

Evaluating scrotal masses

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ABSTRACT

Scrotal complaints can be challenging to diagnose because of overlapping signs and symptoms among various presentations. Failure to properly identify and manage testicular malfunctions such as testicular torsion, testicular cancer, varicocele, and hydrocele may lead to patient infertility, testicle loss, or death. This article describes proper assessment of scrotal masses, recognition of potentially life-threatening testicular conditions, and appropriate diagnostic evaluations for each pathology.

Keywords: scrotal masses, testicular torsion, cancer, varicocele, epididymitis, inguinal hernia

Learning objectives

- Discuss the assessment of scrotal masses, including potentially life-threatening testicular conditions.
- Explain the appropriate diagnostic evaluations for testicular pathologies.

Scrotal masses are common complaints in primary care and account for 1% of ED visits annually.¹ They may present at any age, although some types of scrotal masses are more common at certain ages. Clinicians must be able to distinguish a benign scrotal mass from more significant types because of the risk of infertility and testicular loss caused by the latter. For details on normal scrotal anatomy, see **Figure 1**.

DIFFERENTIAL DIAGNOSIS

Because various scrotal conditions present similarly, differentiation can be challenging. According to Davis and Silverman, the most reliable way to provide adequate treatment to a patient presenting with a testicular mass is to ask about pain.²

Painful scrotal masses Masses accompanied by acute scrotal pain must be treated emergently to preserve male reproductive function. The differential diagnosis should

include the most common types of scrotal masses that present with pain: testicular torsion, epididymitis/orchitis, torsion of the testicular appendage, hydrocele or testicular rupture, and inguinal hernias.

Nonpainful scrotal masses Scrotal masses that present without pain include early-stage testicular cancer, hydrocele, spermatocele, and epididymal cyst.³

The ease of appreciating the anatomy of the scrotum on inspection and physical examination will help clinicians form accurate differential diagnoses.⁴ Because of the seriousness of the outcomes, maintain a high index of suspicion in ruling out potentially life- and organ-threatening scrotal masses.

TESTICULAR TORSION

Testicular torsion is a urologic emergency. Rotation of the testicle along its vertical axis around the spermatic cord may constrict the testicular artery and cause ischemia. The condition accounts for 12% to 16% of acute scrotal presentations among children and is the leading cause of morbidity because of the high potential for testicular loss.⁵

Risk factors Torsion can occur at any age. Risk factors include undescended testicles at birth and genetic structural defects such as bell clapper deformity.^{6,7} This condition occurs when the tunica vaginalis covers the entire testicle and epididymis, preventing fixation to the posterior wall, and causing the testicle to rotate more freely than normal (**Figure 2**).⁷

Presentation Testicular torsion most commonly presents as unilateral intravaginal torsion in which the descended testis rotates within the tunica vaginalis. Symptom onset is sudden; the patient will have severe scrotal pain and swelling and may also present with nausea, vomiting, and lower abdominal pain. An elevated, horizontally aligned testicle resulting from the shortened spermatic cord occurs in 50% of patients.⁶ The patient will have extreme tenderness and firmness to palpation.

The absence of the cremasteric reflex and Phren sign differentiate torsion from epididymitis. The normal cremasteric reflex, which involves testicular retraction of at least 0.5 cm and is induced by stroking the medial aspect of the thigh, is absent in patients with testicular torsion. The normal Phren sign, in which pain is relieved by scrotal elevation, is also absent in these patients.^{6,8} The absence of all four clinical variables—nausea and vomiting, pain

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Key points

- Scrotal masses accompanied by acute pain should be treated emergently.
- Failure to properly diagnose scrotal pathology can lead to patient infertility.
- Diagnosis of most scrotal masses is made clinically.
- Doppler ultrasound is the best diagnostic test.

duration of less than 24 hours, high position of the testis, and absent cremasteric reflex—has very high negative predictive value for testicular torsion.⁵

Diagnosis and treatment Color Doppler ultrasound is the preferred initial diagnostic test, with 94% sensitivity and 96% specificity.⁹ Because torsion is an emergent condition, surgery is the definitive treatment and should not be delayed to perform ultrasound.¹⁰ There is a 90% to 100% salvage rate if surgery is performed within 6 hours of symptom onset.¹¹ The salvage rate drops to 50% at 12 hours and 10% at 24 hours.¹¹

If surgical intervention is delayed, the best immediate treatment is manual detorsion via twisting the affected testicle in an outward motion or using the “open book” technique.²

Ultrasonography of the scrotum
is the best imaging modality
for differentiating the causes of
scrotal masses.

