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The diagnosis of genitourinary pathology may be challenging, especially in a busy emergency department. It is important in any infant with a complaint of fussiness, vomiting, or "not acting right" to undo the diaper and do a careful assessment of the genitalia. It is easy to miss a hernia or testicular torsion if an infant is not fully examined. Identification of children with a potential for underlying pathology is also essential.

The author carefully and thoroughly reviews common male genitourinary complaints, focusing on key aspects of the history and physical examination that assist in a timely diagnosis. In addition, the author offers clinical pearls and key associations for busy emergency medicine physicians.

—The Editor

Introduction

Pediatric patients with acute scrotal or testicular pain may present a challenge to the emergency physician. Testicular torsion is the most common surgical genitourinary emer-

gency in the pediatric age group, and a delay in diagnosis can result in testicular ischemia with ultimate testicular infarction. The immediate decision that the emergency physician

must make is whether the patient should undergo an acute surgical intervention vs. a diagnostic evaluation. Misdiagnosis of the acute scrotum can occur in up to 50% of cases, and a high index of suspicion is critical to a timely diagnosis.¹ The history and physical may be difficult to obtain due to patient age. Regardless of the underlying disease process, the caregiver should be questioned regarding the presence of fever,

vomiting, abdominal pain, a change in the color or frequency of urine output, and increasing fussiness. To avoid a delay in diagnosis, it is imperative that patients undergo a complete physical examination, including the genitalia. Patients who present with increased crying may have an incarcerated or strangulated inguinal hernia, testicular torsion, or a penile hair tourniquet. This article discusses the most common causes of painful and painless scrotal, testicular, and penile swelling.

Genitourinary Emergencies in Male Children: Recognition and Management

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Physiology

During the third gestational month, the foreskin begins to form at the base of the glans penis. It ultimately grows dorsally until the dorsum of the glans is completely covered. When the urethra closes, the ventral prepuce fuses to form the ventral frenulum. The testis descends from the abdominal cavity and enters the scrotum via the inguinal canal. The peritoneum invaginates into the scrotum, forming the tunica vaginalis, which may completely or partially cover the testicle and epididymis. Typically, the tunica vaginalis attaches to the posterior wall of the hemiscrotum and to the superior pole of the testes to achieve testicular fixation. If the tunica completely covers the testis and attaches higher up on the spermatic cord (bell clapper deformity), proper testicular fixation does not occur and the testicle is predisposed to torsion.

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Table 1. Painless Causes of Scrotal/Testicular Swelling

- Phimosis without uropathy
- Inguinal hernia
- Henoch-Schoenlein purpura
- Idiopathic scrotal edema
- Varicocele
- Testicular tumor
- Hydrocele

The penis is comprised of three cylindrical bodies of erectile tissue—the corpus spongiosum, and the two corpora cavernosa. The penis contains several valves in the sinusoidal spaces and arteries that usually are in a state of contraction secondary to sympathetic system control. As a result of this contractile state, most of the penile blood flow bypasses the corpora cavernosa and drains directly into the emissary veins. During an erection, the parasympathetic system allows sinusoidal and arterial filling, with closing of the venous valves to prevent the outflow of blood. The three corpora then become distended and elongated. Following orgasm, sympathetic stimulation results in smooth muscle constriction and detumescence.

Painless Scrotal/Testicular Swelling

Hydrocele. The most common causes of painless scrotal swelling are listed in Table 1. A hydrocele is a collection of fluid that accumulates in the tunica vaginalis. Communicating hydroceles occur when the upper processus vaginalis fails to obliterate and there is an open tract between the peritoneum and the scrotum. The upper processus vaginalis is closed in non-communicating hydroceles. The majority of hydroceles are right-sided. Hydroceles may be present at birth, usually are painless, and may resolve spontaneously by 18 months of age. Physical examination will reveal enlargement of the scrotum and the fluid may trans-illuminate. If the hydrocele is a result of an acute process, the patient may present with a tender mass. A color-flow Doppler ultrasound or radionuclide synctiograph may be necessary to differentiate the cause of the hydrocele and to exclude acute pathology. Asymptomatic patients can be discharged with urologic follow-up.

Testicular Cancer. Testicular cancer represents approximately 1% of solid tumors in children. There is an increased incidence of testicular cancer in patients with cryptorchidism in both the undescended testicle and in the contralateral descended testicle. Rhabdomyosarcoma is one of the most common solid malignancies of childhood, and has a bimodal age distribution, with the first peak between 2 and 6 years of age, and the second peak between 14 and 18 years of age. Other common solid malignancies include lymphomas, Wilms tumor, and neuroblastoma. Patients present with a painless, unilateral mass that typically is palpated separately from the testis. However, a reactive hydrocele may be seen in 7-25% of patients,² and can result in misdiagnosis with delayed intervention. The diagnosis is confirmed by ultrasound. These patients should be referred to a pediatric oncologist for staging and management, and a prompt urologic evaluation should be obtained for biopsy.

