Testicular Conditions in Athletes: Torsion, Tumors, and Epididymitis

Bradley Sandella, DO; Brett Hartmann, MD; David Berkson, MD; and Eugene Hong, MD

Abstract
Individuals involved in sports are at risk for sustaining various injuries. In addition to musculoskeletal complaints, male athletes are at risk of incurring testicular injuries. These issues can range from an acute emergency such as testicular torsion to indolent testicular tumors. In contrast, epididymitis can present in stages. Presentation and management of testicular complaints can vary depending on the condition. Physicians who provide medical care to athletes need to be competent in diagnosing and managing testicular injuries.

Introduction
Testicular conditions can occur in active sports medicine patients of all ages and abilities. Some conditions are common, and some are less so, and some have devastating consequences. The differential diagnosis for testicular pain includes testicular torsion, epididymitis, hernia, varicocele, testicle fracture, scrotal edema, or appendix testis torsion. Successful management of any testicular condition includes accurate evaluation and appropriate treatment. Consequently, this also requires prompt recognition of the anatomic structures. This article will discuss three testicular conditions that may be encountered by sports medicine physicians: testicular torsion, epididymitis, and testicular tumors. The sports medicine physician should be familiar with the evaluation of these three testicular conditions.

Testicular Anatomy
The testicle is the male gonad in mammals. During embryonic development starting at about week 4, the process of male gonad development begins (9). Between the third month of pregnancy and delivery, the testes become transferred from the lumbar area into the future scrotum, secondary to a combination of growth processes and hormones including insulin-like peptide hormone 3 and testosterone (14). The testes pass through the abdomen and into the scrotum in the third trimester of pregnancy through the processus vaginalis, an out pouching of the peritoneum. Following this descent, the processus vaginalis closes, and the remaining portion around the testes becomes the tunica vaginalis, which covers the anterior two-thirds of the testis. The left testis usually suspends lower than the right (16). The epididymis is situated on the posterior margin of the testis and is composed of a head, body, and tail. The sinus of the epididymis, which is a recess of the tunica vaginalis, spans the lateral surface of the testis and the body of the epididymis.

The tests and epididymis are supplied by the testicular artery, and their veins drain into the pampiniform plexus, which forms the majority of the spermatic cord. Lymphatics accompany the testicular vessels and drain into the aortic nodes (16). When blood flow to the testicle is compromised, usually a result of torsion, within 6 to 12 h, infarction and atrophy of the testicle can develop.

Testicular Torsion
Testicular torsion is the twisting of the spermatic cord causing severe pain and ischemia of the testicle. This condition is a true urologic emergency and must be differentiated from other etiologies of testicular pain because a delay in diagnosis and management can lead to loss of the testicle (8). When blood flow to the testicle is compromised, infarction and atrophy can develop within 6 to 12 h.

Though testicular torsion can occur at any age, including the prenatal and perinatal periods, it most commonly occurs in adolescent boys. About 65% of cases present between 12 and 18 years with an overall incidence of 1 in 4,000 males per year before 25 years (2). Interestingly, in regards to the active sports medicine patient, only 4% to 8% of testicular torsion cases result from trauma — most cases have no acute traumatic precipitating event.

There are two different groups of torsion: extravaginal and intravaginal. Extravaginal torsion mostly is seen in neonates because of an undescended testicle and involves torsion of the testes, spermatic cord, and processus vaginalis. Intravaginal torsion is caused by a congenital malformation of the processus vaginalis, creating a “bell clapper deformity,”
which is the failure of normal posterioranchoring of the gubernaculum, epididymis, and testis, allowing the testis to rotate freely within the tunica vaginalis. In this malformation, the tunica vaginalis covers not only the testicle and the epididymis but also the spermatic cord. This type of torsion accounts for about 90% of cases and typically presents in adolescent boys (5). A larger testicle due to either normal variation or a tumor increases the risk of torsion (3).

**Signs and Symptoms**

Testicular torsion usually presents with an acute onset of diffuse unilateral testicular pain and tenderness of less than 6 h of duration. Many of the symptoms of testicular torsion are similar to the infection epididymitis (13) as shown in the Table. About half of patients with torsion complain of nausea and vomiting, and about one in four complain of fever (3). Typical presentation does not involve urinary symptoms such as dysuria, hematuria, frequency, or discharge. Scrotal edema develops rapidly, however, and often obscures the physical examination findings. A “blue dot” sign may be visible, which is a blue discoloration upon transillumination; this may be consistent with torsion of the appendix testis. The Prehn sign, a decrease in pain with physical lifting of the testicle, will relieve pain in epididymitis but not the pain caused by testicular torsion. Although a classic physical examination finding, it has not been found to be reliable in distinguishing torsion from other causes of testicular pain (26). The most reliable examination findings are absence of the cremasteric reflex and the affected testis palpated in a horizontal lie (26).