TORSION OF THE TESTICULAR APPENDIX

Torsion of the testicular appendix is the most common cause of acute scrotal pain in boys ages 7 to 14 years. The prevalence of this condition among children with scrotal pain in the ED is 31% to 57%.⁷ The testicular appendix is a nonfunctional remnant of the Mullerian duct, which in females develops into the uterus, Fallopian tubes, cervix, and proximal vagina. It is located in the upper pole of the testes and attaches to the tunica vaginalis (**Figure 3**). Although it serves no physiologic function, the testicular appendix can become twisted, causing acute unilateral testicular pain. Torsion of the appendix differs from testicular torsion of the spermatic cord in that the pain is usually localized in the upper pole of the testicle.⁸

Diagnosis The pathognomonic finding is the blue dot sign, a nodule with blue discoloration visible in the upper scrotum, especially in light-skinned patients.¹⁰ In fact, clinical diagnosis may be sufficient if the patient is between ages 7 and 14 years and presents with the blue dot nodule

and pain in the upper scrotum. However, if the presenting symptoms of acute scrotal pain in the child do not fit the criteria, an ultrasound is useful to rule out testicular torsion or epididymitis.

Treatment Unlike testicular torsion, which requires prompt surgery, the management of torsion of the testicular appendage is conservative, consisting of treatment with an NSAID and bed rest.⁶ However, if the diagnosis of testicular appendix torsion cannot be made with confidence, surgical intervention may be necessary.

EPIDIDYMITIS AND EPIDIDYMOORCHITIS

Epididymitis, the inflammation of the epididymis and/or testis (epididymoorchitis), is the most common urologic complaint among men ages 18 to 65 years.^{1,2} Most cases are due to microbial invasion of the epididymis, an elongated structure located on the posterior border of the testis. In men under age 35 years, the most common causes of epididymitis are *Chlamydia trachomatis* and *Neisseria gonorrhoea*. In men older than age 35 years, the most common cause of epididymitis is urinary tract infection (UTI) or bladder stasis secondary to obstruction; thus, *Escherichia coli*, *Pseudomonas*, and gram-positive cocci are common causes.²

Risk factors Risk factors for epididymitis and epididymoorchitis include sexual activity, bladder obstruction, urogenital malformations, prolonged bicycle riding, prolonged motorcycle riding, and strenuous physical activity such as running sports.⁸

Presentation and differential The clinical presentation of epididymitis is similar to that of testicular torsion. The patient will have unilateral scrotal pain, erythema, and edema on the affected side; however, the onset of pain in patients with epididymitis typically progresses over days rather than hours. Patients may have fever, rigors, and lower UTI symptoms such as dysuria, urgency, and frequency. Palpation reveals an indurated, tender, or swollen epididymis. A positive cremasteric reflex (in which the testicle rises) will not confirm epididymitis but will help rule out torsion.⁵

An elevated C-reactive protein (CRP) level (greater than 24 mg/L) and increased blood flow to the epididymis on ultrasonography help to differentiate epididymitis from testicular torsion.¹⁰ Color Doppler ultrasound has 92% to 100% sensitivity and 100% specificity in detecting epididymitis.³ Common laboratory tests include urinalysis (with findings of pyuria or bacteriuria), urine culture, and urethral culture (if discharge is present).

