Foundations I:

Renal/Male GU Teaching Points

Testicular Torsion

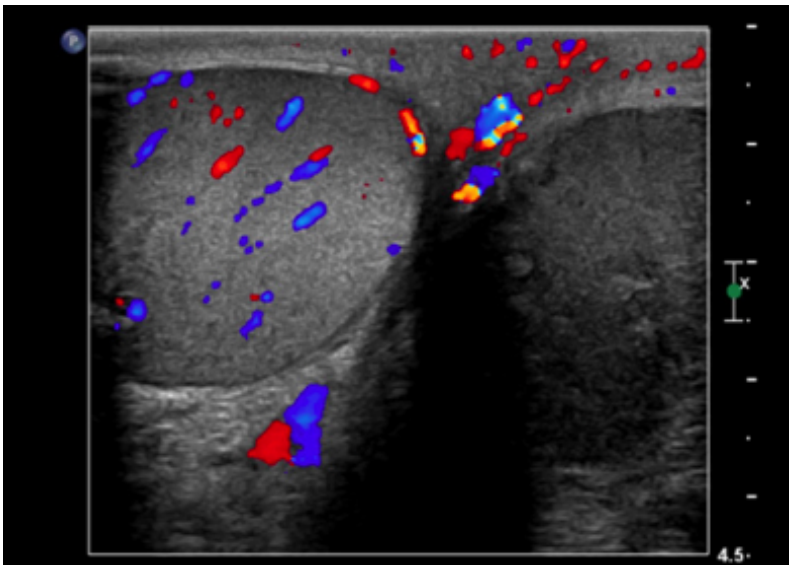
- **Differential Diagnosis**
  - Differential for concerning causes of abdominal pain in pediatric patients by age includes:
    - 0-3 mo- necrotizing enterocolitis, Hirschprung's/toxic megacolon, volvulus, pyloric stenosis, testicular torsion, incarcerated inguinal hernia;
    - 3 mo-2 yr- intussusception, Meckels diverticulum, foreign bodies, testicular torsion, incarcerated Inguinal hernia;
    - School age- similar to adults, including testicular torsion, appendicitis, epididymitis, orchitis, renal colic, varicocele, hydrocele, gastritis, constipation, STI, pyelonephritis, Strep pharyngitis, incarcerated or strangulated hernia, or pregnancy or ovarian torsion in female patients.

- **What is testicular torsion and how does it present?**
  - Testicular torsion is the twisting of the spermatic cord. This initially causes obstruction of venous return, followed by compromised arterial flow to the testicle.
  - In this age group, testicular torsion can be associated with nocturnal erections due to increased vagal excitability and cremaster muscle contraction.
  - Onset of testicular pain is usually sudden and severe. Pain is often referred to the lower abdomen or inguinal canal.
  - Sometimes the pain associated with testicular torsion can wax and wane, indicating spontaneous torsion (pain) and detorsion (relief of pain).
  - Nausea and vomiting are associated with this condition secondary to pain.

- **What are risk factors for testicular torsion?**
  - Although symptoms tend to occur after exertion or trauma, they can occur from unilateral cremasteric muscle contraction during sleep.
  - Testicular torsion is associated with testicular malignancy, especially in adults; one study found a 64% association of testicular torsion with testicular malignancy.

- **How is testicular torsion diagnosed?**
  - In patients with lower abdominal pain, always include a genitourinary examination. Up to 50% of torsion cases may initially report abdominal pain without scrotal pain; this is an area of high medicolegal risk.

- In children, unilateral absence of the cremasteric reflex is a sensitive but nonspecific finding. The cremasteric reflex is less consistent in males > 12 years.
- Other abnormal exam findings may include:
  - Exquisitely tender and swollen testicle
  - The affected testicle may sit higher within the scrotum than the other testicle or may have a transverse lie.
  - Significant distress due to pain
  - Difficulty walking due to severe pain
  - Prehn's sign (or relief of pain upon elevation of the scrotum), although it is often is often associated with epididymitis and therefore does not help differentiate between the two diagnoses
- Testicular ultrasound with color doppler flow is the diagnostic imaging of choice (sensitivity 80-85%, specificity approaching 100%).
  - Classically doppler ultrasound would show reduced or absent blood flow to the involved testicle. The US may also show a "whirlpool sign" (twisted spermatic cord).
  - Recognize that the absence of blood flow is diagnostic, but the presence of flow does not necessarily rule out testicular torsion, particularly if the patient has intermittent symptoms.
  - Sensitivity of color doppler ultrasound is lower with less experienced operators and in early torsion when arterial flow may still be intact.



