The fibrous capsule of the tunica albuginea surrounds each testis. A break in the integrity of the tunica albuginea represents a “ruptured” testicle, which can be caused by blunt trauma. External to the testicular parenchyma and tunica albuginea is the tunica vaginalis, which envelopes each testicle and fastens it to the posterior scrotal wall.

The gubernaculum, or scrotal ligament, anchors each testis inferiorly and provides additional stability. The tunica vaginalis consists of both visceral (contiguous with the tunica albuginea) and parietal (contiguous with the deep spermatic fascia) layers, with an interposed potential space. A lack of firm attachment of the testicle to the posterior scrotal wall makes the testis prone to rotation in a horizontal plane about the spermatic cord, a condition termed testicular torsion.

The testicular artery originates from the aorta just below or directly from the renal artery. The spermatic cord contains both the blood supply to each testicle via the gonadal vessels and the vas deferens. Interruption of blood flow to the testis by twisting of the spermatic cord can lead to rapid ischemia and subsequent infarction of the affected testicle in cases of testicular torsion.

The appendix testes are embryologic remnants with no known physiologic function. These appendages are prone to torsion as well, which can lead to localized, self-limited necrosis. It results in clinical findings that may be confused with testicular torsion.

The epididymis adheres closely to the posterolateral aspect of each testis. It is involved in promoting sperm maturation and motility. The appendix epididymis is an embryologic remnant typically attached to each epididymis. These too are prone to torsion.

The vas deferens is a tubular structure involved in sperm transit; it extends from the epididymis distally to the prostatic portion of the urethra proximally.

The penis consists of the corpora cavernosa (erectile bodies) and the corpus spongiosum, which surrounds the urethra. In uncircumcised males, the retractile penile foreskin covers the glans. The potential constricting effect of proximally retracted foreskin may lead to paraphimosis. In paraphimosis, venous engorgement of the glans and edema resulting from constriction can potentially progress to arterial compromise and necrosis of the distal end of the penis. Each corpus cavernosum is surrounded by the tunica albuginea as well.

Priapism is a pathologic condition defined as the presence of a persistent erection lasting longer than 4 hours in the

- The five major male genitourinary emergencies are testicular torsion, Fournier gangrene (necrotizing fasciitis of the perineum), priapism, paraphimosis, and genitourinary tract trauma. An associated emergent condition is an incarcerated or strangulated inguinal hernia.
- Ultrasound examination is the primary diagnostic tool for differentiation of causes of acute scrotal pain.
- Urology services should be consulted immediately after initial patient evaluation when testicular torsion is suspected.
- Pain out of proportion to the findings on physical examination is the hallmark of early Fournier gangrene.
- In the setting of severe scrotal pain, a necrotic or ischemic cause should be suspected. Testicular torsion, Fournier gangrene, and an incarcerated or strangulated inguinal hernia are surgical emergencies.
- A trial of oral terbutaline, a β-adrenergic agonist, is the least invasive initial treatment of priapism. Corporal blood aspiration with or without irrigation or injection of an α-adrenergic receptor agonist (e.g., phenylephrine) may be necessary if the condition is not reversed rapidly.
- Successful reduction of paraphimosis can often be performed at the bedside without specialty consultation.
- A urologist should be engaged in the care of all but the most minor cases of genitourinary trauma.

ANATOMY AND PATHOPHYSIOLOGY

The male genitalia is composed of the penis, with paired erectile bodies and the penile urethra, and the scrotum, which encases the testis, epididymis, and spermatic cord bilaterally. Beneath the scrotal skin is the superficial scrotal (dartos) fascia (which is contiguous with the fascia of the abdomen, known as the fascia of Scarpa), the perineal (Colles) fascia, and the penile (dartos) fascia. The spermatic fascia lies beneath the dartos fascia; it has three layers, with the middle layer forming the cremaster muscle. These anatomic layers may provide a conduit for the rapid spread of infection.
absence of sexual desire or stimulation. It most frequently results from engorgement of the corpora cavernosa with stagnant blood (termed low-flow priapism). Box 111.1 lists several causes of low-flow priapism.

High-flow priapism is rare and is caused by the development of traumatic arterial-cavernosal fistulas, which results in the accumulation of oxygen-rich blood in the corpora.

