

GENITOURINARY TRAUMA

Of all the injuries to the genitourinary system, only major *renovascular* injuries or a severely *shattered kidney* lead to rapid death.....

Genitourinary trauma is frequently a covert entity but occurs in up to 10% of all multi-trauma patients. Unfortunately these injuries are often overlooked and can result (long-term) in renal insufficiency, chronic hypertension, incontinence and sexual dysfunction.

Definitions.

- Often divided into *lower tract* (bladder or urethral injury), *upper tract* (renal or ureteral injury) or *external genitalia* (penile, scrotal, testicular & vulval injury).
- Each is subdivided into *blunt* vs *penetrating*.

Clinical Features.

Signs & symptoms of genitourinary trauma are varied & non-specific.

Physical Examination.

- Torso & pelvis examination/inspection on secondary survey is usually the first step.
- Tenderness.
 - raises possibility of *bladder rupture* (significantly more likely in the presence of a pelvic fracture).
- Inspection of genitalia.
 - Haematoma or ecchymoses @ penile shaft, scrotal skin or perineum.
 - Gross blood at urethral meatus is suggestive of *urethral injury*.
 - Catheterisation can convert a partial urethral tear into a complete disruption.
 - Vagina / vulva = ?lacerations or haematoma.
 - Urethral injuries more difficult to diagnose in women
 - PR examination.
 - ?gross blood
 - bowel wall integrity
 - prostate position (?high-riding position).

Foley Catheter.

- Upon passage of a catheter, the presence of gross haematuria indicated urological injury (usually a lower-tract injury).
- DDx = rhabdomyolysis

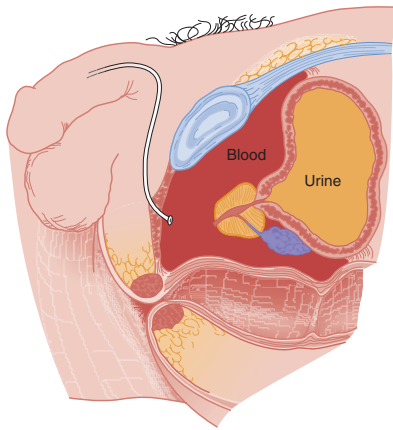
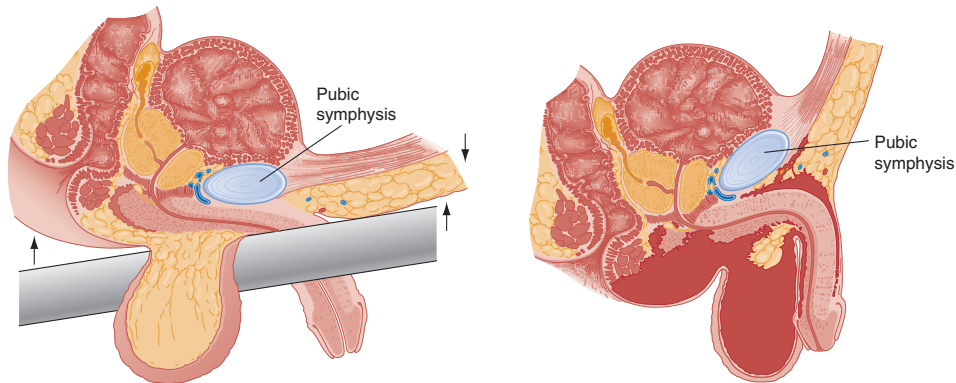
Lower Urinary Tract (Urethral Trauma).

Anatomy.

- The urogenital diaphragm divides the urethra into anterior (bulbous & pendulous) & posterior (membranous & prostatic).
 - Injuries to anterior & posterior urethra involve different mechanisms & have different symptoms.
- Prostatic urethra attached to posterior pubic symphysis by puboprostatic ligaments.

Pathophysiology.