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Idiopathic Scrotal Edema. Idiopathic scrotal edema is painless erythema and induration of the scrotum. This disorder typically occurs in patients between 2 and 11 years of age, with 77% of cases occurring before 10 years of age.³ Two-thirds of cases are unilateral and no specific allergens are identified. Patients develop painless erythema and induration of the scrotum, which may be pruritic. There is minimal tenderness on physical examination, but the edema and erythema may extend to the phallus, groin, and abdomen. Examination of the testes and epididymis reveals no palpable masses or tenderness. Fever is rare. Patients can be discharged home with outpatient follow-up once acute pathology has been ruled out. Most cases will resolve spontaneously within 1-4 days; however, recurrence rates may be as high as 21%. Patient and parental reassurance usually are all that is necessary. The differential diagnosis of localized scrotal swelling includes insect bites, allergic reactions, contact dermatitis and cellulitis. Although nephrotic syndrome typically presents with generalized edema, patients may present with scrotal swelling.

Henoch-Schoenlein Purpura. Henoch-Schoenlein purpura (HSP) is an IgA mediated systemic vasculitis involving the small blood vessels supplying the skin, gastrointestinal tract, and joints. It was first described in 1837 by Schoenlein, who noted the association of microscopic hematuria with joint pain and purpura.⁴ The peak incidence of HSP is 4-7 years of age, with an overall occurrence rate of 13.5 episodes per 100,000 children annually. There is a slight male predominance, with an increased incidence in the spring and fall. Although most cases are self-limited, up to 33% of patients do experience recurrences. Approximately 50% of children have a history of a preceding upper respiratory tract infection, and as many as 75% have group A beta-hemolytic streptococcus cultured from the oropharynx. Other factors that can predispose to HSP include exposure to cold weather, certain foods, drugs, and insect bites. Preceding infections from varicella-zoster, Mycoplasma, Parvovirus, *Campylobacter enteritis*, Parvovirus B19, and Epstein-Barr virus also have been implicated.

The hallmark of HSP is a palpable, purpuric, or petechial rash that is most prominent on the lower extremities, starting around the lateral malleoli and extending to the buttocks. The face, palms, and soles typically are spared. The cutaneous manifestations of HSP usually precede the other findings and are the initial presenting complaint in 50% of patients. The second most common manifestation is arthralgia or arthritis, which occurs in 65 to 85% of patients⁵ and usually involves the knee and ankle joints. Gastrointestinal complaints are present in up to 65% of patients, with the most common symptom being periumbilical, dull pain caused by bleeding into the intestinal wall from the diffuse vasculitis. The abdominal pain typically presents concurrent with or immediately after the rash. However, in up to 15% of patients, abdominal pain can be the initial complaint, making diagnosis extremely difficult.⁶ Vomiting, hematemesis, hematochezia, and melena also may occur. The most common surgical complication of HSP is ileocolic intussusception, which occurs in 1-3% of patients. Ischemic bowel and perforation are rare findings.

Figure 1. Henoch-Schoenlein Purpura

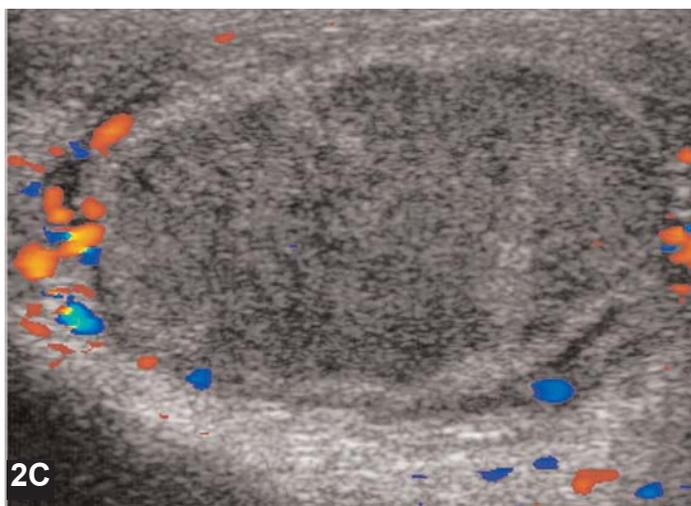
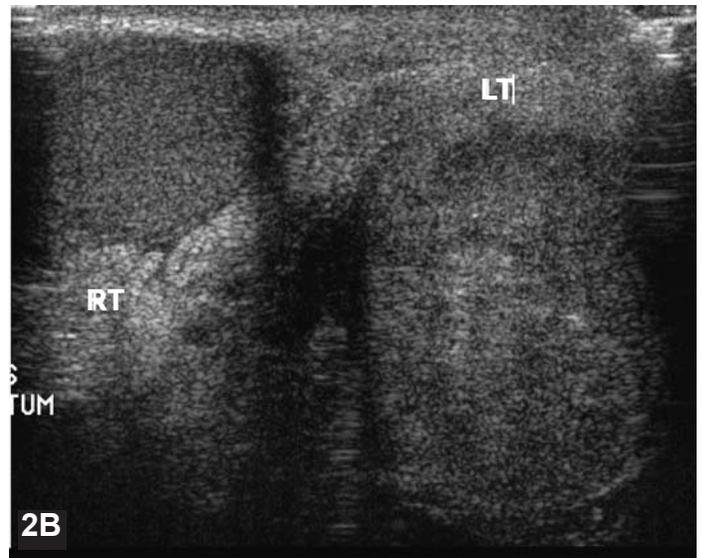
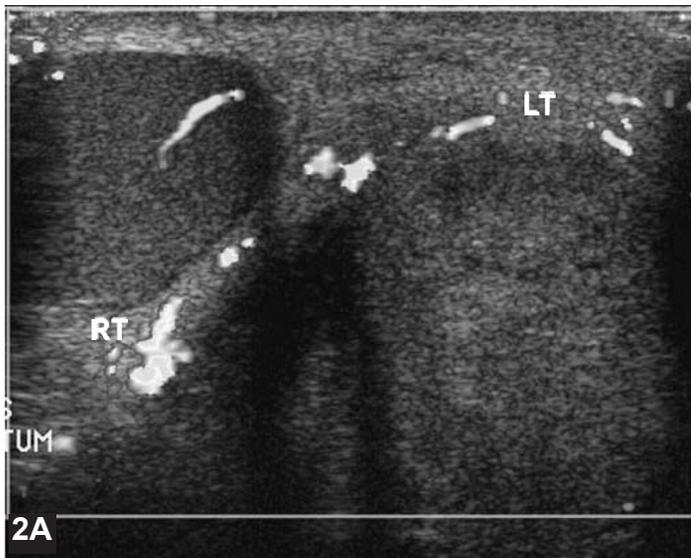


