Chapter 40 - Genitourinary System

EPISODE CONTENT BASED ON ROSEN'S EMERGENCY MEDICINE (9TH ED.)

Italicized text is quoted directly from Rosen's.

Key Concepts:

1. *Microscopic or gross hematuria is suggestive of genitourinary trauma; however, the degree of hematuria does not correlate well with the severity of injury.*
2. *The kidney is the most frequently injured genitourinary organ, and imaging should be considered in patients with gross hematuria or microscopic hematuria with hemodynamic instability.*
3. *Delayed CT images after IV contrast should be obtained in patients with mechanism or findings suggestive of ureteral trauma. Blunt ureteral trauma is rare.*
4. *CT scan with IV contrast is not sensitive for diagnosing bladder injury, and retrograde cystography should be obtained if there is any concerns to allow proper distention of the bladder to allow for urinary extravasation.*
5. *Pelvic fractures associated with hematuria strongly suggest urethral injury.*
6. *Retrograde urethrography (RUG) should be performed in patients with pelvic fractures and hematuria, perineal ecchymosis or swelling, or those with blood at the urethral meatus, because passage of a Foley catheter blindly in these settings can worsen a preexisting urethral injury.*
7. *Genital injury is rarely life threatening, but prompt diagnosis and evaluation is necessary to decrease the likelihood of future morbidity in these patients.*

Core Questions

1. Outline the AAST's Classification System for Renal Trauma
2. List four complications of renal trauma.
3. Outline the spectrum of testicular injury.
4. Compare and contrast true and false penile fractures.
5. List five indications for renal injury in the trauma patient.
6. List four indications for imaging in the patient suspected of having a bladder injury.
7. List four indications for ureteral imaging in the context of trauma.
8. Outline the indications for and procedural specifics of a retrograde urethrogram (RUG).
9. Outline the procedural steps required to perform suprapubic catheterization.
10. Outline an approach to the management of zipper injuries.

Wisecracks

1. What is the structurally weakest portion of the bladder?
2. List four anatomic variations that increase the likelihood of renal injury in pediatrics?
3. What can be done if delayed CT imaging for ureteral injury is not performed initially?
4. How much force is required to fracture a testicle?
5. How does one “reduce” a testicle?

Rosen’s in Perspective

We did it! We have reached the end of CRACKCast. In today’s episode, we review Chapter 40 in Rosen’s 9th Edition - Genitourinary System.

I can already hear everyone wincing in pain as they listen in, but try to pay attention because this episode is going to cover some pretty valuable content. GU trauma is EXCEEDINGLY common. About 10% of all trauma cases in the US involve the GU tract. While not usually life-threatening, GU trauma can bring with it a whole host of life-long complications. Renal insufficiency, chronic hypertension, incontinence, and sexual dysfunction can all be the consequence of missed injuries in the ED. Thus, knowing this content cold is key to making sure your patients live happy and full lives after leaving your department doors.

If you are now reflecting on your last trauma case and thinking about how a renal injury may have been missed, fear not - we got all the content to help quell your anxieties. This episode will give you the information you will need for your next ED GU trauma patient. First, we will review the classification system used to describe and steward management of renal injuries. Then, we will dive into the hazy waters of diagnostic imaging in these patients. After that, we will crush out some of the high-yield procedural content your will need to investigate and treat some tough GU trauma-related pathology. Last, we will end the episode as we always have - with those high yield quick snappers to get you ready for exam time. So, with that said, get your cup of coffee, relax, and enjoy our final voyage together!

Core Questions:

[1] Outline the AAST’s Classification System for Renal Trauma

This table was modeled after Table 40.1 - The American Association for the Surgery of Trauma Grading Scale for Classification of Renal Trauma in Rosen’s 9th Edition. Please see the text for further clarification.

Grade	Type	Description
I	Contusion	Microscopic or gross hematuria
	Hematoma	Subcapsular, non-expanding without parenchymal laceration
II	Hematoma	Non-expanding perirenal hematoma confirmed to renal retroperitoneum
	Laceration	<1 cm parenchymal depth of renal cortex without urinary extravasation
III	Laceration	>1 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation
IV	Laceration	Parenchymal laceration extending through the renal cortex, medulla, collecting system
	Vascular	Main renal artery or vein injury with contained hemorrhage
V	Laceration	Completely shattered kidney
	Vascular	Avulsion of the renal hilum that devascularizes kidney

Important to note that “high grade injuries” are defined as grades III, IV, V and that the grade is made based on the highest grade assessment. Additionally, while multiple grades of injury can coexist, the injury is largely defined by its most significant injury.