- **How is testicular torsion treated?**
  - "Time is testicle"- diagnosis and surgical management are time-sensitive. Testicular salvage is likely if detorsion in the OR occurs within 8 hours of symptom onset but becomes more unlikely with increasing time after 12 hours.
  - If surgery is delayed, bedside manual detorsion may be attempted using the following steps:

        - Provide adequate analgesia with IV narcotics. Note it is valuable to preserve patient consciousness to assess the adequacy of detorsion attempts.
        - Elevate the affected testicle toward the inguinal ring.
        - "Open the book" by rotating the testicle in a medial-to-lateral motion.
        - Initially rotate 180° and assess the patient for pain relief; repeat 180° rotations up to 720°.
        - Pain relief suggests partial or complete detorsion.
    - Limitations of manual detorsion
        - Recognise that the success rate of this procedure is low and the procedure should be stopped if the patient has worsening pain.
        - While "opening the book" (lateral rotation) is the norm, up to ⅓ of patients may require medial rotation. Use increasing or decreasing pain as a guide.
        - Emergent urology consultation is necessary, even if symptoms improve with manual detorsion.
        - Contraindications for manual detorsion include unclear diagnosis and concern for testicular infarction (delayed presentations).
    - All cases of testicular torsion require operative management to fix the torsion and prevent future episodes of torsion. OR disposition should not be delayed by manual detorsion attempts.

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    - **References:**
        - ChatGPT (2025) was used for idea generation for refinement and improvement of the 2025 update of this case. All FoEM case content is vetted and verified by board-certified emergency medicine physicians.
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- Image References
    - POCUS images courtesy of: Emory Emergency Medicine POCUS Archive

Fournier's Gangrene

- **Differential Diagnosis**
    - The differential for this patient with fever and rectal pain should include Fournier's gangrene, cellulitis, sexually transmitted infection, perianal/perirectal abscess, and incarcerated or strangulated hernia. In female patients, the differential should also include vaginitis, pelvic inflammatory disease, and tubovarian abscess. A complete physical exam, including GU, rectal exam and abdominal exams, is necessary to narrow-down the broad differential diagnosis. Crepitus, purulent drainage, and other skin changes in the perianal, perineal, and genital region should lead to a high suspicion for a necrotizing GU infection (i.e., Fournier's gangrene).

- **What is Fournier's gangrene?**
    - A necrotizing soft tissue infection which extends into the perineal, perianal, and genital area. It is considered a surgical emergency and carries high mortality (around 20%, higher with delayed care).
    - Progression of infection is rapid (over hours); marking margins of skin involvement can help identify rapid progression.
    - Risk factors include:
        - Male > Female (8:1)
        - Advanced age (peaking in 50-79 year olds)
        - Diabetes
        - Alcohol misuse disorder
        - Obesity
        - Immunocompromised state (including HIV, cancer, and patients on immunosuppressive therapies)
        - Recent surgery
    - The infection typically arises from local trauma, seeded from the GI tract, GU tract, or other cutaneous injuries.
    - Infections are usually polymicrobial with synergism of typically non-aggressive microbes leading to severe disease. Common organisms include E coli., Klebsiella pneumoniae, Staph aureus, anaerobes, and fungi.
    - An explosion of bacterial growth in the subcutaneous tissues of the perineum leads to destruction of smaller arterial branches in the perineum and scrotum. This leads to incredibly quick destruction of the fascia and deep tissue, up 2-3 cm/hr.

- **How is Fournier's gangrene diagnosed?**
    - Fournier's is a **clinical diagnosis**, classically determined by identifying fluctuance, crepitus, tenderness, and tissue breakdown along the genitalia and perineum. **Surgical exploration** is the only way to reliably confirm or rule out the diagnosis of necrotizing infection.
    - Skin changes in Fournier's gangrene can be highly variable and skin exam can be falsely reassuring.

