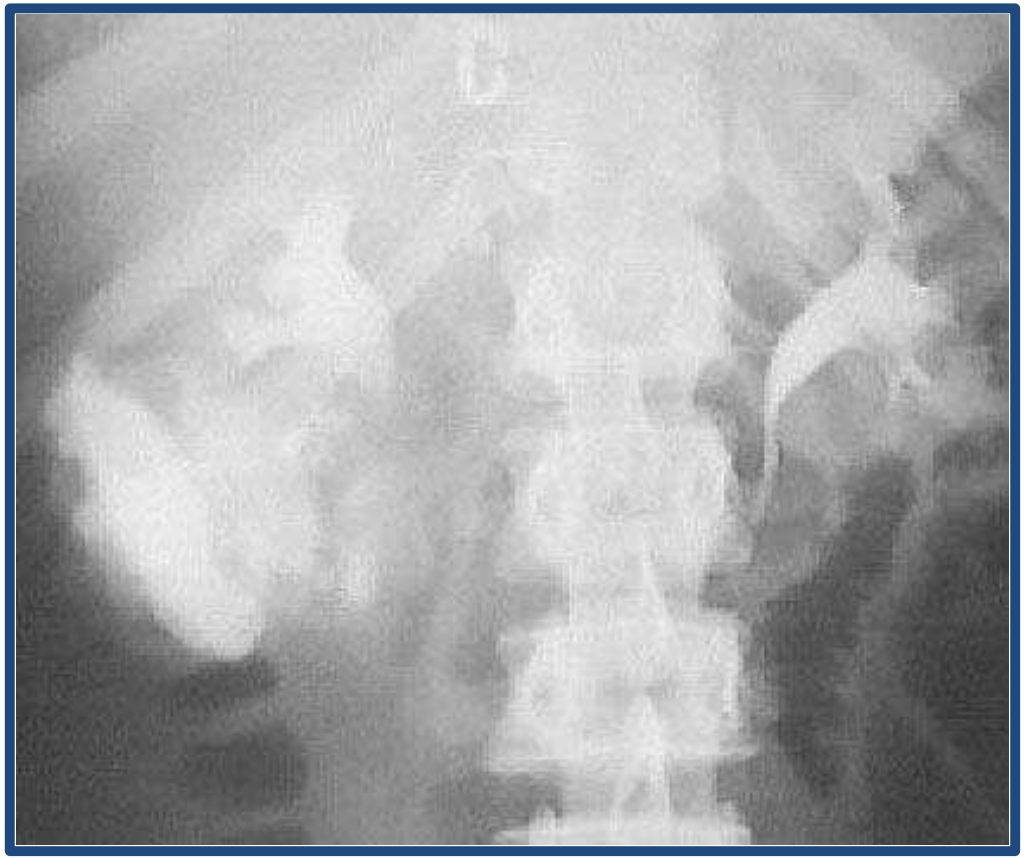


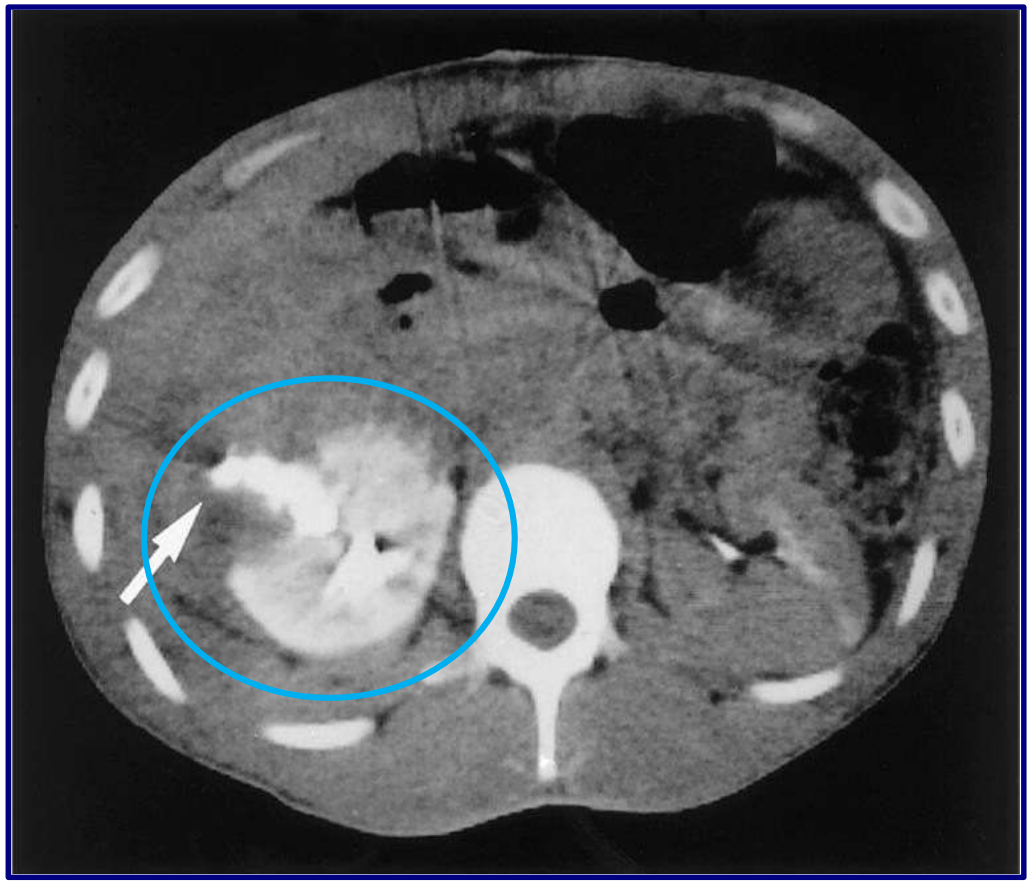
Renal Trauma - CT Abdomen: Grade II & III Laceration



