

# Pediatric Urology Emergencies & Urgent Consults

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## 1. Introduction

This section will highlight the evaluation and management of several emergent and urgent consults most frequently requested of the pediatric urologist. The reader should be able to develop a differential diagnosis and be able to recognize the most common pathologies for each of the consults.

## 2. The Acute scrotum – the red, painful, swollen scrotum

See ([Figure 1](#))

Things to Consider in the History:

- Onset of symptoms: testicular torsion typically presents with acute onset, severe pain whereas appendiceal torsion and/or epididymitis may have a more gradual onset of symptoms
- Age of patient: testicular torsion classically occurs in a bimodal distribution: in the neonatal period and peripubertal
- Is patient sexually active? Epididymo-orchitis may be associated with sexually transmitted infections.
- Is there a history of acute trauma?
- Are there associated lower urinary tract symptoms?

Things to Consider in the Physical Exam:

- Tanner stage
- Position and consistency of the testis
- Presence or absence of cremasteric reflex
- Associated hydrocele/hematoma?
- Can the pain be localized to a specific area of the scrotum?



Figure 1: The “acute scrotum” which is frequently erythematous, tender, and enlarged at presentation.

#### Differential Diagnoses:

##### 1. Acute Testicular Torsion (Consults & Emergencies **Testicular Torsion, Common Pediatric Scrotal Conditions**)<sup>1</sup>

###### a. Intravaginal Torsion (**Figure 2a** and **Figure 2b**)

- More frequently seen in pubertal/postpubertal adolescents but can be seen in any age group
- May be associated with “bell-clapper” abnormality, in which the testis lacks normal fixation to the tunica vaginalis
- Typically presents with acute onset severe pain
- Testis may be firm, high-riding and demonstrate a horizontal lie (**Figure 3**)
- If clinical suspicion is high, treatment should not be delayed
- Prompt surgical exploration (< 6 hours) with detorsion and orchidopexy is indicated for highest chance of testicular salvage
- Doppler ultrasound has a high level of sensitivity and specificity for evaluation if the diagnosis is unclear
- Manual detorsion may be attempted, rotating the testis from medial to lateral (“open

the book"); if successful, resolution of pain is immediately reported. Restoration of flow should be confirmed with Doppler ultrasound, if surgical exploration is to be delayed.<sup>2</sup>

b. Extravaginal Torsion (**Figure 4a** and **Figure 4b**)

- Seen exclusively in the perinatal/neonatal period, prior to fusion of the tunica vaginalis with the scrotum which typically occurs by 6-8 weeks after birth.
- May be associated with overlying discoloration and/or fixation of the overlying scrotal skin
- Management is controversial ranging from no surgery to prompt vs. semi-elective surgical exploration, removal of the necrotic testis, and contralateral orchidopexy, as asynchronous torsion has been reported. <sup>2</sup>

**2. Epididymitis/Ochitis (Consults & Emergencies: Testicular Torsion, Common Pediatric Scrotal Conditions Section 5.3)**

- a. Doppler US typically shows hyperemia of the epididymis and/or testis (**Figure 5**)
- b. UA/urine culture should be obtained and antibiotics tailored to results/sensitivities. In general, bacterial epididymitis will have positive UA and urine culture.
- c. Sterile inflammation of the epididymitis may be idiopathic, due to torsion of testicular appendage (see below), or occur secondary to reflux of urine into the ejaculatory ducts associated with **dysfunctional voiding** behaviors.
  - Treatment: NSAIDS, rest, and time
  - Treatment: address underlying voiding dysfunction
- d. Radiographic imaging including renal ultrasound and VCUG should be considered in cases of recurrent epididymitis or bacterial epididymitis in a prepubertal boy to evaluate for structural abnormalities including:
  - a. **Ectopic ureter**
  - b. **Vesicoureteral reflux**
  - c. Prostatic utricle – a Müllerian remnant which, if enlarged, can contribute to urinary stasis and UTI
  - d. **Urethral valves** or stricture
- e. In sexually active patients, C. trachomatis and N. gonorrhea are the most common organisms. Recommendation: Ceftriaxone 250 mg IM plus Doxycycline 100 mg BID x 10 days.<sup>3</sup>

**3. Torsion of Testicular Appendage (Figure 6)**

- Typically seen in prepubertal patients
- Doppler US may show a hypoechoic mass at the superior aspect of the testis, and associated hyperemia of the adjacent epididymis may mimic epididymitis.
- Most common cause of acute scrotum and finding of "epididymitis" on ultrasound in prepubertal patients. Antibiotics are not needed.
- Pain is typically gradual and less severe than in acute testicular torsion

- Exam may reveal point tenderness at the superior pole of the testis and a “blue dot sign” may sometimes be appreciated on the scrotal skin, corresponding to the underlying hemorrhagic appendage.

#### 4. Hernia/Hydrocele (Figure 7)

- Secondary to patent process vaginalis
- Typically presents with painless swelling in the groin or scrotum that may fluctuate
- An incarcerated hernia may be associated with pain and persistent mass that extends to the inguinal canal – prompt manual reduction should be attempted with emergent surgical exploration if reduction is not possible.<sup>2</sup>

#### 5. Scrotal Trauma (Figure 8)

- Usually secondary to direct blunt force trauma or straddle injury
- Can precipitate acute torsion
- Presence of hematoma may make exam difficult and doppler US may be useful to better assess the testicle and intactness of the tunica albuginea
- A high level of suspicion for testicular rupture should be maintained with low threshold for exploration, if the ultrasound findings are equivocal.<sup>4</sup>

#### 6. Testicular or Paratesticular Neoplasm

- Typically presents as a painless mass in the scrotum
- Prepubertal children are more likely to have benign masses, while pubertal/adolescent patients are more likely to have malignant tumors.<sup>5</sup>
- Scrotal US imaging is helpful for further assessment, and obtaining tumor markers and/or abdominal cross sectional imaging may be appropriate based on clinical suspicion

#### 7. Varicocele (Figure 9)

- Typically presents peripubertal with swelling of the left hemiscrotum
- Present in 15% of males
- Examination in the standing position with and without Valsalva may demonstrate dilation of the spermatic veins, which reduce in the supine position
- Varicoceles in younger boys, right sided varicoceles, and those that do not readily reduce may raise concern for a retroperitoneal mass
- May be associated with discomfort, smaller testicular volume and decreased sperm counts in a subset of patients
- Surgical repair can be open or laparoscopic and may be offered in the setting of significant testicular size discrepancy, abnormal semen parameters, or pain.
- Indications for and overall benefit of surgical repair remains controversial; repair may improve testicular volume and sperm concentration, however fertility outcomes remain unclear.<sup>6</sup>



Figure 2a: Torsion of the spermatic cord typically occurs in a lateral to medial fashion.