Treatment Antibacterial treatment should be based on the patient’s age and the most likely causative organism within that age group. Patients age 35 years and younger should be started on ceftriaxone plus doxycycline, while those over age 35 years should be started on ciprofloxacin. If urine cultures are positive for *Chlamydia* or *Neisseria* both partners must be treated.

Nonpharmacologic supportive measures include reduction in physical activity, scrotal elevation with support, ice packs, and sitz baths.⁸

INGUINAL HERNIAS: DIRECT AND INDIRECT

Inguinal hernias, which are protrusions in the groin that form due to muscle weakness, account for 75% of all abdominal hernias. About 600,000 inguinal hernia repairs are performed annually in the United States.¹²

Risk factors Risk factors for the development of inguinal hernias include abdominal wall injury, older age, male sex, and white race.¹²

Presentation and differential The presentation varies from harmless and pain-free to life-threatening and painful.²

The transillumination test, which involves shining a penlight on the scrotum, may be useful in differentiating a scrotal hernia from a hydrocele.² Light transilluminates through fluid (hydroceles) but not through mass (hernias). Scrotal ultrasonography is useful to differentiate a scrotal hernia from other scrotal masses.⁷

Anatomy The two types of inguinal hernias differ in their location. *Indirect inguinal hernias* pass lateral to the inferior epigastric vessels to enter the deep inguinal ring.² *Direct hernias* travel medial to the inferior epigastric vessels.²

Indirect hernias are the most common type of inguinal hernia, accounting for more than two-thirds of cases. They are more common in younger men due to the congenital patency of the processus vaginalis.¹³ Direct hernias are usually acquired during events that weaken or disrupt the abdominal wall, such as heavy lifting exercises that significantly increase intra-abdominal pressure.

On physical examination, clinicians may differentiate an indirect hernia from a direct hernia by inserting the examining finger into the inguinal canal and asking the patient to perform the Valsalva maneuver. On this maneuver, an indirect inguinal hernia will travel inferiorly to touch the tip of the examining finger; a direct inguinal hernia will travel inferior to touch the side of the examining finger.¹⁴