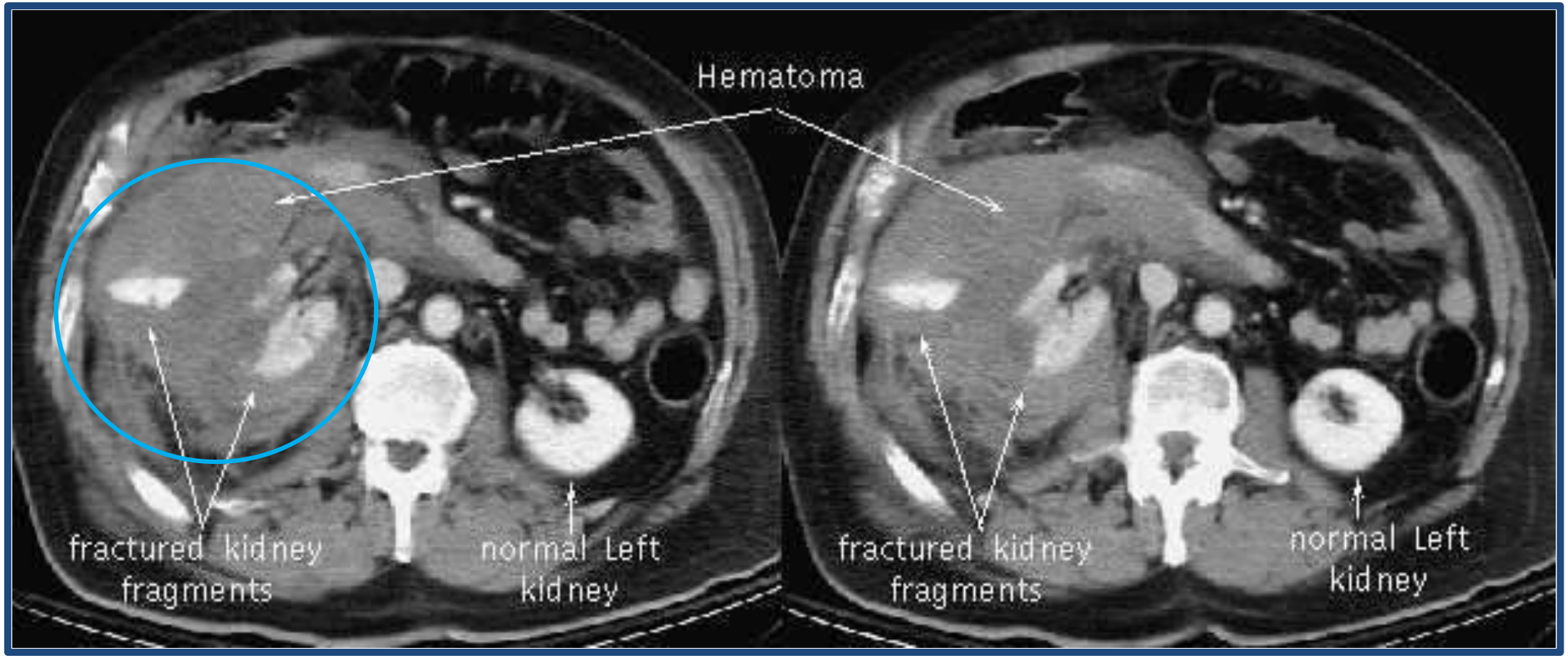


Renal Trauma – CT Abdomen
Grade IV Laceration





Renal Trauma - CT Abdomen
Grade V - Shattered Kidney



Renal Trauma – Management

The majority of injuries (especially blunt) are managed non-operatively.

If interventions needed, first line would be selective angioembolization to prevent nephrectomy

Operative Intervention

Absolute Indications:

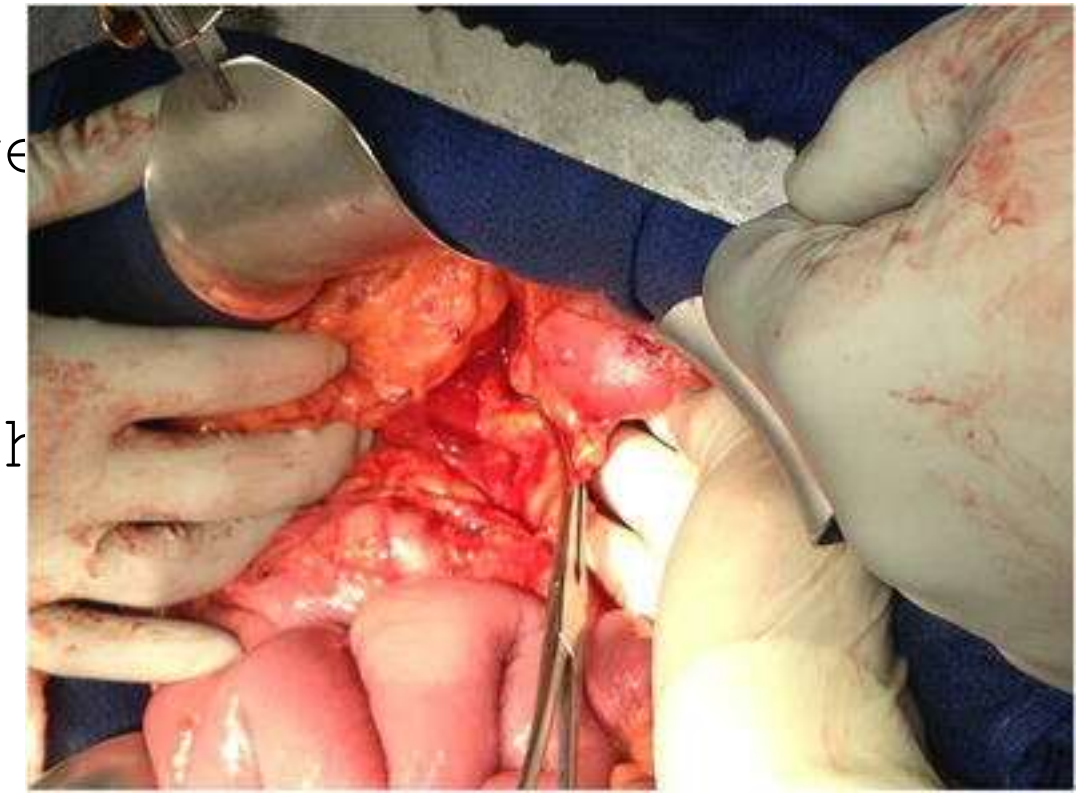
- Uncontrolled bleeding
- Unstable patient (hypotension)
- Expanding RP hematoma during concurrent laparotomy
- Major renal artery injury

Relative Indications:

- Renovascular injury
- Large amounts of nonviable parenchyma
- Major urine leaks

Renal Trauma: Operative Exploration

- Usually performed in the case of multisystem injury, or not stable enough to have maging
- Midline laparotomy
- Allows for inspection of oth organ systems
- Goals:
  - Damage control
  - Stop bleeding
  - Control urine leak



https://www.researchgate.net/figure/Exploratory-laparotomy-of-a-patient-with-left-kidney-trauma-showing-primary-renal-pedicle_fig2_320692753

Renal Trauma: Complications

- Early Complications:
  - Delayed bleeding
  - Urinoma
  - Abscess
- Late Complications:
  - Hypertension
  - Arteriovenous fistula
  - Renal failure

Renal Trauma: Summary

- Most common GU organ injured in trauma
- Found in ~ 10% of abdominal trauma
- Hematuria is the cardinal symptom
- 90% blunt
- Greatest determinant of mortality is severity of concurrent injuries
- Accurate staging (CT) is very important
- In patients with blunt trauma and in certain cases o f penetrating trauma, a progressive trend is towards

Ureteral Trauma

Ureteral Trauma

Least commonly injured part of GU tract

- Small and mobile
- <1% of GU injuries

Etiology:

- External trauma (<1% have ureter injury)
- Iatrogenic Trauma (gynecology, vascular surgery, general surgery...)

Diagnosing Ureteral Trauma

Hematuria:

- Occurs in 90% of external trauma
- Only in 10% of iatrogenic injury

CT with contrast with delayed phase films is preferred for diagnosing ureteral injuries

Retrograde pyelogram can be used intraoperatively or if diagnosis remains unclear