How does this affect management? Well, there has been a decent amount of change in this field over the last several years. More and more, surgeons are opting for more conservative management strategies for renal trauma. Injuries graded I-III often are managed with serial imaging (typically ultrasound unless hemodynamically unstable, hemoglobin falling, or poor quality US images generated). Grade IV segmental vascular/collecting system injuries are also managed in this way. Grade V injuries are split into two camps: those who are hemodynamically unstable and those that are not. Those that are unstable generally go for surgical exploration

while those who are stable are observed and have serial imaging. Individuals who only have microscopic hematuria and are hemodynamically stable generally have a repeat urinalysis in 6 weeks time and are investigated as per those results.

[2] List four complications of renal trauma.

Again, another hidden list. Here are the complications listed in Rosen's:

1. Urinary tract infection
2. Urinary leak and resultant urinoma
3. Loss of renal function
    a. Grade III injuries typically decrease renal function by 15%
    b. Grade IV injuries typically decrease renal function by 30%
    c. Grade V injuries typically decrease renal function by 65%
4. Hypertension

It is important to note that the risk of infection is fairly high in these folks. As such, antibiotics should be considered for all patients with renal trauma to avoid UTI's and the dreaded perinephric abscess formation.

[3] Outline the spectrum of testicular injury.

This is a tight hidden list in Rosen's that is high yield. The spectrum of testicular injury is as follows:

1. Testicular contusions
    a. Defined as intrascrotal blood vessel rupture and subsequent intrascrotal hematoma formation
2. Testicular fractures
    a. Defined as linear avascular areas within the testicle without rupture of the tunica albuginea
3. Testicular dislocation
    a. Defined as forced extra scrotal migration of one of both testicles along the path of the spermatic cord, usually being found in the superficial inguinal area
4. Testicular rupture
    a. Defined as the disruption of the testicular tunica albuginea
5. Traumatic testicular torsion
    a. Defined as rotation of the testicle about its axis causing decreased blood flow to testicular tissue in the setting of trauma
6. Traumatic testicular epididymitis
    a. Defined as epididymal inflammation secondary to trauma

[4] Compare and contrast true and false penile fractures.

True penile fractures are defined as traumatic rupture of both the tunica albuginea and the corpus cavernosum. This leads to a swollen, ecchymotic, and deviated penis. Typically, patients present after vigorous sexual interourse or masturbation, having heard a loud “pop” and subsequently having rapid detumescence and discoloration of the penile shaft.

False penile fractures generally do not have rupture of either of the structures listed above. These are penile vascular injuries, generally to the dorsal veins or arteries. Typically, patients will present after sexual intercourse or masturbation but will deny having heard a “pop”, may have had gradual detumescence, and often can have a new post-injury erection that occurs.

[5] List five indications for renal imaging in the trauma patient.

Yet another hidden list in Rosen’s 9th Edition. Here are your indications for renal imaging in the context of trauma:

1. Hemodynamic instability with evidence of intraperitoneal injury on abdominal examination
2. Presence of pelvic fracture
3. Penetrating traumatic mechanism
4. Presence of lower rib fractures
5. Post-traumatic gross hematuria

It is important to note here that the first four indications, if present, should prompt imaging regardless of whether the patient has hematuria or not. Additionally, it is important to note that CT scan is your imaging modality of choice, with delayed phase (scanning 10 minutes after administration of contrast) imaging being indicated if there are concerns about collecting system injury.

[6] List four indications for imaging in the patient suspected of having a bladder injury?

Indications for imaging for suspected bladder injury are as follows:

1. Gross hematuria and pelvic fracture
2. Microscopic hematuria and:
    a. Pelvic ring fractures
    b. Obturator fractures
3. Penetrating trauma to the pelvis

Remember that CT scan with IV contrast alone is insufficient to evaluate for bladder injuries as it does not sufficiently distend the bladder. You need retrograde stress cystography, performed by

diluting 30 cc of water-soluble ionic contrast in a 500 cc bag of warmed saline. Approximately 300-400 cc is instilled via a Foley catheter, displacing those clots that may have formed to allow for extravasation. To differentiate extraperitoneal bladder rupture from intraperitoneal bladder rupture, look for a “molar tooth” appearance on cystography. This pattern is consistent with extraperitoneal rupture. Intraperitoneal bladder rupture cystography typically shows intraperitoneal structures being outlined.

Remember, differentiating between intra and extraperitoneal bladder rupture changes management. Most EBR’s are managed conservatively, while almost all IBR’s require surgical exploration and intervention.

[7] List four indications for ureteral imaging in the context of trauma.

Your indications are as follows:

1. Unexplained and persistent hematuria
2. Evidence of injury adjacent to the ureter, including:
    a. Retroperitoneal vascular injury
    b. Vertebral fractures
    c. Penetrating injuries to the flank

It is important to note that blunt ureteral injury is rare, but missed injuries to these structures have significant implications. These patients typically present later on after their injuries with sepsis, hydronephrosis from obstruction, or a urinary fistula.

Again, your imaging strategy of choice here is CT with IV contrast. This has supplanted IV pyelography/urography and retrograde pyelography. Remember that these patients need a DELAYED PHASE CT scan.

[8] Outline the indications for and procedural specifics of a retrograde urethrogram (RUG).