        - Early signs may include erythema, edema, and pain out of proportion to exam.
            - Erythema typically does not have sharp margins.
            - Edema typically extends beyond the area of erythema.
            - Pain out of proportion to exam may also be delayed.
        - As the disease progresses, patients may develop crepitus (50%), fever (60%), a "dusky" appearance to the skin, ulcerations or blisters, purulent "dishwater" discharge, foul odor, or necrosis.
        - As disease progresses, destruction of small blood vessels and nerves can lead to diminished sensation and thus lack of pain relative to concerning exam findings ("la belle indifference").
        - Any isolated diagnosis of cellulitis in the perineum or genitalia should be evaluated for Fournier's.
    - Necrotizing skin infections can rapidly progress to include sepsis, septic shock, and multi-organ system failure.
    - The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) and Fournier's Gangrene Severity Index (FGSI) are two studied scoring systems developed to assist in the diagnosis of Fournier's, though available data show **poor sensitivity** or are limited.
        - The LRINEC score is based on CRP, WBC, Hgb, Na, creatinine, and glucose.
        - FGSI is based on temperature, heart rate, respiratory rate, Na, K, creatinine, hematocrit, and WBC
    - Point-of-care ultrasound can aid in diagnosis by identifying inflammation, edema, fluid collections, and subcutaneous gas. Basic radiographs may also pick up subcutaneous emphysema, however **both POCUS and radiographs are poorly sensitive**.
    - CT with contrast may show subcutaneous emphysema and fascial thickening in addition to typical findings of cellulitis or abscess. CT has excellent sensitivity (93%) and specificity for Fournier's, however the time to utilize such modalities should be an important decision point for providers and **should not delay operative management** when the diagnosis has already been made clinically.

- **How is Fournier's gangrene managed?**
    - **Prompt antibiotics and surgical management** are cornerstones of treatment, with delay leading to significantly increased risk of mortality. Your role is to minimize delays to this definitive care.
        - Broad spectrum antibiotics are chosen to treat common organisms, resistant *Staphylococcus*, and to reduce toxin production (Group A Strep and Clostridium species). Options include:
            - MRSA (Vancomycin or Linezolid)
            - Anaerobes (Clindamycin or Metronidazole)
                - Clindamycin specifically ceases toxin production
            - Gram negative rods (Zosyn, Carbapenem)
                - If penicillin allergic, consider aminoglycosides or fluoroquinolones plus metronidazole.
            - For salt and fresh water exposures, consider doxycycline.

        - For fungal involvement, consider amphotericin B or fluconazole.
    - Ensure adequate resuscitation for associated sepsis, supportive care, and management of patient comorbidities.
    - Hyperbaric oxygen therapy can be considered, however available data is poor on its efficacy.
    - IVIG has been shown to improve mortality in patients with Group A Strep.
    - Disposition to the OR for surgical debridement followed by the ICU should be made as soon as possible. Mortality approaches 100% with antibiotic treatment alone.

- **POCUS Pearls** (see Figures **68.2 A & B**)
    - When in their early stages, necrotizing infections such as Fournier's gangrene can often appear indistinguishable from simple soft tissue infections such as cellulitis. In these cases, point of care ultrasound can be used as a useful adjunct to the physical exam.
    - The ultrasound findings associated with necrotizing infections such as Fournier's gangrene are fascial and subcutaneous tissue thickening and abnormal fluid collection in the deep fascial layer. Fournier's gangrene will often show marked thickening of the scrotal skin and subcutaneous air which will appear as discrete focal regions of hyperechogenicity with posterior shadowing ("dirty shadows"). [see **Figure 68.2 A**]
    - While Fournier's gangrene can appear similar to simple cellulitis on ultrasound, the defining features of necrotizing infections on ultrasound are fluid in the deep fascial layers and subcutaneous air. [see **Figure 68.2 B**]
    - Ultrasound has been shown to be fairly specific for necrotizing soft tissue infections (93%), but it should not be used to rule out the diagnosis.

