specific mechanisms tend to injure different parts of the genitourinary system. The lower genitourinary tract consists of the external genitalia, urethra, and bladder (Figs. 82.1 and 82.2). The upper genitourinary tract consists of the ureters and kidneys.

**EXTERNAL GENITALIA**

The male external genitalia consist of the penis, scrotum, testicles, and ejaculatory complex. The female external genitalia consist of the vagina and vulva; the latter includes the labia majora, labia minora, and clitoris.

Injuries to the external genitalia may occur by blunt or penetrating mechanisms or by circulatory compromise induced by constricting devices applied either accidentally (as in the case of a hair tourniquet) or intentionally (e.g., to enhance sexual performance and pleasure). Additionally, the skin of the penis, scrotum, or labia may become ensnared by a metal zipper. Blunt trauma mechanisms include a kick or other direct blow to the genitals, falls, and straddle injuries. Penile fracture is a blunt injury that occurs when an erect penis is bent suddenly and forcefully, with rupture of the tunica albuginea of one or both of the corpora cavernosa. This injury occurs most commonly during sexual intercourse when the penis slips out of the vagina and strikes the partner’s pubis or perineum, but it may also occur during masturbation. Significant injury to the external genitalia may accompany pelvic fractures. Penetrating injuries may be inflicted by gunshot wounds, knives, or other sharp objects.

**URETHRA**

The male urethra is divided into anterior (bulbous and pendulous) and posterior (prostatic and membranous) portions. Traditionally, this division has been described at the level of the urogenital diaphragm; however, recent work has questioned the existence of this structure, as classically taught. Regardless, the weakest point of the posterior urethra is the bulbomembranous junction, and it is the area where the majority of posterior urethral disruptions occur.

Injuries to the anterior urethra occur from direct blows, straddle injuries, or instrumentation or in conjunction with a penile fracture (Fig. 82.3). By contrast, posterior urethral injuries usually occur in the setting of significant pelvic fractures, often caused by motor vehicle collisions (Fig. 82.4). Penetrating injuries may be inflicted by gunshot wounds, knives, or other sharp objects. Urethral injuries are much less common in women because the female urethra is short and relatively mobile and lacks significant attachment to the pubis.
Posterior urethral disruption occurs when a significant pelvic fracture causes upward displacement of the bladder and prostate. Avulsion of the puboprostatic ligament is followed by stretching of the membranous urethra and subsequent partial or complete disruption at the anatomic weak point, the bulbomembranous junction. Overall, urethral disruption accompanies pelvic fracture in approximately 5% of cases in women and up to 25% of cases in men. However, the risk for urethral injury varies with the type of pelvic fracture. High-risk fractures include concomitant fractures of all four pubic rami (straddle fractures; Fig. 82.5) or fractures of both ipsilateral rami accompanied by massive posterior disruption through the sacrum, sacroiliac joint, or ilium. Low-risk injuries include single ramus fractures and ipsilateral ramus fractures without disruption of the posterior ring. The risk for urethral injury approaches zero with isolated fractures of the acetabulum, ilium, and sacrum.

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**BLADDER**

When empty, the bladder lies along the floor of the pelvis, where it is relatively protected unless the force of an injury fractures the bony pelvis. When distended by urine, the
bladder may extend up to the level of the umbilicus, where it is vulnerable to blunt force trauma inflicted on the lower part of the abdomen. The weakest and most mobile area of the bladder is at the peritoneal surface of the dome.

Blunt force bladder injuries are seen with lower abdominal trauma and in conjunction with pelvic fractures, often resulting from a motor vehicle collision. They are classified as contusions, intraperitoneal rupture, or extraperitoneal rupture. Contusions are partial-thickness injuries to the bladder wall without rupture. Intra-peritoneal rupture is caused by a blunt force injury to the lower part of the abdomen in a patient with a full bladder, which results in rupture at the bladder dome followed by extravasation of urine into the peritoneal cavity. Extraperitoneal rupture occurs most often in association with a pelvic fracture, and the injuring force causes rupture at the anterior or anterolateral wall. In other cases, bony fragments from the pelvic fracture impale the bladder and result in extra-peritoneal rupture. Penetrating injuries may be inflicted by gunshot wounds, knives, or other sharp objects.

