

Genitourinary Trauma in Boys

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Genital trauma is commonly seen in boys but rarely results in serious injury necessitating surgical intervention. This article discusses both blunt and penetrating injuries to the penis, urethra, and scrotum. The anatomy, epidemiology, pathophysiology, clinical symptoms, and evaluation of each type of injury are discussed. Testicular rupture, urethral disruption, and penile fracture and amputation are acute surgical emergencies that require emergent referral to and management by a qualified urologist. Most of the other conditions can be diagnosed and managed by an emergency physician with access to high-resolution ultrasonography. *Clin Ped Emerg Med* 10:45-49 © 2009 Elsevier Inc. All rights reserved.

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Males have a greater incidence of genital trauma than females, primarily because of obvious anatomical differences but also because of increased exposure to violence and participation in contact sports. Trauma to the external genitalia in children varies in severity from zipper entrapment to more serious injuries and is seen in all age groups. In young children, blunt trauma is the predominant mechanism. Penetrating injuries are most frequently seen after straddle-type falls or falls on sharp objects or as a result of interpersonal violence, such as stabbing and gunshot wounds in older adolescents and young adults. Penetrating injuries to the genitourinary tract are also seen in association with dog bites.

The rise in popularity of certain sports, such as off-road bicycling and motorbike riding, have been associated with an increase in genital trauma [1]. Injuries from in-line skating, hockey, and football all have been associated with blunt testicular trauma. In addition, participation in any contact sport without the use of protective equipment may be associated with genital trauma. Lastly, the emergency

department (ED) physician should always be alert to the possibility of sexual abuse when caring for a child with genital injury.

Scrotal Trauma

The peak occurrence of scrotal trauma is in older boys or young adults [2]. Mechanisms include blunt, penetrating, and thermal trauma (ie, burn), as well as degloving or avulsion injuries. Although scrotal trauma is relatively common, the necessity for surgical intervention is not. This is due in part to the small size of the testes and their mobility within the scrotal sac. Blunt trauma is most common and usually results from a direct blow to the groin during sports (>50% of blunt trauma cases), motor vehicle collision (9%-17% of cases), falls, or straddle injuries [3]. In the absence of testicular rupture, these injuries rarely require surgical exploration. In adolescent males, penetrating trauma is usually secondary to gunshot wounds and less commonly due to stab wounds, animal attacks, and self-mutilation [4].

The testicles are enclosed in multiple layers within the scrotum, including the scrotal skin, dartos layer, and tunica vaginalis. The tunica albuginea comprises the tough capsule of the testis itself. Rupture of the testes with or without concomitant hematocele can occur after blunt or penetrating scrotal trauma. In blunt trauma, the scrotum is trapped between the striking object and the

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pubic bone or inner thigh. Rupture results from tearing of the inelastic tunica albuginea with extrusion of the seminiferous tubules [5].

Patients and caregivers may report immediate scrotal pain, sometimes accompanied by nausea and/or vomiting. The child with testicular trauma often presents with a tender, swollen, ecchymotic hemiscrotum. The testis may not be palpable if rupture has occurred. More minor trauma produces milder symptoms and delayed presentation of traumatic hydrocele. Testicular rupture may have delayed presentation as well [6].

Clinical evaluation should include palpation of the testes and epididymis and a penile examination. High-resolution ultrasonography is ideal for the assessment of scrotal trauma because it can be used for noninvasive evaluation of the scrotal contents, evaluation of testicular integrity and blood flow, as well as visualization of hematomas, other fluid collections, and foreign bodies. The use of a high-frequency transducer allows greater resolution of the scrotal contents to determine the presence of intra- and/or extratesticular bleeding, testicular contusion, or rupture [7,8]. Color and power Doppler imaging are used to detect flow within the scrotal structures and to confirm symmetric or abnormal flow patterns. The emergency physician should be aware, however, that false-negative ultrasound results have been reported in the presence of testicular rupture.

Salvage of the testis is dependent on the rapid differentiation of surgical from nonsurgical emergencies. Therefore, immediate exploration is warranted if the tunica is violated (indicating rupture), if there is nonperfusion of the testis, or if the ultrasound findings are nondiagnostic and there is a high clinical suspicion of rupture [5]. Several studies have shown that conservative management and subsequent delayed intervention (>3 days) results in a significantly higher rate of orchiectomy, even in a nonruptured testis. Delay in diagnosis or inaccurate diagnosis may result in decreased fertility, delayed orchiectomy, infection, ischemia, infarction, and atrophy [5,6,8-11].

