GENITOURINARY TRAUMA

INTRODUCTION (ALEXIS PANKOW, M.D. 12/2014)
Patients may present with genitourinary (GU) trauma from a variety of mechanisms. Identification of these injuries is essential as they can be overlooked in the setting of multi-trauma. In particular, pelvic fractures may be the source of major hemorrhage. This guide reviews major GU injuries including injuries to the kidneys, ureters, bladder, urethra and pelvis.

Major GU injuries may be identified during the primary survey. Injuries resulting in major bleeding can present with hemorrhagic (hypovolemic) shock during circulation assessment. Examination of external signs of abdominal or back trauma can be identified during the exposure phase of the primary survey. Injuries may also be identified during the secondary survey. For example, a careful examination of the perinuem and genital exam may reveal blood at the urethral meatus or perineal eccymosis/lacerations, In addition, bedside testing may reveal hematuria and the extended focused adominal assessment in trauma (E-FAST) may reveal intraperitoneal bladder rupture. It is important to note that the E-FAST exam will not identify retroperitoneal bleeding.

DIAGNOSTIC STUDIES
Urinalysis - >50 WBC/HPF
Pelvic XRAY
Abdominal ultrasound
Retrograde urethragram
Cystoscopy
CT scan of abdomen and pelvis

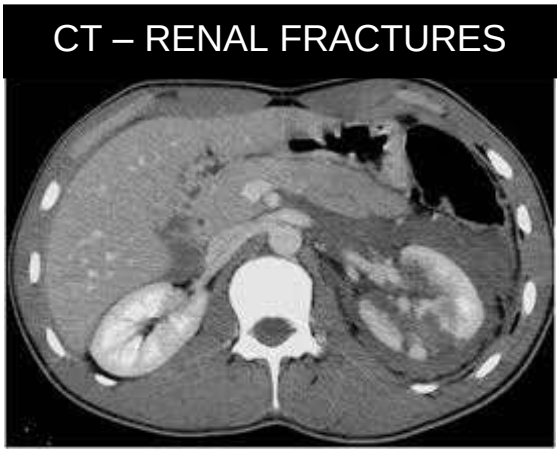
Gross of microscopic hematuria may be present with a GU injury. Patients with physical exam findings or mechanism of injury suspicious for GU trauma should have imaging regardless of urinalysis results. Urologic Injury has been found in patients without hematuria and hematuria found in patients with no injury (Thorp et al., 2011).

1. RENAL INJURY

Children have larger kidneys in relation to abdomen size and less perinephric fat and musculature to protect the kidney. These factors predispose them to renal injuries. Renal injuries may occur from motor vehicle collisions, lower rib fractures, and direct blows. General signs of renal injury include abdominal tenderness, rigidity, paralytic ileus, and hypovolemic (hemorrhagic) shock. More specific indicators of renal injury may include flank tenderness, hematoma or mass.

Hematuria may be present with renal injury but the degree of hematuria does not correlate with the severity of injury. In additon, the absence of hematuria does not preclude the presence of a renal injury. Gross hematuria or microscopic hematuria with greater than 50 RBC/HPF should prompt evaluation for kidney injury in trauma patient.

CT imaging can be used to: determine the degree of renal parenchymal injury, evaluate the presence of nonviable tissue, demonstrate extravasation and perirenal collections, and diagnose pedicle injuries. The diagnostic accuracy of the CT scan for renal injuries has been reported to be as high as 98%.



Ultrasonography is readily available and can be performed at the bedside. Despite these benefits it is not widely accepted in identifying renal injuries. The E-FAST exam will not identify retroperitneal fluid collections. The sensitivity in demonstrating renal injury is only 70% compared to 98% with CT. Pulsed-flow duplex Doppler ultrasound can assess renal arterial and venous flow and may represent the most immediate means of screening for renal pedicle injury.

A one shot intravenous pyelogram (IVP) could be utilized to identlfy renal injury in the hemodynamically unstable patient who could not tolerated a delay to obtain a CT scan of the abdomen and pelvis or when a CT scan is not available. Delayed excretion, extravasation and nonvisualization of calices on an IVP indicates renal injury

Angiography can be useful to both diagnosis ongoing bleeding and to perform embolization if required.