A young male with the classic palpable purpuric rash and scrotal edema associated with Henoch-Schoenlein purpura.

Between 25-50% of children develop a self-limited glomerulonephritis manifested by hematuria. Fewer than 1% of these patients develop chronic renal insufficiency. Testicular involvement occurs in up to 35% of patients who may present with severe scrotal edema resembling acute testicular torsion.⁷ (See Figure 1.) Central nervous system and pulmonary involvement, however, are rare.

There are no specific tests to confirm HSP, and it usually is a clinical diagnosis. However, this can be difficult if the classic rash is absent at the time of presentation. If the diagnosis is unclear, then the patient should have screening tests such as urinalysis, blood urea nitrogen and creatinine, complete blood count, and coagulation studies to rule out other pathologic diseases. If the patient presents with abdominal pain, an ultrasound can help to facilitate the diagnosis. Typical findings are intraluminal hematomas, duodenal wall thickening, and luminal enlargement secondary to the vasculitis. Treatment of HSP remains controversial as most cases resolve spontaneously and do not require therapy. Nonsteroidal anti-inflammatory agents can be used to treat joint pain, but close attention must be paid to renal function. Corticosteroids have been used to treat severe renal or gastrointestinal involvement. Prednisone has shown some benefit, but it is imperative that an acute, surgical process be excluded prior to steroid initiation. Therapy for patients with severe renal involvement also includes intravenous immunoglobulins. Promising results with this therapy have been seen in patients with severe abdominal pain.⁸ A nephrologist should be consulted for patients with renal involvement and good follow-up ensured. Patients with resultant nephrotic syndrome, glomerular crescent formation, or patients younger than 6 years of age have a poor prognosis. Patients with only skin manifesta-

Figure 2 A-C. Testicular torsion



2A: Note the absence of blood flow to the left testicle when compared to the right testicle.

2B: The difference in the tissue composition of the testicles is apparent, with the left testicle having a more heterogeneous appearance.

2C: Another image of the left testicle, showing no blood flow to the testicle

tions of HSP usually can be discharged home with symptomatic therapy for the joint pain and malaise. Nonsteroidal anti-inflammatory agents or acetaminophen usually are sufficient, but close follow-up should be ensured. Patients with abdominal pain or renal insufficiency and/or nephrotic range proteinuria should be admitted for further evaluation and treatment.

Varicocele. A varicocele is a collection of venous varicosities in the scrotum. There is a reported incidence of 13.7-16.2% in adolescent males.⁹ Varicoceles are rare in children younger than 10 years of age.¹⁰ The left spermatic vein empties directly into the left renal vein, whereas the right spermatic vein drains into the inferior vena cava (IVC) and then into the right renal vein. Therefore, left-sided varicoceles account for 85-95% of cases; however, up to 22% of patients may have bilateral varicoceles. Incomplete drainage of the pampiniform plexus develops, resulting in dilation of the spermatic veins. Intra-abdominal pathology should be suspected in cases of right-sided varicoceles, since these usually are caused by IVC thrombosis or compression of the inferior vena

cava by tumors.¹¹ The sudden onset of left-sided varicocele should raise the suspicion of renal cell carcinoma with obstruction of the left renal vein. The venous dilatation can be tender on physical exam and can be palpated superior and posterior to the testis. Varicoceles usually are more pronounced in the upright position, and have often been described as feeling like a “bag of worms.” Intravenous pyelogram, ultrasound, abdominal computed tomography scan, or angiography may be necessary for differentiation of the underlying cause. Patients with uncomplicated varicoceles may remain asymptomatic, or the varicocele may resolve spontaneously. Surgical correction may be required if the patient develops pain, decreased spermatogenesis, infertility, testicular hypotrophy, or if there are bilateral varicoceles. Surgical options include spermatic vein embolization or spermatic vein ligation.¹²

Painful Scrotal/Testicular Swelling

Although acute scrotal or testicular pain may be caused by a benign underlying diagnosis, the emergency physician is always

concerned about the diagnoses that can cause irreversible genitourinary injury with resultant testicular loss, atrophy, or infertility. Patients who present with acute scrotal pain should be suspected of having testicular torsion, torsion of the testicular appendage, epididymitis/orchitis, strangulated or incarcerated inguinal hernia, testicular rupture, or hemorrhage into a testicular mass. (See Table 2.)