**Evaluation**

Because of the risk of rapid progression to testicular ischemia, acute testicular torsion should be evaluated immediately. It is a surgical emergency, and rapid surgical exploration is required and the gold standard for diagnosis. Upon presentation, there should be a complete genito-urinary examination, while also monitoring the patient’s level of pain and ability to ambulate and communicate appropriately (25). Early in testicular torsion, the testicle is firm, swollen, and tender. The cremasteric reflex is a vital part of the evaluation of testicular pain and is performed by stroking the superior medial thigh in a downward motion while observing the scrotum. The normal response is a contraction of the cremasteric muscle, which elevates the scrotum and testis on the stroked side. This reflex is absent in testicular torsion but present in torsion of the appendix testis (11). Multiple studies have determined the loss of this reflex in testicular torsion to be 99% sensitive (12,18).

Laboratory results do not provide much aid in the diagnosis of testicular torsion. A urinalysis is typically normal, but up to half of patients may have an elevated white blood cell count. If a diagnosis is not certain, high-frequency color Doppler ultrasound is the preferred imaging modality when looking for decreased or absent perfusion (8). Sensitivity is between 86% and 100%, and specificity is 97% to 100% (3). A more accurate study is a radionuclide testicular scintigraphy with $^{99m}$Tc with a sensitivity and specificity of 98% and 100%; however, it is more time-consuming and not as readily available (3).

**Treatment**

With prompt diagnosis and treatment, the testicle can be saved. Prompt surgical exploration and correction are the treatment of choice (26). In some instances, the testicle can untwist on its own, or it can be untwisted manually in a process called “detorsion,” with success evaluated by the degree of pain relief. Because, typically, the testis rotates toward the midline, the examiner should attempt to rotate the testis laterally toward the thigh (as if opening a book) after cooling the scrotum and performing a cord block with lidocaine if possible (25); 66% of torsions are rotated in the medial direction. If relief is not achieved, an attempt to rotate the testis in the opposite direction can be considered. Manual detorsion is successful in 26% to 80% of patients based upon a number of different studies (19).

Testicular torsion that cannot be reduced is a surgical emergency that needs immediate intervention. If treated within 6 h, there is about a 90% chance of saving the testicle. Within 12 h, the rate decreases to 50%; within 24 h,

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<td><strong>Testicular Torsion</strong></td>
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<td>Age of onset</td>
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<td>Presence of pain</td>
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<td>Presence of swelling</td>
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<td>Urinary symptoms (dysuria, hematuria)</td>
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<td>Prehn sign</td>
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<td>Cremasteric reflex</td>
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the rate decreases to 10%; and after 24 h, the rate approaches zero (26). Once the testicle is dead, it must be removed to prevent gangrenous infection. All torsions require exploratory surgery of the contralateral testis, and orchiopexy of both testes should be performed to prevent recurrence. Return-to-play principles after testicular torsion include healing of surgical wounds, if any, and resolution of any testicular pain of symptoms. Current recommendations also include use of a protective cup for high-risk sports.

**Epididymitis**

Epididymitis is a condition in which the epididymis becomes inflamed. It can be classified into one of three categories — acute, subacute, and chronic — depending on the duration of symptoms (24). Acute epididymitis is the most common cause of acute-onset scrotal pain when symptoms of pain and swelling are present for less than 6 wk (24). Acute epididymitis is also the most common cause of intrascrotal inflammation, typically caused by retrograde bacterial infection into the ejaculatory duct (24). Chronic epididymitis is characterized by pain usually without swelling that persists for more than 3 months. Subacute epididymitis usually consists of mild tenderness and no dysuria for greater than 6 wk and less than 3 months. Orchitis is seen when the inflammation spreads to the adjacent testicle.

There are approximately 600,000 cases of epididymitis per year in the United States, typically occurring in men between 18 and 50 years (15). It is the fifth most common urological condition in men of this age (23). The most common cause is sexually transmitted infections by Neisseria gonorrhoeae or Chlamydia trachomatis. In the younger and older age groups, epididymitis generally is caused by common urinary pathogens such as Escherichia coli. Although less common, noninfectious etiologies include vasculitides, sarcoidosis, Behçet disease, and medications such as amiodarone.

**Signs and Symptoms**

Epididymitis usually presents with gradual onset of pain localized posterior to the testis with potential radiation to the lower abdomen (24). The testicle may be warm and/or red. Other symptoms of urinary tract infections such as fever, tachycardia, frequency, urgency, hematuria, and dysuria also may be present (24).

**Evaluation**

When evaluating a patient with acute testicular pain and swelling, the diagnosis should be testicular torsion until proven otherwise. Whereas testicular torsion usually presents as rapid-onset pain, epididymitis and orchitis have a gradual onset of pain. The scrotum should be examined for greater than 6 wk (24). Acute epididymitis is also the most common cause of intrascrotal inflammation, typically caused by retrograde bacterial infection into the ejaculatory duct (24). Chronic epididymitis is characterized by pain usually without swelling that persists for more than 3 months. Subacute epididymitis usually consists of mild tenderness and no dysuria for greater than 6 wk and less than 3 months. Orchitis is seen when the inflammation spreads to the adjacent testicle.