AAST* GRADING OF RENAL INJURIES		
I	Contusion	Microscopic or gross hematuria, urologic studies normal
	Hematoma	Subcapsular, nonexpanding without parenchymal laceration
II	Hematoma	Nonexpanding peri-renal hematoma confined to renal retroperitoneum
	Laceration	<1.0 cm parenchymal depth of renal cortex without urinary extravagation
III	Laceration	<1.0 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravagation
IV	Laceration	Parenchymal laceration extending through renal cortex, medulla, and collecting system
	Vascular	Main renal artery or vein injury with contained hemorrhage
V	Laceration	Completely shattered kidney
	Vascular	Avulsion of renal hilum which devascularizes kidney
* The American Association for the Surgery of Trauma		

Grade 2 and 3 injuries require hospitalization for 24 hours at a minimum because risk of bleeding is high within that time frame. Management includes intravenous hydration, antibiotics, serial hematocrits and serial examinations.

Grade 4 and 5 require admission with serial hematocrit and surgical repair. Patient who continue to bleed will require more urgent surgical intervention with many grade 5 injuries progressing to nephrectomy.

2. URETERAL INJURY

Ureteral injury can result from a deceleration force. It should be considered in patients with transverse fracture of lumbar vertebrae, pelvic fracture, lower rib fracture, splenic laceration and liver laceration. Penetrating trauma can rarely cause ureteral injury. The onset of symptoms may be delayed.

INDICATORS - URETERAL INJURY
Fever
Pain
Palpable urinoma
Pyuria
Bacteriuria
Fistula
Hematuria

Hematuria is not a reliable sign. The urinalysis may be normal in up to 30% of cases.

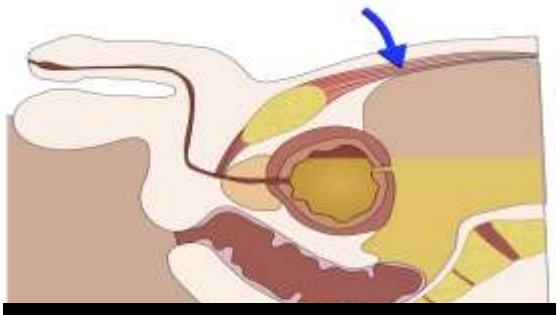
Management of ureteral injuries depends on the degree of injury and timing of diagnosis. Stents are used for partial tears or avulsions. Complete tears presenting in the first 15 – 10 days undergo surgical repair. Complete tears presenting after 10 days undergo urinary diversion with a delayed definitive repair.

3. BLADDER INJURY

Bladder injuries are more likely to occur when the bladder is full. The weakest point is at the dome. The bladder in children is higher in the abdominal cavity and more likely to be injured.

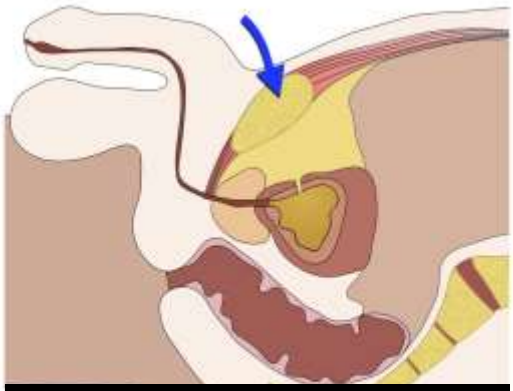
Urinalysis will identify gross or microscopic for hematuria. Gross hematuria is reliable sign of bladder injury. Hematuria is present in nearly 100% of cases of significant bladder trauma. However it is nonspecific as it can be seen with both urethral and renal injuries as well. Microscopic hematuria is more commonly associated with less severe injury such as a bladder contusion. Pelvic XRAY and CT will identify pelvic fractures that may result in bladder trauma.

The diagnosis of bladder injury is made with retrograde cystography if no signs of urethral injury are present. Cystoscopy is contraindicated if signs of urethral injury such as blood at the urethral meatus or perineal hematoma are present.



Intraperitoneal Bladder Rupture
(From a Blow to the Abdomen)

Bladder rupture may be extraperitoneal (most common) or intraperitoneal. Extraperitoneal bladder rupture requires catherization for urine drainage to assist healing. Suprapubic drainage can be used for patients with urethral injuries. Intraperitoneal bladder rupture requires surgical repair. Treatment is supportive for bladder contusions. A Foley catheter can be placed to keep bladder from overextending.



Extraperitoneal Bladder Rupture
(From a Pelvic Fracture)

4. URETHRAL INJURY

Symptoms of urethral injury include difficulty voiding and hematuria. Signs of urethral injury include: blood at the urethral meatus and perineal/periurethral swelling or ecchymosis. The digital rectal examination for a “high riding” prostate has not been demonstrated to be sensitive or specific. In one trial of health volunteers nearly 25% had a prostate that was not palable.