**PRESENTING SIGNS AND SYMPTOMS**

Genitourinary complaints are often influenced by patient embarrassment and apprehension, especially in children and adolescents. Complaints of abdominal pain, fever, or nausea may be offered by the patient, but information about scrotal or penile issues may be withheld. It is important to speak with the patient alone to maximize patient disclosure, privacy, and confidentiality.

**ACUTE SCROTAL PAIN**

One of the most challenging aspects of male genitourinary complaints is that a wide variety of clinical conditions may all be manifested as acute, unilateral (or bilateral) pain and swelling of the scrotum. Although the differential diagnosis for such symptoms is extensive, threats to life and fertility need to be excluded. Testicular torsion, Fournier gangrene, and an incarcerated or strangulated inguinal hernia are surgical emergencies. The vast majority of acute testicular pain, however, can be attributed to one of three diagnostic entities: testicular torsion, epididymitis, or appendage torsion (Table 111.1).

**HISTORY**

Pain may be due to structures within or adjoining a particular region or may be referred from other areas. Delineation of the source of the pathology is essential. For example, pain from abdominal aortic aneurysms, renal colic, and pyelonephritis can radiate to the testicles.

**ONSET OF SYMPTOMS**

Pain that begins abruptly and is severe suggests testicular torsion. Intermittent severe pain can signal intermittent torsion. Twisting of the spermatic cord leads to rapid diminution of blood supply to the affected testicle and resultant ischemic pain. This is in contrast to the more indolent pain of epididymitis, a gradually progressive inflammatory process. Patients with long-standing inguinal hernias often complain of isolated genital pain of prolonged duration. However, patients with an incarcerated (cannot be reduced) or strangulated hernia (with ischemic or infarcted, herniated bowel) may experience more acute pain. Testicular torsion may accompany a report of minor scrotal trauma. Testicular torsion can also take place in the absence of such events and may even occur during sleep.

**CHARACTER OF SYMPTOMS**

The distinction between constant progressive and intermittent colicky pain is potentially useful in the diagnosis of acute scrotal pain. Constant and progressive pain typically results from progressive inflammatory processes such as epididymitis. Patients may exhibit pain with ambulation and other movements as a result of the inflammation. Intermittent and colicky pain is more consistent with rapid onset and offset conditions, as occurs with twisting of the spermatic cord, either suddenly or intermittently.

Patients with testicular torsion often complain of severe pain as a consequence of ongoing testicular ischemia. Pain resulting from inflammatory processes (epididymitis) may be relieved temporarily by rest and scrotal elevation with a supportive undergarment such as a jockstrap. Similarly, the inflammatory pain is often exacerbated by movement, thus leading a patient to remain still. Alternatively, patients exhibiting the colicky symptoms of testicular torsion may writhe in pain as they try (and often fail) to find a position of comfort. These symptoms are generalizations and, when considered alone, lack high sensitivity or specificity.

**ASSOCIATED SYMPTOMS**

Patients with nausea or emesis are less likely to have torsion of an appendage or simple, uncomplicated epididymitis. It is more likely that substantial pathology is present. Patients
is useful. It is important to assess for lower abdominal tenderness or a mass, which potentially signals acute appendicitis, inguinal hernia, genitourinary malignancy, abdominal trauma, or an advanced perineal infection such as Fournier gangrene. Tenderness at the costovertebral angle may be present with retroperitoneal processes such as pyelonephritis, renal colic, and an expanding or ruptured abdominal aortic aneurysm.

**GENITAL EXAMINATION**

**ABDOMINAL EXAMINATION**

Because many intraabdominal conditions may be associated with genitourinary pain, abdominal, flank, and back evaluation is useful. It is important to assess for lower abdominal tenderness or a mass, which potentially signals acute appendicitis, inguinal hernia, genitourinary malignancy, abdominal trauma, or an advanced perineal infection such as Fournier gangrene. Tenderness at the costovertebral angle may be present with retroperitoneal processes such as pyelonephritis, renal colic, and an expanding or ruptured abdominal aortic aneurysm.