Figure 2b: After detorsion of the cord.



Figure 3: A “high-riding” testis with an abnormal, horizontal lie may be observed with torsion.



Figure 4a: Discoloration of the scrotum or skin fixation may be seen in the setting of neonatal torsion.

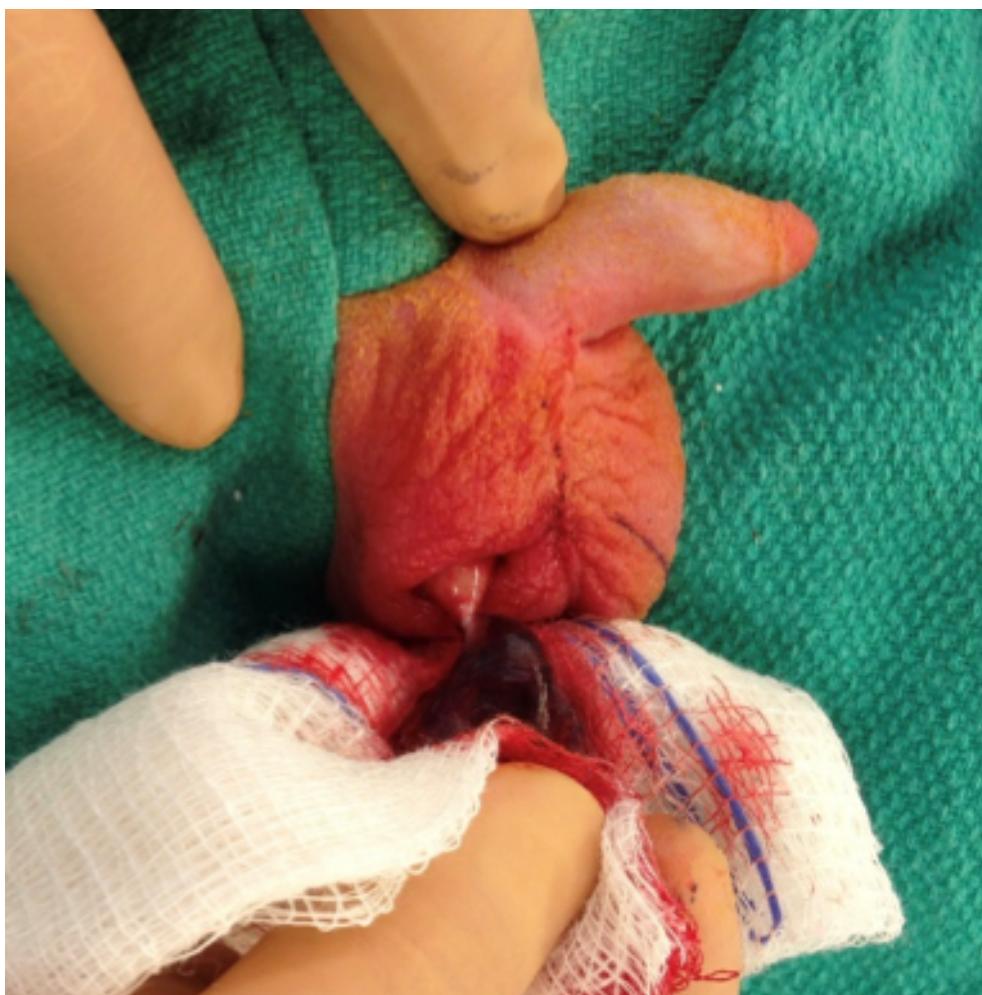


Figure 4b: The testis and associated tunics twist together on the pedicle, prior to fixation within the dartos of the scrotum.

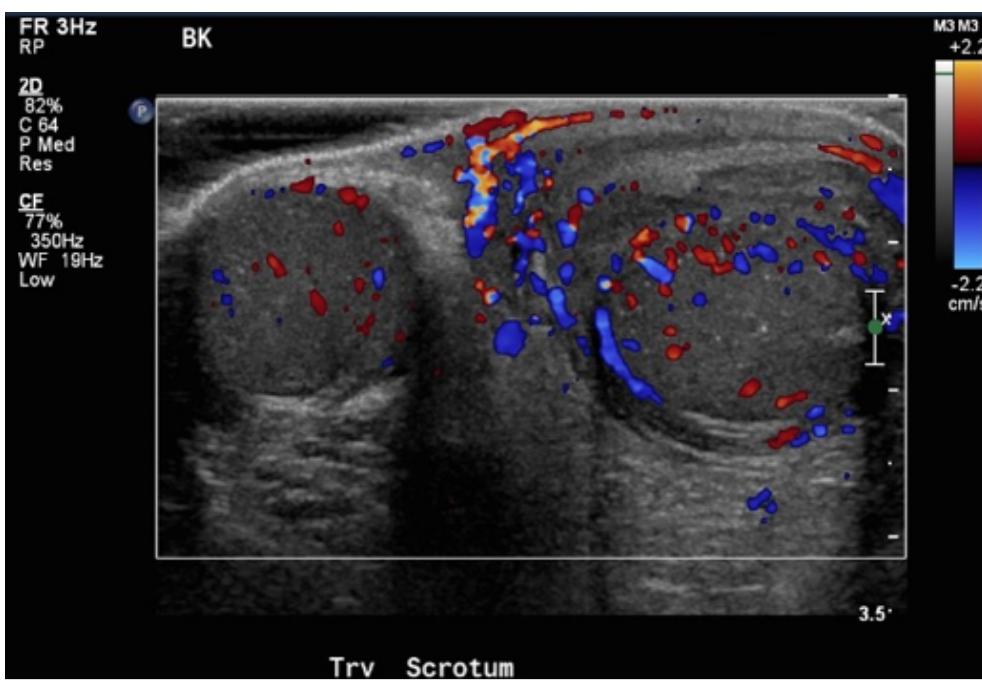


Figure 5: Increased blood flow is detected in the affected testis and/or epididymis.



