

Acute Testicular Pain

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Case Presentation

A 35-year-old man presented to the emergency department with acute onset of right testicular pain. He denied any fever, night sweats, chills, dysuria, hematuria or urethral discharge. Physical examination revealed right testicular pain radiating to right inguinal region and swelling with an intact cremasteric reflex. There was testicular asymmetry with the right testicle vertically-oriented. The patient was subsequently referred for an ultrasound examination to exclude torsion or infection. (**Fig.**)

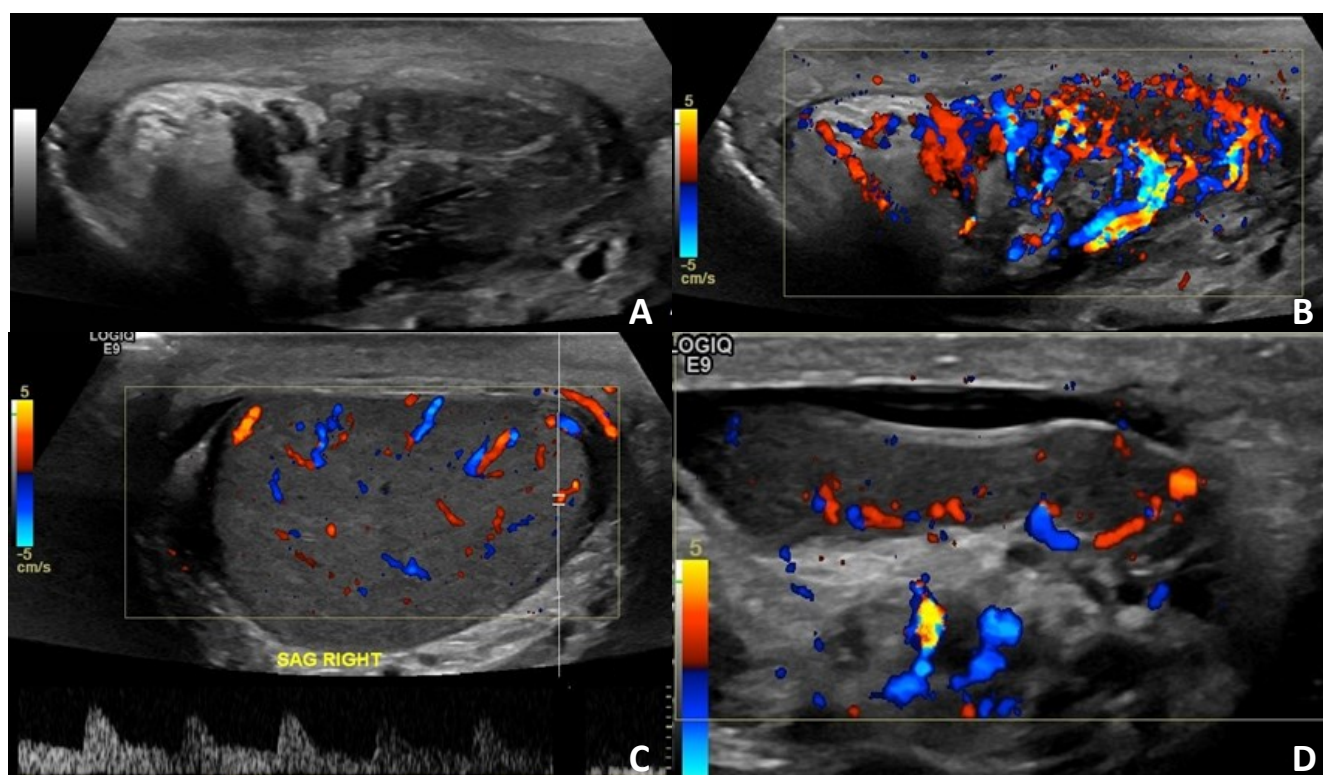


Figure. Sagittal gray-scale (A) and color Doppler (B) ultrasound images of the right scrotum demonstrate an enlarged, heterogeneous, and hypervascular epididymis. Color and spectral Doppler sonogram (C) of the right testis shows normal blood flow and perfusion. Color Doppler ultrasound image of the contralateral left epididymis (D) demonstrates normal color flow and perfusion.