Incarcerated Hernia. A patient who presents with the acute onset of scrotal pain may have a strangulated or incarcerated hernia. There is an increased incidence of inguinal hernias in males and premature infants. Bimodal peaks occur before 1 year of age, and then after 40 years of age. Indirect inguinal hernias occur when the processus vaginalis fails to obliterate and abdominal contents invaginate through this patent sac. Inguinal hernias are more common on the right side since passage of the testis enlarges the diameter of the canal, and the right testis passes later than the left side. If the inguinal mass can be palpated separately from the testes, then it may be possible to diagnose the hernia clinically. However, if the incarceration results in bowel ischemia, it may be difficult to exclude other acute testicular pathology. In these cases, a testicular ultrasound or radionuclide scintigraphy may be necessary. Once the diagnosis is made, the hernia should be reduced unless there is suspicion of strangulation. The patient should be placed in the Trendelenburg position and an ice pack can be placed on the groin to reduce swelling, although this has variable results. Sedation may be necessary prior to reduction attempts. Slow, firm pressure should be applied to reduce the hernia. If the emergency physician is unable to reduce the hernia or strangulation is present, the patient should receive prompt surgical consultation.

Torsion. Torsion of the spermatic cord is a common cause of an acutely painful scrotum. Delay in diagnosis and treatment can result in a loss of spermatogenesis, and in severe cases a necrotic, gangrenous testes. The incidence of testicular torsion is 1 in 4000 males, with a peak incidence at age 13.¹³ In intravaginal torsion, the testicle may rotate within the tunica vaginalis and thereby constrict the arterial blood flow. Extravaginal torsion is seen most commonly in neonates who are premature, and also can occur antenatally. Patients present with acute scrotal pain and swelling, an elevated testicle, and an absent cremasteric reflex. A normal cremasteric reflex is the drawing up of the ipsilateral scrotum and testicle when the skin on the medial aspect of the thigh is stroked. In one series, the cremasteric reflex was absent in 100% of patients with torsion, and only absent in 14% of patients with epididymitis.¹⁴ Abnormal epididymal position and abnormal testicular position also may be present, with left-sided torsions slightly more common than right. Nausea, vomiting, and a low-grade fever also may be seen. In the patient with an undescended testicle who presents with abdominal pain, torsion should be a consideration.¹⁵ If the diagnosis is not clear and there is a delay in patient presentation, then diagnostic studies may be indicated. A leukocytosis is present in up to 50% of patients and urinalysis typically is normal. Color-flow Doppler ultrasound has a sensitiv-

Table 2. Painful Causes of Scrotal/Testicular Swelling

- | | |
|------------------------------------|--------------------------------------|
| • Epididymitis | • Priapism |
| • Testicular torsion | • Penile tourniquet syndrome |
| • Torsion of the appendix testis | • Testicular rupture |
| • Incarcerated/strangulated hernia | • Hemorrhage into a testicular tumor |
| • Paraphimosis | • Balanoposthitis |

ity of 82-86%, with a specificity of almost 100% for testicular torsion. (See Figures 2A-C.) Scintigraphy has a sensitivity ranging from 80% to 100%, and a specificity of 89-100%.¹⁶

The history and physical examination should determine the need for immediate intervention. If there is a strong clinical suspicion that the patient has testicular torsion, surgical exploration should not be delayed for diagnostic studies, particularly in patients who present within 12 hours of symptom onset. Testicular salvage is dependent on rapid detorsion, and a delay in treatment and diagnosis can result in an infarcted and gangrenous testicle. Knight and Vassy report that testicular salvage rates are time-dependent, with a 96% success rate if detorsion is performed within four hours of symptom onset, 93% 4-8 hours after symptom onset, 80% 8-12 hours after onset, 40% between 12 and 24 hours, and less than a 10% testicular salvage rate if the patient presents more than 24 hours after symptom onset.¹⁷ If immediate surgical assistance is not available and there is a palpable twist in the spermatic cord, then the emergency physician can attempt to manually detorse the testicle by rotating the testicle in an open-book fashion. The rotation is performed in a medial to lateral position until detorsion is complete.¹⁸ Sedation and pain relief should be administered prior to performing this intervention. Elective orchiopexy of the involved testicle and the contralateral testicle typically is performed after detorsion to avoid recurrent torsion. Approximately 40% of patients have a bell clapper deformity of the contralateral testicle.

Torsion of the Testicular Appendage. Patients with torsion of the testicular appendage typically present with the sudden onset of moderate to severe pain localized to the involved hemiscrotum. Point tenderness often can be elicited. Fever, dysuria, and abdominal pain are rare. A tender nodule may be palpable beneath the scrotal skin. The pathognomonic finding is the "blue dot sign," which is comprised of the cyanotic appendage immediately below the scrotal wall. This finding is present in 14-22% of cases³ and is visualized as a blue reflection when a light shines upon the scrotal skin. Color-flow Doppler ultrasound may be performed to exclude testicular torsion. Once the diagnosis is ascertained, patients can be discharged home on conservative therapy with analgesics. The discomfort generally lasts less than one week, with the involved appendage undergoing atrophy and autoamputation.