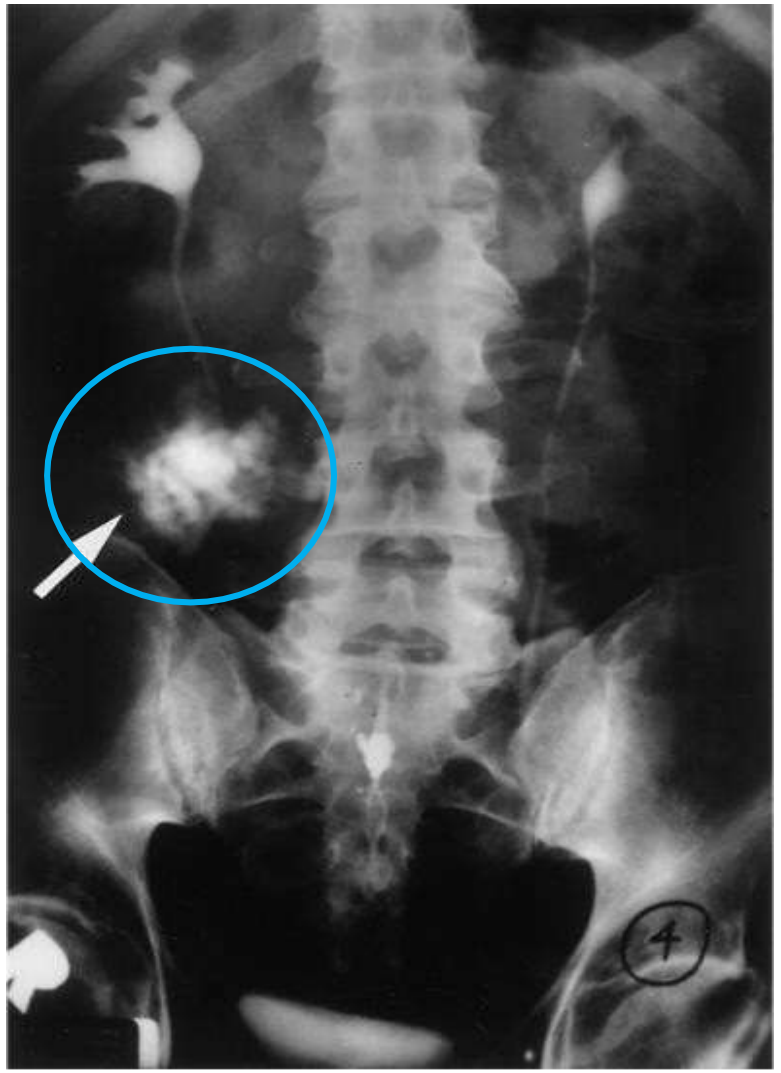
Direct inspection during laparotomy is the best diagnostic tool, but must exercise a high index of suspicion

Classifying Ureteral Trauma

- **Mechanism**
  - Blunt
  - Penetrating
- **Level of Injury**
  - Proximal, Mid, Distal
- **Time of Recognition**
  - Early
  - Delayed

Ureteral Trauma

- Ureteral stricture
- Urine leak, urinoma
- Pyelonephritis



Bladder Trauma

Bladder Trauma – Mechanism of Injury

- 80% of injuries have associated pelvic fracture
- ~10% of pelvic fractures have bladder injury
- **Blunt Trauma (80%)**
  - 90% associated with MVC
- **Penetrating (20%)**
  - Iatrogenic
  - Gunshots

Bladder Trauma – Signs and Symptoms

- **Gross hematuria (>95%)**
- Associated Injuries/Mechanism
  - Pelvic fracture
  - Rapid deceleration
- Lower abdominal pain (62%)
- Rectal & vaginal exam important

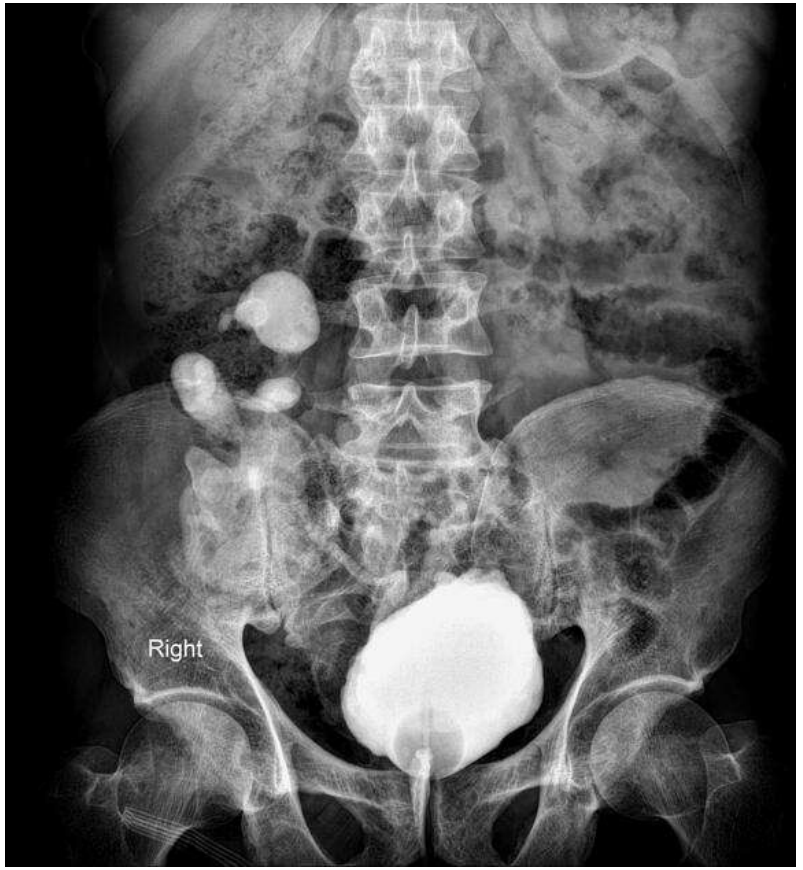
Bladder Trauma – Diagnosis

A cystogram is the most important test

- Indications:
  - Gross hematuria
  - Multiple organ injuries & pelvic fractures with microscopic hematuria
- Not microscopic hematuria alone

Bladder Trauma – Standard Cystogram

- **Consider retrograde urethrogram (RUG)**
  - 10-20% have concurrent urethral injury
- Minimum 300mL gravity filled contrast
- Views
  - Plain film
  - Stress cystogram (anteroposterior & oblique)



https://radiopaedia.org/articles/cystography-1

Bladder Trauma – CT Cystogram

- CT abdomen/pelvis before & after bladder contrast
- Look for:
  - New or increasing extraperitoneal contrast
  - New extraluminal contrast surrounding bowel loops or in paracolic gutters
- At least as good as (likely better) than standard cystogram