Urethral catheterization is contraindicated if there is a suspicion of urethral injury. Instead, a retrograde urethrogram should be performed (most commonly by a urologist or trauma surgeon). A catheter is placed in the tip of the urethra, the balloon is inflated with 1.0-1.5 cc and die is injected under fluoroscopic guidance to determine urethral integrity.

RETROGRADE URETHROGRAM
(Demonstrating Urethral Rupture)

Urethral rupture is managed with stenting of the urethra, suprapubic drainage or surgery depending on the extent of the injury. Antibiotic prophylaxis for urinary tract infection is recommended

CLASSIFICATION OF URETHRAL INJURIES		
I	Contusion	Blood at the urethral meatus. Normal urethrogram (without extravasation)
II	Stretch	Elongation of the urethra without extravasation on urethrography
III	Partial	Extravasation of contrast at injury site with contrast visualized in the bladder
IV	Complete	Extravasation of contrast at injury site without visualization in the bladder. < 2 cm of urethral separation
V	Complete	Complete transection with >2 cm urethral separation, or extension into the prostate or vagina

CONTRAINDICATIONS TO FOLEY CATHETER PLACEMENT*
Inability to void
Unstable pelvic fractures
Blood at the urethral meatus
Scrotal hematoma
Perineal hematoma, ecchymosis or laceration
Digital rectal exam with high riding prostate
* Factors associated with urethral injury or indications for a retrograde urethrogram

5. PELVIC FRACTURES

Pelvic fractures can be associated with significant hemorrhage and mortality. Patients with an open pelvic fracture can have 50% mortality.

Pediatric bones have a thicker periosteum and are more pliable than adult bones with relatively stronger ligaments. Therefore avulsion fractures and isolated pelvic ring fractures are more common in the pediatric population. Significant force is required to disrupt the posterior ring.

Since pelvic fractures are a result of high-energy impact they are often associated with other injuries. Associated injuries include hemorrhage from liver or spleen lacerations. Associated genitourinary trauma is seen in 11-12% of pelvic fractures. Neurologic injuries including spinal cord injury, chest and abdominal injuries, head injuries and extremity injuries can be associated with pelvic fractures. Pelvic vein disruption can lead to life threatening hemorrhage.

CLINICAL INDICATORS OF PELVIC FRACTURES
Laceration to the perineum, vagina, rectum, buttocks
Ruptured urethra – blood at the meatus, scrotal hematoma, high riding prostate
Limb abnormalities – limb length discrepancy, rotation deformity
Unstable pelvis – moves cephalad and rotated outward
Pelvic instability – compression distraction maneuver if indicated (see below)

In patients with signs of pelvic fractures, manipulation of the pelvis may dislodge clots and precipitate hemorrhage. Assessment of pelvic instability should not be performed in patients with shock and an obvious pelvic fracture. Using the compression-distraction maneuver, the hips are held at the iliac crests at the anterior superior iliac spines and pressure is placed first medially then laterally. The pelvis is considered unstable if it moves in either direction.

Pelvic fractures can be identified with plain XRAYS. CT scans of the abdomen and pelvis can identify retroperitoneal hemorrhage and pelvic injuries that are difficult to assess clinically and are the gold standard for identification of pelvic fractures and associated injuries.

MODIFIED TORODE AND ZIEG CLASSIFICATION OF PELVIC FRACTURES		
I	Avulsion Injury	Caused by forceful muscle contraction Most common site at the anterior iliac spine – Sartorius
II	Iliac Wing Fracture	Lateral compression fracture on the side of injury
III	Simple Ring Fracture	Symphysis pubis diastasis or superior and Inferior pubic rami fractures
IV	Unstable Ring Disruption	Double ring breaks Open book deformity – fracture of pubic diastasis and anterior sacroiliac joint disruption

The primary management goal in the patient with a pelvic fracture is to treat hypovolemic/hemorrhagic shock with crystalloid and blood and to decrease ongoing bleeding through manual stabilization of the pelvic ring.

Hemorrhage control can be obtained through stabilization of the pelvic ring with external counter pressure with a pelvic binder or bed sheet at the level of the greater trochanter.

Urgent operative repair may be required if intraperitoneal hemorrhage is present. Angiographic embolization by interventional radiology is the best option for ongoing hemorrhage if intraperitoneal hemorrhage is not present.

Treatment includes bed rest and orthopedic management. Open reduction and internal fixation may be necessary for unstable ring disruptions.