ORIGINAL ARTICLE

Abdominal imaging

Ultrasonographic findings in testicular appendage torsion in children and correlation with surgical and histopathologic findings

Priftis Dimitrios[1], Karfis Alexandros[2], Ouroumidou Kristina[1], Hadjichristou Elena[1], Plakias Charalambos[2], Papadimitriou Aggeliki[1], Manavi Aikaterini[2]

[1]Radiology Department, "G. Gennimatas" General Hospital Thessaloniki, Greece

Radiology Department, "Ag. Dimitrios" General Hospital Thessaloniki, Greece

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ABSTRACT

Objective: The purpose of our study was to determine the ultrasound findings in the testicular appendage torsion, the sensitivity and specificity of the method, and the correlation with surgical and histopathologic findings.

Subjects and method: During 5 years 227 boys of age 2 to 13, with acute scrotal pain, were referred from the pediatric surgery emergency department for scrotal US evaluation. In 40 of the patients, a diagnosis of appendix testis torsion was made, and underwent surgery. These patients were our study group. After the clinical evaluation, the following clinical diagnoses were made: suspected testicular torsion in 22 patients, suspected appendix testis torsion in 8 patients, and suspected epididymitis or orchitis in 10 patients. 7 patients had the "blue dot sign" on physical examination.

Results: On gray-scale US all patients showed a round lesion with heterogenous echotexture adjacent to the upper pole of the testis/epididymis with a diameter >6mm. Scrotal skin thickening was seen in 16 (40%) of the cases and a hydrocele was found in all of the cases. On color Doppler images, the torsed appendage was avascular, and in 20 (50%) patients we observed hyperemia in the surrounding tissues.

Conclusion: Torsion of the testicular appendages has a set of features on the multiparametric US. Thus, we believe that it is the method of choice for diagnosing torsion of the scrotal appendages and safely ruling out

CORRESPONDING AUTHOR, GUARANTOR

Priftis Dimitrios, Radiology Department, "G. Gennimatas" General Hospital Thessaloniki, Greece
E mail: dhimiterprifti@hotmail.com

other disorders as well as avoiding unwarranted surgical intervention or antibiotic treatment. The identification of a testicular appendage larger than 6 mm is suggestive of torsion.

KEY WORDS | Testis,testicular appedage,ultrasound

Introduction

Appendage torsion is the most common cause of acute scrotum in prepubertal children [1,2]. The appendix testis and appendix epididymis are vestiges of embryologic development without a known function. (Fig. 1,2) The appendix testis (from the müllerian duct) and appendix epididymis (from the Wolffian duct) are present in 76% to 83% and 22% to 28% of testes, respectively [3]. The appendix testis, located at the cranial testicular pole or in the groove between the testis and epididymis, and the appendix epididymis, located along the caput, may be sessile or pedunculated. Although the sessile type may be more common [3], the pedunculated type may be more prone to torsion [4]. The cause of torsion is unknown but may be related to anatomy, trauma, and/or prepubertal enlargement.

The peak age at occurrence is 7 to 12 years (mean 8 to 9 years) [1] but the condition may occur at any age. Symptoms vary with sudden or insidious onset of pain, which may be mild or severe and intermittent with physical activity. Similarly, physical findings depend on the severity of inflammation and duration of symptoms [5]. Early on, a “blue dot sign” [6], a discoloration at the upper pole of the testis representing the ischemic appendage, may be seen through stretched scrotal skin in 0% to 52% of patients [7]. Other early signs include a tender nodule superior to the testis with limited testicular tenderness and symmetrical cremasteric reflexes. However, with longer duration and progressive inflammation, increased swelling and tenderness, lack of distinction between testis and epididymis, and marked scrotal wall edema and erythema may make it difficult to distinguish it from testis torsion or epididymitis [8].