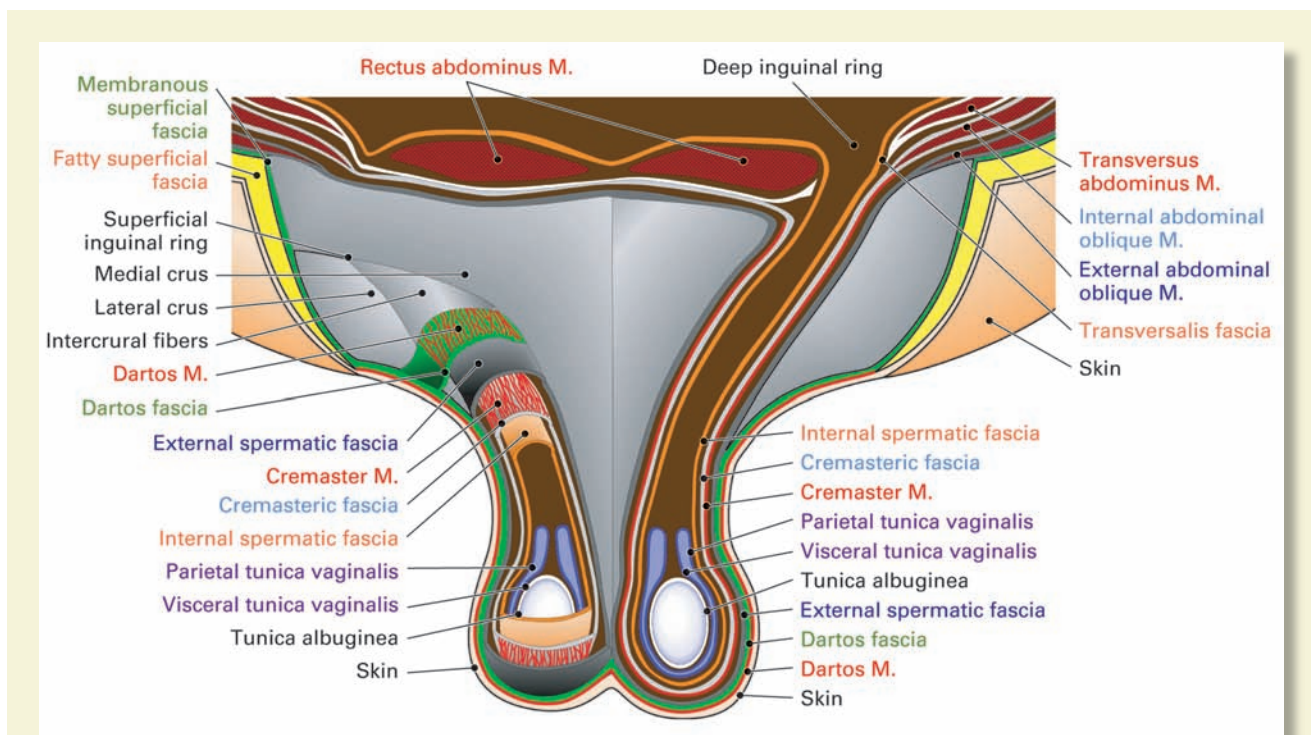
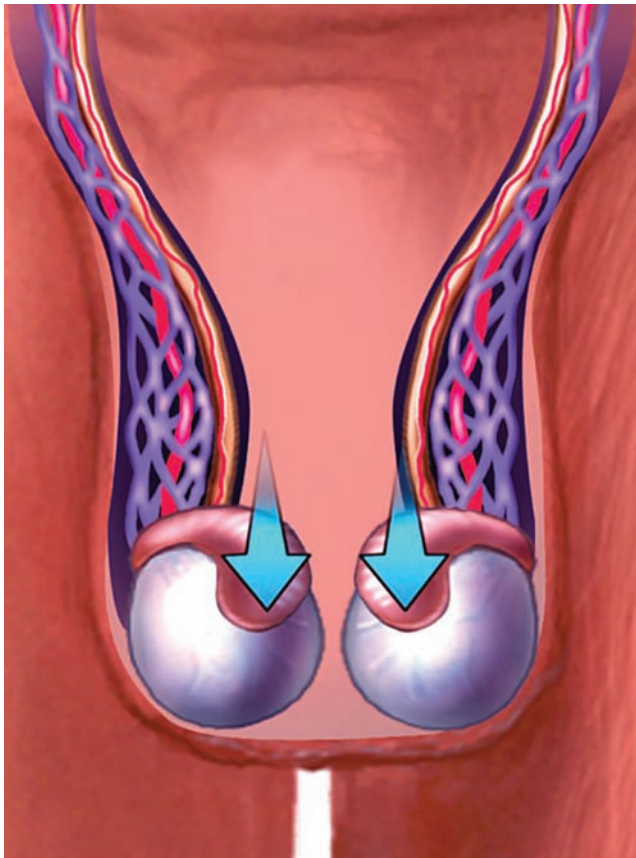


FIGURE 1. Anatomy of the scrotum

The scrotum houses the testicles, the site of sperm and male sex hormone production. During the eighth month in utero, the testes descend through the deep inguinal ring, pass through the inguinal canal, and exit the peritoneum into the scrotum through the superficial inguinal ring. During the process, the gubernaculum guides the descent of the testes and later forms the scrotal ligament, which anchors the testes to the base of the scrotum. The testes are attached to the peritoneum by the spermatic cord, which houses the pampiniform plexus (a network of veins),

testicular artery, genital branch of genitofemoral nerve, ductus deferens (semen carrying vessel that attaches to the epididymis), cremasteric muscle (which contracts the scrotum), and processus vaginalis (extension of the perineum that connects to the tunica vaginalis but normally is closed). The tunica vaginalis extends from the processus vaginalis and covers the testes. The seminiferous tubules are the structures within the testes that produce immature sperm that travel to the epididymis for storage and maturation. The epididymis sits on the superior-posterior aspect of the testicle and provides additional support for the testicle.



