Urology/GU Trauma

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I. NON-TRAUMATIC PROBLEMS

A. Paraphimosis

1. The inability to reduce the proximal foreskin over the glans, resulting in distal venous congestion. This can progress to arterial compromise, gangrene, and amputation from the foreskin acting as a tourniquet around the glans.
2. Most common cause is a circular scar in the prepuce from preexisting phimosis which is then re-tracted behind the glans cutting off blood supply.
3. This is a **true urologic emergency**.
4. May be iatrogenic (i.e., foreskin not reduced after placement of a urinary catheter).
5. Attempt to reduce the foreskin often requires penile nerve block with 1% lidocaine (without epinephrine) to be successful.
6. Techniques to **reduce edema** of the glans:
   a. Place glans in rubber glove filled with ice water.
   c. Several punctures of the glans with a small needle to drain edema fluid.
7. If all else fails, the constricting band may be released by cutting a **small dorsal slit** or ultimately by **circumcision**.

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**Paraphimosis**

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B. Phimosis

1. A constriction of the foreskin, with the inability to retract it over the glans.
2. Physiologic phimosis occurs in 96% of uncircumcised newborns, and resolves itself by the age of 3
3. Caused by infection, poor hygiene or trauma that results in scarrring.
4. If causing urinary outlet obstruction, you can dilate the meatus with forceps.
5. Topical steroids have been proven beneficial.
6. Definitive treatment is circumcision.

**C. Priapism**

1. A prolonged, often painful erection occurring without sexual stimulation.
2. CBC and coagulation studies are indicated.
3. Immediate IV fluids and analgesia are given.
4. **High flow priapism** (less common) is caused by increased arterial blood flow due to an arterial-cavernosal shunt usually formed as a result of a groin or straddle injury.
   a. This type does not cause ischemia; is usually painless and is at low risk for permanent complications.
   b. Can usually be treated with arterial embolization.
5. **Low flow priapism** is due to a decreased penile venous outflow.
   a. Causes include *sickle cell disease* (the most common cause in children), leukemic infiltration, spinal trauma, medications (usually phenothiazine, SSRI or antihypertensives) and illicit drugs (cocaine and marijuana). In adults, usually it is idiopathic.
   b. Corpus cavernosum is hard but the glans and corpus spongiosum is soft. (Pathophysiology usually involves sludging of RBCs in the corpus cavernosum.)
   c. Treatment in sickle cell patients includes oxygen, alkalinization, hydration, pain control and, ultimately, exchange transfusion.
   d. Other treatment options include local anesthesia through a dorsal penile nerve block, parenterally administered vasodilators such as terbutaline or hydralazine, and cavernosal aspiration and irrigation - often with phenylephrine or epinephrine added to the irrigation solution.
   e. If priapism recurs after aspiration of blood, surgical shunting is needed.
   f. If left untreated, corporal fibrosis and erectile dysfunction may result.
D. Testicular torsion

1. Peak incidence at 13 years; however, there is a bimodal age distribution between the teens and the first year of life. Torsion can occur at any age.

2. At-risk testes align in a horizontal rather than a vertical axis (i.e., the “bell-clapper deformity”— see Figure 3). This is caused by malformed tunica vaginalis in infants and incomplete attachment of the gubernaculum in adults. Both of these malformations leave the testicles free to rotate.

3. Classically a sudden onset of lower abdominal or testicular pain.

4. Involved testicle is firm, tender, swollen and higher in the scrotum than the other testicle.

5. Cremasteric reflex is typically absent, which is highly sensitive for testicular torsion. **SURGICAL EXPLORATION SHOULD NOT BE DELAYED FOR DIAGNOSTIC STUDIES**, especially if symptoms are <12 hours old.

6. Newer color Doppler ultrasound has sensitivities of 90%-100% and specificity of 100%; helpful in indeterminate cases.

7. Manual detorsion may be attempted by “dialing out” or “opening a book” (i.e., medial to lateral direction). This is done for acute pain relief and some return of blood flow; it is not a definitive treatment and surgery is still indicated even if successful.

8. Testicular salvage rate of >90% if de-torsed within 4 hours, 20% within 12 hours, and almost 0% if de-torsed after 24 hours.