- *Urethral disruption* is the most significant injury that must be identified.
- Anterior injuries usually result from:
 - Straddle injuries, falls, GSWs & self-instrumentation.



Pelvic fractures account for most posterior urethral injuries.

Usually involve ischiopubic rami.

Straddle-fractures & *Malgaigne* fractures are high-risk fractures.

Clinical Features.

- Direct inspection for penile, scrotal or perineal haematoma as well as blood at urethral meatus.
- Absence of these findings permits safe passage of a Foley-catheter.

Diagnostic Strategies.

Catheter Placement.

- If resistance to passage occurs in a male with features of urethral injury, then *retrograde urethrogram* should be organised.
- Successful passage precludes a complete urethral disruption (but not partial injury).

Radiology.

- Retrograde urethrogram is diagnostic procedure of choice (but is not an emergency).
 - Extravasation w/ evidence of bladder filling = partial injury
 - Absent contrast within bladder = complete disruption.

Management.

- Partial urethral disruption allows for *one careful attempt* of Foley passage.
- *Suprapubic catheter insertion* is indicated for:
 - failure to insert Foley w/ partial tear
 - complete urethral disruption.
- Definitive treatment remains controversial amongst the urological literature.
 - Stenting, open or endoscopic repair are all options.
- Females with proximal urethral injuries require immediate surgical exploration & repair
 - Delays lead to fistula formation & strictures.

Lower Urinary Tract (Bladder Trauma).

Anatomy.

- The empty bladder lies within the bony pelvis, when full can extend to the umbilicus.
- Blood supply via *internal iliac artery & vein*. Nerve supply via *lumbar & sacral plexus*.

Pathophysiology.

- Over 2/3 of bladder injuries result from blunt trauma.
 - 90% from MVAs (compression from lap-belt).
 - 80% associated w/ pelvic fractures.
- Bladder injuries can be classified as:
 - Contusions
 - Intraperitoneal ruptures
 - Extraperitoneal ruptures (or combination of both).

Clinical Features.

- Lower abdominal pain / suprapubic pain & inability to urinate.
- Blood at urethral meatus.

Diagnostic Strategies.

Laboratory Tests.

- Gross haematuria is a cardinal sign of bladder injury.
- Microscopic haematuria w/ pelvic fracture = investigate further for bladder injury.

Radiology.

- Conventional retrograde cystography & retrograde CT cystography are main investigations utilised.
- *Conventional Retrograde Cystography.*

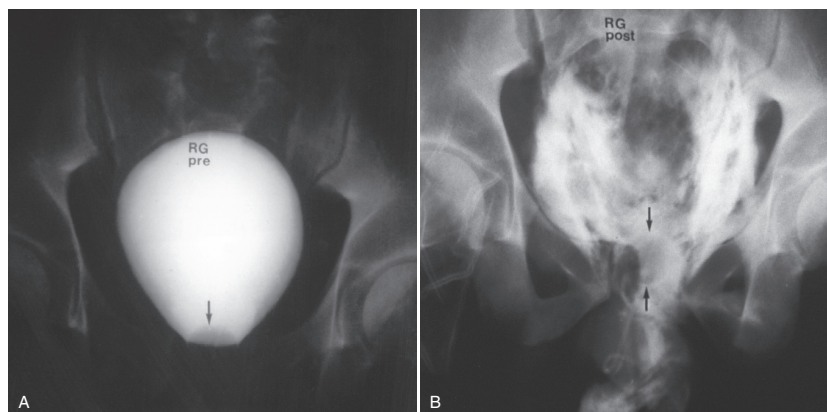


Figure 44-14. Retrograde cystogram. A, Film of filled bladder. B, Postevacuation film showing extensive extraperitoneal extravasation. Arrows point to the Foley catheter balloon.