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FIGURE 2. Bell clapper deformity

Management The first step in managing an inguinal hernia is to assess its reducibility. Uncomplicated hernias may be easily pushed back into place and then followed for close observation. Incarcerated hernias are irreducible trapped hernias with a high risk of impaired blood supply. A hernia is considered strangulated when the affected organ's blood supply is impaired. Patients with incarcerated or strangulated hernias may present with fever, nausea, vomiting, pain, and hernial erythema.² Painful or strangulated hernias should not be reduced but should be repaired surgically.

HYDROCELE

Fluid accumulation within the peritoneal cavity of the scrotum is a pathologic condition known as a hydrocele. Hydroceles are most common in newborn males due to the congenital patency of the processus vaginalis.⁴ Causes of hydrocele development later in life include local injury, testicular torsion, epididymitis, orchitis, gonorrhea, lymph node obstruction, germ cell testicular tumor, and radiation therapy.⁴ On physical examination, a hydrocele presents as an enlarged scrotum.

Presentation and differential Depending on the weight of the fluid, the patient may have no pain or may experience discomfort and pain. The main diagnostic devices



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FIGURE 3. Torsion of testicular appendix

used to narrow the differential are the transillumination test and scrotal ultrasonography. As mentioned earlier, a hydrocele will present with a positive transillumination test. A scrotal ultrasonography that is positive for hydrocele reveals fluid surrounding the testicles.²

Treatment Hydrocele treatment depends on the amount of fluid present and the patient's level of discomfort. A patient who presents with minimal fluid accumulation may not require analgesia or surgery; a patient with excess fluid accumulation may require surgery to drain the fluid.⁸

VARICOCELE

A varicocele is the dilation and swelling of the pampiniform plexus, a network of veins supplying the testes, resulting in blood pooling in the testes. Typically, this dilation occurs in the left testicle due to the differences in the right and left testicular vein anatomy.⁸ Varicoceles are the most common cause of male infertility worldwide. They are generally acquired due to venular valve dysfunction.⁸

Risk factors There are no known risk factors for varicocele, and the cause of venular valve dysfunction is idiopathic.

Presentation and differential A common presenting symptom in a patient with a varicocele is an abnormal

feeling of unilateral heaviness in the scrotum. The clinician may palpate the scrotum and describe the collection of dilated veins as a “bag of worms.”⁸ Some clinicians use the Valsalva maneuver to accentuate the contour of the varicose veins. The diagnosis of varicocele is mainly clinical, although the use of Doppler ultrasonography may provide a clearer picture. Ultrasonography that is positive for varicocele reveals retrograde blood flow to the scrotum due to the incompetent venous valves.

Treatment A varicocele may not require treatment if symptoms are not bothersome. Analgesics may be prescribed for pain. Long-term dilation of the pampiniform plexus may cause hypertrophy to the veins, affecting sperm concentration, sperm motility, male fertility, and testicular function.¹¹ In the case of high-risk male infertility, varicolectomy or surgical repair of the affected veins is recommended.³

SPERMATOCELE

Spermatoceles are retention cysts of the scrotum that form above and posterior to the testis and are attached to the epididymis.

Anatomy The testicle is composed of hundreds of lobules, each containing seminiferous (sperm-producing) tubules. These lead into the rete testes, where efferent ducts emerge to lead into the epididymis. At times, the efferent ducts that lead into the epididymis can become obstructed by the traveling sperm and form a diverticulum from the tubules, creating a cyst. The cyst will grow and typically result in a painless mass (Figure 4).

Diagnosis and differential The benign retention cyst transilluminates and can be easily differentiated from

a testicular neoplasm. Ultrasound can resolve uncertainty about the diagnosis because a positive ultrasound finding will show an area of black (cyst with sperm) next to an area of gray (the testicle). A small cyst that does not cause any discomfort will resolve and does not require treatment. However, if the cyst is painful or interferes with surrounding structures, a spermatocelectomy, which is a minor outpatient procedure, is indicated.⁸

HEMATOCELE

A hematocele is the collection of blood in the tunica vaginalis, the double-layered membrane that encloses the testes (Figure 5).