Color Doppler ultrasonography is the imaging modality of choice for the evaluation of the acute scrotum in all age groups. Color Doppler US rarely demonstrates an abnormal appendage but commonly shows hyperperfusion of the epididymis. The normal appendix testis contains no internal blood flow, whereas the twisted appendage may appear as an ovoid hyperechoic, hypo-

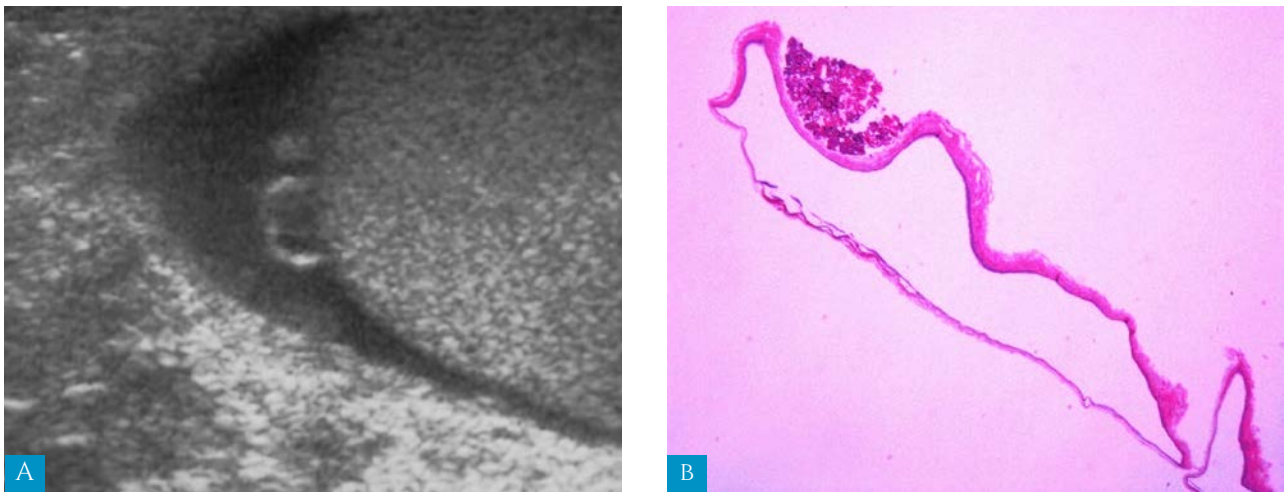

Fig.1: a) *Ultrasound image of normal testicular appendage (cystic form) of a 12-year-old child,* ***b)*** *the histological image.*