**PHYSICAL EXAMINATION**

**ABDOMINAL EXAMINATION**

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**GENITAL EXAMINATION**

The genitalia should be examined while the patient is both standing and lying supine. Caution should be used when examining a standing patient because some males experience a strong vagal response to scrotal (or prostate) stimulation that can lead to presyncope or syncope. In addition, examination of the testicles and epididymis may cause significant discomfort, even in the absence of pathology. Because many patients have unilateral pain, the unaffected side should be examined first. This serves as a control and helps gain the trust of the patient.
Visual examination of the genitals may reveal cutaneous rashes or lesions, abnormal testicular symmetry or position, edema evident by loss of the scrotal skin folds, and masses. Key visual features of testicular torsion include a high-riding and transverse lie of the affected testicle.1,2,7

It is important to look for evidence of scrotal and perineal erythema or ecchymoses, particularly in older patients with scrotal pain. This may be the only clue to the presence of Fournier gangrene, which often affects diabetics and other immunocompromised individuals. However, a prominent feature of necrotizing fasciitis is significant pain in the absence of pronounced physical findings.

A digital rectal examination provides information regarding the prostate and the prostatic portion of the urethra. Exquisite prostate tenderness may indicate acute prostatitis. Firmness and enlargement of the prostate are typically signs of benign prostatic hypertrophy; nodularity is concerning for prostatic carcinoma. These conditions may be accompanied by variable genitourinary symptoms.

ACUTE PENILE PAIN

Patients with low-flow priapism often complain of an exquisitely painful and prolonged erection. Stagnant, oxygen-poor, acidic blood accumulates in the corpora and results in ischemic pain. Ischemia may lead to irreversible cellular damage, permanent fibrosis, and impotence if the duration of the pathologic erection is prolonged. Of note, the use of oral erectile dysfunction treatments such as sildenafil (Viagra) have only rarely been associated with priapism.1 Patients with high-flow priapism often complain of a persistent, yet painless erection that is caused by continuous inflow of well-oxygenated blood through traumatic arterial-cavernosal fistulas.

Paraphimosis classically develops in uncircumcised males when the proximally retracted foreskin acts as a constricting band on the mid to distal portion of the penile shaft. Disruption of venous drainage by the constricting foreskin leads to a vicious cycle of progressive glans edema. Progressive glans edema will eventually cause arterial compromise, ischemic pain, glans necrosis, and gangrene. Penile foreskin should always be replaced after retraction during examination or placement of a urethral catheter to avoid the development of iatrogenic paraphimosis.

Penile constriction analogous to paraphimosis can also occur. Objects constricting the penile shaft lead to the same pathophysiologic derangements seen with paraphimosis. These objects may be placed intentionally (e.g., string, metal, rubber rings), or the constriction may occur sporadically, as in the case of a hair tourniquet. Hair tourniquets may be very difficult to diagnose because the offending hair is nearly invisible within an edematous coronal sulcus. An occult hair tourniquet should be considered along with testicular torsion in a male infant with inconsolable crying. Removal of the offending hair from the coronal sulcus can be difficult. It has been reported that over-the-counter hair removal products, including depilatories such as Nair, have been used successfully for the removal of digital (finger, toe) hair tourniquets, thus suggesting its utility for penile hair tourniquets as well.9

SEXUALLY TRANSMITTED DISEASES

Genital infections that are likely to cause acute symptoms can generally be divided into diseases characterized by genital ulceration (e.g., genital herpes) and diseases causing penile discharge (urethritis).

Among the many infections that can cause genital ulceration, genital herpes, syphilis, and chancroid are the most common in the United States; genital herpes is the most prevalent.10

Primary or recurrent genital herpetic lesions may be manifested as severe pain, pruritus, or burning localized to the penis, scrotum, rectum, or elsewhere in the perineum. The typical pattern of multiple grouped vesicular or ulcerative lesions may be absent entirely in many acutely infected persons, however, thus rendering the diagnosis elusive.

Syphilis is a systemic disease caused by Treponema pallidum. Patients with syphilis may seek treatment for signs or symptoms of primary infection, which is often a painless ulcer (chancre) at the infection site, typically on the head or distal shaft of the penis.

Chancroid is caused by Haemophilus ducreyi and is classically manifested by the combination of a painful ulcer and tender inguinal adenopathy.