Diagnosis and differential Hematoceles can be caused by trauma, testicular cancer in the case of a hemorrhagic neoplasm, or they may be complications of abdominal surgery.⁴ Because of the various causes, a thorough history is crucial in determining the diagnosis.

Suspect a hematocele if the affected testicle or testes are dark red or purple.^{2,4} The patient may have some pain, especially if the blood leaks and subsequent clot formation impinges other structures. A hard irregular mass can be palpated.

Imaging studies Although an ultrasound is the key imaging tool to differentiate scrotal masses, MRI is used to establish the diagnosis of a hematocele, as it has higher sensitivity and allows for a clear demonstration of blood. MRI also is valuable because both the physical

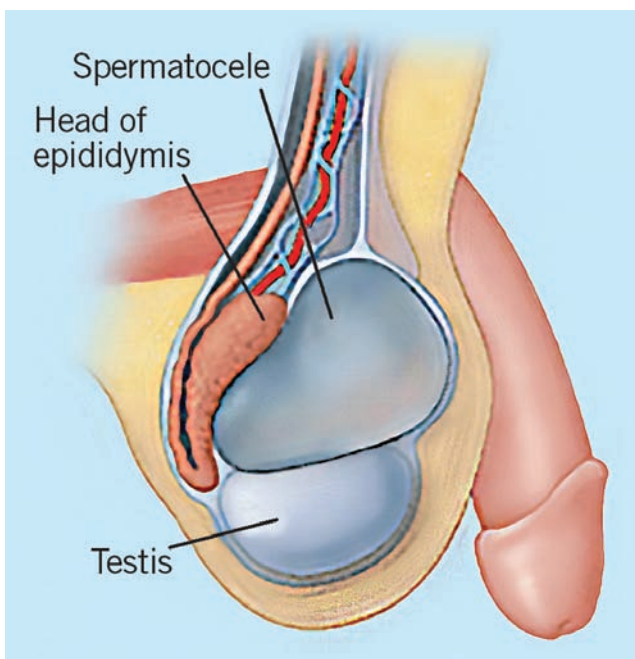


FIGURE 4. Spermatocele

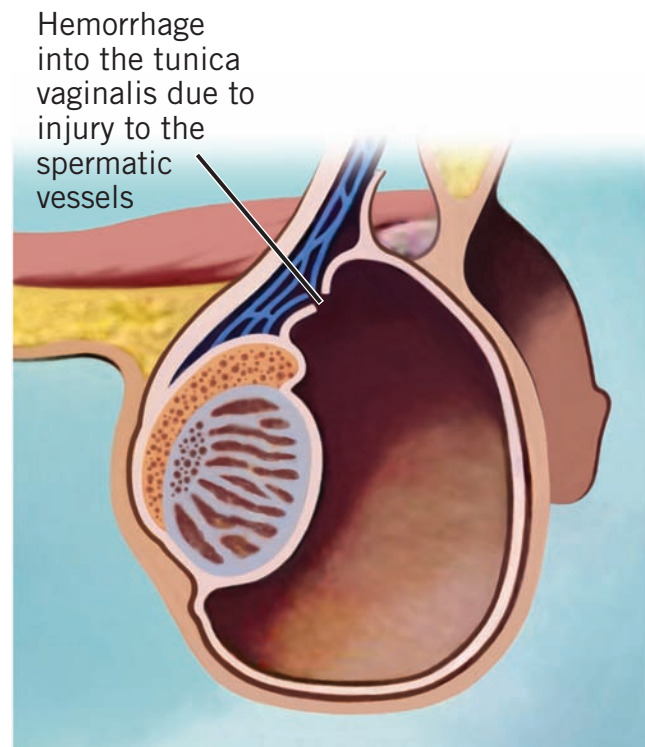


FIGURE 5. Hematocele

ILLUSTRATION COURTESY OF AARON MCCLELLAN

examination and the ultrasound findings of a hematocele mimic those of a testicular neoplasm. Because the blood clot cannot always assume a uniform shape on ultrasound, the hematocele will appear as a hyper-echoic mass with irregular borders just like a neoplasm.