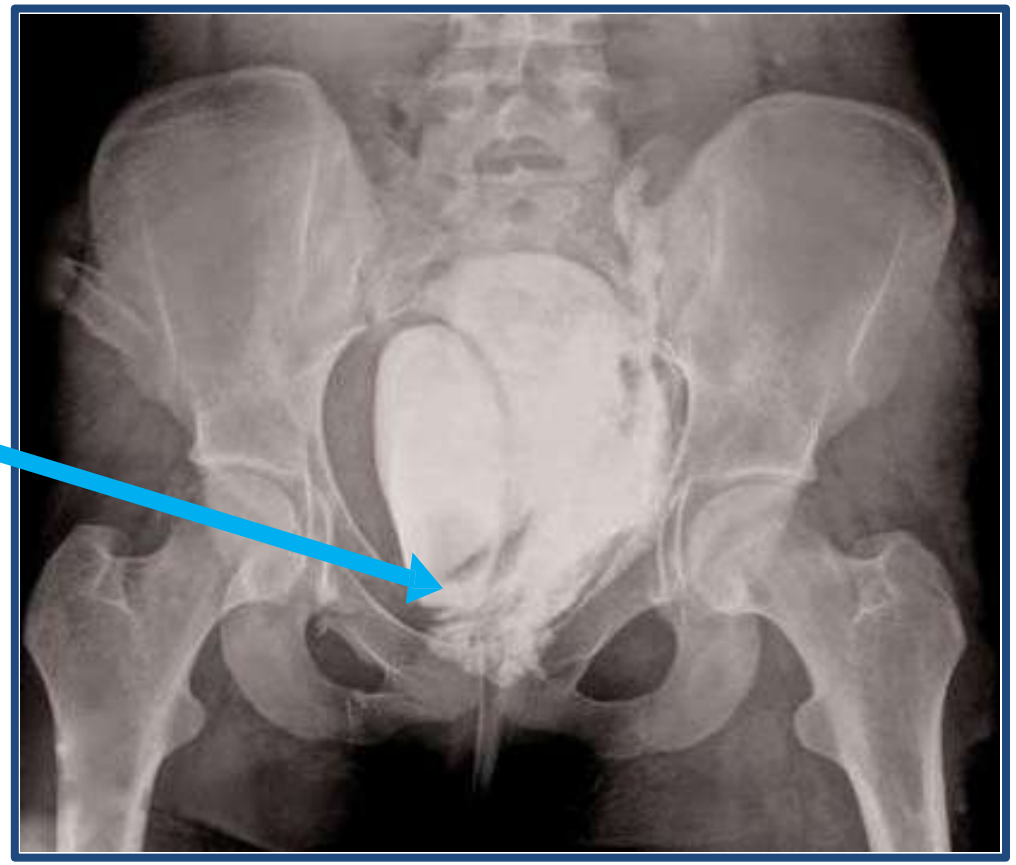
Classifying Bladder Trauma

Based on cystogram

- Blunt Trauma
  - Contusion
  - Intraperitoneal Rupture
  - Extraperitoneal Rupture
  - Intra & Extraperitoneal
- Penetrating Trauma

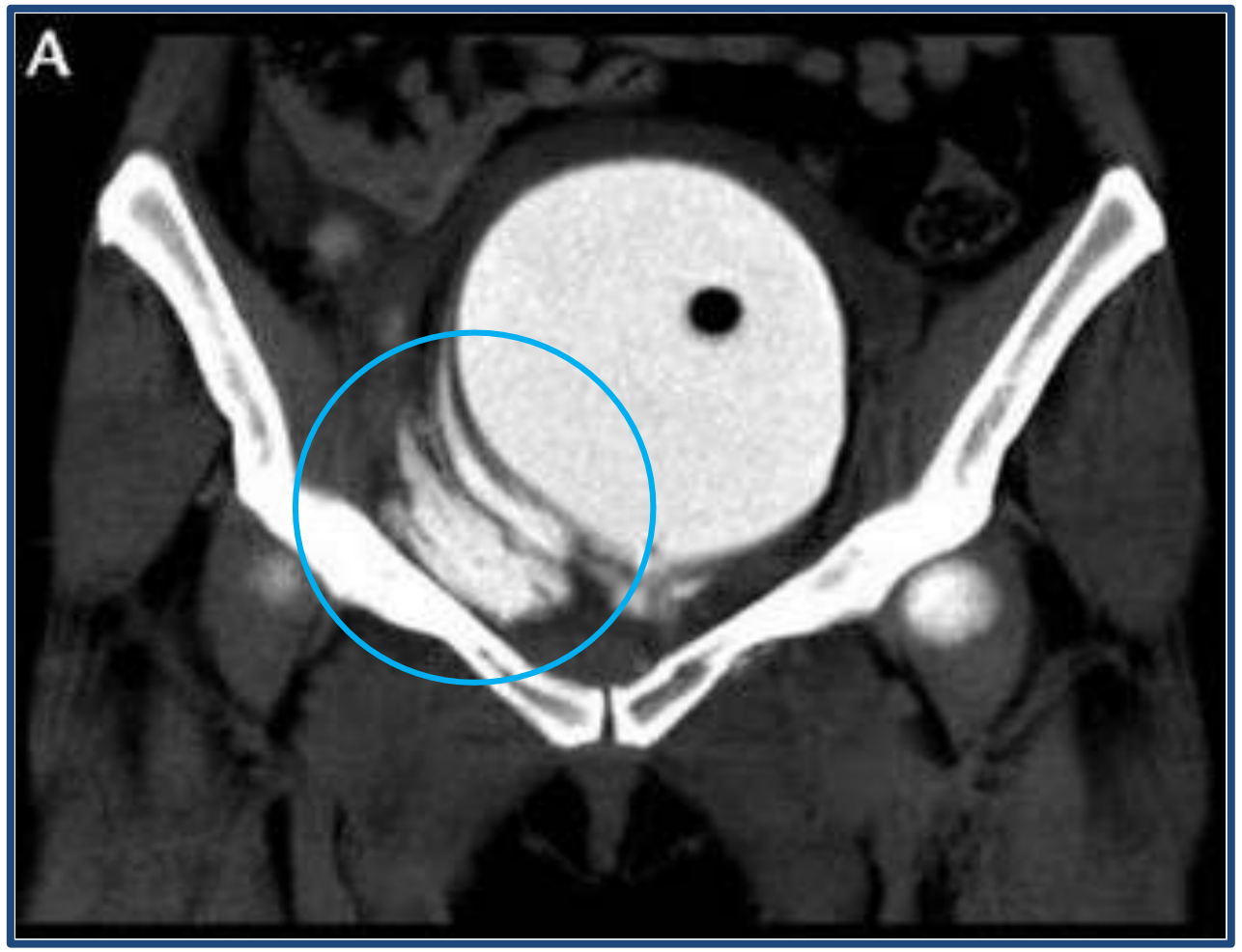
Blunt Trauma: Extraperitoneal Rupture

- More common - 60%
- Extravasation through retroperitoneum
- Less severe pain
- "Flame" shaped collection around bladder base
- Pelvic hematoma effect



CT Cystogram – Extraperitoneal Rupture

- Extravasated contrast in the space of Retzius

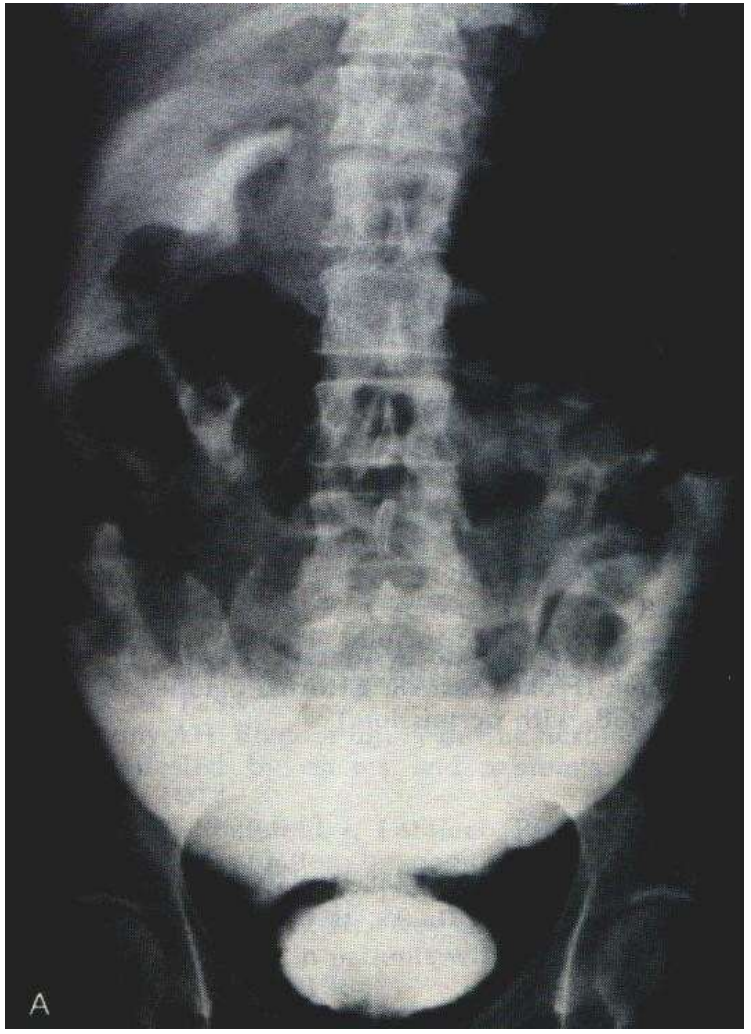


Extraperitoneal Rupture – Treatment

- LARGE catheter drainage for 10days
  - Injury is contained, sealed off and heals readily with catheter alone
- Prophylactic antibiotics
- Cystogram prior to catheter removal
- Open repair if:
  - Laparotomy for concurrent injuries
  - Laceration of bladder neck, vagina or rectum