*Figure 3: “Bell-clapper” deformity*
E. Epididymitis (Inclusion for its similarity in presentation to torsion)

1. Rarely occurs before puberty. Caused by retrograde spread of urethral and bladder pathogens.
2. Under age 35, chlamydia and gonorrhea are the main pathogens. Over age 35, it’s E. coli.
3. Presents with lower abdominal and testicular pain, usually with a low grade fever. Pain may be relieved with scrotal elevation (Prehn’s sign).
   a. Can be difficult to distinguish from torsion. Negative Prehn’s sign can help to distinguish from epididymitis but is insensitive. (see Figure 4)
   b. Erythema and edema of the hemiscrotum may be noted. The epididymis is usually swollen and tender. A reactive hydrocele may be present.
4. UA, urine culture, and urethral STD cultures should be sent.
5. UA may not show evidence of infection.
6. Empiric treatment (see Box 1):
   a. If presumed sexually acquired: single dose ceftriaxone plus doxycycline for 10 days
   b. If presumed not sexually acquired: Cipro/levofloxacin for 10 days OR ofloxacin for 10 days.
   c. Also: bed rest, scrotal elevation (athletic supporter), ice packs, NSAIDs, urologic follow-up.
7. Complications: orchitis, abscess formation and infertility.

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Box 1. Centers for Disease Control’s 2006 guidelines for the diagnosis and management of epididymitis

Younger than 35
- Gram stain of urethral exudate for urethritis (>5 white blood cells/high power field) or leukocyte esterase test or microscopic examination of first-void urine sediment demonstrating at or above 10 WBC/hpf
- Culture or nucleic acid amplification test of urethral swab (or urine)
- Empiric antibiotics to cover N. gonorrhoeae and C. trachomatis
  - *Ceftriaxone 250 mg intramuscularly × 1
  - *Doxycycline 100 mg po bid × 10 days

Older than 35
- Leukocyte esterase test or microscopic examination of first-void urine sediment demonstrating at or above 10 WBC/hpf
- Culture and gram stain of voided urine
- Empiric antibiotics to cover coliform bacteria
  - *Levofloxacin 500 mg qd × 10 days
  - *Ofloxacin 300 mg bid × 10 days

* Patients younger than 35 with allergies to penicillins or tetracyclines should be treated with levofloxacin or ofloxacin.
* If N. gonorrhoeae is suspected, patients may need to be desensitized to penicillin on account of the high rate of fluoroquinolone resistance evolving in N. gonorrhoeae.
F. Torsion of the testicular appendage

1. Torsion of the appendix testis, a remnant of the Müllerian duct.
2. Average age is 10 years.
3. Sudden onset of testicular pain, but usually more gradual than testicular torsion. A tender nodule may be palpated.
4. The **blue dot sign** may be seen on cranial portion of testes or epididymis.
5. **Cremasteric reflex normally present**, helps to differentiate from testicular torsion.

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**Figure 4: Torsion versus epididymitis**
6. Doppler ultrasound, or alternatively, nuclear scintigraphy can be used to confirm the diagnosis.

7. **Treatment is conservative.** The appendages will autoamputate within a week.

G. Acute urinary retention

1. Most common cause is **prostatic hypertrophy.** Other causes include: multiple sclerosis, diabetes, urethral stricture, spinal cord compression and drugs (antihistamines, anticholinergics, TCAs and sympathomimetics).

2. “An intact sensory exam, anal sphincter, and bulbocavernous reflex differentiates chronic outlet obstruction from the sensory or motor neurogenic bladder” (Tintinalli, 2004).

3. A normal-sized prostate on physical exam does not eliminate it as a cause of obstruction.

4. To **decompress the bladder,** start with a 16Fr or 18Fr catheter. If the obstruction is at the level of the prostate, a 16Fr Coude-catheter can be tried. Ultimately, a suprapubic cystostomy may be needed.

5. **BUN/Cr and UA** should be sent to check renal function and for infection respectively.

6. “Spontaneous, complete drainage of a distended bladder can be accomplished rapidly without the need for repeated clamping of the catheter” (Tintinalli, 2004). Rapid decompression may cause transient gross hematuria or hypotension, but this is usually insignificant.

7. Postobstructive diuresis may occur. For this reason, patients should have urinary output measured for 4-6 hours after catheterization. Postobstructive diuresis warrants admission for IVF and monitoring of electrolytes.

H. Fournier’s gangrene

1. A **necrotizing fasciitis** of the perineum, usually involving the penis and scrotum, but can also affect women

2. Main risk factor is immunosuppression, especially diabetes.

3. Often proceeded by perineal trauma (i.e., scratches, burns, anal intercourse).

4. Perineal and genital pain and itching is followed by fever, toxic appearance and perineal swelling. **Subcutaneous crepitance** is often present. CT may show edema and gas in scrotal skin.