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    - **References:**

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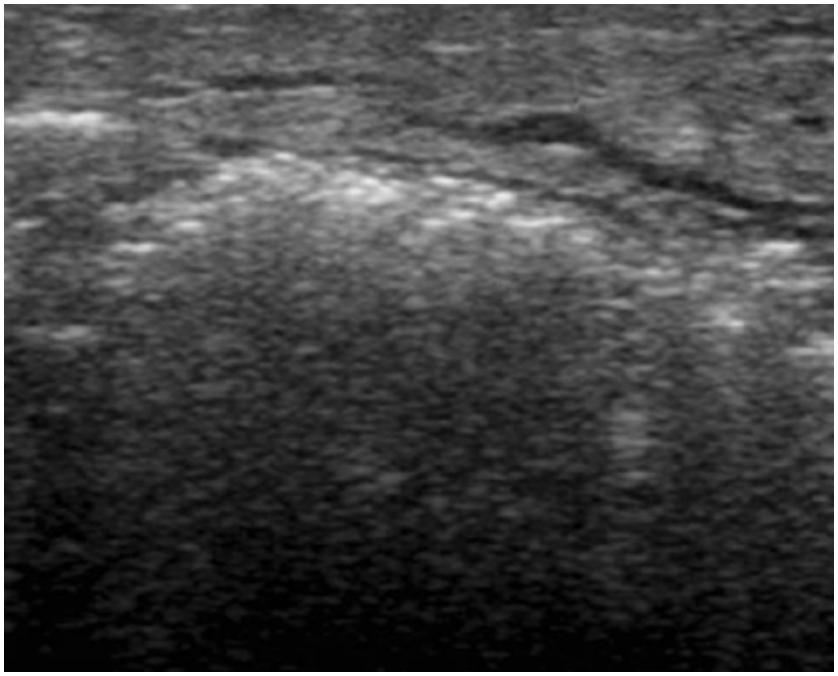
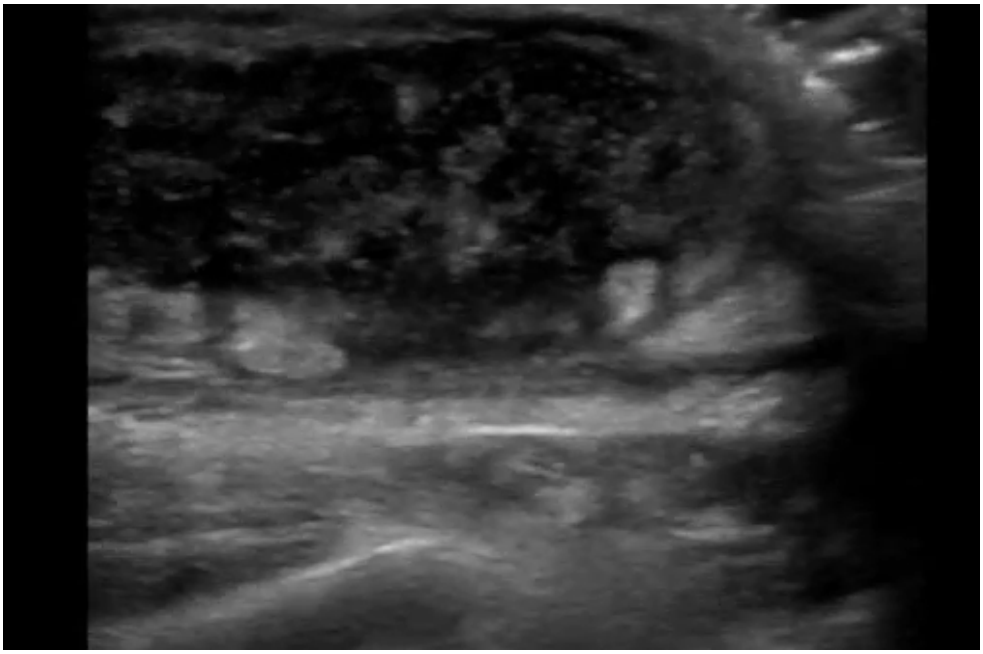
    - POCUS images courtesy of: Emory Emergency Medicine POCUS Archive
    - CT Pelvis: Case courtesy of Nayara Hernández González, Radiopaedia.org, rID: 209543

Figure 68.2- POCUS Soft Tissue

A.



B.



Back to Teaching Points

Priapism

- **Differential Diagnosis**
    - The differential for priapism should include medication-induced, substance-induced, sickle cell crisis, leukemia, penile trauma, urethral foreign body, spinal cord injury, Peyronie's disease, normal sexual arousal, and penile implant.