Figure 6: Hemorrhagic necrosis of the appendix testis. The initial clinical exam can mimic acute testicular torsion.

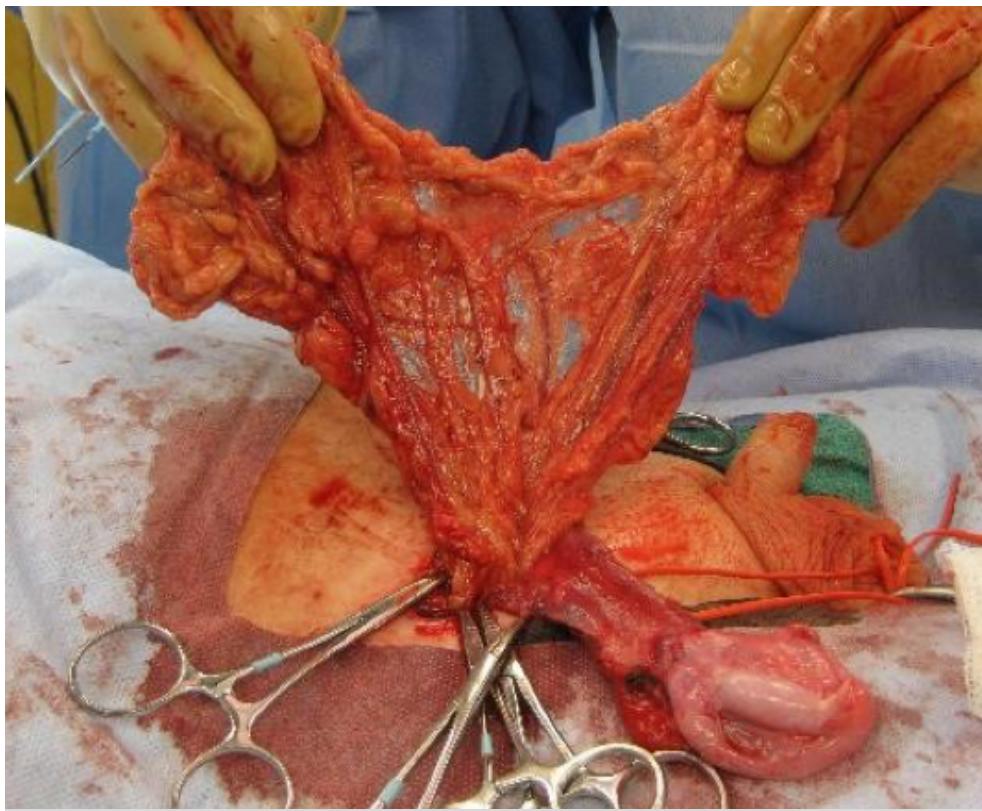


Figure 7: Hernia containing omentum.



Figure 8: Testicular rupture of the tunica albuginea with exposed, hemorrhagic tubules.



Figure 9: Grade 3 left varicocele resembling a “bag of worms”.

### 3. Penile Problems – the swollen, tender penis

Things to Consider:

- Circumcision status – paraphimosis is seen in uncircumcised males but can mimic a severe case of balanitis
- Race/ethnicity of patient – as it relates to hemoglobinopathies and contributing risk factors for priapism
- Medications – as it relates to possible agents associated with priapism
- Associated symptoms: penile pain, dysuria, fever, urinary retention

Differential Diagnosis:

## 1. **Balanoposthitis**

- Inflammation of the glans and foreskin
- Presentation with edematous, tender and erythematous prepuce with or without associated discharge from the preputial opening
- May be secondary to infection, irritation, trauma or allergy
- **Often associated with phimosis**
- Treatment: topical steroids and/or antifungal and antibacterial ointments; oral antibiotics may be indicated in the setting of surrounding cellulitis or associated UTI. Prevention with good hygiene and possible topical steroids to resolve any phimosis.

## 2. **Paraphimosis (Figure 10a and Figure 10b)**

- Constriction of the penis by the phimotic ring when the prepuce is left retracted proximal to the glans, leading to edema of the distal prepuce and glans
- Prompt recognition and reduction is important to minimize the risk of ischemia to the glans
- In cases of severe edema, reduction may be facilitated by use of ice, compression, or topical application of granulated sugar to create an osmotic gradient by which the edema fluid can be released.<sup>7</sup>

## 3. **Priapism** - prolonged erection lasting $\geq$ 4 hours unrelated to sexual stimulus (though can be precipitated by), which can lead to ischemia of the penile tissues, corporal scarring, penile curvature/shortening and erectile dysfunction.<sup>8</sup> (**Table 1**)**(Figure 11)**

### i. **Ischemic** (low flow, veno-occlusive) ( $pO_2 < 40$ mmHg)

- most common type
- rigidity of corpora with flaccid glans/spongiosum is typical
- elevated pressures lead to a compartment syndrome within the tunica albuginea
- most often associated with sickle-cell disease, in which deoxygenated hemoglobin S leads to sickling, resulting in microvascular obstruction
- nocturnal erections, sexual activity, dehydration, fever and exposure to cold are common precipitants
- initial management may include hydration, oxygen, analgesia, and alkalization
- can occur in setting of childhood leukemia, in which abnormal interactions between leukoblasts and endothelial cells lead to thrombus formation and venous obstruction

### ii. **Stuttering** (intermittent, recurrent ischemic)

### iii. **Non-ischemic** (high-flow, arterial)

- May be related to prior trauma (e.g. straddle injury) and/or vascular fistulization in which there is unregulated arterial inflow to the cavernosa
- Typically painless