Penile Trauma

The root of the penis is fixed to the perineum within the superficial pouch. The corpora cavernosa join beneath the pubis to form the major portion of the body of the penis. The corpus spongiosum tapers and runs on the underside (ventrum) of the corpora cavernosa and then expands to cap them as the glans penis. The skin of the penile shaft is highly elastic and without appendages (hair or glandular elements), except for the smegma-producing glands at the base of the corona. The penis receives its blood supply from the anterior trunk of the internal iliac artery and innervation from the pelvic autonomic plexus.

Penile trauma is uncommon because the penis is mobile and largely protected by its position. However, in the erect state, especially in postpubertal males, the penis is more

prone to trauma in the form of penile fracture [12,13]. In younger children, penile trauma has different underlying etiologies. These include iatrogenic injury during circumcision, domestic animal attack, child abuse, motor vehicle accidents, entrapment in a zipper, or penile strangulation by tourniquet.

Blunt Penile Trauma

In adolescent males, a direct blow to the erect penis may cause penile fracture. Such injury is rarely encountered in the prepubertal child. In adolescents and young adults, blunt penile trauma is usually related to sexual intercourse or manipulation. Penile fracture is caused by rupture of the cavernosal tunica albuginea [14-16]. Injury to the corpus spongiosum and urethra may occur in a minority of cases [12]. Blunt penile injuries can also be sustained when a toilet seat falls on a young boy who is just learning to stand to void [17].

Patients with penile fracture report a sudden cracking or popping sound associated with local pain and immediate detumescence [14,16,18]. As a result, local swelling of the penile shaft develops with a progressive hematoma, which may occur along fascial layers. This hematoma can extend to the lower abdominal wall in the case of rupture of Buck's fascia. When examining the patient, penile injury is usually self-evident. In a typical penile fracture, the normal external penile appearance is completely obliterated because of significant penile deformity, swelling, and ecchymosis (the so-called eggplant deformity) [15,19]. Toilet seat injuries this severe have not been reported. Penile edema may be visible; however, significant underlying injury to the corporal bodies or urethra is rare [17].

Historically, treatment of a fractured penis was nonsurgical (eg, cold compresses, pressure dressings, penile splinting, and antiinflammatory medications). Today, the treatment of choice is immediate surgical intervention. Conservative management of penile fractures is no longer recommended because of reported complications, including penile abscess, missed partial urethral disruption, penile curvature, and persistent hematoma requiring delayed surgical intervention [13,14]. Blunt penile trauma that is more minor, however, should be managed with conservative symptomatic care [17]. The young child who has sustained injury secondary to a toilet seat fall may benefit from tub voiding or a temporary return to diapers if newly toilet trained.

Blunt Urethral Trauma

Most urethral injuries are caused by vehicular accidents, falls, or blows. Pelvic fracture, especially in association with a motor vehicle crash, is a significant risk factor for urethral injury [20], especially to the posterior urethra. In contrast, anterior urethral injuries are rarely associated with pelvic fractures. They are usually straddle-type injuries caused by blows to the perineum, such as bicycle handlebars or the top of a fence [16,21]. In this type of injury, the relatively

immobile bulbar urethra is trapped and compressed against the inferior surface of the symphysis pubis [22].

A diagnosis of acute urethral trauma should be suspected from the history. In a conscious patient, a thorough voiding history should be obtained to establish the time of last urination, force of urinary stream, painful urination, and presence of hematuria. A pelvic fracture or any external penile or perineal trauma may be associated with urethral trauma [23,24]. Blood at the meatus is the classic symptom of urethral injury, and its presence should preclude any attempts at urethral instrumentation until the entire urethra is adequately imaged with a retrograde urethrogram.

Hematuria on a first voided specimen, although non-specific, may also indicate urethral injury. However, the amount of bleeding does not necessarily correlate with the severity of injury. A minor injury may cause copious bleeding, whereas a complete transaction may result in scant bleeding [24]. Penile or scrotal hematoma or swelling can also occur with anterior urethral trauma. The pattern of the hematoma can be useful in identifying the anatomical boundaries violated by the injury [25].

A high-riding prostate is a relatively unreliable finding in the acute phase because the pelvic hematoma associated with pelvic fractures often precludes the adequate palpation of a small prostate, particularly in younger children [26]. Other findings of importance are pain on urination or inability to void, which suggests urethral disruption.

Controversy exists regarding the optimal definitive management of urethral tears and is dependent on their location and severity [21,24,27]. Complete urethral tears are usually managed with a suprapubic catheter and delayed operative repair. Many urologists manage partial tears with careful placement of a Foley catheter [28].

Penetrating Penile Trauma

Penetrating trauma to the external genitalia is frequently associated with complex injuries of other organs. In children, penetrating injuries are most frequently seen after straddle-type falls or laceration of genital skin due to falls on sharp objects [29,30]. Increasing domestic violence has led to stab and/or gunshot injuries of the genitourinary tract. The extent of injury secondary to gunshot injury is related to the caliber and velocity of the missile [31].