URETERS
The ureters course distally along the psoas muscles and enter the bladder posteriorly and inferiorly at the trigone.

Ureteral injury is rare and occurs in less than 1% of all genitourinary injuries. In adults, penetrating injuries account for approximately 90% of cases, most commonly inflicted by gunshot wounds. In children, the most common mechanism is blunt avulsion at the ureteropelvic junction as a result of a motor vehicle collision or a fall from a height. This injury pattern is thought to be due to the increased mobility of the pediatric vertebral column, which allows extreme hyperextension that results in upward displacement of the kidney and separates it from the relatively immobile ureter.

KIDNEYS
The kidneys lie in the retroperitoneal space and are protected by the lower ribs, the back musculature, and perinephric fat. The right kidney extends lower than the left one because of the presence of the liver.

Significant force is required to injure the kidney. Motor vehicle collisions, falls, direct blows, and lower rib fractures are common mechanisms. Significant decelerating force may cause avulsion of the renal pedicle. In children, bicycle accidents represent a prominent mechanism of renal injury. Penetrating injuries may be inflicted by gunshot wounds, knives, or other sharp objects.

PRESENTING SIGNS AND SYMPTOMS
EXTERNAL GENITALIA INJURIES
Blunt scrotal trauma may result in superficial ecchymosis and swelling or testicular rupture, torsion, or displacement. In testicular rupture, the tunica albuginea is disrupted. Even in the absence of testicular rupture, blood or fluid may
accumulate between the tunica albuginea and tunica vaginalis and result in a hematoccele or hydrocele, respectively. Testicular torsion disrupts the vascular supply and causes ischemia. Testicular displacement occurs when the testicle is forced from the scrotum, usually into the peritoneal cavity. Physical examination may be limited because of pain and swelling.

Penile fracture is often accompanied by an audible snapping sound and is followed immediately by severe pain, detumescence, swelling, and ecchymosis. The corpus spongiosum is involved in 20% to 30% of cases, and urethral injury occurs in 10% to 20%. If the Buck fascia remains intact, the swelling and ecchymosis are confined to the penile shaft. If not, blood and urine may dissect into the scrotum, perineum, and suprapubic spaces.8,9

In patients with penetrating mechanisms, a careful and complete physical examination should be conducted to search for associated or additional occult injuries. In one series, gunshot wounds involving the penis were associated with injury to other organ structures in 80% of cases.10 Violation of the corpora cavernosa requires operative intervention and is heralded by an expanding penile hematoma, significant bleeding from a wound to the penile shaft, or a palpable corporal defect.

Injuries to the female genitalia are often associated with pelvic fractures. Important mechanisms include physical or sexual assault, consensual intercourse, and penetrating injuries. In the presence of a pelvic fracture or blood at the introitus, meticulous vaginal examination is mandated. Complications of missed vaginal injuries include infection, fistula formation, and significant hemorrhage.11,12 In one series, 25% of women sustaining injury to the external genitalia required blood cell transfusion because of blood loss from the genital injury alone.11

URETHRAL INJURIES
In blunt trauma, the signs and symptoms of urethral injury include blood at the urethral meatus, gross hematuria, inability to void, absent or abnormally positioned prostate on digital rectal examination, or ecchymosis or hematoma involving the penis, scrotum, or perineum. In penetrating trauma, urethral disruption should be suspected when the injury trajectory lies in proximity to the urethra.

