

Urologic Trauma

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Introduction

Urologic trauma is a frequently encountered entity in urologic practice. In the United States, **1 of every 14 deaths—more than 150,000 per year—is caused by trauma.** Standard tenants of advanced trauma life support are the primary treatment. Once the patient is stabilized the secondary survey should include evaluation for urologic trauma.

Trauma is the leading cause of death for people between ages 1 and 37 years

Etiology

The etiology of urologic trauma can range from blunt force to penetrating injury. It may result from auto accidents, falls, gunshot or stab wounds, et cetra. In addition wounds may be self inflicted or iatrogenic.

Physiopathology

Internal Urinary Tract:

Trauma to the kidneys, ureter, bladder, and urethra can broadly be classified into blunt and penetrating injuries. Blunt injuries are generally due to coup/ contra coup injuries or shearing forces. In the case of renal injury, the rapid deceleration can lead to injuries to the renal parenchyma, collecting system, or vasculature. Often there is a combination of injuries. Renal injuries are classified into lacerations, hematomas, and vascular injury (Table I).

Blunt renal injuries are most often caused by motor vehicle accidents, falls from heights, and assaults

Ureteral injuries from blunt force are much less common than renal injuries due to their location and surrounding structures. The majority of ureteral injuries are due to penetrating trauma or iatrogenic damage during open surgery, laparoscopic surgery, or endourologic procedures. Iatrogenic injuries are sometimes identified at the time of injury but there is often a delay in diagnosis. It is important to identify the mechanism of injury as high velocity injury and thermal injury will often cause much more vascular damage than is readily visible at inspection.

Table 1 -- American Association for the Surgery of Trauma Organ Injury Severity Scale for the Kidney

Grade * —	Type	Description
I	Contusion	Microscopic or gross hematuria, urologic studies normal
	Hematoma	Subcapsular, nonexpanding without parenchymal laceration
II	Hematoma	Nonexpanding perirenal hematoma confined 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 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, devascularizing the kidney

Bladder and urethral injuries are frequently seen in polytrauma patients, especially those with pelvic fractures. The majority of patients with bladder and urethral injuries have associated pelvic fractures however, the opposite is not true. Most patients with pelvic fracture do not suffer injury to the bladder or urethra. The cause of injury can be rapid deceleration, penetrating trauma, bone fragment laceration, or iatrogenic injury during pelvic surgery. Urethral injuries are associated with pelvic rami fractures in the many cases.

External Genitalia

Trauma to the penis and scrotum can occur as a result of burns, blunt injury, traction, or penetrating injury. Again, the cause of injury is important to ascertain because the amount of damage may not be appreciable on examination only. Trauma to the testicles can occur as blunt or penetrating trauma and must be differentiated from testicular torsion and epididymitis/ orchitis.

Clinical Manifestations

Internal Urinary Tract

Urologic trauma can present with a spectrum of symptoms from asymptomatic to hemodynamic failure. While penetrating injuries are relatively easy to diagnose, blunt injuries may have a variety of symptoms. The typical findings of renal injury may include flank pain, flank hematoma, hematuria, tachycardia, and hypotension. Some patients may be asymptomatic while many have multiple non urologic injuries. Ureteral injuries will often be asymptomatic for a period until obstruction occurs. They may then present with dull aching flank pain, acute colic and/or sepsis from retained urine or urinoma formation. Some patients may fistulize to the bowel, skin, or vagina.

Manifestations of injuries to the bladder vary depending if it is intraperitoneal or extraperitoneal. Bladder injuries are rarely isolated as discussed previously. Intraperitoneal bladder injuries may be asymptomatic or associated with hematuria and peritoneal signs from urinary ascites. Extraperitoneal bladder injuries typically present with gross hematuria.

Injuries to the urethra often present with inability to pass a catheter in the trauma bay. Other, less consistent findings, include blood at the meatus and a “high riding prostate.”

Hematuria is the best indicator of traumatic urinary system injury. However, the degree of hematuria and the severity of the renal injury do not correlate consistently

External Genitalia

Injuries to the external genitalia are typically identified on physical examination and may present with bruising, penetrating wounds, and pain in the affected area. Testicular injuries can present with gastrointestinal complaints such as nausea, vomiting, and low abdominal pain.

- Diagnosis

Internal Urinary Tract

The first step to the diagnosis of urologic trauma is a systematic history and physical examination. Basic laboratory analysis is also indicated to include complete blood count, serum chemistry, and urinalysis are in order. Foley catheter placement is generally performed as part of the advanced trauma life support protocol. In cases of blunt or penetrating trauma, a CT scan of the abdomen and pelvis with oral and IV contrast is commonly obtained if the patient is hemodynamically stable. This is effective in diagnosis of renal injury however it may not be sensitive for ureteral or bladder injuries. Gross hematuria at the time of catheter placement can be suggestive of a bladder injury and a static cystogram (3 views and with a minimum of 350ml of contrast) or CT cystogram is indicated. Paramount to the diagnosis of bladder injury is the determination of intraperitoneal or extraperitoneal bladder rupture. Extraperitoneal bladder rupture will have contained contrast that persists on post drainage films. Intraperitoneal bladder rupture will demonstrate contrast outlines of the large and small intestine. Cross table lateral and post drainage films are important to assist in the diagnosis.