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**Diagnostic studies** can help confirm epididymitis and rule out other pathologies. Gram staining of urethral discharge should be performed to detect bacterial urethritis. Urinalysis may be normal, but the presence of leukocyte esterase and white blood cells is suggestive of urethritis (24). In all patients with suspected epididymitis, color Doppler ultrasound is the preferred test. It can demonstrate increased blood flow, as opposed to testicular torsion with decreased blood flow. Measuring C-reactive protein and erythrocyte sedimentation rate levels also has been shown to be a useful aid in the diagnosis of epididymitis, with a sensitivity and specificity of up to 96% (7).

**Treatment**

If epididymitis is suspected, antibiotics should be initiated. The treatment of choice is a single dose of 250 mg of intramuscular ceftriaxone and twice-daily 100 mg of doxycycline for 10 d. If compliance is an issue, a single dose of 1 g of per os azithromycin may be substituted for the doxycycline. For cases caused by enteric organisms such as E. coli, a fluoroquinolone is recommended (21). In children, fluoroquinolones and doxycycline should be avoided, and cephalexin is recommended (24). When treating athletes and active patients, caution needs to be exercised with using fluoroquinolones because of the increased incidence of tendon ruptures. If there is a sexually transmitted disease, the partner also should be treated.

Pain control usually is necessary and aided by cold compresses and elevation of the scrotum, as well as narcotics or anti-inflammatories. While an epididymitis patient typically can be treated as an outpatient with close follow-up, hospitalization is indicated for severe cases, which include intractable pain, vomiting, abscess formation, and signs of sepsis. Surgery rarely is necessary, except, for example, in rare instances of abscess formation.

**Testicular Tumors**

In American men aged 20 to 35 years, primary testicular tumors represent the most common solid malignancy, and for unknown reasons, the incidence has increased over the last century (20). This alarming trend forces physicians to be more vigilant in recognizing and treating this condition. Roughly 1 in 300 males will develop a testicular tumor, but because of its responsiveness to treatment, the mortality rate is 1 in 5,000 with a 5-year survival rate of 90% to 95% (20). The keys to the high survival rate are early detection and an accurate treatment protocol.

Testicular neoplasms can be divided into two broad categories. Germ cell tumors (GCT) make up more than 90%, while non-germ cell tumors (non-GCT) only account for less than 10% of testicular cancers. The most common GCT is the seminoma followed by the embryonal cell carcinoma and mixed testicular GCT. The incidence of these tumors increases after the onset of puberty (1). In contrast, non-GCT, including the yolk sac tumor and teratoma, are rare in adults and usually occur in children (1). The two most common risk factors for the development of a tumor in an adult are cryptorchidism or a prior history of a GCT (1).
Signs and Symptoms

Patients with a testicular tumor usually present with a painless mass found either by the patient or by the physician on routine examination. If there is discomfort, it is often reported as a dull ache or sense of heaviness in the scrotum. Sharp pain, which is an uncommon symptom, can be reported and is usually secondary to bleeding or a hematoma (10).

Evaluation

After completion of a detailed history, the physical examination usually reveals a small nontender palpable lesion at the posterior aspect of the affected testicle. Once a lesion is identified, the scrotum should be transilluminated. A solid mass will not allow light to pass through or give a red glow. A secondary examination of the chest should be performed to evaluate for gynecomastia, as well as evaluation of the abdomen.

Follow-up testing includes diagnostic imaging and laboratory testing. Scrotal ultrasonography will help define suspect lesions (10) revealing a hypoechoic signal (6). Magnetic resonance imaging also can be employed and will demonstrate a mass that is relatively isointense on T1 imaging and enhancement with intravenous gadolinium on T2 imaging (6). Obtaining tumor markers, α fetoprotein, human chorionic gonadotropin, and lactate dehydrogenase also is useful for monitoring progression but cannot be used to screen or to make an initial diagnosis.

Treatment

Radical orchiectomy is the treatment of choice for testicular tumors. An inguinal approach through the spermatic cord is the preferred method to help reduce the incidence of scrotal recurrence, lymph node metastases (10), or nerve injury. Adjunct treatment with radiation and chemotherapy also is used. Consideration for lymph node dissection also is necessary because tumor cells can spread along lymph channels to the retroperitoneal cavity. Finally, follow-up serum markers can be obtained to check for elimination or recurrence.

Preventive measures also can be taken. To decrease the risk of cancer, undescended testicles should be treated before puberty with orchiopexy (17). In addition, identification of bilateral undescended testicles places the patient at a greater risk for cancer, so careful examination and diagnostic testing, and develop an optimal course of management.

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References