This table was modeled after Box 40.1 - Technique for Performing Retrograde Urethrography in Rosen’s 9th Edition. Please see the text for further clarification.

Technique for Performing Retrograde Urethrography
1. A 16-18 Fr Foley catheter or a hysterosalpingogram catheter is flushed with radiopaque contrast to avoid air bubbles 2. The glans penus and urethral meatus are cleansed with antiseptic 3. The catheter is inserted into the penis, and the balloon is partially inflated (1-2 cc) in the fossa navicularis

4. The penis is then pulled laterally to straighten the urethra under moderate traction
5. A preconstrast scout view is obtained, because prostatic calcifications may be confused for extravasated contrast
6. Under fluoroscopic visualization, 20-30 cc of contrast is injected with the goal of filling the entire urethra
7. If spasm of the external sphincter prevents posterior urethral filling, slow and gentle pressure may allow opacification
8. Static images are obtained to demonstrate the identified pathologic condition

[9] Outline the procedural steps required to perform suprapubic catheterization.

So, let's say that the RUG you just shot shows a urethral injury. Now what do you do? The answer is another procedure - suprapubic catheterization! It is important not to attempt to catheterize these patients in the ED, as instrumentation of a damaged urethra can worsen the injury. Here's how you can do it:

Check out WikEM's post for more here: https://wikem.org/wiki/Suprapubic_catheter_placement

Indications:

1. Traumatic urethral disruption
2. Severe stricture or prosthetic disease

Contraindications:

1. Empty or unidentifiable bladder
2. Bowel anterior to the bladder

Steps:

1. Use bedside ultrasound to locate and mark the bladder (can use real-time US guidance or Seldinger technique)
2. Sterilize field with antiseptic
3. Fill a syringe with local anesthetic and attach spinal needle
4. Raise a wheal at marked site and infiltrate tissues down to and including the rectus muscle fascia
5. Advance spinal needle into the bladder while constantly aspirating
6. Once flashback of urine is obtained, remove the syringe
7. Advance a guidewire through the needle into the bladder
8. Remove the needle and leave the guidewire in situ
9. Use a scalpel to make a stab incision at the site of the guidewire
10. Pass a peel-away sheath and indwelling dilator over the guidewire into the bladder
11. Remove the guidewire and fascial dilator, leaving only the peel-away sheath

12. Insert a Foley catheter through the sheath into the bladder
13. Aspirate urine through foley to confirm placement
14. Inflate Foley balloon
15. Remove the peel-away sheath
16. Dress the site

[10]Outline an approach to the management of zipper injuries.

For those of you out there in podcast land thinking that this is something only really seen in movies like “There’s Something About Mary”, think again. Zipper injuries are common - so common, in fact, that the US Military actually has a how-to guide for managing these. Here is how to treat the next Ben Stiller that walks through your ED doors:

1. If the zipper is stuck pinching the penis or scrotum AND some cloth material, try cutting the cloth between the interlocking dentition of the zipper. This may free the patient’s tissue without having to go much further.
2. If the penis is caught in the buckle of the fastener, unzipping can be attempted, using mineral oil to help with removal
3. If the above two tricks do not work, the medial bar of the zipper can be cut with a set of bone cutters or wire cutters to separate the two plates of the zipper.
4. If all else fails, a circumcision or elliptical incision of the penile skin can be performed to release the trapped tissue.

Wisecracks:

[1] What is the structurally weakest portion of the bladder?

Answer:

The dome of the bladder where it sits against the peritoneum is the weakest portion of this organ. This weakness is highlighted in patients with rupture after blunt trauma is directed against a distended bladder.

[2]List four anatomic variations that increase the likelihood of renal injury in pediatrics?

Answer:

Tight list here:

1. Weaker abdominal walls
2. Less perinephric fat

3. Relatively larger kidneys
4. Elastic chest wall

[3] What can be done if delayed CT imaging for ureteral injury is not performed initially?

Answer:

If you boofed it and forgot to order a delayed phase CT scan, here is a trick you can use to avoid sending your patient back to the scanner.

Wait 30 minutes from the contrast injection and shoot a plain radiograph of the abdomen. This can reliably identify large scale extravasation into the pelvis. Alternatively, you can order a retrograde pyelogram.

[4] How much force is required to fracture a testicle?

Answer:

Surprisingly, it takes a decent amount of force to rupture the tunica albuginea and cause a testicular rupture - roughly 50 kg!

[5] How does one “reduce” a testicle?

Answer:

This is something that is not frequently done in the ED, but in general, this is how you reduce a testicle:

- Reduction is achieved by applying gentle caudad pressure along the path of the spermatic cord. Good analgesia and potential sedation may be required to perform this.
- Ultrasound should be performed whether is procedure is successful or unsuccessful to assess for vascular compromise of the testicle.
- After this is done, operative intervention with potential orchiopexy to prevent future torsion is considered.