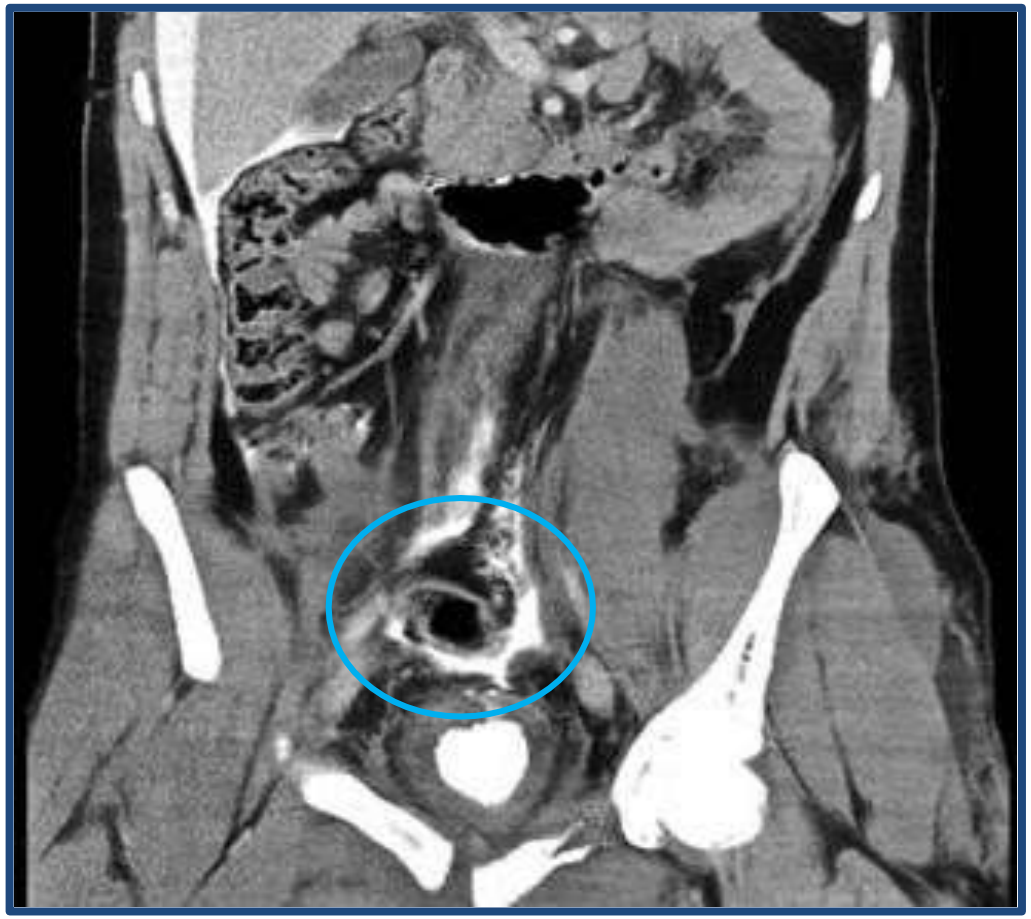
Blunt Trauma – Intraperitoneal Rupture

- Less common – 30%
- Rapid rise in pressure
  - When a full bladder is rapidly compressed (ie: MVC)
- Ruptures at dome (weakest point)
- Outlined bowel loops
- Filling cul-de-sac & paracoloic gutters



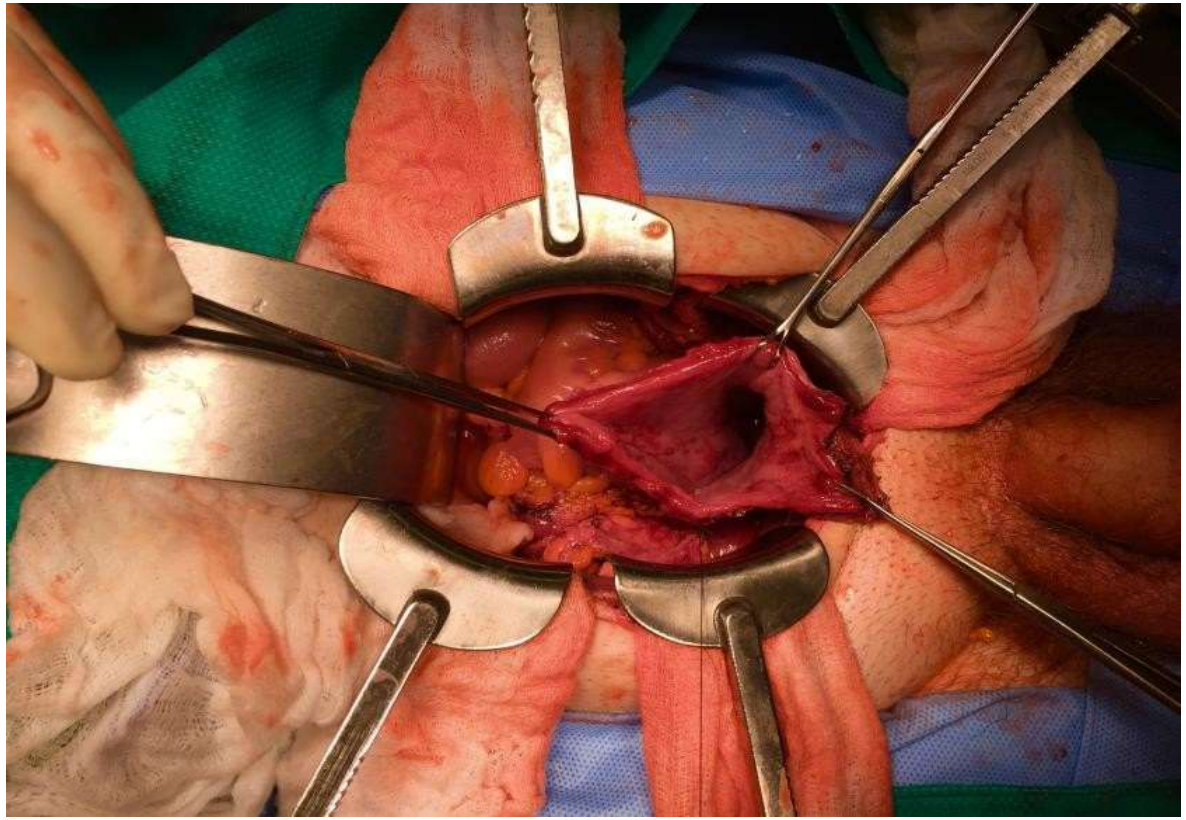
CT Cystogram – Intraperitoneal Rupture

- Extravasated contrast at bladder dome



Treatment – Intraperitoneal Rupture

- Formal operative repair
- Antibiotics
- Bladder explored
- Two-layer closure
- Catheter (two weeks)



Treatment – Penetrating Trauma

- Explore emergently
- Debridement of devitalized tissue
- 29% associated ureteral injuries
- Drain
- BIG Catheter drainage