### iv. **Neonatal** – anecdotally reported, occurring during the first month of life

- Idiopathic and not associated with sickle cell disease
- Not felt to be ischemic, and full recovery reported in all cases with conservative

management

- Corporal access achieved either via glans or mid-shaft with a 19-23G butterfly needle (depending on size of child), and aspiration of blood and saline irrigation of the corpora performed
- Proceed to intracorporal injection of sympathomimetic with cardiovascular monitoring if detumescence is not achieved with aspiration/irrigation.
  - ≥11 yo: Phenylephrine 100 µg every 5-10 min to a maximum of 1000 µg
  - For younger children, epinephrine 1 µg/mL (5-20 mL total) has been advocated as a safe alternative
- General anesthesia recommended over sedation but may have greater risks, particularly in setting of sickle cell disease
- Ketamine has been reported to cause detumescence

#### 4. Hair Tourniquet

- If skin is intact, depilatory cream can be applied to “dissolve” the hair
- If skin is ulcerated or broken or there is associated injury to underlying tissues, surgical removal and repair may be required (**Figure 12a, b , c**)

#### 5. Penile Fracture

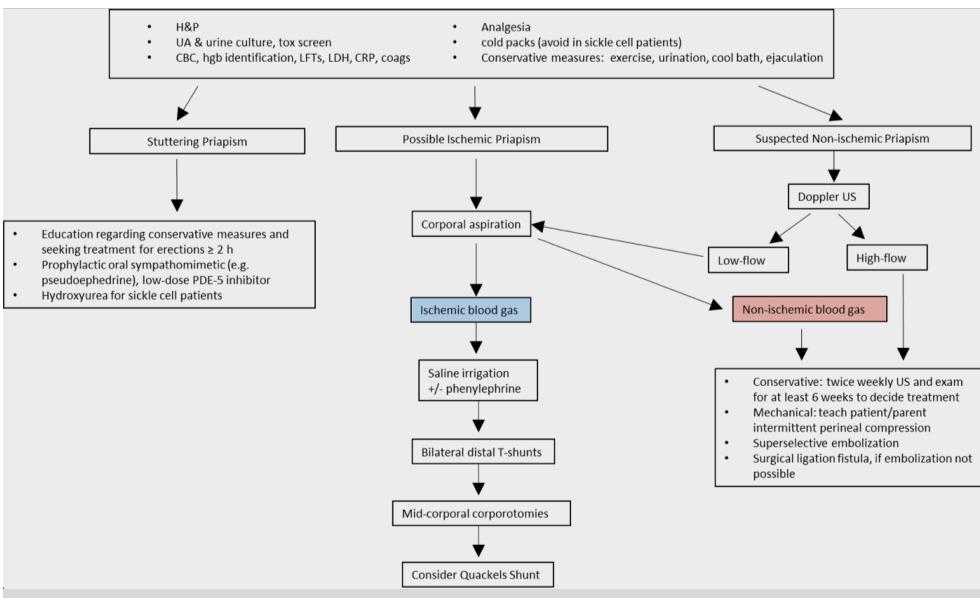
- Rupture of the tunica albuginea of the corporal body(ies) +/- urethral injury (**Figure 13b**)
- Sustained during traumatic masturbation or sexual intercourse, during which the erect penis inadvertently strikes a firm surface (e.g. pubic bone)
- Gross appearance often described as “eggplant deformity” in which the combination of penile swelling, discoloration and deviation is toward the opposite side of the fracture (**Figure 13a**)
- Retrograde urethrography recommended in the setting of associated voiding difficulty, hematuria or blood at the meatus.
- Bilateral corporal injuries should also raise the suspicion for urethral injury.
- Prompt surgical repair advocated to minimize the risk of painful erections, acquired penile curvature, arterial-venous fistulas, infection, and erectile dysfunction.
- The hematoma is typically confined within Buck's fascia; if Buck's fascia is ruptured, the hematoma spreads within Colles fascia, creating a “butterfly” pattern on the perineum.<sup>9</sup>



Figure 10a: Paraphimosis with edema of the inner prepuce.



**Figure 10b: After reduction of paraphimosis.**



**Figure 11: Management algorithm for pediatric priapism adapted from JF Donaldson et al., 2013.**



Figure 12a: Hair tourniquet on the penis. Photos courtesy of Dr. Paul Bowlin



Figure 12b: Significant erosion into the penile tissue. Photos courtesy of Dr. Paul Bowlin



Figure 12c: Hair tourniquet removed with attached epithelium.

Photos courtesy of Dr. Paul Bowlin



Figure 13a: Penile fracture: “Eggplant deformity” with ecchymosis.



Figure 13b: Rupture of the right corporal body.

**Table 1 Causes of Priapism in Children<sup>\*</sup> from J.f. Donaldson et al., 2013**

<b>Ischaemic</b>	<b>Pharmacologically induced</b>
Hemoglobinopathy	PDE-5 inhibitors
Neoplasm	Hormones (e.g. testosterone)
Infection	Anti-psychotics
Neurogenic	Anti-depressants
Toxins (malaria, scorpion, spider)	Anti-hypertensives
Henoch-Schönlein purpura	Erythropoietin
Hemodialysis	Anesthetics
Parental nutrition	Recreational drugs
<b>Non-ischaemic</b>	<b>Neonatal</b>
Trauma	Polycythemia
Hemoglobinopathy	Infection (syphilis, pyocavernositis)
Neoplasm	Cranial birth trauma (forceps)
Fabry's disease	Respiratory distress syndrome
Iatrogenic (aspiration/surgery)	Umbilical artery catheterization

\*Causes of priapism in children (in approximate order of frequency compiled from the literature search).

## 4. Interlabial Masses

Things to Consider:

- What are the associated symptoms? Is the child voiding? Is there bleeding?
- What is the age and race of the child?
- What is the gross appearance of the mass?
- What is the exact location of mass and is the urethral meatus visible?