- Often a post-contrast lateral film will be used (as well as the AP) to diagnose a posterior bladder wall or extraperitoneal extravasation.
 - Extraperitoneal perforation = contrast is in the area of pubic symphysis & pelvic outlet.
 - Intraperitoneal perforation = contrast outlines intraperitoneal structures (bowel loops, liver, spleen).
- *CT-Retrograde Cystogram.*
 - Obtains the same anatomical information as traditional cystography.



* Intraperitoneal bladder perforation

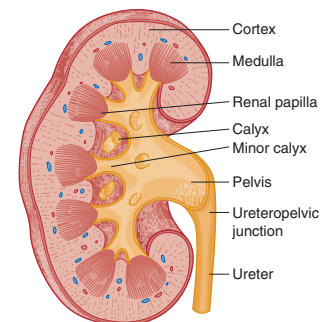
Management.

- Contusions are managed expectantly.
- Most uncomplicated extraperitoneal bladder ruptures heal spontaneously with catheterisation alone.
 - Surgical repair required with concomitant injury to rectum, vagina or bladder neck.
- Intraperitoneal rupture requires surgical repair (high risk for peritonitis).
- *NB. bladder repairs are never urgent !*

Upper Tract (Renal Trauma).

Perspective & Complications.

- Rarely occurs in isolation.
- Only responsible for ~ 0.1% of trauma related deaths.
- Urinary extravasation is the most common complication.
- Incidence of post-traumatic hypertension is controversial. (0.2 to 55% !!!)



Anatomy & Physiology.

- Located in retroperitoneal space, the kidneys are surrounded by adipose tissue & connective tissue.
- They lie along the lower 2 thoracic vertebrae & first 4 lumbar vertebrae.
- Cortex, medulla, papilla, calyx (minor and major), pelvis.
- Blood flow = 1200mL / min (20-25% of cardiac output).

Epidemiology & Pathophysiology.

- Rapid deceleration, displacement & explosion type injuries.
- Penetrating injuries carry a higher rate of nephrectomy.
- Renal vein injuries are common.
- Vascular injuries commonly occur with rapid deceleration (vessel avulsion).
 - Result in haemodynamic instability (venous >> arterial, due to protective vasoconstriction within renal artery).

Diagnostic Strategies.

Laboratory.

- Haematuria - degree of blood does not correlate with severity of renal injury.

A clinically significant blunt renal injury can be predicted by;

- gross haematuria
- microscopic haematuria with shock (systolic BP < 90 mmHg).
- sudden deceleration injury (w/out haematuria or shock).

Radiology.

- *Computed Tomography:*

- Diagnostic tool of choice.
- Detects contusions, lacerations, pedicle injuries, devitalised segments & urinary extravasation.
- Allows grading of injuries & assessment of non-urological injuries.