Key Clinical findings

Testicular pain with intact cremasteric reflex

Key Imaging findings

Edematous, heterogeneous, and hypervascular right epididymis

Differential diagnosis

Acute epididymitis

Acute orchitis

Testicular torsion

Discussion

Acute scrotal pain requires prompt diagnosis for appropriate treatment. Often times, the differential considerations include infection versus torsion in the absence of trauma. Ultrasound is the modality of choice for evaluating the scrotum. Because of the continuous improvement in the ultrasound technology and increasing experience, sonographers, radiologists, and clinicians can often distinguish between different diseases with greater certainty when vascular hyperemia, edema, and distinctive echotextures are observed on both gray-scale and color Doppler sonography.

Acute Epididymitis

Acute epididymitis is the most common cause of acute scrotal pain in post-pubertal men, representing 75% of all acute intra-scrotal inflammatory diseases. It is clinically defined by pain, swelling and inflammation of the epididymis in the acute (up to 6 weeks) or chronic (> 6 weeks) stages.¹ Although epididymitis can occur at any age group, it is most common between 18 and 35 years of age, with an estimated 600,000 cases per year in the United States. In children, epididymitis accounts for 6 to 47% of cases of acute scrotal pain.²

Frequently, epididymitis is caused by a retrograde ascent of pathogens from the lower urinary tract, such as the bladder or prostate, via the lymphatics of the spermatic cord to the epididymis. Rarely, epididymitis

may result from hematogenous spread. Epididymitis is typically caused by sexually transmitted pathogens such as *Neisseria gonorrhoeae* or *Chlamydia trachomatis* in adolescents. Less common pathogens, such as *Escherichia coli*, *Ureaplasma urealyticum*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Haemophilus influenza*, and *Pseudomonas aeruginosa* are seen with different age groups.³

The risk factors of epididymitis include high-risk sexual behaviors, strenuous physical activities, prolonged sitting periods, prostate invasive procedures, prostate and urinary tract infections, prostate hypertrophy, urinary tract surgeries, urogenital anomalies and posterior urethral valves in prepubertal boys, human immunodeficiency virus (HIV), *Mycobacterium tuberculosis*, medications (amiodarone), and trauma. Less commonly, epididymitis can be idiopathic.²⁻⁴

The signs and symptoms of acute epididymitis are etiologically dependent. Typically, patients present with a more gradual onset of pain. Scrotal tenderness, edema, erythema, dysuria, fever, urethral discharge, and hematospermia have also been reported.^{1,3} Acute epididymitis can occur anywhere along the epididymis with the head being most commonly affected.⁵

Although the diagnosis of epididymitis depends on clinical and laboratory findings, ultrasonography has enhanced the evaluation of the scrotal structures, excluded differentials, identified possible complications, and provided clinical monitoring.¹ On ultrasonography, patients with mild epididymitis may not show any sonographic findings. In severe cases of epididymitis, high-resolution gray-scale ultrasonography reveals a thickened, enlarged, and edematous epididymis with decreased (hypoechoic) or coarse (heterogeneous) echogenicity with or without abscess formation. Less common sonographic findings, such as focal hyperechoic areas or diffuse hyperechogenicity of the epididymis, can be seen.⁶ Other sonographic findings, such as a reactive hydrocele, concomitant orchitis (in 20% to 40% of patients), testicular infarction, and scrotal wall thickening may also be seen.^{6,7} In addition, increased flow and vascularity secondary to inflammatory changes within the epididymis on color or power Doppler sonography have been reported.^{1,6,7}

In evaluating color flow within the epididymis, it is

important to compare to the other side. The mere presence of blood flow within a normal epididymis should not be considered diagnosis of acute epididymitis. However, it is the asymmetrical increase of blood flow, which is key. Consequently, increased vascularity is used as a distinguishing factor for the diagnosis of acute epididymitis. When compared to the contralateral side, the presence of normal or increased vascularity on the affected side will assist in the differentiation between epididymitis and torsion. On spectral Doppler, the epididymis will demonstrate a low-resistance index (≤ 0.7) and high-velocity flow pattern when compared to normal flow patterns.^{6,8,9}

Complications of acute epididymitis are testicular infarction, chronic pain, orchitis, abscess, pyocele, gangrene, atrophy, cutaneous scrotal fistula, and infertility.^{1,3,8,9}

The treatment of acute epididymitis often focuses on treating the infection, improving the symptoms, preventing the progression and transmission of disease, and minimizing any future complications by selecting the appropriate antibiotic. Different kinds of antibiotics have been reported to be effective in treating acute epididymitis.^{4,5} If antibiotic therapy fails to control the disease in the outpatient setting, hospital admission is necessary. In addition to antibiotic therapy, rest, scrotal elevation, analgesics and utilization of cold packs are recommended. Overall, the treatment of acute epididymitis must be tailored to each patient and the severity of the disease.⁴