Epididymitis. Epididymitis results from inflammation of the epididymis, which is located along the posterior aspect of the testicle and serves as the storage center for sperm. The most common cause is bacterial infection, and the etiology varies by age.

Adolescents should be evaluated for possible sexually transmitted diseases, such as gonorrhea and chlamydia. Patients may have a history of previous urinary tract infections, anatomic abnormalities, or prior genitourinary instrumentation. Urinary tract infections typically are caused by *Escheria coli*, *Klebsiella pneumoniae*, *Pseudomonas*, and enterobacteriae. There are reports of brucellosis and *Haemophilus influenza* resulting in epididymitis.¹⁹ Patients with epididymitis typically present with a tender, edematous scrotum, and the epididymis is in its normal location posterolateral to the testes. A urethral discharge may be present, particularly when the epididymitis is secondary to a sexually transmitted disease. Systemic symptoms also may be present and include nausea, vomiting, fever, and lower abdominal, scrotal, and testicular pain. As the swelling increases, obliteration of the sulcus between the testis and epididymis occurs, making differentiation from torsion extremely difficult. Relief of pain with scrotal elevation (Prehn's sign) is unreliable. A reactive hydrocele also may be present. Patients may be febrile with an average temperature of 38°C. A urinalysis should be obtained and sent for culture if the results are positive. A lack of pyuria does not rule out epididymitis, since up to 20-50% of patients may have normal studies. A leukocytosis may be present on a peripheral blood smear. Any urethral discharge should be cultured and sent for Gram's stain and *Neisseria gonorrhoeae* and *Chlamydia trachomatis* cultures. Color-flow duplex Doppler sonography or radionuclide scintigraphy will reveal a normal testis and preserved or increased vascular flow toward the side of the inflamed epididymis.^{20,21} In addition to antibiotic administration, pain control is imperative. Scrotal elevation, placement of ice packs on the swollen area, non-steroidal anti-inflammatory drugs, and narcotic medication may be necessary. If there is urethral discharge, the patient should be treated for both *N. gonorrhoeae* and *C. trachomatis*. The treatment for sexually acquired epididymitis includes ceftriaxone 125 mg intramuscularly or cefixime 400 mg orally as a single dose (if available), followed by either doxycycline 100 mg orally twice a day, tetracycline 500 mg orally four times a day, or azithromycin 1 gram orally as a single dose. Patients younger than 9 years of age should be treated with erythromycin (50 mg/kg/day divided 4 times a day) instead of doxycycline. Nonsexually acquired epididymitis can be treated with trimethoprim 8 mg/kg/day divided twice a day for 10 days. Other treatment options for non-gonococcal epididymitis includes ampicillin, erythromycin, and cephalexin. Patients with systemic symptoms and toxicity should be admitted for intravenous antibiotics with either ceftriaxone or cefotaxime. Children will need close urologic follow-up to ensure that there are no contributing urologic abnormalities, and they may require a voiding cystourethrography and renal ultrasound. If the epididymitis is found to be sexually transmitted in an underage child, the appropriate child protective agency should be contacted immediately and a report filed by the emergency department physician.

Testicular Rupture. Testicular rupture occurs as a result of trauma when the testis is crushed against the bony pelvis. Patients present with immediate pain, with resultant testicular and scrotal

swelling and ecchymosis. The testis may be difficult to palpate due to the hemorrhage. An ultrasound should be performed for diagnosis. If there is a testicular rupture, immediate urologic consultation with surgical exploration is imperative. If there is a contusion or scrotal hematoma without rupture, then bed rest, scrotal support, and analgesics are the treatment of choice.

Penile Pain and Swelling

Balanitis. Balanitis is inflammation of the glans, while balanoposthitis is inflammation that involves the glans and the foreskin, and occurs in up to 3% of uncircumcised males.

The primary cause of balanoposthitis is infection; however, chemical irritation, trauma, fixed drug eruption, or contact dermatitis also can be contributory. The typical organisms involved in infection-related balanoposthitis are gram-positive and gram-negative organisms that are normal flora but cause infection as a result of a break in the penile foreskin. Group A beta-hemolytic streptococci has been reported to cause balanitis.²² *Candida albicans* also may be contributory in prepubertal males, and recurrent cases should raise the suspicion of diabetes mellitus. In adolescents, sexually transmitted diseases may lead to inflammation and subsequent balanoposthitis. Physical examination reveals penile erythema, edema and a discharge may be present. It is unusual to develop systemic symptoms such as fever, vomiting, and diarrhea. Diagnosis is clinical, but the offending organism can be identified by culturing any discharge. Adolescent males also can be cultured for *N. gonorrhoeae* and chlamydia if the clinical presentation is suspicious for sexually transmitted diseases. Management includes emphasis on adequate hygiene with gentle retraction and cleaning of the foreskin and sitz baths to reduce inflammation. It also may be more comfortable for the child to void in a tub of warm water. In patients with cellulitis, 5-7 days of a first-generation cephalosporin may be required. If Group A beta-hemolytic streptococcus is identified, management with streptococcus-specific antibiotics is required. Inflammation also can be treated with 0.5% hydrocortisone cream applied sparingly to the area; however, this usually is not necessary in routine cases. Circumcision may be required for recurrent disease.