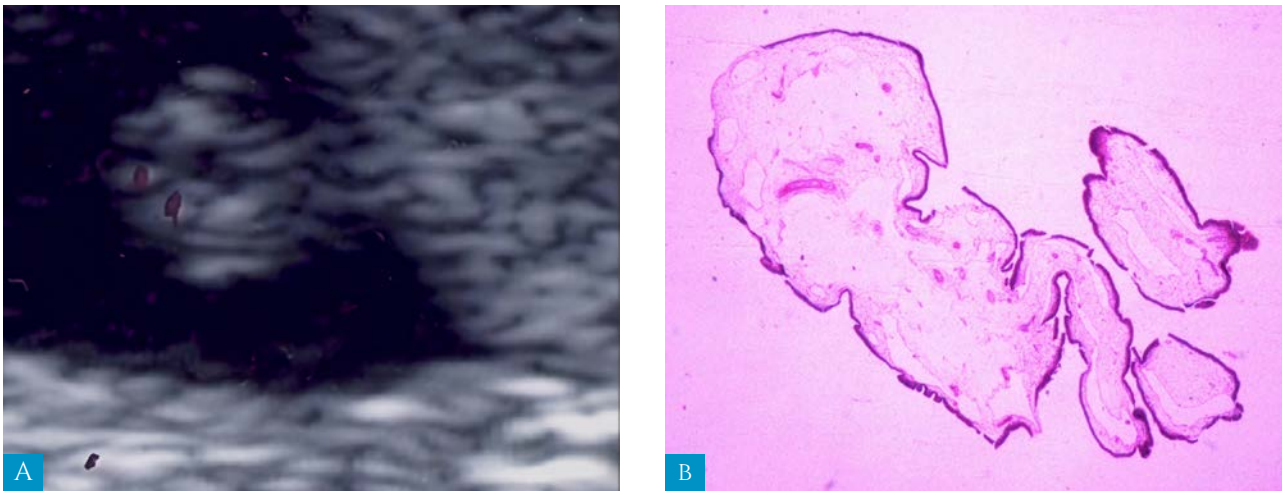

Fig.2: a) *Ultrasound image of normal testicular appendage (fibrous form),* ***b)*** *The histological image.*

echoic, or heterogeneous nodule without blood flow. If the testicular appendage is seen on ultrasound, a normal appendix testis will be less than 5.6mm in size [9,14].

A torsed testicular appendage will be over 5.6 mm and, depending upon the duration of torsion, may appear as an ovoid hypoechoic nodule in boys presenting before 24 hours compared to a hyperechoic or heterogeneous nodule after 24 hours [9]. A torsed appendix testis may also appear as an avascular lesion surrounded by a hyperemic epididymis with posterior enhancement. The hyperemia of the surrounding structures may make it difficult to distinguish a torsed testicular appendage from epididymitis [10]. A large torsed appendage may even give the sonographic appearance of a pyocele, making the clinical history and physical examination even more important [11].

Subjects and Methods

Patients

In our study conducted from January 2019 to December 2023, 227 boys 2 to 13 years old with acute scrotum (pain, hyperemia, and hemiscrotal swelling) were clinically evaluated by the pediatric surgeon on duty in the emergency department of our hospital. Patients were included in the study if clinical examination (history and physical examination) suggested torsion of the testis or of the testicular appendage, or epidymitis/orchitis. Children with a history of trauma were excluded. All patients underwent gray-scale sonography, which was complemented with color Doppler sonography to identify testicular appendages and to assess blood flow of the testicular appendage and the testis in the symptomatic hemiscrotum.

Forty patients who were diagnosed with torsion of the testicular appendage underwent scrotal exploration to establish a final diagnosis and resolve symptoms. The testicular appendages of these patients were excised and sent to the laboratory for histopathologic examination. Gray-scale and color Doppler sonographic findings of testicular appendages were correlated with surgical and histopathologic findings for this group of 40 patients.

Scrotal US Examination

The examination started with gray-scale sonography, followed by color Doppler sonography. Color Doppler gain was adjusted to avoid the appearance of artifacts, and the system was preset to detect low-velocity flows. The routine examination started with transverse scanning of the scrotum, followed by longitudinal scanning. Volume, echogenicity, texture, and blood flow were evaluated for both testes and epididymides.

The upper pole of the testis in the symptomatic side was carefully examined. Whenever a structure likely to correspond to the testicular appendage was identified, its location, size, texture, echogenicity, and blood flow were evaluated. The volume, shape, echogenicity, and blood flow of the epididymis and testis were also evaluated on both sides of the scrotum. The spermatic cord was scanned in both sides to assess its thickness and vessels.

Results

We diagnosed torsion of the testicular or epididymal appendages in all 40 patients; 16 of the torsions occurred on the left side. The torsed appendages were adjacent or in close proximity to the upper pole of the testis. Because of the close proximity of the upper pole of the testis, the epididymis, and the appendage, it was not possible to differentiate between testicular and epididymal appendages.

The US scans revealed that the 40 round or oval lesions had a maximal diameter ranging from 6,2 to 15.4 mm (mean, 9 mm). The echotexture of 30 (75%) of the torsed appendages was heterogeneous and included tiny cystic structures separated by echogenic septa or isoechoic tissue. On color Doppler images, most of the torsed appendages were avascular, although increased vascularity was present in the tissues surrounding them. Of those 20, the hyperemia involved both the testis and the epididymis in 12 and the epididymis alone in 8; none had increased vascularity limited to the testis. (Fig 3 to 6)

In addition, peritesticular fluid was present in all cases. Scrotal skin thickening was seen in 16 cases (40%). None of the patients had similar findings on the contralateral side of the scrotum.