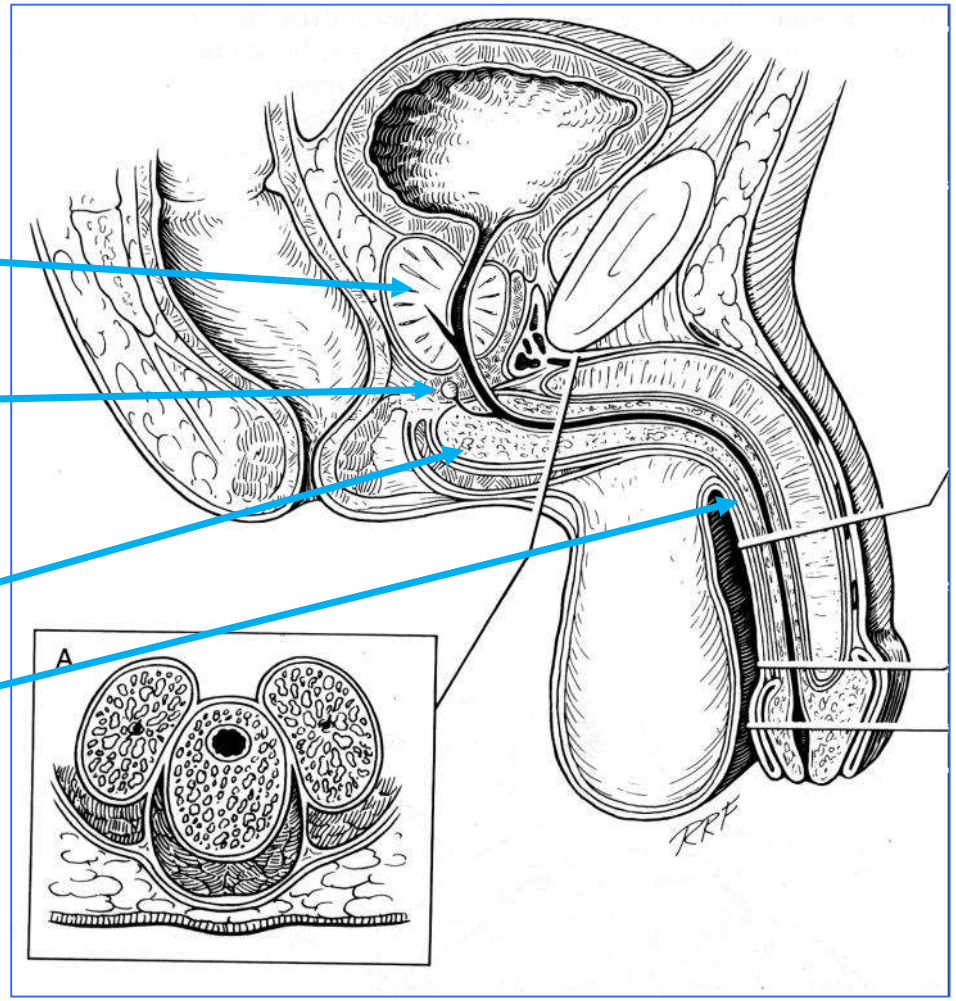
Bladder Trauma – Summary

- Bladder heals well if drained with catheter
- Suspect injury if hematuria and/or pelvic fracture
- Do cystogram to confirm diagnosis
- Extraperitoneal - Conservative Tx
- Intraperitoneal – Formal operative repair

Urethral Trauma

Anatomy – The Urethra

- **Posterior**
  - Prostatic Urethra
  - Membranous Urethra
- **Anterior**
  - Bulbous Urethra
  - Penile Urethra

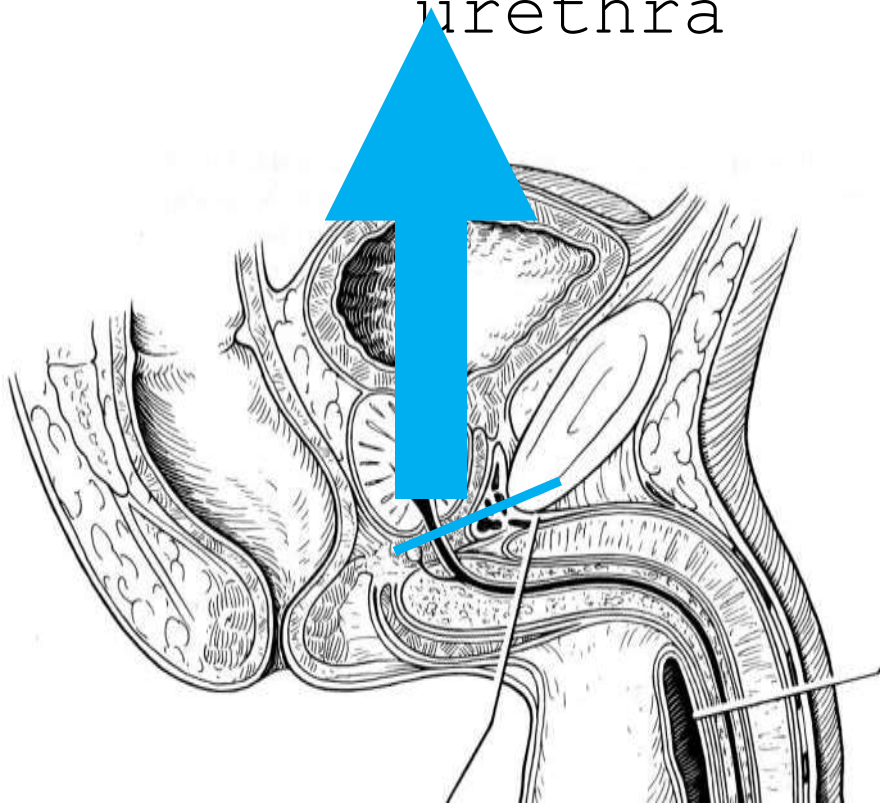


Posterior Urethral Trauma – Epidemiology

- **Occurs with pelvic fractures (ie: crush injuries)**
- **MVA (90%)**
- **5% of all pelvic fractures**
- **Mostly in males (90%) due to anatomical differences**
- **Signs & Symptoms**
  1) Inability to urinate
  2) Blood at urethral meatus
  3) Gross hematuria
  4) Perineal swelling/hematoma