5. A polymicrobial infection, usually aerobic and anaerobic, with bacteria from the distal colon.

6. Treat with aggressive fluid resuscitation, appropriate antibiotics (ticarcillin/clavulanate or ampicillin/sulbactam or piperacillin plus gentamicin plus metronidazole), and, most importantly, immediate urologic consultation and **surgical debridement.**
7. Elasticity of genital skin allows for surgical closure even if 60% of skin is lost; more than 60% loss with require grafts.
8. Mortality rate of 13-22%

I. Renal calculi (kidney stones)

1. Incidence may be as high as 10% -12%. Three times more common in males.
2. Usually occur in between the ages of 20 and 50 years.
3. Risk factors include: arid climates, family history, sedentary lifestyle, a history of hyperparathyroidism, milk-alkali syndrome, sarcoidosis, history of recurrent UTIs, and HIV medications (protease inhibitors)
   a. Types of stones
      i. Calcium. Calcium oxalate or calcium phosphate stones comprise 75% of all kidney stones.
      ii. Struvite (magnesium-ammonium-phosphate) stones account for 15% of stones. These occur exclusively in patients with UTIs caused by urea-splitting organisms.
      iii. Uric acid stones make up 10% of renal calculi. These are radiolucent.
      iv. Cystine stones are rare and due to inborn errors in metabolism.
   b. Clinical features
      i. Classically, a sudden onset of a colicky pain in the flank, radiating laterally around the abdomen and into the groin. Pain may radiate to the testicle. Nausea and vomiting are common.
      c. Patient unable to find a position of comfort - writhing in bed.
      d. Abdomen is minimally tender, if at all.
4. Diagnostic studies
   a. Hematuria, gross or microscopic is present in 85% of cases.
   b. Urinary pH >7.6 many indicate the presence of urea-splitting organisms (struvite stones).
   c. “Unenhanced helical CT is best radiographical test for diagnosing urolithiasis in patients with acute flank pain” (Miller, 2007). Sensitivity and specificity >94%.
   d. Intravenous pyelogram (IVP) is not as sensitive as CT, but has the advantage of evaluating kidney function.
      i. The most reliable and earliest indicator of a calculus is a delay in the appearance of the contrast on the affected side.
      ii. Other signs of a calculus: visualization of the entire ureter (columnization), dilatation of the collecting system, extravasation of the contrast out of the collecting system.
   e. Ultrasound causes no radiation exposure, making it the study of choice in pregnant patients. It is only modestly sensitive and specific for kidney stones, though 98% sensitive for
detecting hydronephrosis.

f. Abdominal plain films can determine whether stones are radio-opaque and can be used to monitor disease activity.

5. Treatment should be with **NSAIDs** (which also help decrease ureteral spasm) and narcotics.
   a. Indications for admission include: obstruction with infection, uncontrolled pain, persistent vomiting, urinary extravasation out of the collecting system, and a solitary or transplanted kidney.
   b. Outpatient treatment includes increased fluid intake and straining of urine. If the stone is obtained, it should be taken to the urologist for analysis.
   c. The most important predictor of stone passage is its size. 90% of stones <4 mm pass spontaneously, while only 10% of those >6 mm do. Stones in the distal ureter have a greater likelihood of passage than those more proximal.
   d. Shock wave lithotripsy can be used to fragment stones <2 cm but is contraindicated for staghorn calculi.
   e. Ureteroscopy with instruments for fragmentation or removal can be used where lithotripsy fails.
   f. Percutaneous nephrolithotomy can be used to create an access tract into the collecting system but is invasive and used only as a last resort.
   g. **Alpha blockers with corticosteroids** have been investigated as agents to aid expulsion of stones based on the idea that they inhibit basal ureteral tone and decrease peristaltic frequency.
   h. Irreversible renal damage begins to occur if obstruction persists beyond two weeks.

II. GU TRAUMA

A. Penile injuries

1. **Penile amputation** should be treated with reimplantation if the distal penis is in satisfactory condition and the ischemia time is <12-24 hours. Chances or reimplantation can be increased by proper handling of amputated portion:
   a. Penis wrapped in saline soaked gauze and put in sterile bag
   b. Immerses bag in ice slush until surgery can be performed

2. **Penile “fracture”** or traumatic rupture of the tunica albuginea and underlying corpus cavernosum occurs when an erect penis impacts forcibly on a hard surface such as the pubic bone (often during vigorous intercourse).
   a. Often a snapping sound is heard, with localized pain, detumescence and a progressive penile hematoma.
   b. Most require surgical repair of the torn tunica albuginea.
   “Eggplant deformity” (see Figure 5) on physical exam with
swollen ecchymotic penis.
c. About 1/3 of penis fractures also involve an underlying urethral injury so a retrograde urethrogram should be performed.
d. Treatment: surgical exploration