Although uncommon, another potential source of penetrating trauma to the external genitalia in children is animal bites. Wounds are usually minor, but there is a potential risk of serious wound infection. The most common bacterial pathogen associated with dog bites is *Pasteurella multocida*, which accounts for up to 50% of infections [32].

In penetrating penile trauma, surgical exploration and conservative debridement of necrotic tissue are recommended with primary closure in most cases [16]. Copious irrigation of the wound should be performed, and the wound should be closed. Human bites are the notable

exception. Tetanus vaccination is mandatory, and antibiotics are recommended [32].

If the penis has been severed, the amputated portion should be wrapped in gauze soaked in sterile saline solution and placed in a plastic bag. The plastic bag should then be put into a second bag or cooler filled with ice water slush. If reattachment of the penis is possible, the lower temperature produced by the slush will increase the likelihood of successful reattachment. Penile reattachment even after 16 hours has been reported to be successful [33].

Zipper Injury

Zipper entrapment of the penis is one of the most common genital injuries in prepubertal boys. These injuries typically involve the foreskin or redundant penile skin. Entrapment of the foreskin between the fastener and the teeth can occur when the zipper is being opened or closed. In a case series from a pediatric ED in the United Kingdom, which described injuries sustained by 30 boys between 2 and 12 years of age, the rate of zipper entrapment was 1 of 4000 new ED attendees. Surprisingly, 60% of the affected boys were wearing underwear at the time of the injury [34].

The patient usually presents crying or anxious, guarding the affected area. Bleeding can range from scant to copious, and the penile tissue may be caught either in the movable zipper part or in the teeth of the zipper. Typically, the foreskin or ventral aspect of the penile shaft is entrapped.

Management of zipper injuries is described primarily in case reports. Historically, general anesthesia and circumcision were recommended. However, recent literature describes techniques that are purported to be quite effective without circumcision. The method recommended is dependent upon the site of entrapment within the zipper. Entrapment of penile skin between the zipper teeth (and not the zipper mechanism) can be released by cutting the cloth of the zipper below the site of entrapment, which will result in separation of the zipper teeth and release of the trapped tissue [35,36].

The technique most often recommended involves cutting the median bar of the zipper. This allows the zipper mechanism to fall apart and leads to release of the entrapped skin [34,37-39]. However, the median bar may be difficult to cut, even with wire or bone cutters, which are the instruments of choice, thus, limiting the use of this technique. If the penile tissue is trapped between the slider and teeth of the zipper, mineral oil application may be the treatment of choice [40], along with the use of topical anesthetic cream, before easing the slider down.

Another recently published method involves inserting the thin blade of a small screwdriver between the outer and inner faceplates of the zip fastener. Twisting movements are then made toward the median bar. These movements widen the gap between faceplates disengaging the prepuce. A single case series describes the use of this technique for 12 children in whom it was found to be safe, effective, painless,

and atraumatic [41]. Regardless of which technique is used, the clinician should check for injury to the urethral meatus and ensure the patient is able to void before discharge.

Tourniquet Injuries

Tourniquet injuries occur when bands, rings, or human hair wrap around the penile shaft. The hair tourniquet is a well-described phenomenon; typically, hair, cotton fiber, or similar material becomes tightly wrapped around the penis [42]. Initially, the hair tie causes swelling of the glans as venous outflow is impeded. Skin ulceration and breakdown may result as the tourniquet tightens. Progressive swelling produces arterial insufficiency, leading to ischemia and tissue necrosis [43]. Infants usually present as irritable or inconsolable, whereas older children may complain of localized symptoms. It is important to remember that hair tourniquet may be misdiagnosed as balanitis or paraphimosis.

Removal with a fine scissors and forceps is usually recommended. If unsuccessful, some clinicians recommend depilatory agents to dissolve the hair. Rarely, surgical removal may be required if the hair or thread is deeply embedded in the tissue. Complications result from delayed recognition and may lead to more serious consequences. The hair may cut dorsally through the neurovascular bundle, sparing the urethra but resulting in the loss of glanular sensation. Alternatively, it may cut through the spongiosa and the urethra, resulting in a urethrocutaneous fistula. The hair tie may eventually transect the cavernosa, leading to partial or complete glanular amputation [44].

Summary

Genital trauma is commonly seen in boys but rarely results in serious injury necessitating surgical intervention. Most injuries to the penis and scrotum are due to blunt trauma and can be diagnosed and managed by the emergency physician with access to high-resolution ultrasonography. Testicular rupture, urethral disruption, and penile fracture and amputation are acute surgical emergencies that require emergent referral to and management by a qualified urologist. The emergency physician must always be vigilant for the possibility of sexual abuse in any child with a genital injury.

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