During the surgical exploration (Fig. 3, Fig. 4), the appendage was found to be swollen in most cases, because of inflammation, discolored and necrotic. The affected appendage was surgically removed without any complications.

Histopathologic examination revealed coagulative necrosis of the appendage, with evidence of ischemic changes such as vascular congestion, edema, and interstitial hemorrhage. In most of the cases, the necrotic tissue was surrounded by inflammatory cells.

Discussion

The normal appendix testis, as visualized in US, measures 1–7 mm in length and is usually oval and sessile [14]. Its identification is facilitated by the presence of a hydrocele [12]. The appendix testis usually has the same echogenicity as the epididymal head, but it can also be cystic. The minority of testicular appendages are pedunculated. It has been suggested that the cystic and pedunculated variants, although in general occurring less commonly, are more likely to undergo torsion [10].

Appendix testis torsion is frequently accompanied by hydrocele, epididymal head enlargement, scrotal wall-thickening, and surrounding hyperemia [13].

Our findings are consistent with the previous studies [14] that have demonstrated the reliability of ultrasonography in diagnosing testicular appendage torsion, as well as the surgical and histopathologic findings that confirm the presence of necrosis and inflammatory changes in the torsed appendage.

Differential Diagnosis

In a patient presenting with acute scrotal pain, the differential includes ischemia (testicular torsion, torsion of a testicular appendage), infection (acute epididymo-orchitis), or trauma (scrotal contusion, testis rupture). However, the acute scrotum should be considered a surgical emergency until a testicular torsion is ruled out due to the potential catastrophic loss

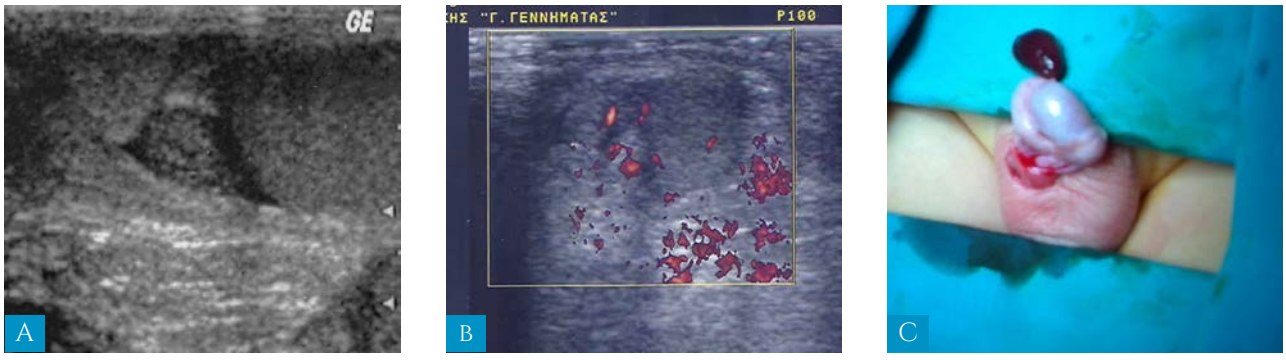

Fig.3: a) *Ultrasound image of torsed appendage of a 3-year-old child.* ***b)*** *Ultrasound color doppler image showing enlargement and hyperemia of the head of the epididymis.* ***c)*** *Scrotal exploration: the torsed appendage is enlarged, dark purple in color, the testis is normal and the epididymis is slightly enlarged.*