3. Superficial penile and scrotal lacerations may be closed with 4-0 absorbable sutures.

4. Penile skin trapped in a zipper can be treated with lidocaine infiltration followed by mineral oil application to help free the skin. Otherwise, wire cutting pliers can be used to divide the median bar of the zipper, causing it to fall apart

Figure 5: Eggplant deformity

B. Scrotal injuries

1. The mobility of the testes combined with their tough, fibrous capsule make their rate of injury low.
   a. Penetrating injuries to the scrotum should be operatively explored.
   b. All blunt testicular injuries should undergo color Doppler ultrasound examination to evaluate the integrity of the testes.

2. “Testicular fracture” or rupture
   a. Caused by a deforming force rupturing the tunica albuginea, which functions to protect the seminiferous tubules
   b. Difficult to distinguish from a scrotal contusion or hematoma
   c. Usually follows assault or sports injury
   d. Risk can be as high as 50% following major blunt trauma to testicles
   e. Ultrasonography aids in diagnosis, but definitive diagnosis is made surgically
   f. Treatment is early surgical correction and medically managed cases result in atrophy, necrosis, and infection.
C. Urethral trauma

1. Urethral trauma is suggested by the presence of a pelvic fracture, **blood at the urethral meatus**, a high-riding or absent prostate on rectal exam, or a perineal, scrotal or penile hematoma. Also these patients have acute urinary retention with a palpable bladder.
   
a. A Foley catheter should never be placed if urethral trauma is suspected without first performing a retrograde urethrogram.
   
b. A retrograde urethrogram (**see Figure 6**) is performed by placing the end of a Toomey syringe into the urethral meatus for a snug fit and then injecting 60 mL of contrast into the urethra over 30-60 seconds. A radiograph of the length of the urethra is taken during the injection of the last 10 mL of contrast. Extravasation of contrast outside of the urethra with concomitant bladder filling distinguishes a partial urethral laceration from a complete disruption (where no contrast reaches the bladder).

2. Anterior (10%) urethral injuries (those below the urogenital diaphragm) are usually secondary to direct trauma (e.g., kicks and straddle injuries).

3. **Posterior (90%) urethral injuries** (those above the UG diaphragm) are typically associated with pelvic fractures, which often cause prostatomembranous urethral disruption (sign: high-riding or absent prostate on DRE). Quick diagnosis and treatment of these injuries significantly lowers chances of incontinence and erectile dysfunction.

4. Partial urethral lacerations are usually managed with an indwelling urethral catheter. Attempted placement of this catheter in the ED is controversial.

5. Complete urethral disruption requires placement of a suprapubic catheter for bladder drainage pending definite surgical repair. **Figure 6**: Retrograde urethrogram

6. Urethral strictures, erectile dysfunction, and incontinence are the main long-term complications.

D. Bladder injuries

1. Usually associated with **blunt trauma, pelvic fractures, and deceleration with compression of the bladder** (as in MVCs). There is a high incidence of associated life-threatening non-urologic injuries.
2. Evaluation of potential bladder injury should take place only after potential urethral injuries have been ruled out (i.e., do the urethrogram before the cystogram).

3. Suspicion of bladder injury should arise with the presence of gross hematuria, especially in the setting of a pelvic fracture. 98% of patients with bladder rupture have gross hematuria.

4. Symptoms are non-specific and include suprapubic pain and inability to void.

5. **Retrograde cystogram or retrograde CT cystography** are the diagnostic procedures of choice for suspected bladder injury.
   a. Retrograde cystogram is performed by allowing 300-400 mL of contrast to flow by gravity from a Toomey syringe through a Foley catheter into the bladder. If the bladder contracts before the instillation of 300 mL, 50 mL more of the contrast should be inserted with hand pressure. The Foley catheter is then clamped, and AP and lateral radiographs of the bladder taken. The Foley is then unclamped, the bladder drained, and a postevacuation film taken.
   b. Retrograde CT cystography is performed in the same fashion but using CT for imaging.
   c. With extraperitoneal bladder perforations, the extravasated dye is seen in the area of the pelvic outlet (see Figure 7) but does not enter the peritoneal cavity.
   d. With intraperitoneal perforations, the contrast enters the peritoneal space and outlines the intraperitoneal structures.
   e. Extraperitoneal bladder ruptures will usually heal spontaneously in 14 days with Foley catheter drainage.
   f. Intraperitoneal bladder ruptures require surgical repair.