- **What causes priapism?**
    - Low-Flow/Ischemic Priapism (emergent)
        - Most common type
        - Decreased venous outflow leads to increased cavernosal pressure; when cavernosal pressure exceeds arterial pressure, ischemia develops.
        - Painful! - aka Compartment Syndrome of Penis - rigid penile shaft, flaccid glans
        - Expedient treatment necessary
            - Ischemia by 4-6 hours
            - Irreversible damage by 24 hours
            - Delay in reversing ischemia leads to fibrosis, impotence, erectile dysfunction, urinary retention, incontinence.
    - High-Flow/Non-ischemic Priapism (non-emergent)
        - Increased arterial inflow into cavernosal tissue
        - Penile Trauma leading to arterio-cavernosal shunt, or high spinal cord injury leading to abnormal parasympathetic tone to penile tissue
        - Often painless, semi-flaccid penile tissue, rigid glans
        - Often self-resolves over hours-days; may need arteriography/embolization or surgical ligation
        - Rarely leads to long-term complications

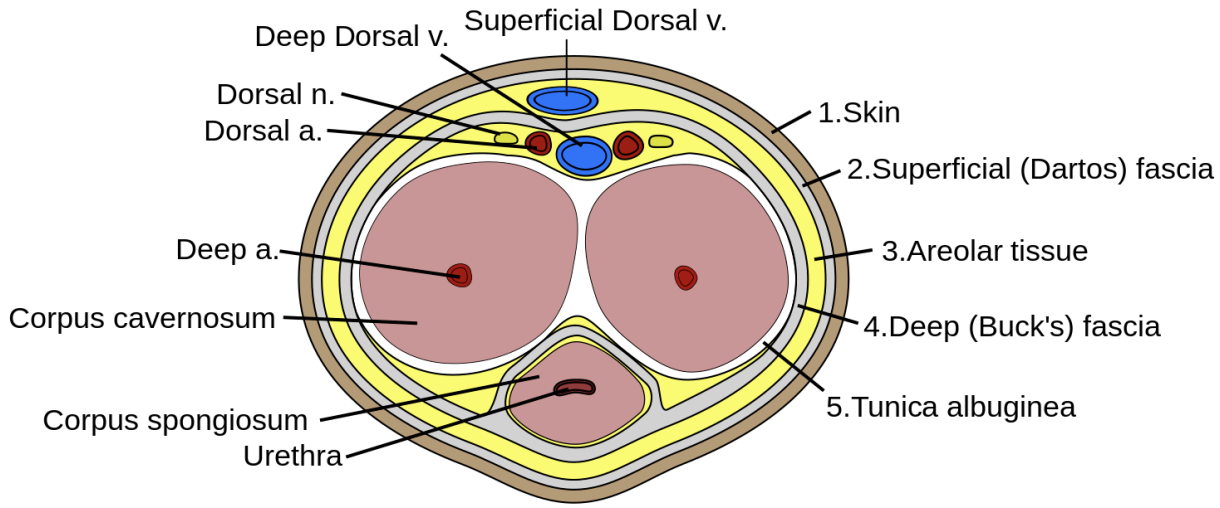
- **What medications/substances are associated with priapism?**
    - Sildenafil (Viagra), Tadalafil (Cialis), Vardenafil (Levitra), intracavernosal injections (Papaverine, phentolamine, prostaglandin E1)
    - Trazodone, SSRIs
    - Cocaine, ecstasy
    - Antipsychotics

- **What labs would you order for a patient with priapism? What abnormalities are you looking for in the labs?**
    - Corporal blood gas (CBG) is important to distinguish ischemic from non-ischemic priapism.
        - Low flow/ischemic
            - Causes hypoxic, hypercarbic, and acidotic cavernosal blood gases
            - pH < 7.25, pO_2 < 30 mmHg, pCO_2 > 60 mmHg
        - High flow/non-ischemic
            - Results normal range for arterial sample

- Additional Labs
  - CBC with differential - evaluate for sickle cell, leukemia, platelet abnormality
  - Reticulocyte count, smear, hemoglobin electrophoresis - evaluate for sickle cell, hemoglobinopathy
  - Urine toxicology screen if substance use is suspected
  - Coagulation studies (PT/INR, aPTT) - evaluate for coagulopathy
  - Consider pre-op type and screen

- **What should be included in the risk/benefit discussion and what expectation should you set for the patient with ischemic priapism?**
  - Concerning outcomes increase as ischemic time increases > 6 hours and include penile necrosis, fibrosis and permanent erectile dysfunction/impotence.
  - 90% of patients have erectile dysfunction if ischemic time is > 24 hours, but patients treated closer to 6 hours are unlikely to have long-term complications.
  - These complications carry considerable legal implications and should be discussed as
  - possibilities with the patient in all cases.
  - Timely intervention with the procedures below are essential to improve outcomes.
  - Typical risks of any procedure should be discussed, including bleeding, infection, damage to surrounding structures. In addition, the risks of hypertension and dysrhythmias with phenylephrine use should be discussed.