Treatment The treatment of a hematocele depends on its cause.

TESTICULAR CANCER

Testicular cancer is responsible for 1% of all cancers in men and 3% of male genitourinary cancers.⁸ Although uncommon, testicular cancer primarily affects younger men.

About 95% of testicular cancers originate in germ cells. Testicular germ cell cancer is the most common malignant tumor among men ages 15 to 44 years.¹⁵ The germ cell tumors are divided into *seminomas* and *nonseminomas* based on their anatomic location in the primordial germ cell.

Seminomas or germinomas These tumors account for half of germ cell tumors, and originate from the germinal epithelial lining of the seminiferous tubules. The peak age for developing seminomas is between ages 40 and 50 years. This tumor grows into a mass composed of a uniform type of cell that secretes one type of tumor marker: human chorionic gonadotropin (hCG).⁸

Nonseminomatous or nongerminomatous germ cell tumors These tumors may produce a mass of one type of cell or mixed cells. Nongerminomatous germ cell tumors can be further subdivided into the following: embryonal carcinoma, yolk sac tumor, choriocarcinoma, teratoma, polyembryoma, and gonadoblastoma. The peak age for developing these tumors is ages 20 to 30 years. There are exceptions, such as the yolk sac tumors and teratomas, which usually appear in younger males.¹⁶

Risk factors Risk factors for the development of testicular cancer include cryptorchidism (the cause of 10% of testicular neoplasms), followed by genetic predisposition and disorders of testicular development such as Klinefelter syndrome.^{8,17}