Differential Diagnosis:

### 1. Labial Adhesions

- Midline fusion of the labia minora, typically due to adherence of the hypo-estrogenized epithelium of the medial labial surface (**Figure 14a**)
- Adherence generally occurs from a posterior to anterior direction, with a small aperture for urine, inferior to the glans clitoris
- Peak age 0-2 years but can persist until puberty in some cases
- Most patients are asymptomatic, and no treatment is required, other than reassurance about eventual spontaneous separation, for the parents and referring primary care provider
- Potential associated symptoms:
  - Deflected urine stream
  - Vaginal trapping of urine
  - Dysuria and possible UTI or contaminated cultures from trapped urine
- Treatment: (**Figure 14b**)
  - Topical estrogen cream or steroid cream such as betamethasone cream can be applied once or twice daily with success rates as high as 90% at 8 weeks.<sup>10</sup>
  - Treatment should be limited to as short a time as possible, as the potential side effects of estrogen cream can include vulvar pigmentation and breast tenderness, which should resolve with discontinuation of treatment. A steroid cream avoids side effects of breast budding and hyperpigmentation.
  - Symptomatic adhesions that fail to respond to estrogen cream can be bluntly separated after application of a topical anesthetic (EMLA) or under brief sedation.
  - Daily separation and application of a lubricating ointment such as petroleum jelly must then be continued post-procedurally to minimize recurrence.

### 2. Urethral Prolapse (**Figure 15**)

- Circumferential eversion of the urethral mucosa through the urethral meatus, which may be associated with vascular congestion and possible strangulation of the prolapsed tissue. The vaginal orifice is typically easily identified posterior to the mass.
- Typically seen in prepubertal (and post-menopausal) patients

- May present with bleeding, as the prolapsed mucosa becomes edematous and friable
- Occurs predominantly in African-American females
- Etiology is unclear but may relate to abnormal attachment between the muscle layers of the urethra with hypoestrogenic mucosa and peri-urethral fascial attachments, in the face of repeated Valsalva maneuvers related to chronic constipation or coughing.
- No imaging studies are required.
- Conservative management should be implemented first:
  - Observation
  - Topical antibiotic or petroleum ointments
  - Estrogen or other mild steroid cream
  - Sitz baths
  - Treatment of constipation
- Surgical treatment can be undertaken if there is severe or recurrent prolapse associated with excessive bleeding, tissue necrosis, or significant voiding symptoms, with excision and suture repair over a urethral catheter.<sup>11</sup>

### 3. Prolapsing Ureterocele (Figure 16)

- Cystic dilation of the terminal intramural ureter, typically associated with the upper pole moiety of a duplex system (only 10% are single-system), which may prolapse into the urethra during voiding.
- The urethral meatus will not be clearly visualized and urinary retention may occur if there is complete obstruction. The vagina may be difficult to appreciate if the ureterocele is large.
- More often seen in Caucasian females
- Manual reduction can be attempted to relieve urethral obstruction and may be facilitated by puncture and aspiration.
- Imaging studies to confirm the diagnosis and delineate the anatomy include renal US and VCUG. Renal scintigraphy may be useful in assessing the upper pole function to guide definitive surgical treatment.

### 4. Periurethral Cyst

- Typically seen in neonates as a smooth mass with a whitish coloration, deriving from paraurethral glands or Skene's duct (**Figure 17**).
- The urethral meatus may be displaced, and the urine stream may be deflected, however a normal vaginal introitus can usually be visualized posteriorly.
- Radiographic evaluation is usually not indicated.
- Spontaneous rupture and resolution typically occur within a few weeks, and unroofing or other procedures are not required.

### 5. Gartner's Duct Cysts

- Typically seen in neonates
- Derives from cystic remnants of the mesonephric system
- May represent a covered ectopic ureter, associated with a dysplastic upper pole moiety
- Treatment may involve incision to relieve obstruction and/or upper pole heminephrectomy if there is associated incontinence related to the ectopic insertion

## 6. Hydro(metro)colpos

- Distension of the vagina (hydrocolpos) and uterus (hydrometrocolpos) with fluid secretions from an obstructive process, presenting as a bulging mass at the introitus
  - a. Imperforate hymen or low transverse vaginal septum (**Figure 18a**)
    - In the neonate, maternal estrogen may result in accumulation of uterine and cervical secretions, producing a pearly, grayish protuberance
    - In pubertal patients, the accumulation of blood (hematocolpos) will result in a dark colored vaginal mass and a history of amenorrhea with possible cyclic abdominal pain associated with menstrual cycles (**Figure 19**).
    - Treatment consists of transverse incision of the imperforate tissue, to avoid injury to the urethra or rectum (**Figure 18b**)
  - b. Stenotic introitus or vaginal atresia
    - May be associated with genital mutilation (infundibulation)
    - Vaginal atresia or a high vaginal septum may be associated with significant congenital anomalies of the GU and GI tract, and additional imaging studies to delineate the anatomy is indicated; associated urinary tract obstruction may require decompressive procedures including vesicostomy and/or vaginostomy

## 7. Rhabdomyosarcoma of the Vagina (Sarcoma Botryoides)

See (**AUA Update Series 2013, Vol 32, Lesson 9 GU Rhabdomyosarcoma**)

- May present with bloody discharge and/or visible mass extruding from vagina (**Figure 20a and Figure 20b**)
  - Pelvic US and/or CT/MRI can help determine mass size and extent
  - Once malignancy is confirmed by biopsy, metastatic evaluation consists of chest CT, bone scan, and bone marrow biopsy
  - Treatment consists of multidrug chemotherapy +/- radiation and surgery
-



Figure 14a: Adhesions of the labia minora



Figure 14b: After adhesiolysis, the urethral meatus and introitus can be visualized.



Figure 15: Urethral prolapse. Dusky mucosa is observed at the meatus in which appears in a “donut” shape.



Figure 16: Prolapsing ureterocele.



Figure 17: Periurethral cyst containing debris.