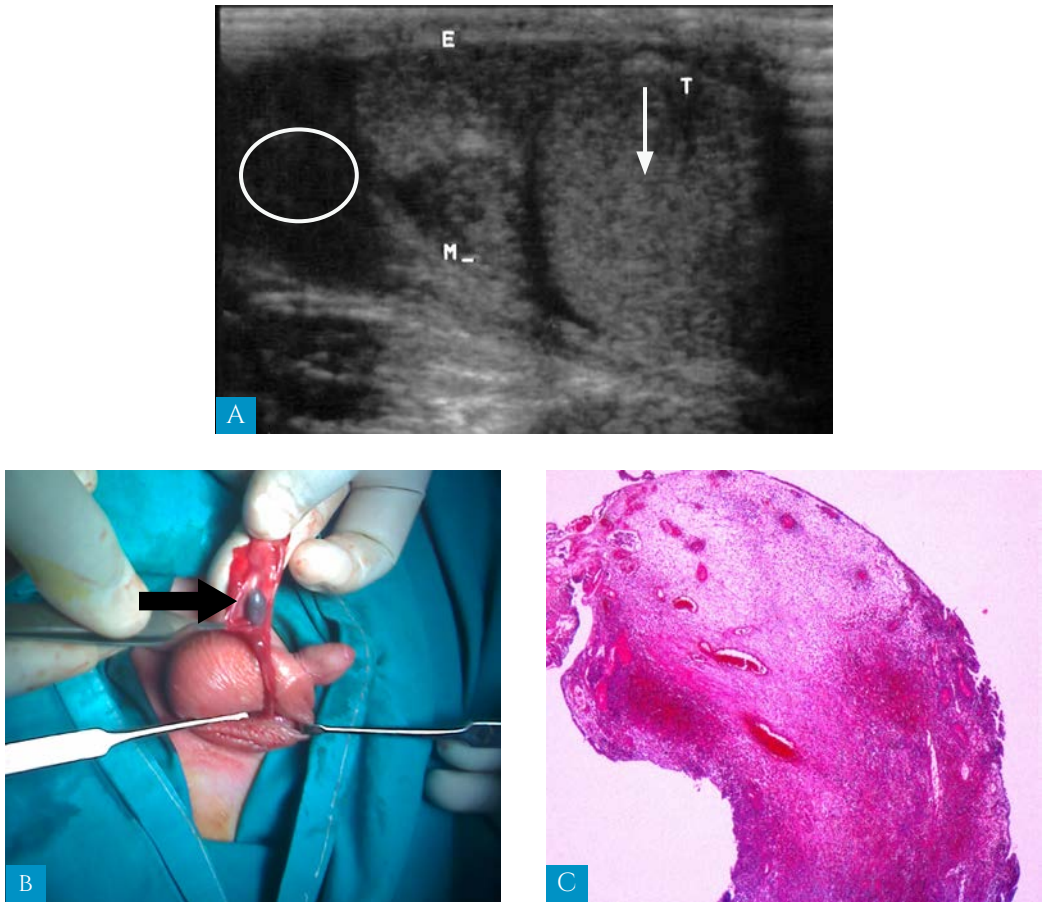

Fig.4: a) *Ultrasound image of a 5-year-old child with torsed testicular appendage (M),* ***b)*** *During the surgical exploration the torsed appendage (arrow) appears blue, and the surrounding tissues are hyperemic,* ***c)*** *the histological image which shows signs of infarction and necrosis.*