Urethral injuries are suggested by blood at the meatus and difficulty with placing a foley catheter both of which should prompt a retrograde urethrogram. Trauma to the testicles is best diagnosed by careful history and physical examination and may be aided with the use of ultrasound. Testicular fractures can be identified on ultrasound as an interruption in the tunica albuginea and can be differentiated from orchitis and epididymitis by a lack of hyperemia.

External Genitalia

The diagnosis of trauma to the external genitalia is generally based on history and physical examination and may be assisted by MRI or CT scanning to assess the depth of injury or presence of foreign bodies.

- Treatment

Trauma to the kidneys can be managed conservatively in the great majority of cases. Direct indications for surgical intervention include persistent bleeding or blush on CT scan, hemodynamic instability, and expanding hematoma. Significantly devitalized tissue may warrant exploration and debridement in some situations. Surgeons should have a lower threshold for surgical exploration in patients with penetrating injuries as these to have more significant injury as well as injury to other organs. Patients treated with non operative management should be kept on bedrest with serial hemoglobin measurements. The patient may have limited ambulation once hematuria resolves but should be followed closely as delayed bleeding can occur. Isolated acute and delayed bleeding can often be treated with selective angiographic embolization. Tenants of surgical therapy include early control of bilateral renal vessels prior to renal exploration.

Injury to the ureter identified at the time of trauma can be repaired primarily depending on the location. This may require ureteropyelostomy, ureteroureterostomy, or ureteral reimplantation with and without psoas hitch. If the patient is unstable a nephrostomy

tube can be placed intraoperatively or at the bedside. Ureteral repair can then be performed electively after all acute issues have resolved.

Management of injuries to the bladder depend on whether the injury is intraperitoneal versus extraperitoneal. Intraperitoneal ruptures are generally managed operatively with primary closure and prolonged drainage with foley and/or suprapubic tube. Extraperitoneal bladder rupture can usually be managed non operatively with large bore foley catheter drainage. A cystogram should be obtained after 2-3 weeks of drainage to ensure resolution of the damage. Indications to surgically repair extraperitoneal ruptures include persistent bleeding and pelvic bone fragments intravesically.

Partial urethral injuries may be treated with prolonged foley catheter drainage if catheter passage is possible. Complete urethral distraction injuries are generally treated with percutaneous or open suprapubic tube management followed by delayed repair 3-12 months after recovery. Many authors recommend early realignment surgery with antegrade and retrograde placement of a catheter however immediate operative repair has been demonstrated to have a significantly higher rate of complications including stricture and erectile dysfunction.

Injury to the testicles can often be treated conservatively with scrotal support, pain management, and close monitoring. A non-viable testicle should be surgically removed when the patient is stable. Testicular fractures should be explored and repaired as soon as patient is stable for elective surgery.

Injuries to the penis and scrotum are best managed with debridement of non viable tissue and supportive care. Wounds should be treated with moist to dry dressing changes with healing by secondary intention or by coverage with mobilized skin flaps or skin grafts.

- Complications

Complications from renal trauma can be classified as short term or delayed. Short term complications include re-bleeding, urinoma formation, abscess formation, and obstruction. Re-bleeding is best managed with supportive care and transfusion as needed. If bleeding persists angiographic embolization may be performed. Delayed nephrectomy is rarely required. Urinoma formation is best managed conservatively or with ureteral stenting with or without percutaneous drain placement. Long term complications from renal trauma may include hypertension.

Complications from ureteral injury include urinoma formation and obstruction. Urinoma formation can be treated with ureteral stenting if possible or percutaneous nephrostomy tube drainage. A percutaneous drain may be necessary to drain the urinoma. Ureteral stricture is often a delayed complication of ureteral injury and may result in progressive hydronephrosis and eventual renal compromise. Treatment options range from endoscopic stenting, balloon dilation, endoscopic incision, laparoscopic repair, or open repair.

Unrecognized bladder injury can lead to urinary ascites and peritonitis. This is best treated with drainage and repair of the bladder defect as well as antibiotics if necessary. Other acute complications of bladder injury may include hemorrhage and abscess formation.

Complications of urethral injuries include urethral stricture disease. This may present in a delayed fashion with lower urinary tract symptoms. It may be amenable to endoscopic therapy however many will require open surgical repair.

Testicular, penile, and scrotal injuries can be complicated by infection. This is best treated with debridement as needed and antibiotics.

-Conclusions

Urologic trauma is frequently encountered in the hospital setting. After stabilization the secondary survey should include evaluation for urologic trauma. The patient should be assessed as above and treated appropriately.

References:

1. Walsh: Campbell's Urology, 8th ed. 2002 Elsevier
2. Morris PJ, Malt RA, Oxford Textbook of Surgery