Paraphimosis. Paraphimosis is the inability to reduce the proximal foreskin over the glans penis. This results in distal venous congestion and resultant inability to return the foreskin to its anatomic position. Infection can result in paraphimosis, as can masturbation, trauma, and hair or clothing tourniquets. It is a true urologic emergency and patients should be evaluated as soon as possible to avoid arterial compression, penile necrosis, and gangrene.

The patient typically is anxious, and physical exam reveals a flaccid proximal penis with erythema and engorgement distal to the obstruction. The foreskin is retracted and there also may be local cellulitis. Pain can be controlled either parenterally or by performing a local dorsal penile block. Edema then can be reduced by placing the tip of a rubber glove filled with ice water over the glans and foreskin for approximately five minutes. The

glove then is removed and circumferential compression of the penis is performed, starting at the glans and moving proximally toward the base. This results in the foreskin slipping over the glans and a decrease in the edema. A careful search for foreign bodies should be performed and any visible tourniquet should be removed.

If the paraphimosis is not reduced, then manual reduction with slow, gentle pressure on the glans (similar to "turning a sock inside out") may be necessary.⁷ Another method is to puncture the edematous foreskin with a 21-gauge needle to allow for fluid drainage.²³ Once the edema has decreased, the foreskin can be returned to its normal position. If all attempts fail, then circumcision or a dorsal slit procedure may be necessary. Patients can be discharged after reduction if they are able to void spontaneously, and urologic follow-up can be arranged. Patients with necrosis or cellulitis of the penis should be admitted for further therapy and intravenous antibiotics.

Phimosis. Phimosis is constriction of the foreskin that results in the inability to retract the prepuce over the glans. Most cases are physiologic in that only 4% of newborn males have a fully retractable foreskin. The ability of the foreskin to retract increases with age, with 25% of 6-month-olds, 50% of 1-year-olds, 80% of 2-year-olds, and 90% of 4-year-old males having fully retractable foreskins.²⁴ Although true phimosis is rare, it can result from trauma, infections, chemical irritation, poor hygiene, or as a complication of circumcision. In the patient with a phimosis, the foreskin adheres tightly to the glans and is not retractable. A decreased urinary stream, pain, and hematuria can result. Medical attention often is sought because the parents suddenly realize that the foreskin is not retractable. Patients with physiologic phimosis need no diagnostic evaluation, and parents need reassurance and instructions on proper hygiene. They also should be instructed not to forcefully retract the foreskin, as this may lead to paraphimosis. Although rare, true phimosis may result in severe stenosis and obstructive uropathy; therefore, kidney function tests such as blood urea nitrogen and creatinine should be obtained, as well as a renal ultrasound. If there is vascular compromise to the glans, a dorsal slit procedure may be necessary after placement of a local penile block.²⁵ If the patient presents with recurrent balanoposthitis and infection, then circumcision or preputial plasty may be necessary.²⁶ Some cases may respond to balloon dilation. Betamethasone valerate cream in a concentration of 0.6% applied twice daily for two weeks has shown tremendous success in the treatment of true phimosis, with a response rate of greater than 95%.^{27,28}

Penile Tourniquet Syndrome. Penile tourniquet syndrome should be suspected in the inconsolable male infant. This syndrome typically results when a band of hair becomes entrapped in the coronal groove. Physical examination will reveal penile swelling dorsal to the foreign body. Sedation and surgical assistance may be required to remove the tourniquet, since it may be difficult to visualize due to coronal sulcus edema. In addition to vascular supply, dorsal penile nerve supply may be occluded.

Urethral function can be evaluated by performing a retrograde urethrogram, and a Doppler ultrasound can be performed to assess penile arterial flow in cases of severe obstruction.

Zipper Entrapment of Foreskin. Zipper entrapment of the penile foreskin may occur, especially in children between 2 and 6 years of age. The classic removal technique is to cut the median bar of the zipper with bone or metal cutters. There is reported success with soaking the penis in mineral oil prior to zipper removal attempts. The lubrication allows the foreskin to be more easily removed with gentle traction alone.²⁹

Priapism. Persistent penile erection not associated with sexual stimulation is referred to as priapism. Priapism involves engorgement of the dorsal corpora cavernosa with resultant dorsal penile erection and glans and ventral penile flaccidity. Low-flow priapism is more common than high-flow priapism and is secondary to decreased venous outflow. The most common cause in children is sickle cell disease, which accounts for approximately 66% of cases and occurs in up to 6% of prepubertal boys with sickle cell disease. Eleven percent of pediatric priapism is secondary to leukemia. Immunosuppressive disorders and anticoagulation also may be contributing factors. Intracavernosal injections such as papaverine, phentolamine, and PGE-1 also can result in priapism. Other drugs, such as phenothiazines, sedative-hypnotics, selective serotonin uptake inhibitors, anti-hypertensives, anticoagulants, and drugs of abuse such as cocaine, alcohol, and marijuana also may be contributory. High-flow priapism typically is associated with penile arterial laceration and excessive inflow of arterial blood, resulting in corporal engorgement that usually is painless. Penile erection that is prolonged and painful is characteristic of low-flow priapism. Complications of priapism include penile fibrosis, impotence, and acute urinary retention.