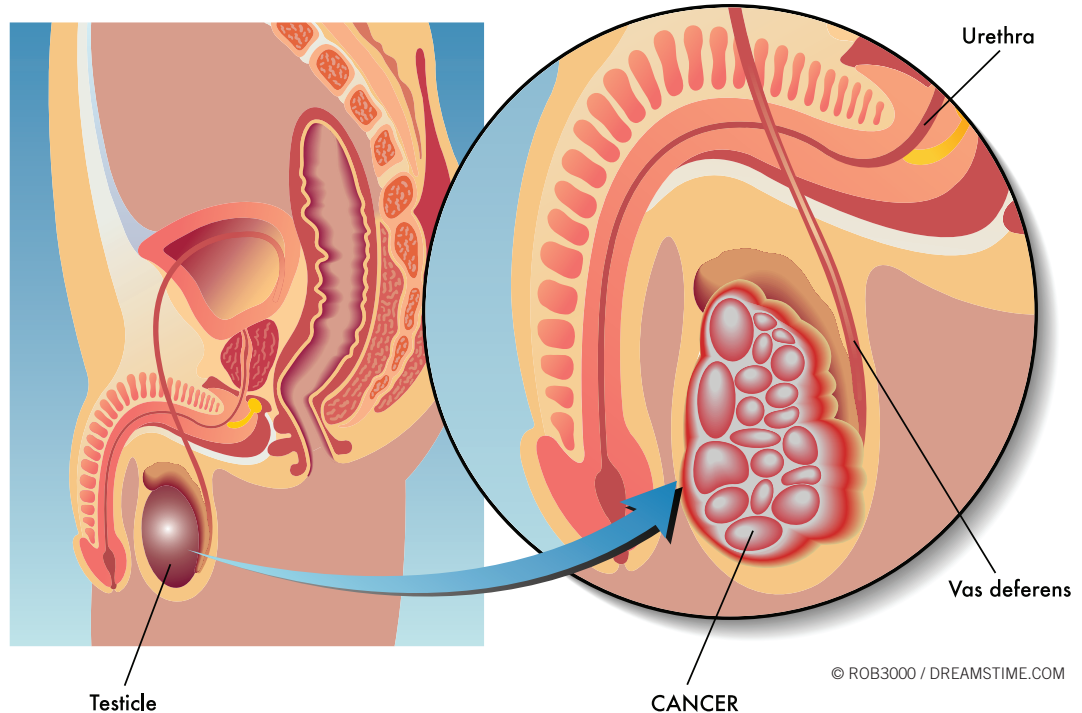


FIGURE 6. Testicular cancer

Diagnosis and differential A painless and slight enlargement of the testicle is a distinguishing factor for testicular cancer. In 5% of patients, gynecomastia may be a sign, caused by the germ cell tumors producing hCG. These signs and symptoms are different from the acute painful scrotal enlargement present in testicular torsion or epididymitis.⁵ Patients with testicular cancer may have a dull discomfort in the abdomen or groin, but profound pain is not reported until the later stages.

Presentation Clinical presentation of metastatic testicular cancer includes lower back pain, swelling of lower extremities, neck mass, or hemoptysis. These symptoms reflect the lymphatic drainage of the scrotum, which connects to the lower extremities, and the lymphatic system of the testes, which connects to the back and abdominal cavity.¹⁷

Suspect testicular cancer in an adolescent or young adult with a unilateral, enlarged, and usually painless testicular mass.^{8,11} An ultrasound is required to define the characteristics of the mass, such as whether it is cystic or solid, uniform or heterogeneous.

Tumor markers The established tumor markers of testicular cancer are alpha-fetoprotein (AFP), hCG, and lactate dehydrogenase. Seminomas produce hCG only, and nonseminomas can produce hCG and AFP.⁸ Tumor markers are essential for diagnosis, staging, evaluating response to therapy, and assessing prognosis.

Self-examination Neither the National Cancer Institute nor the US Preventive Services Task Force recommends testicular self-examinations, due to the low number of cases and the very positive prognosis.^{18,19}

Treatment The treatment of testicular cancer is inguinal orchiectomy, which is performed at the same time that tissue is obtained for histology and staging. More extensive surgical therapy, such as retroperitoneal lymph node dissection, may be necessary based on the tumor's histologic characteristics and stage (Figure 6).⁸ The presence of metastases requires adjuvant therapy involving chemotherapeutic drugs such as cisplatin and carboplatin.

The prognosis and the success of treatment depend on the stage of the cancer at the time of clinical presentation. The cure rate for testicular neoplasms is 90% with early detection.^{8,17}

NECROTIZING FASCIITIS

Necrotizing fasciitis, also known as Fournier gangrene or flesh-eating bacteria syndrome, is a fulminant, life-threatening skin infection of the scrotum and perineum that may spread to surrounding areas at the very rapid rate of 2 to 3 cm per hour.²⁰

Presentation All patients will have pain, swelling, and erythema of the scrotal skin and surrounding affected areas; those with more severe infection will have skin necrosis, hemorrhagic bullae, and symptoms of septic shock.

Skin injury is the most common cause of necrotizing fasciitis; surgery patients and IV drug users are at highest risk.²⁰

Pathogens include *Streptococcus pyogenes*, *Staphylococcus aureus*, and methicillin-resistant *Staphylococcus aureus* (MRSA).²⁰

Diagnosis The diagnosis is made clinically, although imaging may also be useful in assessing the extent of necrosis.²¹ Patients with necrotizing fasciitis should be treated empirically with ampicillin or clindamycin.²⁰ A gram stain and culture should also be obtained to guide antibiotic therapy. Emergent surgical intervention is crucial to explore the extent of necrosis and to debride affected sites.

CONCLUSION

Understanding the presentation and differences among scrotal masses can help clinicians achieve correct diagnoses and provide optimal patient care. Ruling out life-threatening emergencies such as testicular torsion and malignancies that require immediate intervention is key. Ultrasonography of the scrotum is the best imaging modality to differentiate between the various origins of scrotal masses; MRI is best for hematoceles. However, sound clinical judgment and decision-making remain the most important factors in successful patient outcomes. **JAAPA**

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