BLADDER INJURIES
The vast majority of blunt bladder injuries are accompanied by gross hematuria, significant pelvic fracture, or both. In general, the diagnosis may be excluded clinically when both are absent. Bladder injury may occur with any pelvic fracture but is more likely with fractures of the anterior arch or when all four pubic rami are fractured. A minority of patients will have a pelvic fracture with microscopic hematuria. Additional signs and symptoms include lower abdominal pain or tenderness and inability to void. In patients with penetrating trauma, bladder rupture should be evaluated when the injury trajectory lies in proximity to the bladder.

URETERAL INJURIES
Hematuria (gross or microscopic) is not a reliable predictor of ureteral injury because the findings on urinalysis are normal approximately 25% of the time.13-15 The diagnosis is frequently missed on the initial evaluation because the signs and symptoms are minimal and nonspecific. Delayed findings include fever, flank pain, and a palpable flank mass (urinoma). Ureteral injury should be considered in patients with any penetrating injury that has a trajectory in proximity to the ureter.

KIDNEY INJURIES
Clinical clues to a potential renal injury include bruising, pain, or tenderness in the flank or abdomen; rib or spine fractures; and hematuria, injury to other organs, and shock. In patients with penetrating trauma, renal involvement should be suspected when the injury trajectory is in proximity to the kidney.

DIGITAL RECTAL EXAMINATION
Classic teaching has held that digital rectal examination provides useful clinical information in the evaluation of a blunt trauma patient who has sustained a pelvic fracture or in whom a urethral injury is suspected. The technique described includes evaluation for an absent or high-riding prostate, the presence of which may be associated with posterior urethral disruption and the need for prompt investigation for urethral integrity. However, multiple studies have now demonstrated a relative lack of utility of digital rectal examination for the detection of urethral injuries.15-17 Accordingly, the decision to evaluate for urethral injury should not rely solely on the findings of digital rectal examination but instead should consider additional clinical features, including the mechanism of injury, physical examination findings such as a scrotal or perineal hematoma or blood at the urethral meatus, and the presence and type of any associated pelvic fracture.

VAGINAL EXAMINATION
Although most multiply injured patients receive a digital rectal examination, the vaginal examination is often omitted in error. To avoid missing occult injuries that may result in significant and potentially life-threatening hemorrhage and infection, a careful vaginal examination should be performed to identify any lacerations or bone fragments in all women with pelvic fractures. This is especially critical in patients with fractures of the anterior pelvic ring.

HEMaturIA
Hematuria is a marker of potential injury to the genitourinary tract. It is important to inspect the initial urine output to avoid missing transient hematuria that may clear with ongoing fluid resuscitation. A spontaneously voided specimen is ideal but is frequently impractical in a multiply injured patient.

Gross hematuria is defined as urine that is any color other than clear or yellow. This is a necessarily conservative definition because the degree of gross hematuria does not correlate with the severity of the injury; a relatively minor urethral injury may result in impressive hemorrhage, whereas major vascular disruption may be accompanied by only slightly discolored urine. False-positive results may be due to many factors, including ingestion of certain food products or dyes, various medications, or the presence of free myoglobin because of rhabdomyolysis.

Microscopic hematuria is defined as more than five red blood cells per high-power field (RBCs/HPF) or a positive dipstick evaluation. The significance of gross versus microscopic hematuria varies with the mechanism of injury (blunt versus penetrating) and is discussed in more detail later in the chapter.
Differential Diagnosis and Medical Decision Making

Ideally, investigation for genitourinary injury is conducted in a retrograde fashion beginning with evaluation of the external genitalia and urethra before the bladder. The ureters and kidneys are evaluated after lower tract injury is excluded or after appropriate emergency management of an identified lower tract injury is initiated.

External Genitalia

Diagnosis of injuries to the external genitalia is based largely on the mechanism of injury and physical examination. Unexpected penile or clitoral swelling necessitates a careful search for a hair tourniquet, especially in infants and young children. Concomitant urethral injury should be considered and a retrograde urethrograph performed to assess urethral integrity in any patient with a penile fracture, blood at the urethral meatus, or penetrating trauma that violates the Buck fascia. Plain radiographs revealing a significant pelvic fracture should prompt a careful examination for occult rectal or vaginal injury.