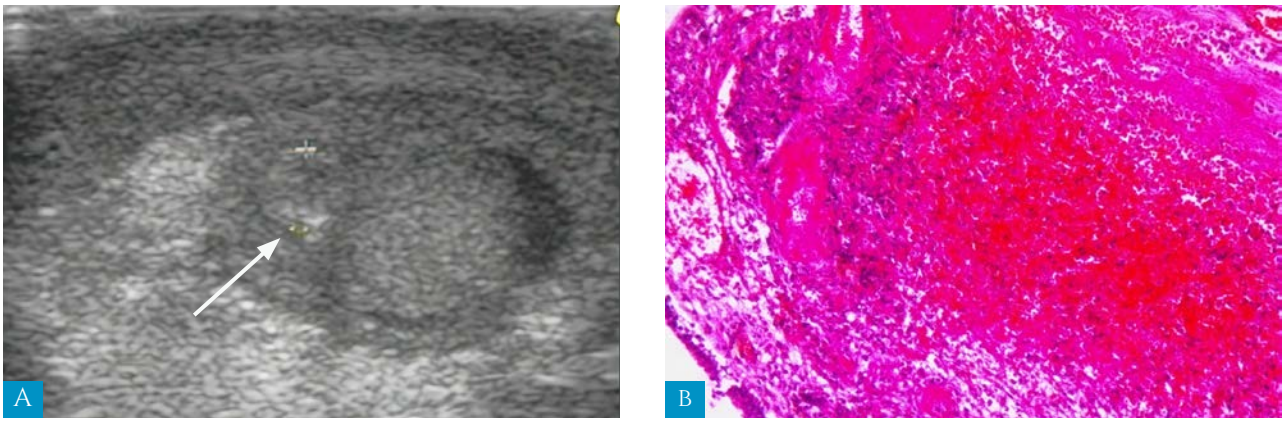

Fig.5: a) *Hyperechoic torsed testicular appendage (arrow) of a 4-year-old child.* ***b)*** *The histological image shows hemorrhagic necrosis of the appendage.*

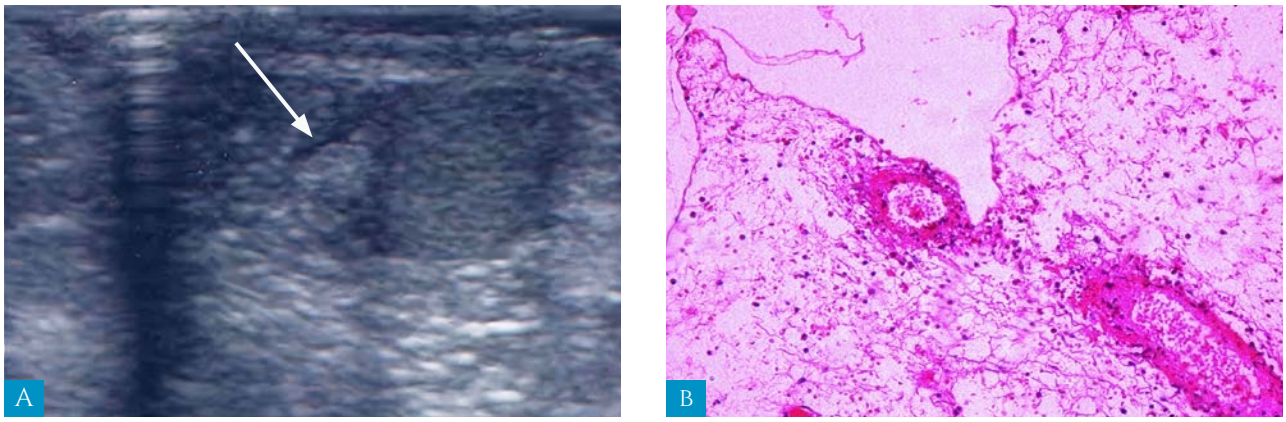

Fig.6: a) *Hyperechoic torsed testicular appendage in a 6-year-old child.* ***b)*** *the histological image shows signs of infarction.*

of a testicle. Testicular salvage is time-dependent, and most testicles remain viable if they are surgically detorsion within 6 hours of the onset of symptoms.

Testicular torsion usually has a more acute onset than torsion of an appendage, but this is variable. The cremasteric reflex is almost always absent on the affected side, and on physical exam, an abnormal transverse lie of the unaffected testicle may present. Lifting the affected testicle does not usually relieve pain (negative Prehn sign), but this is not considered a reliable indicator. Doppler ultrasound will show arterial flow to the affected testicle to be absent or minimal. Interestingly, onset during sleep is an indicator of testicular torsion [15]. The affected testicle is often found to be "high riding" in testicular torsion but not in a torsed testicular appendage.