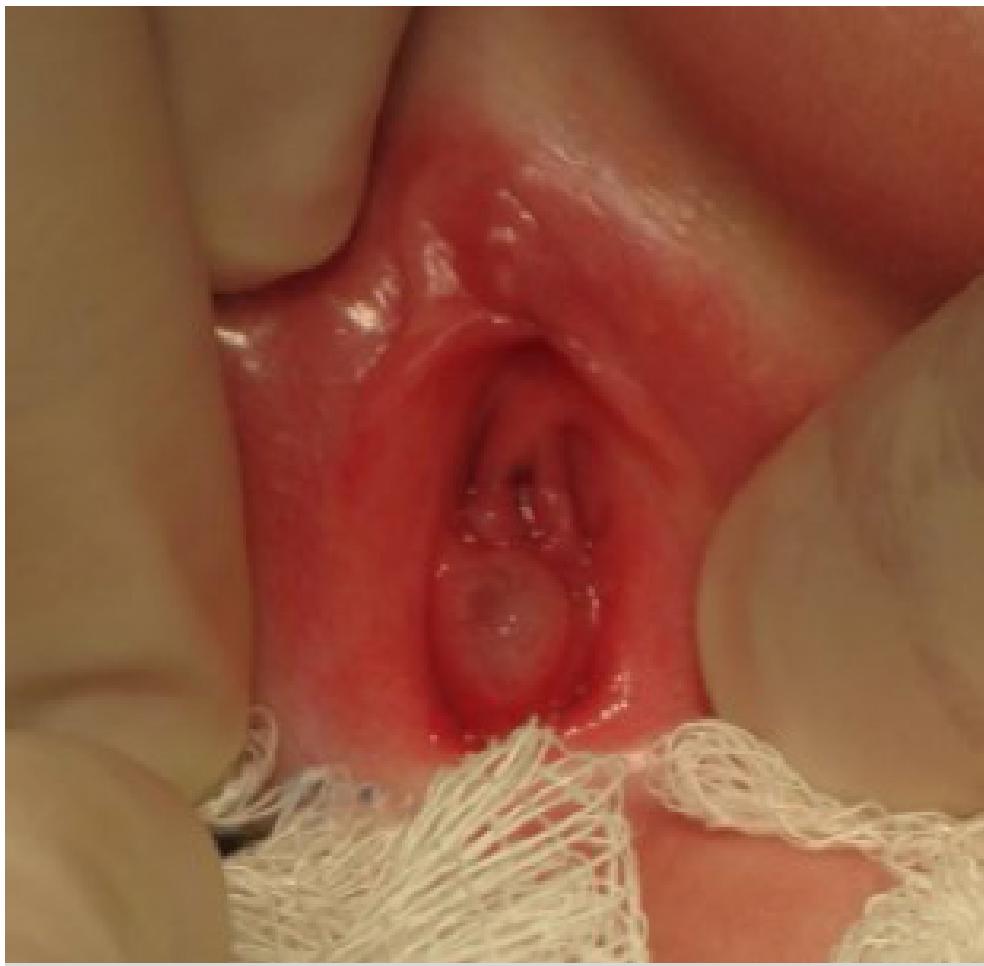


Figure 18a: Imperforate hymen in an infant.

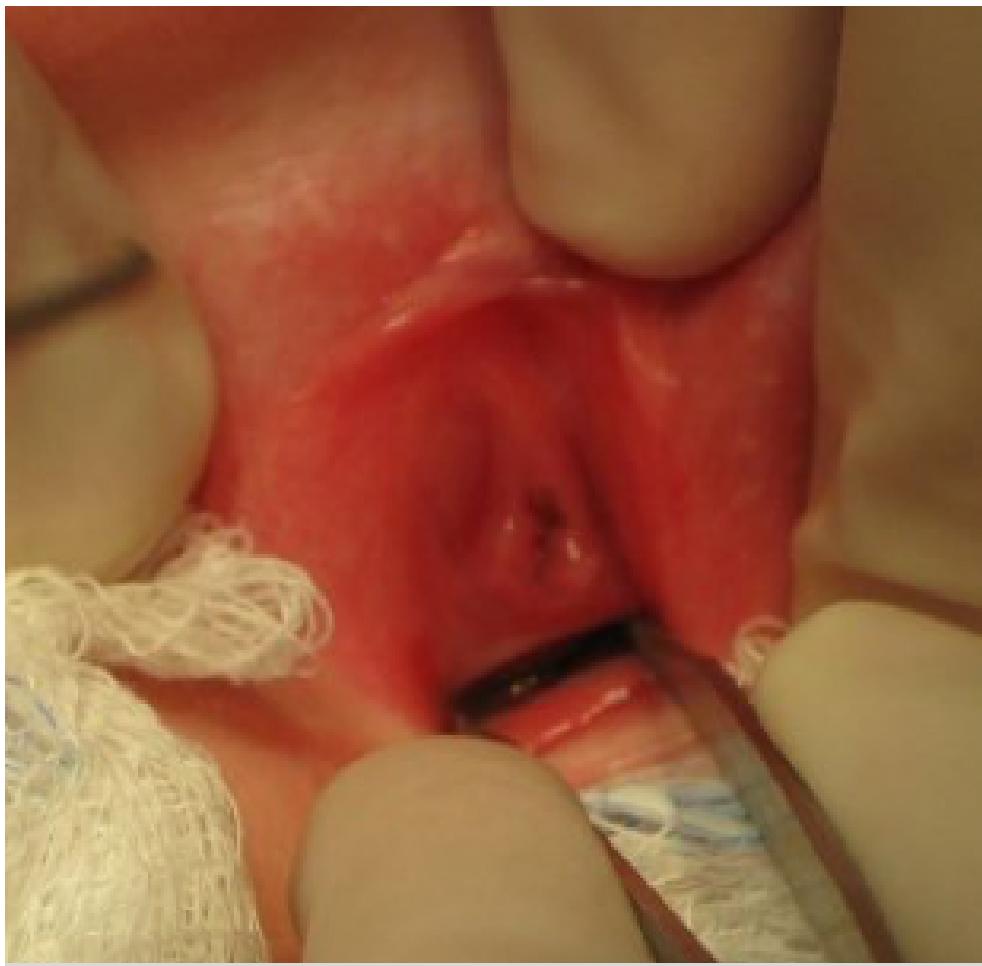


Figure 18b: Transverse opening of the hymenal tissue.