Ultrasoundography is used to evaluate testicular blood flow in cases of suspected torsion and to supplement the physical examination in cases of testicular trauma. However, this modality has only modest sensitivity and specificity in detecting testicular rupture and is quite operator dependent.17

Urethra

After the initial history and physical examination, an anteroposterior (AP) pelvic radiograph should be obtained to assess for fracture. In cases of suspected urethral injury, classic teaching has held that it is imperative to evaluate the integrity of the urethra with a retrograde urethrogram before attempting to place a urinary catheter to avoid worsening a partial urethral disruption. Although the literature on this topic is sparse, one small retrospective review of 13 cases of urethral injury demonstrated no evidence that a blind attempt to insert a urinary catheter worsened the initial injury.18 Consequently, in the presence of gross hematuria without other signs of urethral injury, it is reasonable to make one attempt at passing a Foley catheter. If resistance is encountered, the attempt should be aborted and urethral integrity evaluated by retrograde urethrography. This procedure should be deferred if pelvic angiography is indicated because extravasation of contrast material from a urethral injury may obscure computed tomography (CT) and angiography images and complicate attempts to control significant pelvic hemorrhage by vascular embolization.19

Retrograde Urethrography Procedure

The patient should be kept supine to avoid potentially disrupting a stable pelvic hematoma. Obtain a baseline kidneys, ureter, and bladder (KUB) radiograph and ensure that the film captures the entire course of the urethra and bladder. Retract the foreskin, if present, and control the shaft of the penis with a 4 × 4-inch gauze pad to prevent slippage. Stretch the penis obliquely over the thigh to promote unfolding and visualization of the entire urethra. Fill a 60-mL syringe with 10% water-soluble contrast material (diluted in sterile saline) and attach a Christmas tree adaptor. Insert the adaptor snugly into the urethral meatus and ensure a tight fit because leaking contrast material will result in spurious findings.

Alternatively, a Foley catheter can be inserted a few centimeters into the urethra and the balloon inflated to ensure a snug fit within the fossa navicularis; next, attach a catheter-tip syringe filled with contrast material as described previously. Inject 50 to 60 mL (0.6 mL/kg in children) of contrast agent and obtain a KUB radiograph simultaneously with infusion of the final 10 mL. Lack of urethral extravasation with filling of the bladder indicates a normal study. Partial disruption is indicated by urethral extravasation accompanied by partial filling of the bladder. Complete disruption results in urethral extravasation with no filling of the bladder (Fig. 82.6). If urethral injury is suspected, obtain a retrograde urethrogram first to ensure urethral integrity before placement of a Foley catheter. Once urethral injury is excluded and a Foley catheter has been placed, evaluate for bladder rupture in all patients with gross hematuria and in those who have sustained a significant pelvic fracture. This is accomplished by retrograde cystography or retrograde CT cystography. Additional relative indications for bladder imaging include gross hematuria without pelvic fracture and microscopic hematuria with pelvic fracture.20

Retrograde Cystography Procedure

As with the procedure for retrograde urethrography, the patient should be kept supine to avoid potentially disrupting a stable pelvic hematoma and care taken to avoid spillage of the contrast agent, which will result in a spurious study. Obtain a baseline KUB radiograph. Remove the central piston from a 60-mL catheter-tip syringe and attach it to the Foley catheter. Hold the syringe upright above the level of the bladder and instill 400 mL of 10% water-soluble contrast agent (diluted in sterile saline) by gravity. In patients younger
to pass, refill the bladder to the point of contraction, and then forcefully inject another 50 mL of contrast agent. The goal is to adequately distend the bladder to avoid missing injuries.