Epididymo-orchitis, like torsion of a testicular appendage, will show hyperemia to the affected epididymis on color Doppler ultrasound but is likely to be more pronounced. They will often be associated with voiding symptoms such as dysuria, frequency and urgency, and possibly a history of urinary tract infections. Patients may also present with systemic signs and symptoms of fever, nausea, or vomiting. On physical exam, the epididymis and/or testis on the affected side will usually be enlarged and diffusely tender. Occasionally, elevating the affected testicle will relieve pain (positive Prehn sign). No "angel wing or bell clapper deformity" will be present [16].

In conclusion, the identification of a testicular appendage larger than 6 mm is suggestive of torsion, and, depending on clinical conditions, conservative treatment can be adopted for these patients. Testicular appendages measuring 3–5.6 mm may be either normal or torsed. In this case, treatment should be decided after considering clinical and physical examination findings and sonographic results [14]. **R**

References

1. Mushtaq I, Fung M, Glasson MJ. Retrospective review of paediatric patients with acute scrotum. ANZ J Surg. 2003 Jan-Feb;73(1-2):55-8.
2. Kim JS, Shin YS, Park JK. Clinical features of acute scrotum in childhood and adolescence: Based on 17years experiences in primary care clinic. Am J Emerg Med 2018; 36:1302-1303.
3. Jacob M, Barteczko K. Contribution to the origin and development of the appendices of the testis and epididymis in humans. Anat Embryol (Berl) 2005; 209:287–302.
4. Jones P. Torsion of the testis and its appendages during childhood. Arch Dis Child 1962; 37:214–26.
5. Rakha E, Puls F, Saidul I, et al. Torsion of the testicular appendix: importance of associated acute inflammation. J Clin Pathol 2006; 59:831–4.
6. Dresner ML. Torsed appendage: diagnosis and management: blue dot sign. Urology 1973; 1:63–6.

7. Lyronis ID, Ploumis N, Vlahakis I, et al. Acute scrotum—etiology, clinical presentation and seasonal variation. Indian J Pediatr 2009; 76:407–10.
8. Wein, Alan J.; Kavoussi, Louis R.; Partin, Alan W.; and Peters, Craig A., "Campbell-Walsh Urology (11th Ed.)" (2016);146:3392.
9. Park SJ, Kim HL, Yi BH. Sonography of intrascrotal appendage torsion: varying echogenicity of the torsed appendage according to the time from onset. J Ultrasound Med. 2011 Oct;30(10):1391-6.
10. Lev M, Ramon J, Mor Y, Jacobson JM, Soudack M. Sonographic appearances of torsion of the appendix testis and appendix epididymis in children. J Clin Ultrasound. 2015 Oct;43(8):485-9.
11. Meher S, Rath S, Sharma R, Sasmal PK, Mishra TS. Torsion of a large appendix testis misdiagnosed as pyocele. Case Rep Urol. 2015; 2015:430871.
12. Johnson KA, Dewbury KC. Ultrasound imaging of the appendix testis and appendix epididymis. Clin Radiol 1996; 51:335.
13. Yang DM, Lim JW, Kim JE, et al. Torsed appendix testis: gray scale and color Doppler sonographic findings compared with normal appendix testis. J Ultrasound Med 2005; 24:87.
14. Baldisserotto M, de Souza JC, Pertence AP, Dora MD. Color Doppler sonography of normal and torsed testicular appendages in children. AJR Am J Roentgenol 2005; 184:1287-1292.
15. Fujita N, Tambo M, Okegawa T, Higashihara E, Nutahara K. Distinguishing testicular torsion from torsion of the appendix testis by clinical features and signs in patients with acute scrotum. Res Rep Urol. 2017; 9:169-174.
16. Pomajzl AJ, Leslie SW. Appendix Testis Torsion. [Updated 2022 Nov 28]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.

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