Posterior Urethral Distraction

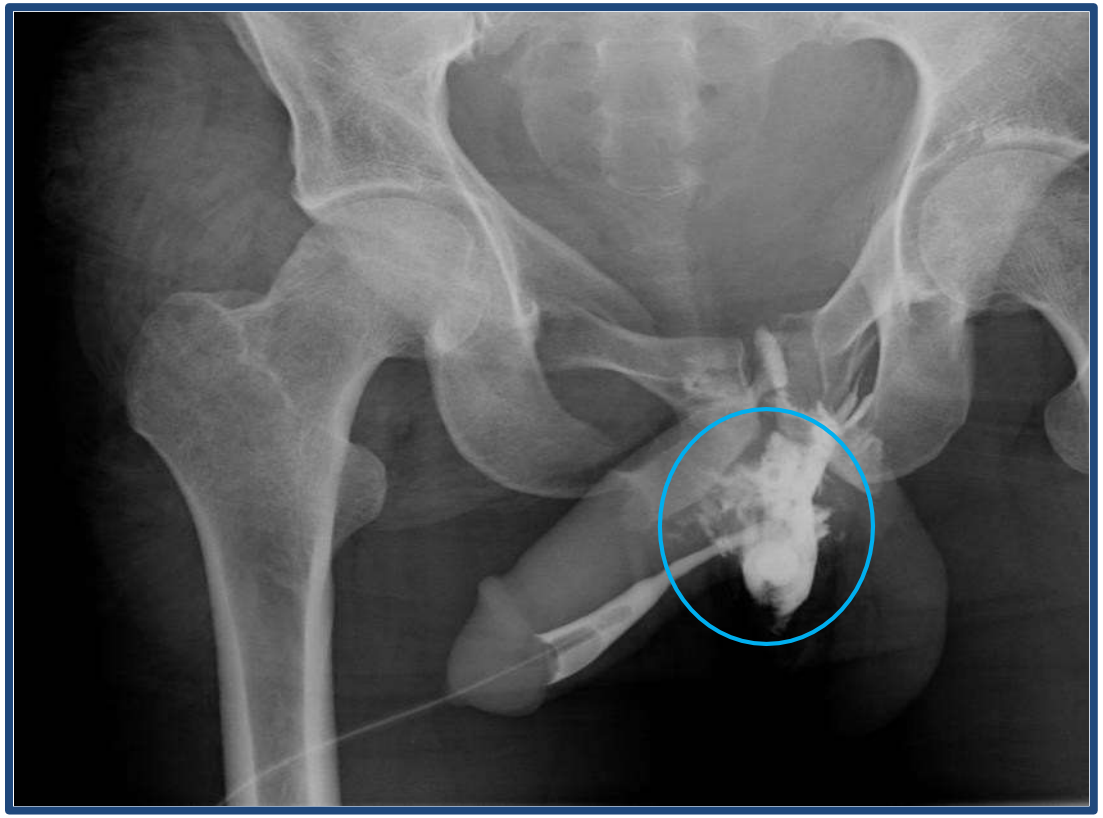
Mechanism: Displacement at membranous urethra



Posterior Urethral Trauma – Diagnosis

Retrograde Urethrogram (RUG)

- Foley 2-3cm into distal urethra
- 1-2mL balloon inflation
- 25 to 35 degree oblique position
- Injection 25-30mL contrast

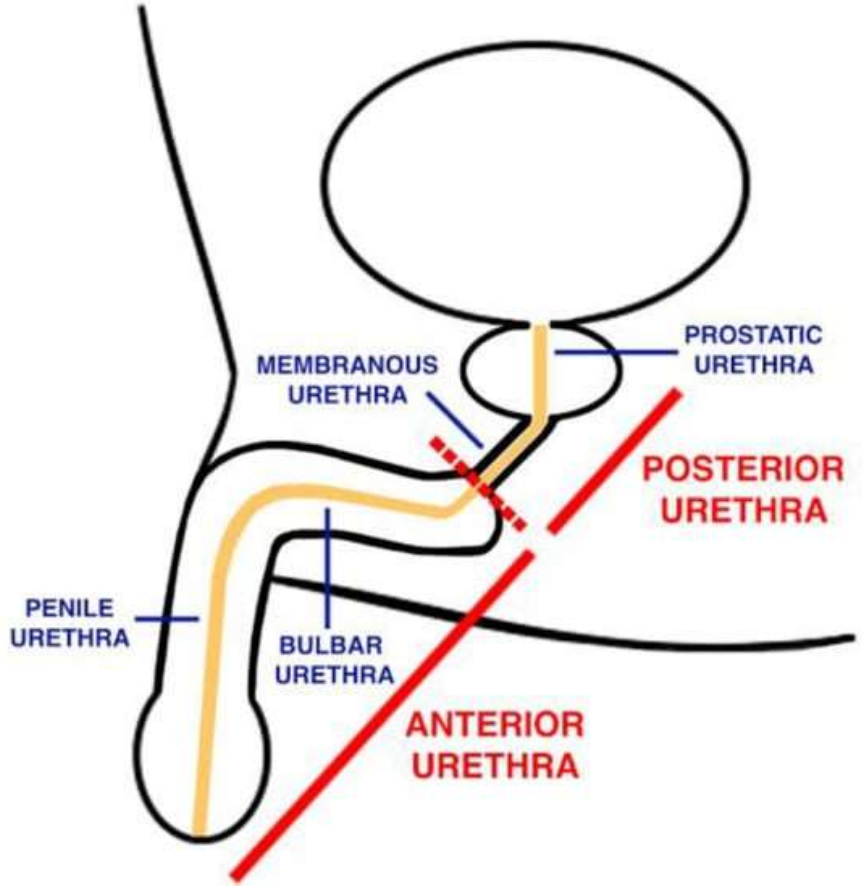


Posterior Urethral Trauma – Complications

- Abscess
- Stricture
- Incontinence
- Erectile dysfunction

Anterior Urethral Trauma

- 10% of lower GU trauma
- More common than posterior injuries
- Usually bulbous urethra
- Etiology:
  - Straddle injury
  - Catheter misadventures



Anterior Urethral Trauma – Diagnosis

- Blood at meatus
- If confined to Buck's fascia
  - "Sleeve of penis" injury
- If not contained within Buck's fascia
  - "Butterfly pattern" on perineum

Urethral Trauma – Summary

- Posterior urethral injuries
  - Pelvic fractures
- Anterior urethral injuries (more common)
  - Straddle injuries, catheter trauma