The most common reason for false-negative cystographic results is failure to instill enough contrast material. Once the bladder is filled, clamp the catheter and obtain a KUB radiograph (Fig. 82.7). After ensuring adequacy of the contrast film, unclamp the catheter, allow the bladder to drain, and obtain a postevacuation film. Extraperitoneal rupture appears as a flamelike area of contrast material confined to the pelvis, often extending lateral to the bladder (Fig. 82.8). In cases of intraperitoneal rupture, contrast material outlines the bowel and other structures in the peritoneal cavity (Fig. 82.9). Using

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\text{age in years/2} \times 30
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than 11 years, calculate the appropriate amount of contrast agent in milliliters with the following formula: (age in years/2) × 30. If a bladder contraction occurs before the instillation of 400 mL of contrast material (as evidenced by the contrast level rising in the syringe), wait for the contraction to pass, refill the bladder to the point of contraction, and then forcefully inject another 50 mL of contrast agent. The goal is to adequately distend the bladder to avoid missing injuries.

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\text{age in years/2} \times 30
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the baseline film for comparison, carefully scrutinize the postevacuation film for any subtle areas of extravasation not seen on the contrast-distended view.

For retrograde CT cystography, the bladder is filled in an identical manner. Do not simply clamp the Foley catheter and rely on passive filling of the bladder by intravenously administered contrast material for CT cystography. Multiple studies have demonstrated missed injuries with this approach. A postevacuation film is not necessary with retrograde CT cystography.

**URETER**

The diagnosis of ureteral injury is elusive. Intravenous pyelography has long been the test of choice, although its reported sensitivity is highly variable. CT imaging has gained popularity of late and is often indicated for identification of related injuries. In cases of suspected ureteral or renal pelvis disruption, additional delayed CT images (obtained 10 minutes after injection of contrast agent) are indicated to allow time for the intravenous contrast material to be excreted by the kidneys. If operative exploration is indicated, the ureters may be directly evaluated in the surgical suite. When the diagnosis remains in doubt, retrograde pyelography may be useful.

**KIDNEY**

Renal imaging is indicated in all patients with penetrating trauma proximate to the kidneys and in those with blunt injuries and gross hematuria or microscopic hematuria with shock (defined as systolic blood pressure lower than 90 mm Hg). Additional relative indications include a significant decelerating mechanism, such as a high-speed motor vehicle collision or a fall from a height. The imaging study of choice is CT scanning with intravenous contrast enhancement. If injury to the collecting system is suspected, additional cuts should be obtained 10 minutes after injection of the contrast agent. Intravenous pyelography has been used extensively in the past but has largely been supplanted by CT.

In an unstable patient requiring immediate laparotomy, a “one-shot” intravenous pyelogram obtained in the operating room has some utility. Although this limited study does not provide sufficient sensitivity to exclude all clinically important renal injuries, it will demonstrate major renal disruption and confirm the presence of a functioning contralateral kidney. This study is accomplished by obtaining a KUB radiograph 10 minutes after rapid intravenous bolus injection of contrast material (2 mL/kg). Angiography performed on an emergency basis can be both diagnostic and therapeutic, but it is time-consuming and impractical in many centers. Ultrasonography lacks sensitivity in visualizing renal trauma and should not be relied on to exclude significant injury.

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**DOCUMENATION**

Note the presence or absence of any abnormalities that suggest genitourinary injury. In blunt trauma patients, such abnormalities include the following:
- Flank tenderness, bruising, or swelling
- The presence (and type) of a pelvic fracture
- Blood at the urethral meatus
- Ecchymosis or hematoma involving the penis, scrotum, or perineum

In patients with penetrating trauma, note whether the injury trajectory occurs in proximity to the genitourinary tract. Document the presence or absence of hematuria in the initial urine specimen.

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**PRIORITY ACTIONS**

Because genitourinary injuries are rarely life-threatening, initial assessment of a multiply injured patient is focused on rapid identification of potentially life-threatening injuries with prompt intervention to preserve life. During the initial resuscitation, note any findings, such as gross hematuria or an unstable pelvic fracture, that may herald genitourinary injury so that the appropriate investigation may be undertaken once the patient has been stabilized.