Figure 309.1: Penile Anatomy



- **How is a dorsal penile nerve block performed?**
    - Prep
        - Have the patient lie supine
        - Clean area with betadine or chlorhexidine solution
        - Cover surrounding area with sterile drapes
    - 1% lidocaine without epinephrine
        - 27 gauge needle, 10 cc syringe
        - Insert needle at the penile base at 10 o'clock and 2 o'clock positions, directing towards the center of the penile shaft.
        - Depth is approximately 0.5 cm; should feel slight give in resistance as Buck's fascia is passed.
        - Inject 1-2 ccs of anesthetic at each position.
        - Aspirate before injecting to ensure the needle is not in a blood vessel.
    - Avoid
        - 12 o'clock (dorsal penile vein) and 6 o'clock (urethra) positions
    - Alternative
        - Circumferential ("ring") Penile Block: inject around full base of penis

- **What are the treatment steps for a low flow (ischemic) priapism?**
    - Urgent urological consultation is indicated, though medical management should begin in the ED prior to urology arrival in patients with low flow priapism.
    - Use **Figure 309.1** (penile anatomy) as you describe techniques for the procedures below.
    - Recommended steps by the American Urological Society:
        - Ischemic priapism < 4 hours -> intracavernosal injection of phenylephrine
        - Ischemic priapism > 4 hours -> Intracavernosal aspiration/irrigation followed by injection of phenylephrine
    - Intracavernosal aspiration/irrigation/manual decompression
        - 19 gauge butterfly needle insertion at 9 o'clock OR 3 o'clock position of the base of the penile shaft.
        - Aspirate only one side as the cavernosal tissue communicates via the intracavernosal shunt.
        - Slowly aspirate 10-20 cc of blood (should be dark red).
        - Send initially withdrawn blood off for cavernosal blood gas analysis.
        - Repeat q 5 min x2 until arterial blood is obtained or detumescence occurs.
        - Can irrigate with 10 cc NS x2 in between aspirations to promote hemolysis of clotted blood.
        - If aspiration, irrigation, manual decompression do not work, inject vasoactive agent
    - Intracavernosal injection of phenylephrine
        - Phenylephrine is an alpha-1 agonist (constricts smooth muscle, promotes venous outflow) with potential side effects of hypertension and dysrhythmias. Ensure continuous cardiac monitoring and frequent blood pressure checks.

        - Use a premade phenylephrine syringe when available; alternately, mix 1 mg phenylephrine with 9 mL of normal saline to make 100 mcg/1 mL solution.
        - Inject 100-200 mcg of phenylephrine every 3-5 minutes at the at 9 o'clock OR 3 o'clock position of the base of the penile shaft until detumescence or max dose (1,000 μg = 1 mg) occurs.
        - Prevent hematoma with compression at injection site.
        - Lower doses are recommended for children or patients with severe CV disease.
    - Post-procedure and disposition if detumescence is successful
        - Penile edema and partial erection may persist even after detumescence but pain should be significantly improved. If in doubt, repeat CBG should show improvement.
        - If successful, place a loose elastic bandage around the shaft of the penis to ensure continued emptying of the corpora and to compress the puncture site.
        - Patients with complete detumescence, no recurrence after multiple hours of observation and clearance by urology may be discharged home with short-term follow up with Urology

- **What is the management for refractory priapism or complicated cases?**
    - Patients with serious underlying disease (sickle cell, leukemia) may require admission
    - Discuss surgical management with Urology if the above techniques fail
    - Refractory cases may require an intracavernosal shunt or penile implant insertion

- **What additional management steps would you consider in a patient with priapism from a sickle cell crisis?**
    - Hydration
    - Oxygenation
    - Pain control
    - Intracavernosal aspiration, irrigation, injection
    - Blood transfusion (goal HCT > 30%), partial exchange transfusion (goal Hb-S < 30%)
    - Exchange transfusion - conflicting evidence for efficacy

- **What is the treatment for priapism related to a high flow state?**
    - Observation
    - Intracavernosal techniques have not shown efficacy
    - F/u Urology in one week
        - Cavernosal artery embolization vs. repair

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