Diagnosis of any of these ulcerative infections is frequently inaccurate when based on the history and physical examination alone.11 Therefore, evaluation of all patients with genital ulcers should include a serologic test for syphilis and a diagnostic evaluation for genital herpes. Testing for H. ducreyi should be performed in settings where chancroid is prevalent.
Findings on urinalysis suggestive of a urinary tract infection may be present in cases of urethritis or epididymitis. Urethritis is typically characterized by discharge of mucopurulent or purulent material, with or without accompanying dysuria or urethral pruritus. The principal bacterial pathogens of proven clinical importance in men who have urethritis are *Neisseria gonorrhoeae* and *Chlamydia trachomatis*. Asymptomatic infections are common as well.

### SPECIAL SIGNS AND TECHNIQUES

Several adjuncts to the traditional examination are commonly used when assessing the male genitourinary tract.

An intact ipsilateral cremasteric reflex is frequently used, though imperfect, for excluding the diagnosis of testicular torsion. This reflex is elicited by stroking the ipsilateral inner aspect of the thigh, which results in a reflexive elevation of the testicle through contraction of the cremaster muscle. Absence of this reflex is nonspecific in that healthy individuals may lack the reflex altogether, particularly boys in the first few years of life. Of note, there have been several published reports of testicular torsion with an intact cremasteric reflex.

The Prehn sign, or relief of pain with scrotal elevation, was previously thought to help in differentiating epididymitis from testicular torsion (the latter condition having no improvement in symptoms with elevation). However, this sign has been found to be unreliable in distinguishing these two disorders, and its use for this purpose should be abandoned.

In appendage torsion, the “blue dot sign” is pathognomonic. Appendage torsion is most common in the prepubescent age group, and the infarcted appendage (the blue dot) is seen through thin, non–hormonally stimulated prepubertal skin.

Scrotal transillumination may be performed in cases of suspected hydrocele. The scrotal contents should become transilluminated when filled with light-transmitting fluid, as is the case with a hydrocele. However, transillumination is neither sensitive nor specific for the diagnosis of hydrocele, and the results should be interpreted with caution.

### DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

Most routine diagnostic aids, such as blood work or urinalysis, add little to distinguish the emergency causes of acute scrotal pain. Rather, they may actually worsen the outcome of patients by causing delays in consultation and therapeutic action. If the history and physical examination suggest the diagnosis of testicular torsion, urology (or general surgery) services should be consulted and plans made for immediate surgical exploration without delay. A patient of appropriate age with the classic history and examination findings of testicular torsion does not require any diagnostic tests. In low-risk or unclear circumstances, a confirmatory imaging study is indicated, and ultrasonography is typically used for this purpose.

In cases of Fournier disease, a delay in recognition and surgical débridement can be life-threatening. Early consultation plus administration of broad-spectrum antibiotics is indicated in all suspected cases. However, prompt surgical débridement remains the definitive treatment.

### LABORATORY TESTING

Any patient encountered in the emergency department (ED) with penile discharge should be assumed to have infectious urethritis. Centers for Disease Control and Prevention (CDC) guidelines recommend testing to determine the specific cause. Urine polymerase chain reaction testing for *N. gonorrhoea* and *Chlamydia* infection is available at most institutions. Urine samples to test for urethritis should be collected at the initiation of the urine stream without cleansing of the glans; midstream collection and glans cleansing are necessary for urine cultures in patients with suspected cystitis or pyelonephritis. If polymerase chain reaction testing is unavailable, swabs of the lining of the distal 1 to 2 cm of the penile urethra are necessary for testing.

An elevated systemic white blood cell count may be present in cases of inflammation, as well as infection, but does little to narrow the differential diagnosis—awaiting results could delay definitive management. Patients with advanced infections (e.g., scrotal abscess, epididymoorchitis, Fournier gangrene) may have a markedly elevated white blood cell count or granulocyte predominance, but the test lacks sufficient sensitivity and specificity.

### ULTRASONOGRAPHY

Ultrasound visualization is the most useful diagnostic modality for the evaluation of genitourinary complaints. Color flow duplex Doppler ultrasound is generally helpful in distinguishing potential causes of acute scrotal pain. The classic finding suggestive of testicular torsion is diminished intratesticular blood flow. In addition, examination of the spermatic cord with high-resolution gray-scale sonography may reveal kinking of the spermatic cord. In epididymitis, perfusion is normal or increased because of the effects of inflammatory mediators on local vascular beds.