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**TREATMENT**

Except in the rare instance of a shattered kidney or major renal vascular laceration with significant hemorrhage, genitourinary injuries seldom pose a threat to life. Therefore, in a multiply injured patient, evaluation for genitourinary injury is deferred until other, potentially life-threatening injuries are excluded and the patient’s condition is stabilized. During the initial evaluation and stabilization, the emergency physician should note any findings that may herald genitourinary injury so that the appropriate investigation can be undertaken once the immediately life-threatening conditions have...
been addressed. The patient should not receive any oral fluids until the need for operative intervention has been excluded. Intravenous fluids and analgesics may be administered as needed.

EXTERNAL GENITALIA INJURIES
Bleeding should be controlled with direct pressure. An amputated penis should be wrapped in saline-moistened gauze and placed in a sealed plastic bag, which is then placed on ice in a second plastic bag until reimplantation.

Any constricting devices should be removed promptly. This may be accomplished by unwinding a hair tourniquet, cutting a tight-fitting constricting ring or band, or wrapping a string or Penrose drain around the penis distal to the object to decrease swelling and facilitate removal. Liberal use of a water-based lubricant may be beneficial. After significant underlying injury has been excluded, copiously irrigate any superficial lacerations of the scrotum or penis and close with absorbable suture.

Zipper entrapment injuries are managed by infiltrating the affected area with 1% plain lidocaine followed by the application of mineral oil and carefully “unzipping” the zipper. If this fails, cut the slide bar of the zipper with an orthopedic pin cutter and gently pull the teeth apart.

Traumatic testicular torsion and displacement are treated surgically. All but the most superficial penetrating injuries to the external genitalia require operative exploration, especially those that violate the corpora cavernosa. Prompt surgical exploration plus repair of penile fractures minimizes the late complications of penile curvature, erectile dysfunction, and dyspareunia. Likewise, in patients with testicular rupture, early operative intervention maximizes the rate of testicular salvage. Reimplantation of an amputated penis should be performed as expeditiously as possible but has been successful after 16 hours of cold ischemia. The majority of women with vaginal injuries will require operative repair or washout to prevent significant morbidity and mortality.

URETHRAL INJURIES
In patients with a low-risk pelvic fracture (as defined previously) and no evidence of urethral injury on physical examination, it is reasonable to make a gentle attempt at passage of a Foley catheter. If any significant resistance is met, remove the catheter and obtain a retrograde urethrogram. If the retrograde urethrogram is normal, insert the catheter and inspect the initial output for evidence of hematuria.

If a urethral injury is suspected subsequent to successful placement of a Foley catheter, do not remove the catheter. A retrograde urethrogram may be obtained by inserting a small feeding tube alongside the catheter and proceeding as described previously. A urologist should be consulted for management of patients with abnormal retrograde urethrogram results or in cases of suspected urethral injury when a retrograde urethrogram cannot be obtained. In female patients, suspected urethral injury mandates urologic consultation; retrograde urethrography is not indicated in the emergency department (ED).

Optimal definitive management of urethral injuries depends on several factors, including the location (anterior or posterior) and severity (partial or complete) of the injury and the preference and expertise of the consulting urologist. Options vary from simple placement of a Foley catheter to allow a partial anterior urethral injury to heal by secondary intention to early endoscopic realignment or delayed urethroplasty of posterior urethral injuries. Frequently, placement of a suprapubic cystostomy tube is required to promote decompression of the bladder and divert urine from the healing urethral injury or anastomosis. Regardless of the approach, the ultimate goal is maintenance of urinary continence and sexual function.