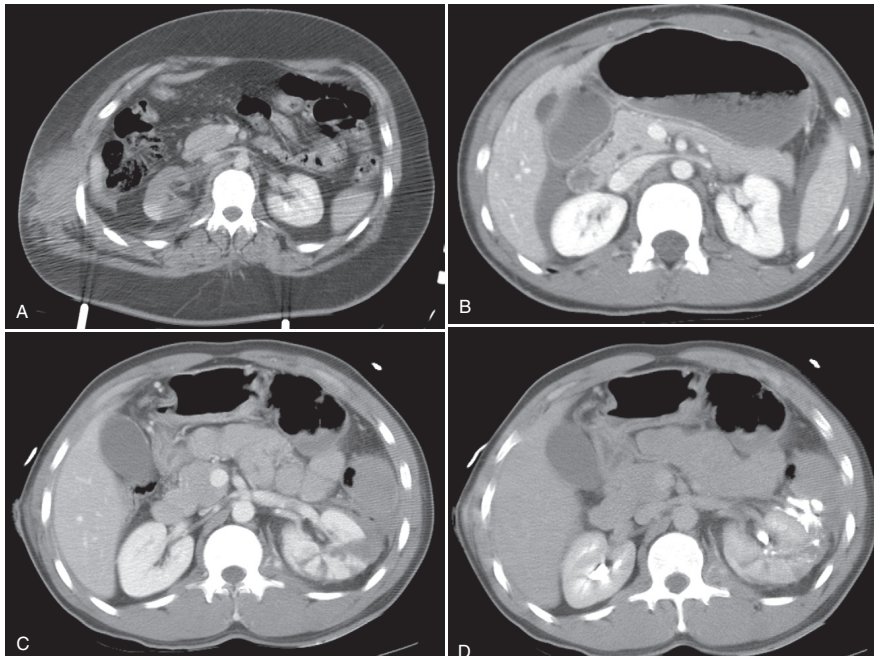


Figure 44-20. **A**, Renal artery injury. The right kidney demonstrates almost complete acute devascularization. (Note the right flank hematoma.) **B**, Subcapsular hematoma. Deforming renal parenchyma on the left. **C** and **D**, Renal laceration. These two images are of the same patient separated by several minutes of delay. The wedge-shaped hypodensities in the left kidney on the first scan (**C**) indicate the lacerations. The delayed scan (**D**) shows extravasation of contrast material from the lacerated kidney.

- *Angiography.*
 - An adjunct for suspected renovascular injury.
 - eg. ?thrombosis, laceration or pseudoaneurysm.
 - Allows stenting or embolisation as required.
- *Intravenous Pyelography.*
 - less accurate than CT / time consuming / labor-intensive
- *Ultrasound.*
 - Not sensitive enough to rule-out renal trauma.
 - Helpful for ruling in/out free-fluid.
 - **NB. no free-fluid detectable in 65% of isolated renal injuries.**

Management.

• **Blunt Injury.**

- Adults w/ no shock, gross haematuria or significant deceleration = *discharge* !!
- Kids w/ no significant deceleration, gross haematuria or microhaematuria (< 50 RBCs / high-power field) = *discharge home* !!
- Further management depends on type & severity of injury.
 - Grades I to V.
 - ~0% of Grade I's need surgery
 - Up to 93% of Grade V's need surgery.
- Immediate surgery for life-threatening haemorrhage.
 - Nephrectomy often required for > 2-3 hours of renal ischaemic time or after main artery injury.

• **Penetrating Injury.**

- Presence or absence of haematuria is of no consequence in predicting injury.
- Location of injury is most important determinant for investigation.
- The majority of injuries require surgical intervention.

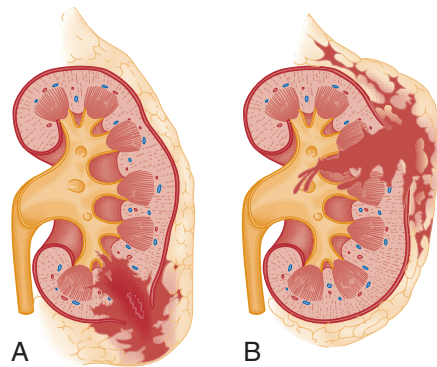


Figure 44-21. Major renal lacerations. **A**, Deep medullary laceration. **B**, Laceration into collecting system. (From Nicolaisen GS, et al: Renal trauma: Re-evaluation of the indications for radiographic assessment. J Urol 133:183, 1985.)

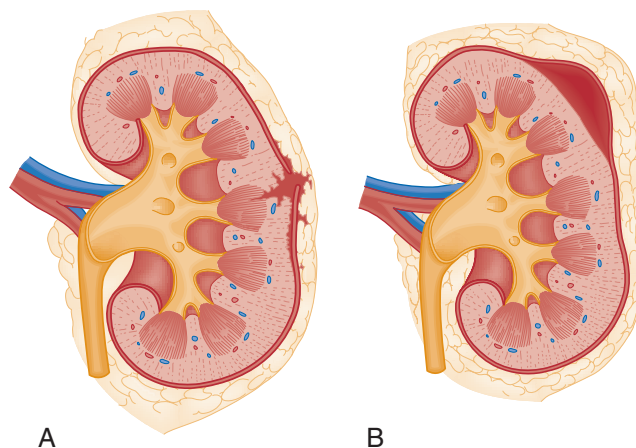


Figure 44-22. Minor renal injuries. **A**, Minor renal laceration. **B**, Renal contusion. (From Nicolaisen GS, et al: Renal trauma: Re-evaluation of the indications for radiographic assessment. J Urol 133:183, 1985.)