If prolonged engorgement of the corpora cavernosa occurs, urinary retention can occur. Stagnant, hypoxic blood results in thrombosis and ischemia if treatment is not promptly initiated. Priapism is a clinical diagnosis, and can be distinguished from other causes of erection by careful history and physical examination. Paraphimosis and phimosis involve the glans penis. Erection due to spinal cord injury involves the ventral penis and glans but is not limited to the dorsal corpora cavernosa. Anti-coagulation induced priapism should be evident by history. Laboratory studies may include a complete blood count in patients with sickle cell anemia and patients in whom leukemia is suspected, and coagulation studies. Occasionally, intracavernosal blood gas analysis may be necessary to differentiate between low-flow and high-flow priapism. Diagnostic studies of penile blood flow include magnetic resonance imaging, color Doppler cavernosonography, and technetium-99 penile scanning. Angiography is helpful in localization of the arterial bleeding site in high-flow priapism and facilitates embolectomy.³⁰

Management centers around hydration, pain control, relief of urinary obstruction, and treatment of other underlying conditions. Parenteral pain control with morphine may be initiated.

Local anesthesia via a dorsal nerve block using 1% lidocaine without epinephrine may be beneficial, as can infiltration of hyaluronidase. In patients with sickle cell disease, red blood cell transfusion may be necessary. The application of heat via hot compresses or sitz baths increases penile blood flow and may be helpful in cases of low-flow priapism.

Cavernosal aspiration and irrigation to induce detumescence has been effective in patients with low-flow priapism and acidosis. However, to be effective, aspiration must be performed within the first few hours of symptom onset, and rarely is beneficial after 48 hours. The use of intracorporal and parenteral agents also may be beneficial in the treatment of priapism. Phentolamine, phenylephrine, or epinephrine (1:1,000,000) often is added to the irrigation solution when corporal aspiration is performed, to induce contraction of the smooth muscle of penile cavernosal arteries and pumping of the blood from the cavernosa back into the venous circulation.³¹ Vasodilators such as papaverine, hydralazine, or terbutaline (0.25-0.5 mg intravenously every 4 hours) also have been used with varying success.³² High-flow priapism can be treated effectively by arterial embolization. If these non-surgical approaches are unsuccessful, then a shunt procedure should be considered. Shunt procedures typically are most effective when performed in the first 24 hours of symptom onset.

Patients with persistent priapism or serious underlying disorders such as sickle cell disease or leukemia should be admitted. A pediatric urologist should be consulted as soon as possible to determine the best management approach. If the priapism has been treated successfully with non-invasive measures without recurrence after observation, the patient may be discharged with close urologic follow-up.

Circumcision. Circumcision usually is advocated for prevention of phimosis, paraphimosis, recurrent balanoposthitis, urinary tract infections, and penile cancer. There are three possible techniques that may be utilized in performing circumcisions. A plastibell or Gomco clamp, excision, or dorsal slit procedure may be employed. The most common complication of circumcision is hemorrhage, which usually is minor and can be controlled by direct pressure, silver nitrate application, or suture placement. The second most common complication is either localized or systemic infection. Typical pathogens include: *Staphylococcus aureus*, *Staphylococcus epidermidis*, *E. coli*, *K. pneumoniae*, Group D streptococcus, Salmonella, and *Proteus mirabilis*. Fournier's gangrene also may develop. Urinary tract infections also may occur as a complication of circumcision. Although rare, systemic infections such as meningitis, tetanus, and sepsis have been reported.

Postoperative pain, edema, and urinary retention may occur. Pain usually resolves within 12-24 hours. Occlusive dressings can contribute to urinary retention and edema, and if present should be removed. In addition to meatal stenosis, complications of the plastibell device include a tourniquet-like effect if the bell is too large and slips proximally onto the penile shaft. Most of these complications occur if the ring remains in place for longer

than 10 days; therefore, parents should be instructed to follow up if the plastibell remains after this time period, or sooner if there are any concerns.

Post-circumcision phimosis may result if the bell clamp is not placed correctly and excess foreskin remains. The resultant scar formation also leads to narrowing of the foreskin orifice, with the foreskin slipping over the glans penis. If the constriction is severe, and urinary outlet obstruction occurs, dilation of the stenosis can be performed by using a hemostat. If this is unsuccessful, a dorsal slit procedure may be necessary and ultimately surgical revision is necessary.³³

Application of a plastibell that is too small also can lead to meatal stenosis. The incidence of post-circumcision meatal stenosis is reported to range between 8% and 31%.³⁴ Meatal stenosis may result from prolonged exposure to the ammonia compounds in urine. The diaper dermatitis that develops leads to sloughing of the epithelial surface of the meatus and results in a narrowed meatus at the tip of the glans. Symptoms include pain with urination, bloody discharge due to the inflamed meatus, high velocity stream, and the need to sit while voiding.

Skin bridges consisting of small fibrotic bands of tissue that attach the glans to the penile shaft may result as a consequence of the postcircumcision scar coming into contact with the inflamed glans. Chordee formation results and leads to pain and possible infection. Manual separation of these adhesions should not be performed, and these patients should be referred for surgical correction. Inclusion cysts also may result following circumcision and result from smegma retained in the wound or from epidermis involution leading to the presence of small cystic lesions along the circumcision site. These cysts are treated by surgical resection. Skin bridges and inclusion cysts may be prevented by proper hygiene and application of an antimicrobial ointment to the circumcision site for 7-10 days following the procedure.