BLADDER INJURIES
The Foley catheter should be irrigated as needed to clear any clots and ensure adequate drainage; the primary goal is to keep the bladder completely decompressed. Because bladder injuries are often associated with intraabdominal trauma, a diligent search for the latter should be undertaken in all patients with positive cystography results. Operative repair is the rule for most intraperitoneal bladder ruptures. By contrast, the majority of extraperitoneal ruptures can be managed nonoperatively with catheter drainage alone. Exceptions include injuries involving the bladder neck, associated rectal or vaginal injuries, and patients requiring laparotomy for other indications.

URETERAL INJURIES
Identification and urologic consultation are the main priorities in the emergency management of ureteral injuries. Depending on the degree and location of the ureteral disruption, management options include cystoscopic stent placement or surgical repair over a stent. Urinary diversion may be required.

KIDNEY INJURIES
The need for operative intervention correlates with the severity of injury as classified by the American Association for the Surgery of Trauma organ injury severity scale for the kidney (Fig. 82.11 and Table 82.1). Most grade I and II injuries can
It is somewhat controversial whether the criteria used to determine the need for renal imaging after blunt trauma in adults may be applied to children. One issue is whether the presence of microscopic hematuria in children warrants imaging even in the absence of shock. Some authors have recommended imaging in children when urine microscopy reveals more than 50 RBCs/HPF.

Certainly, the criterion of shock as defined by a systolic blood pressure lower than 90 mm Hg is unhelpful in the pediatric population. Even age-specific definitions of hypotension are of little utility because children manifest shock differently than do adults. A recent study reviewing 720 consecutive pediatric patients with suspected renal trauma concluded that using the criteria of gross hematuria, shock, and significant deceleration injury can identify all cases of renal injury. However, like the definition of shock, “significant deceleration injury” was not well defined in this study.

For now, consensus guidelines recommend that hemodynamically stable children with blunt trauma undergo imaging if they have gross hematuria (i.e., more than 50 RBCs/HPF) on urine microscopy. All children with penetrating trauma in proximity to the kidneys warrant imaging.

Most patients with significant genitourinary injuries require urgent or emergency urologic consultation in the ED. Additionally, many patients will have associated, nonurologic injuries that mandate trauma surgery or general surgery consultation. In the event that the appropriate specialists are unavailable, expeditious transfer to an appropriate referral center is indicated after the initial evaluation and stabilization.

A minority of hemodynamically stable patients with no other indications for admission may be considered for discharge from the ED after telephone consultation with the urologist who will see the patient for follow-up care. Such cases include minor lacerations, zipper injuries, and isolated partial anterior urethral injuries in the presence of a functioning Foley catheter. These patients should be counseled on the signs and symptoms of infection and Foley catheter dysfunction and be asked to return to the ED if these or any other concerning symptoms develop. Finally, make sure that they understand the importance of complying with the scheduled follow-up plan.

Pediatric Contrast Agent Dosage

The pediatric dose of a contrast agent for a retrograde urethrogram is 0.6 mL/kg to a maximum of 60 mL. In patients younger than 11 years, calculate the appropriate amount of contrast agent in milliliters for retrograde cystography by using the formula (age in years + 2) × 30 to a maximum of 400 mL.
SUGGESTED READINGS


REFERENCES

References can be found on Expert Consult @ www.expertconsult.com.

TIPS AND TRICKS

If a urethral injury is suspected subsequent to successful placement of a Foley catheter, a retrograde urethrogram may be obtained by injecting the contrast agent through a small feeding tube inserted alongside the catheter.

Cautions for the emergency physician:
- To avoid the risk of completing a partial urethral disruption, defer Foley catheter placement in a patient with a suspected urethral injury until urethral integrity is ensured by the retrograde urethrogram.
- Perform a careful rectal examination in all patients and a vaginal examination in women with a pelvic fracture to evaluate for rectal or vaginal lacerations.
- For computed tomographic cystography, do not simply clamp the Foley catheter and rely on passive filling of the bladder by intravenously administered contrast material. Multiple studies have demonstrated missed injuries with this approach.21-24
- In the setting of penetrating trauma, significant renal vascular injury may exist in the absence of hematuria.
REFERENCES