Upper Tract (Ureteral Trauma).

Pathophysiology.

- Rare = ~1% of all genitourinary injuries.
- ~80% of ureteral injuries are iatrogenic (complications of abdominal or pelvic surgery)
 - Most frequently associated with GSW to abdomen.
- Ureters are relatively protected from injury by the bony pelvis, spine & psoas muscle.
- Concomitant major organ injuries & hypotension are common.

Clinical Features.

- No reliable signs or symptoms (including haematuria).
- Missed injury or delayed presentation can result in fever, N&V, haematuria, flank pain and palpable flank mass.

Diagnostic Strategies.

- CT (abdomen & pelvis) with IV contrast;
 - Highly sensitive.
 - Delayed images (>10mins post contrast) enable detection of delayed extravasation (and increases diagnostic accuracy).
- Retrograde pyelography is slightly more sensitive than CT.

Management.

- Operative repair is indicated for *all ureteral injuries*.

External Genitalia (Penile Trauma).

Anatomy.

- Three masses of erectile tissue (2x corpora cavernosa, 1x corpus spongiosum).
- Each mass contains an artery, plus two additional dorsal penile arteries.
- There is a single dorsal vein.

Clinical Features.

- Mechanism of injury is crucial to ascertain.
- State of penis (flaccid or erect); now & at time of injury.
- ADT status.
- Injuries range from *small lacerations or contusions to degloving & amputation*.
- *Penile incarceration* is common amongst adolescents.
 - Leads to loss of skin, urethral necrosis & occasional amputation.
- Traumatic rupture can occur with forceful bending of an erect penis (*penile fracture*)
 - Tearing of tunica albuginea. Haematoma limited by Buck's fascia
 - Vigorous sexual activity or masturbation.
 - Corporal defect may be palpable.
 - *Gross haematuria & often unable to void*.
- *Penetrating trauma*.
 - usually with concomitant injuries to bladder, urethra, rectum, testes & iliac/femoral vasculature.
- The *testes* are vulnerable due to their location.
 - most commonly blunt injuries
 - Rupture of testes can occur.

- Additional injuries include; *scrotal or intratesticular haematoma, haematocele, testicular torsion / avulsion / displacement or epididymal injury.*
- Examination often limited by pain tolerance.
- *Bite wounds* should be treated like other bite-wounds (antibiotics required)
 - *Consider transmission of hepatitis & HIV.*
- *Female genitalia* commonly injured in straddle-injuries, sexual assault and pelvic fractures.
 - *Consider screening for interpersonal violence* (holds true for children also).

Diagnostic Strategies.

- Examination is usually sufficient.
- Retrograde urethrography is indicated with suggested urethral injury.
- Ultrasound & MRI can be used in selected cases.
- *USS is investigation of choice for scrotal & testicular trauma.*
 - 95% sensitive for testicular rupture.

Management.

- Constricting devices must be promptly removed.
- Reconstructive surgery may be required.
- Superficial haematomas can be treated conservatively.
- Superficial lacerations can be primarily closed.
- Degloving injuries = Urologist / Plastic surgeon consultation.
- Early exploration for all penetrating injuries is recommended.
- Surgical exploration of the scrotum is required for;
 - Torsion, rupture, large haematocele & testicular dislocation.
 - A normal USS usually means *no operation.*
- Antibiotics for bite-wounds.