Summary

A high index of suspicion is imperative when evaluating pediatric patients for acute scrotal and testicular pain. Boys with acute testicular pain should be presumed to have testicular torsion until proven otherwise. Common pitfalls to making the correct diagnosis include: failure to obtain an immediate surgical consultation on patients in whom acute testicular torsion is suspected; failure to evaluate the cremasteric reflex; emphasis incorrectly placed on Prehn's sign to rule out testicular torsion; and the failure to perform a complete genitourinary exam in infant males who present with crying.

If there is strong clinical suspicion that the patient has testicular torsion and the patient presents early, time should not be spent performing diagnostic tests. An immediate surgical consultation is warranted since testicular salvage rates are dependent on timely detorsion. Testicular damage or loss can occur if the testicular torsion is diagnosed after 12 hours.³⁵ If a surgical consultation is not available, the emergency physician can try to manually detorse the testicle after appropriate sedation is administered

to the patient. If there is clinical uncertainty, color Doppler ultrasound or nuclear scanning are imperative to make a timely and accurate diagnosis. In addition, these studies may potentially minimize unnecessary surgical interventions.

Although most cases of painless scrotal/testicular swelling are benign, severe underlying disease should be considered.³⁶ For example, the sudden appearance of a hydrocele or varicocele is suspicious for underlying abdominal or scrotal pathology. In addition, recurrent cases of candidal balanoposthitis mandate a search for diabetes mellitus. Regardless of the emergency department diagnosis, close follow-up is warranted even in patients with seemingly minor complaints.

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Physicians participate in this continuing medical education program by reading the article, using the provided references for further research, and studying the questions at the end of the article. Participants should select what they believe to be the correct answers, then refer to the list of correct answers to test their knowledge.

To clarify confusion surrounding any questions answered incorrectly, please consult the source material. After completing this activity, you must complete the evaluation form that will be provided at the end of the semester and return it in the reply envelope provided to receive a certificate of completion. When your evaluation is received, a certificate will be mailed to you.

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CME Questions

21. What percentage of newborns have fully retractable foreskins?
- A. 94%
 - B. 70%
 - C. 4%
 - D. 24%
22. A patient for whom there is a high index of suspicion for testicular torsion should undergo which one of the following?
- A. Nuclear scan
 - B. Surgical exploration
 - C. Color Doppler ultrasound
 - D. Computed tomography scan
23. The “blue dot” sign is pathognomonic for:
- A. torsion of the testicular appendage.
 - B. testicular torsion.
 - C. epididymitis.
 - D. hemorrhage into a testicular tumor.
24. The lack of a cremasteric reflex in a patient with acute testicular pain should raise the suspicion for which one of the following?
- A. Paraphimosis
 - B. Torsion of the testicular appendage
 - C. Priapism
 - D. Testicular torsion
25. A patient presents with recurrent episodes of candidal balanoposthitis. Which of the following should be suspected?
- A. Testicular cancer
 - B. Granulocytopenia
 - C. Diabetes mellitus
 - D. Child abuse
26. Which of the following is *not* an acceptable approach to the immediate management of paraphimosis?
- A. Referral to a urologist within 24 hours
 - B. Foreskin needle puncture
 - C. Manual reduction
 - D. Dorsal slit procedure
27. Which of the following is true?
- A. Patients with recurrent balanoposthitis always should undergo circumcision.
 - B. Most cases of phimosis require further diagnostic evaluation.
 - C. Prehn’s sign is reliable in the evaluation of epididymitis and

testicular torsion.

- D. Patients with testicular contusion can be discharged home with analgesics and scrotal support.
28. Which of the following is true?
- A. Most hydroceles are left-sided.
 - B. Hydroceles result from fluid accumulation within the tunica vaginalis.
 - C. Hydroceles do not transilluminate.
 - D. Hydroceles are more common in the adolescent male.
29. Which of the following is true regarding idiopathic scrotal edema?
- A. It usually occurs in children younger than 1 year of age.
 - B. Two-thirds of cases are unilateral.
 - C. An etiologic agent usually is identified.
 - D. The testicle is always very tender.
30. A patient presents with a right-sided varicocele. Which of the following should be considered?
- A. Nephrotic syndrome
 - B. Infection
 - C. Intra-abdominal pathology
 - D. Testicular torsion

Answer Key:

- | | |
|-------|-------|
| 21. C | 26. A |
| 22. B | 27. D |
| 23. A | 28. B |
| 24. D | 29. B |
| 25. C | 30. C |

CME Objectives

The CME objectives for *Pediatric Emergency Medicine Reports* are to help physicians:

- a.) Quickly recognize or increase index of suspicion for specific conditions;
- b.) Understand the epidemiology, etiology, pathophysiology, historical and physical examination findings associated with the entity discussed;
- c.) Be educated about how to correctly formulate a differential diagnosis and perform necessary diagnostic tests;
- d.) Apply state-of-the-art therapeutic techniques (including the implications of pharmacologic therapy discussed) to patients with the particular medical problems discussed;
- e.) Provide patients with any necessary discharge instructions.

In Future Issues:

ENT Emergencies