Figure 19: Bulging mass at the introitus in a menarchal female consistent with imperforate hymen.



Figure 20a: Vaginal rhabdomyosarcoma Used with permission from  
<http://www.pediatricurologybook.com/rhabdomyosarcoma.html>



Figure 20b: Vaginal rhabdomyosarcoma Used with permission from  
<http://www.pediatricurologybook.com/rhabdomyosarcoma.html>

## 5. Urinary Retention/Urinary Tract Obstruction

See ([Figure 21](#))

Things to Consider:

- What is the **child's age?** Certain diagnoses more commonly present in the neonatal period (i.e. posterior urethral valves) versus toddler/childhood (voiding dysfunction, phimosis, meatal stenosis).
- Is there a **history of abnormal antenatal ultrasounds?** Abnormal postnatal imaging often, but not always, coincides with a history of abnormal prenatal imaging that will guide the clinician towards the urinary structures under suspicion. Posterior urethral valves typically present pre- and post-natally with bilateral hydronephrosis and a thickened distended bladder with possible keyhole sign on ultrasound.
- Was the child **previously voiding normally?** Were the symptoms **acute or progressive in onset?** Likely a child with valves never voided normally, however a child with previously normal and subsequent abnormal voiding may have strictures, phimosis, or even voiding dysfunction as an underlying cause.
- Are there **other systemic symptoms**, i.e. **abdominal or flank pain, constipation, or other**

**urinary symptoms (dysuria, hematuria, incontinence)?** Additional symptoms may aid with localizing the underlying disease process.

- **What is the child's surgical history?** Is there a history of hypospadias repair or prior urethral surgeries/cystoscopies/instrumentation that may put the patient at risk for a urethral diverticulum or stricture?
- **Is there a history of perineal trauma?** This may put the child at risk for urethral or bladder neck disruption or subsequent stricture formation.
- Is there a palpable **abdominal or suprapubic mass** (i.e. hydronephrosis or distended bladder)?
- What is the **circumcision status?** Easily retractable foreskin or pathologic phimosis? Patent or stenotic meatus?



Figure 21: Distended bladder in a boy with balanoposthitis.

Differential Diagnoses:

**1. Upper Tract Causes**

- a. Ureteral strictures or polyps
- b. **Ureterolithiasis**
- c. **Ureteropelvic junction obstruction**
- d. **Ureterovesical junction obstruction**

**2. Lower Tract Causes**

- a. **Posterior or anterior urethral valves**
- b. Urethral stricture/meatal stenosis
- c. Constipation
- d. **Ureterocele**
- e. **Neurogenic bladder**
- f. Phimosis/acute balanitis
- g. Urinary tract infection (cystitis)
- h. Voiding dysfunction
- i. Dysuria related to instrumentation (e.g. attempted catheterization)

Imaging/laboratory studies to consider:

- **Urinalysis/urine culture** - Recommended if infection is suspected.
- **Post-void residual** - In toilet trained children, this helps assess for bladder outlet obstruction due to urethral strictures, meatal stenosis, or neurogenic/non-neurogenic bladder.
- **Uroflowmetry/observation of urinary stream** - In toilet trained children, may lend additional information towards diagnosis of voiding dysfunction (plateaued voiding curve) versus meatal stenosis (rapid, forceful, fine stream).
- **Renal and bladder ultrasound** - Evaluates for hydronephrosis suggesting ureteral stricture, UPJO/UVJO or bladder distention and thickening with or without trabeculation/diverticulae suggestive of bladder outlet obstruction or neurogenic bladder.
- **Voiding cystourethrogram** - Required to assess for posterior/anterior urethral valves, also assesses for adequacy of bladder neck opening during voiding, bladder architecture and ureterocele.
- **Urodynamics** - Evaluates quiescent and voiding bladder pressures, presence/absence of leak, coordinated or disordinated detrusor and sphincter muscle activity, and compliance of bladder to determine hostility of bladder.

Management (directed towards specific underlying cause/diagnosis):

## 1. Upper Tract Causes

- a. Ureteral strictures or polyps - endoscopic incision(laser incision/balloon dilation and incision) versus open/robotic excision (to excise diseased segment)
- b. Ureterolithiasis - medical expulsive therapy, ureteral stent and/or ureteroscopic extraction/PCNL
- c. Ureteropelvic junction obstruction - pyeloplasty
- d. Ureterovesical junction obstruction - ureteral reimplant or ureterovesicostomy<sup>12,13</sup>

## 2. Lower Tract Causes

- a. Posterior or anterior urethral valves - cystoscopic valve ablation
- b. Urethral stricture - cystoscopy, direct vision internal urethrotomy or urethroplasty
- c. Meatal stenosis - meatotomy/meatoplasty

- d. Constipation - increased dietary fiber intake, laxatives, enemas
- e. Ureterocele - observation if small and asymptomatic with stable/improving hydronephrosis versus cystoscopy, incision of ureterocele (laser or fulguration)
- f. Neurogenic bladder - as needed: anticholinergics and/or botulinum toxin injection, timed voiding versus clean intermittent catheterization, concurrent bowel management
- g. Phimosis/acute balanitis - steroid cream +/- oral or topical antibiotics, preputioplasty/dorsal slit/circumcision
- h. Infection (cystitis) - culture-specific antibiotics
- i. i. Dysuria due to instrumentation – pain medications, encourage spontaneous voiding, pyridium

## 6. Hematuria

See [AUA Update Series 2016, Vol 35, Lesson 4 Pediatric Hematuria](#) and Core Curriculum [Abnormal Urinalysis/Hematuria and Medical Renal Disease](#).