Orchitis

Orchitis refers to inflammation of the testes and can occur in association with acute epididymitis. It is characterized by scrotal pain and swelling. The etiologies differ by age group and are similar to those described above for epididymitis.^{1,2,4,5-8}

Orchitis may be focal or diffuse and cause testicular enlargement.^{5,6} The typical gray-scale ultrasound findings include a diffusely enlarged, homogeneous, and hypoechoic testis or poorly or well-defined focal hypoechoic intra-testicular areas. However, these findings are nonspecific and may also be seen with tumors, infarction, or torsion. Consequently, color and spectral Doppler are important adjuncts to gray-scale Doppler.^{6,8,10} On color Doppler, increased vascularity

or hyperemia, a distinguishing characteristic, is seen when compared to the asymptomatic side. Spectral Doppler demonstrates an increase in diastolic flow in uncomplicated orchitis.^{6-8,10}

If left untreated, severe testicular edema can compromise the venous drainage from the testis and potentially lead to ischemia and subsequently to infarction. Consequently, decreased or absent flow may be seen on color Doppler and high resistance with little, no, or reversed diastolic flow on spectral Doppler.^{4,6,8-10}

Testicular Torsion

Testicular torsion is caused by twisting of the spermatic cord or of the testis itself on its attachments and cessation of testicular blood flow. It is a urological emergency and accounts for 20% of cases of the acute scrotum. Torsion may occur at any age; however, it is most common in adolescent boys.¹⁰ Prompt diagnosis, intervention and definitive management are essential for viability. The salvage rates are nearly 80% to 100 % within 5 to 6 hours; 70% at 6 to 12 hours; and 20% at 12 to 24 hours.⁹

Two types of torsion- intravaginal and extravaginal- have been reported, with intravaginal being the most common in puberty.⁹ Intravaginal torsion, also known as bell-clapper deformity, occurs when the tunica vaginalis completely surrounds the epididymis, distal spermatic cord, and the testis, preventing fixation to the posterolateral aspect of the scrotal wall. This allows the testis to freely move within the scrotum.^{6,8,9}

Typically, patients present with sudden onset of scrotal or inguinal pain, nausea, vomiting, low-grade fever, anorexia, unilateral scrotal swelling and erythema, absence of a cremasteric reflex, negative Prehn's sign, Brunzel's sign, and a high-riding testis.^{1,2,9} Although history and physical examination may suggest the diagnosis, high resolution gray-scale sonography and color Doppler have proven to be reliable and essential in the diagnosis of torsion because of their high sensitivity and specificity.^{6,8,9}

High-resolution gray-scale findings are dependent on the duration of torsion and the severity of ischemia. In early torsion, the testis can be normal. In the acute phase of torsion (4 to 6 hours), the testis becomes enlarged and hypoechoic due to edema. Later (> 24 hours), it becomes heterogeneous due to

hemorrhage and infarction, which often indicates testicular non-viability. Color or power Doppler sonography shows decrease or absence of detectable intra-testicular blood flow with hypervascularity of surrounding thickened scrotal wall tissues.^{1,6,8}

Additionally, increased resistive index, absent or reversed diastolic flow, and monophasic waveforms can be seen.^{2,6,9} False-positive diagnosis of torsion can be avoided by optimizing parameters for slow flow, such as increasing the color gain, decreasing the wall filter, decreasing the pulse repetition frequency, and increasing the frequency of the transducer. Other associated findings, such as epididymal enlargement, reactive hydrocele, scrotal wall thickening, and ipsilateral enlarged twisted spermatic cord (whirlpool sign), have also been reported.^{1,9}

Treatment of testicular torsion involves rapid restoration of blood flow to the affected testis by manual detorsion (by external rotation) of the testis or orchiopexy of the affected testis (definitive treatment).^{5,6,8,9}

Diagnosis

Acute epididymitis

Summary

Given the continued improvement in sonographic technology and the superior resolution and sensitivity of color and spectral Doppler sonography, the visualization and characterization of scrotal contents is now more advanced. Acute epididymitis should be suspected at sonography when the epididymis is enlarged, edematous, and hypervascular. These sonographic characteristics assist the sonographer and physician in establishing the correct diagnosis, while excluding differential considerations, such as orchitis and testicular torsion. Prompt and accurate diagnosis is necessary to expedite appropriate treatment and avoid complications.

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