Ultrasonography may also identify an infarcted appendage, hydroceles, hematoceles, varicoceles, hernias, tumors, abscesses, and gonadal vasculitis, among other conditions. In patients with testicular trauma, ultrasonography may identify disruption of the tunica albuginea, which signals testicular rupture. Doppler blood flow studies can measure the adequacy of blood flow. Absent blood flow means that traumatic torsion or vascular injury has occurred.

Ultrasound evaluation of acute scrotal problems has its limitations. Surgical scrotal exploration remains the only definitive diagnostic modality in assessing for testicular torsion. When is the risk low enough to safely send a patient home following “normal” ultrasound findings? Even though some series have found ultrasound to be unreliable, other larger series have reported a negative predictive value approaching 97%. However, if ultrasound is nondiagnostic of testicular torsion and the clinical picture is still concerning, emergency surgical consultation is prudent.

### COMPUTED TOMOGRAPHY

Computed tomography may be helpful in assessing the extension or depth of a genitourinary abscess or Fournier disease and may aid in the search for coexisting injuries or foreign bodies in the evaluation of a trauma patient.
**TREATMENT**

**ANALGESIA**
Analgesia should be administered parenterally in most cases because of the significant pain associated with the majority of the aforementioned conditions. Analgesia should not be withheld pending consultation. If the likelihood of surgical intervention is low or if the pain is mild on arrival, a trial of oral medications can be offered. The agents used most frequently are narcotic analgesics, nonsteroidal antiinflammatory drugs, and acetaminophen.

**MANUAL TESTICULAR DETORSION**
In the case of prolonged time until definitive treatment, manual testicular repositioning may be attempted. Because testicular torsion usually occurs in a lateral to medial fashion, detorsion is often accomplished by rotation of the affected testicle from medial to lateral. However, medial to lateral torsion occurs up to a third of the time. The end point of the detorsion procedure is relief of pain.

**Emergency Surgery for Testicular Torsion**
Testicular salvage rates are time dependent; more than 90% of testicles are salvaged if detorsion occurs within 6 hours after the onset of symptoms, whereas the salvage rate is less than 20% when treatment is delayed by more than 24 hours. Immediate surgical consultation is important when testicular torsion is likely.

**SCROTAL ELEVATION**
Elevation of the scrotum may be beneficial in patients with inflammatory conditions such as epididymitis. It is easily accomplished with the use of a towel roll or supportive undergarments, such as a jockstrap. In addition, ice may reduce edema and provide mild symptomatic relief.

**ANTIBIOTIC THERAPY**
Antimicrobial agents are indicated in cases of suspected or proven infection. Early broad-spectrum antibiotic therapy is imperative in any patient with suspected Fournier disease. Recommended empiric intravenous antimicrobials include ampicillin-sulbactam plus clindamycin and ciprofloxacin or clindamycin plus an aminoglycoside in individuals with known penicillin hypersensitivity. The addition of vancomycin to either regimen for expanded gram-positive coverage is reasonable.

**SEXUALLY TRANSMITTED DISEASES**
Because timely follow-up counseling and treatment of patients with abnormal test results are impractical in the ED setting, empiric antimicrobial treatment of the probable pathogens should be initiated (Table 111.2), and counseling regarding notification of the patient’s sexual contacts should be underscored. Patients should wear a condom during intercourse following treatment for at least 1 week after the symptoms have resolved, although the CDC recommends consistent use of latex condoms to reduce the risk for many sexually transmitted diseases, including human immunodeficiency virus.

Antibiotics are the cornerstone of therapy for epididymitis. Antimicrobial selection is guided by patient demographics: sexually active males younger than 35 years are treated presumptively for *N. gonorrhoeae* and *C. trachomatis* with intramuscular ceftriaxone and oral doxycycline, respectively. Broader coverage should be considered for coliform and fungal species in males who engage in anal insertive intercourse (with presumed gonorrhea and *Chlamydia* coinfection).

Patients older than 35 years are treated with agents that cover the common urinary pathogens. This age distinction, however, is arbitrary and variability exists.