- Definition: > 5 RBC/hpf on at least 2 urinalyses over a 2-3 week period
- In children, hematuria more frequently is from a nephrologic source vs. a urologic source
- Most children with isolated microscopic hematuria do not have a treatable or serious cause for the hematuria and do not require an extensive evaluation.<sup>14</sup>

Things to Consider:

- What is the **child's age?** Certain malignancies have typical ages of presentation, i.e. toddlers/young children for Wilm's tumors, whereas renal vein thromboses are typically only seen in newborns.
- Is the child **toilet trained?** Children who are not yet toilet trained are less likely to have underlying voiding dysfunction as an explanation for their hematuria.
- What is the **child's race?** Certain ethnic backgrounds (i.e. African American) will have higher rates of bleeding dyscrasias (i.e. sickle cell disease) which may predispose them to papillary necrosis, and thus hematuria.
- Any **family history of bleeding dyscrasias? Hematuria or GU pathology?** Patients may have a family history of stone disease (i.e. cystinuria) which may predispose them to similar disease processes.
- Is the hematuria **gross or microscopic? Are there clots?** The volume and type of bleeding and presence/type of clots may help the clinician distinguish between upper versus lower tract bleeding and the acuity/severity with which it needs to be addressed, however, this is not extremely specific for diagnosis.
- **When is it occurring? (i.e. initiation, termination, or throughout entire stream)?** Hematuria noted only at the initiation or termination of bleeding may steer the clinician towards an anatomic/structural issue of the lower urinary tract (i.e. meatal stenosis/meatal arteriovenous malformation or urethrorrhagia/voiding dysfunction respectively).

- Are there **other systemic symptoms**, (e.g. **fever, flank or bladder pain, nausea/emeisis, infrequent voiding, dehydration, constipation, systemic edema or other vasculitis symptoms?**) Additional symptoms may aid with localizing the underlying disease process.
- **Is the patient able to void and empty?** Inadequate or prolonged bladder emptying may lead the clinician to suspect a urethral stricture or other bladder outlet obstruction or underlying voiding dysfunction.
- Has the **patient recently traveled outside the country?** Foreign travel or residency in areas endemic for tuberculosis (TB) should warrant appropriate studies for TB (urine AFB, PPD/quantiferon gold and/or Chest X-ray as indicated).
- Is there a recent history of **trauma?** The mechanism and location of trauma will often dictate what GU structure is at risk for injury and what types of diagnostic imaging are indicated.
- Has the patient recently been **catheterized or currently have an indwelling stent or catheter?** Traumatic catheterizations or the mere presence of an indwelling foreign body can intermittently cause benign hematuria. Must ensure that the patient is adequately emptying bladder in either of these situations.
- Is there associated **hypertension or proteinuria, edema, rash or arthritis?** These may suggest glomerulonephritis, autoimmune or vasculitic process

Differential Diagnoses:

## 1. Upper Tract Causes

- Malignancies – Wilms tumor**
- Benign tumors – fibroepithelial polyps of ureter
- Urolithiasis – kidney or ureter**
- Ureteropelvic junction obstruction**
- Renal vein thrombosis
- Arteriovenous malformation
- Nutcracker syndrome – compression of the left renal vein between the aorta and superior mesenteric artery
- Nephritis/glomerular bleeding/intrinsic renal disease
  - Assess for presence of proteinuria on urine dip and follow-up with quantitative urinalysis
  - Consider referral to nephrology for further diagnostic work-up and management
- Recent nephrotoxic medications – (i.e. papillary necrosis from NSAIDs)
- Trauma – renal laceration, UPJ disruption, urethral injury (i.e. secondary to pelvic fracture)**
- Infection – pyelonephritis or GU TB

## 2. Lower Tract Causes

- Malignancy – Bladder or prostate rhabdomyosarcoma**
- Bladder stone**

c. **Voiding dysfunction – typically terminal gross hematuria, urethrorrhagia**

d. Chemotherapy exposure – cyclophosphamide or other agents for bone marrow/stem cell transplantation

e. **Trauma – bladder or urethral injury (i.e. secondary to pelvic fracture)**

f. **Infection – cystitis**

Laboratory/Imaging Studies to Consider:

- Urinalysis
  - Quantify and qualify the hematuria (gross or microscopic? RBC casts which may suggest nephrologic cause?)
  - Concurrent proteinuria, nitrites, or leukocyte esterase?
- CBC, throat culture, serum C3, BMP
- Renal and bladder ultrasound
  - Ideal initial imaging modality in children as there is no ionizing radiation or need for sedation
  - Does not image the ureters, therefore, if inconclusive but with high suspicion for ureterolithiasis or other ureteral process, recommend proceeding to CT (see below)
- CT scan with/without delayed imaging
  - Consider in patients with high suspicion for ureteral stones (non-contrast), trauma to the collecting system with urinary or blood extravasation (with contrast and delayed imaging), or evaluation of any masses concerning for malignancy to assess vascularity, size, morphology, extension, and potential nodal/extra-GU involvement (with contrast)

Management of *gross hematuria*:

i. Initial/Conservative measures

- Ensure patient is hemodynamically stable (resuscitate with crystalloid/blood replacement as indicated) and emptying bladder adequately
- Stop any potential anticoagulant medications (heparin, NSAIDs, etc.)
- In the setting of hemorrhagic cystitis, place 3-way catheter if patient experiencing clot retention, evacuate clots, initiate continuous saline bladder irrigation
- Laboratory/imaging work-up as indicated

ii. Invasive Treatment for refractory gross hematuria

• **Upper tract bleeding**

- Ureteroscopy and focused fulguration of bleeding lesions
- Nephrostomy tube placement for urinary diversion to allow system to clot off distally
- Focused angioembolization by Interventional Radiology colleagues
- Exirpative surgery (nephrectomy) or vascular surgery

• **Lower tract bleeding<sup>15</sup>**

- Cystoscopy, evacuation of clot and fulguration
- Cystoscopy, instillation of intravesical agents under anesthesia (silver nitrate,

- formalin, fibrin glue)
- Hyperbaric oxygen therapy
- Nephrostomy tube placement for urinary diversion to allow system to clot off
- Supraselective bilateral vesical artery embolization
- Cutaneous vesicostomy
- Simple cystectomy

## Presentations

### Pediatric Urology Emergencies & Urgent Consults Presentation 1

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