External Genital Trauma – **URGENT**

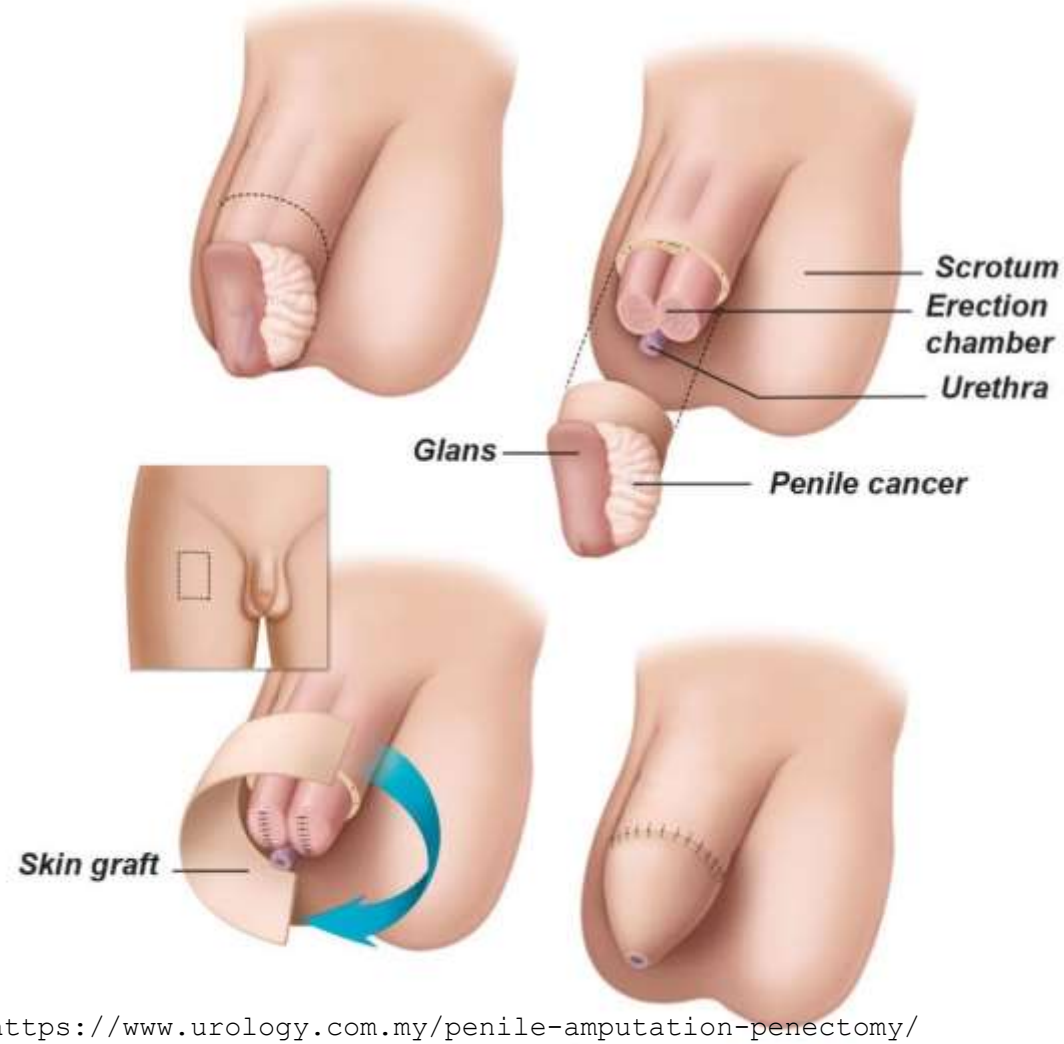
Genital Trauma

1) Penile Amputation

2) Penile Fracture

3) Testicular Fracture

Penile Amputation

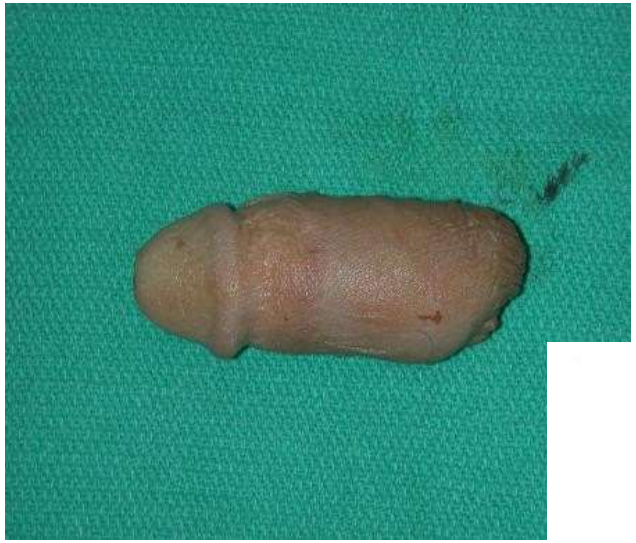


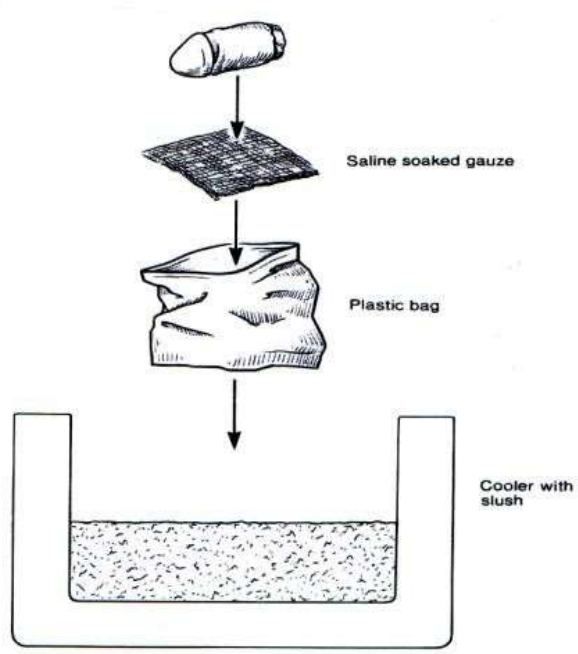
https://www.urology.com.my/penile-amputation-penectomy/

https://casereports.bmj.com/content/13/6/e234964

Penile Amputation

- Complete or partial severing of the penis.
- Complete = severing of both corpora cavernosa and the urethra
- Usually caused by self-infliction, accidents, circumcision, assault and animal attacks
- **Immediate treatment:**
  - Place on ice (in a bag)
- **Microsurgical reimplantation (up to 24 hours)**





https://doi.org/10.1016/j.ijscr.2021.10635

Penile Fracture

Disruption of both laminas of the tunica albuginea

Mechanism

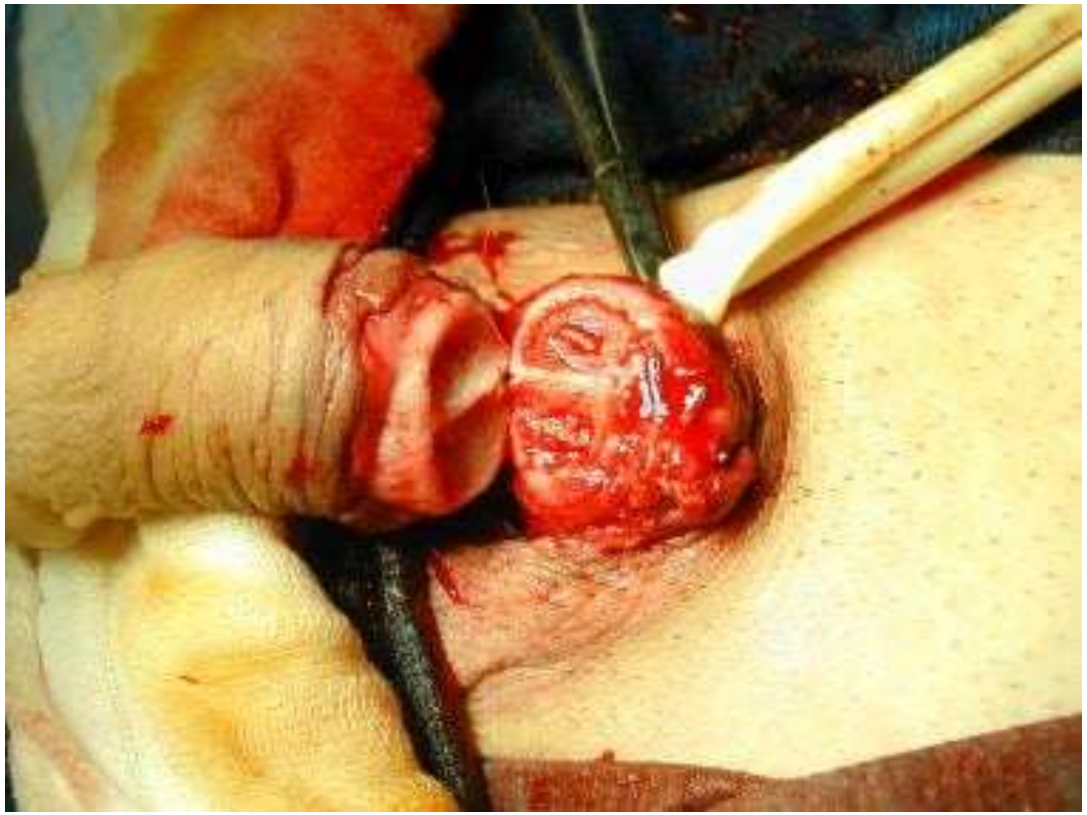
- Vigorous intercourse (58%
- "Abnormal" bending

Clinical Findings

- Audible "snap"
- Pain, immediate detumesce
- Rapid swelling, displacement
- Blood at urethral meatus (urethral injury)

Penile Fracture – Treatment

- Surgical exploration is the preferred option
- Primary repair of corporal defect
- Mandatory repair of urethral injury (if present)



https://emedicine.medscape.com/article/456305-treatment

Testicular Fracture

- Disruption of the tunica albuginea of the testicle
- High velocity injury
- Acute swelling, tenderness
- Ultrasound
  - Scrotal exploration if testicle not definitely intact