Distinction between urethritis with or without accompanying epididymitis is important in patients with a penile discharge. When accompanying epididymal pain or tenderness is present, the duration of antimicrobial treatment is lengthened because epididymitis represents a more advanced stage of reproductive tract disease. The typical treatment regimen for isolated urethritis is a single dose of ceftriaxone, 250 mg intramuscularly (IM), for gonorrhea, plus a single dose of azithromycin, 1 g orally, for *Chlamydia*; typical treatment of epididymitis is a single dose of ceftriaxone, 250 mg IM, plus doxycycline, 100 mg orally given twice a day for 10 days.

Epididymitis may also occur in prepubescent boys as a result of reflux of sterile urine into the epididymis; it often results from minor congenital genitourinary anomalies that need diagnostic evaluation. Treatment typically includes

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**Table 111.2 Medication Dosages for Sexually Transmitted Diseases**

<table>
<thead>
<tr>
<th>Ulcerative Disease</th>
<th>Genital herpes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary</strong></td>
<td><strong>Alternative</strong></td>
</tr>
<tr>
<td>Acyclovir, 400 mg tid × 7-10 days</td>
<td>Valacyclovir, 1 g bid × 7-10 days</td>
</tr>
<tr>
<td>Recurrent</td>
<td>Acyclovir, 400 mg tid × 5 days</td>
</tr>
<tr>
<td>Syphilis</td>
<td>Benzathine penicillin G, 2.4 million units IM × 1 dose</td>
</tr>
<tr>
<td>Chancroid</td>
<td>Azithromycin, 1 g PO × 1 dose</td>
</tr>
<tr>
<td><em><strong>Urethritis</strong></em></td>
<td><strong>Ceftriaxone, 250 mg IM × 1 dose</strong></td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>Ceftriaxone, 250 mg IM × 1 dose</td>
</tr>
<tr>
<td>Chlamydia</td>
<td>Azithromycin, 1 g PO × 1 dose</td>
</tr>
</tbody>
</table>

prophylactic antimicrobials to cover the common urinary pathogens.27

PRIAPISM
A urologist usually manages the treatment of priapism; however, in certain circumstances the emergency physician may have to initiate treatment of low-flow priapism. The classic teaching is that the initial treatment—oral (or subcutaneous) terbutaline—is the same regardless of the inciting etiology, although its utility is debated.28-30 It is thought that terbutaline, a β2-adrenergic agonist, increases venous outflow from the engorged corpora by way of relaxation of venous sinusoidal smooth muscle. Terbutaline is of unproved benefit; however, given its limited propensity for adverse effects, a trial is reasonable in selected circumstances while awaiting urology consultation.31

If terbutaline fails to work rapidly, the next step in the treatment of priapism is corporal blood aspiration with or without irrigation and injection of an α-adrenergic receptor agonist such as dilute phenylephrine. Phenylephrine should be diluted in normal saline to a concentration of 0.1 to 0.5 mg/mL and 1-mL injections made intermittently for upward of 1 hour. Lower concentrations in smaller volumes should be used in children and patients with severe cardiovascular disease.30

The goal of treatment for patients with sickle cell disease and priapism is reduction of red blood cell sickling, thereby reducing vascular sludging and vasoocclusion. Treatments in this setting include oxygen, intravenous hydration, and simple or exchange transfusions.

Regardless of the precipitating cause of priapism, surgical shunt procedures are used as a last resort in patients with low-flow priapism unresponsive to the aforementioned treatments.

PARAPHIMOSIS
Paraphimosis can frequently be managed in the ED without the need for emergency specialty consultation. Many methods for successful reduction of paraphimosis have been reported; however, the most commonly used initial maneuver involves manual compression of the distal glans penis to decrease edema, followed by reduction of the glans penis back through the proximal constricting band of foreskin.32

TESTICULAR TRAUMA
Patients with penetrating injury to the scrotum generally undergo exploration in the operating room. Patients with blunt testicular trauma and ultrasonographic evidence of significant testicular injury also generally undergo surgical exploration for débridement of devitalized tissue, treatment of an acute hematocele larger than 5 cm, or repair of the tunica albuginea.31 Documented testicular injury requires early repair to minimize the potential for infection, infarction, necrosis, abscess, infertility, atrophy, and testicular loss.

REFERENCES

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