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**Figure 7:** Cystograms in bladder rupture

Fig. 3. (A) Cystogram demonstrating extraperitoneal bladder rupture. (B) CT cystogram shows intraperitoneal bladder rupture with contrast outlining loops of intestine.
E. Ureteral injuries

1. Rare and usually occur secondary to penetrating trauma. Often, several non-urologic injuries are also present.
2. Much more likely to be iatrogenic from gynecological, vascular, or complex urological procedures.
3. **Hematuria, flank pain and a palpable mass in the lower abdomen are the classic features.** Often there is a delay in making this diagnosis and hematuria is not sensitive for ureteral injury.
4. These are usually diagnosed by CT with contrast or retrograde pyelogram. IVP may be used though is less sensitive.
5. If the cause is penetrating trauma, a ureterocutaneous fistula may form.
6. Most are treated surgically.

F. Renal injuries

1. The most common of all urologic injuries; usually due to blunt trauma. History is important to distinguish blunt from penetrating traumas.
2. More than 80% of those patients with kidney injuries have other concurrent injuries, often life-threatening.
3. Contusions account for over 90% of renal injuries. Kidney lacerations and pedicle injuries each make up <5% of all renal injuries.
4. The main indications for imaging the kidneys after blunt trauma are:
   a. Gross hematuria.
   b. Microscopic hematuria with multiple injuries or hemodynamic instability (shock).
   c. A mechanism that includes rapid deceleration.
5. Any penetrating trauma with the potential for renal injury warrants an imaging study, even in the absence of hematuria. Hematuria, often present, does not correlate with severity of injury.
6. CT with IV contrast is the imaging procedure of choice for potential renal injuries. IVP may be used if CT is not available or if the patient’s instability does not allow time for CT (i.e., a “one shot” IVP in the ED or OR).
7. Renal contusions are managed non-operatively.
8. Renal injuries are graded from I-V (see Figure 8). Higher grade injuries are more likely to require surgical repair.
9. **Indications for operative intervention** for renal injuries include:
   a. Uncontrolled renal hemorrhage.
   b. Penetrating injuries.
c. An avulsed major renal vessel.

d. Extensive urine extravasation.

e. Shattered kidney or lacerations extending through to the collecting system.

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Figure 8: Grades of Renal Trauma
UROLOGY/GU TRAUMA

PEARLS

Urology

1. Definitive treatment of phimosis is circumcision.
2. Sickle cell anemia is the most common cause of priapism in children.
3. Color flow Doppler ultrasound of the scrotum is as accurate as radionuclide scanning and much faster to rule out torsion.
4. Don’t delay surgical exploration of a potential testicular torsion for diagnostic studies, since the salvage rate markedly decreases after 4 hours of ischemia.
5. Manual detorsion may be attempted, medial to lateral.
6. Epididymitis under age 35 is usually caused by gonorrhea or chlamydia. Over 35, E. coli is the main pathogen.
7. BPH is the #1 cause of acute urinary retention in men.
8. Patients catheterized for acute urinary retention should be observed for 4-6 hours for postobstructive diuresis.
9. Treatment of Fournier’s gangrene involves aggressive fluid resuscitation, antibiotics, and, most importantly, surgical debridement.
10. The majority of kidney stones contain calcium.
11. Struvite stones (staghorn calculi) are infection stones associated with a high urinary pH.
12. Stones caused by indinavir are radiolucent.
13. The most common site of ureteral stone impaction is the ureterovesical junction.
14. Helical CT is the preferred imaging study for kidney stones.
15. Ultrasound is good to diagnose ureteral hydronephrosis and obstruction. It is poor for imaging the stone itself.
16. 90% of kidney stones <4 mm in size will pass spontaneously, while only 10% of those >6 mm will.
GU Trauma

1. A retrograde urethrogram should be performed before inserting a Foley catheter if urethral injury is suspected.

2. 95% of patients with bladder rupture will have gross hematuria.

3. Retrograde cystogram or retrograde CT cystography are the diagnostic procedures of choice for suspected bladder injury.

4. Extraperitoneal bladder ruptures usually heal spontaneously (with Foley catheter drainage), while intraperitoneal ruptures require operative repair.

5. Indications for imaging the kidneys after blunt trauma are: gross hematuria, microscopic hematuria in the presence of multiple injuries or hemodynamic instability, and a mechanism that includes rapid deceleration.

6. CT with IV contrast is the imaging procedure of choice for potential renal injuries.

7. The majority of renal injuries occur in the presence of other, usually life-threatening injuries.
REFERENCES


