

Original Article

An Evaluation of Testicular Torsion Management in the Emergency Department

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ABSTRACT

Objective: The aim of this study was to investigate the adequacy of colored Doppler ultrasonography (CDUS) and the capability of emergency department (ED) doctors in managing testicular torsion (TT), which is a urologic emergency.

Design: The study was conducted retrospectively between January 2012 and December 2015.

Setting: The study group consisted of patients who presented to Adiyaman Research and Education Hospital at the ED.

Subjects: Patients with acute scrotal or testicular pain and a presumptive diagnosis of TT which was later confirmed by colored Doppler ultrasonography

Intervention: None

Main Outcome Measure(s): Capability of ED doctors in requesting colored Doppler ultrasonography for diagnosis of TT

Results: Two hundred and twenty-five male patients, with a mean age of 24.1 ± 17.6 were included in the study, all of whom underwent CDUS. A female doctor, who was the patient's primary physician, examined 18 (8%) of the patients, and a female radiological operator evaluated 24 (10.7%) of the CDUS images. Of the 225 patients, 9 (4%) were confirmed radiologically as having TT. The most prevalent diagnosis was epididymo-orchitis (EO) ($n = 87$ [38.7%], $p < 0.005$), and the least common diagnoses were hydroceles and testicular masses (both $n = 3$ [1.3%], $p < 0.001$). The gender of the attending physician or radiological operator and the time of the CDUS (day/night shift) did not influence the diagnosis of TT ($p > 0.05$, each one).

Conclusion: The results suggest that ED doctors are not sufficiently familiar with performing genital exams and managing TT. This may lead to unnecessary delays.

KEYWORDS: colored doppler ultrasonography, emergency medicine, torsion of testicular cord

INTRODUCTION

Acute scrotal pain is a common urologic complaint in the emergency department (ED), with differential diagnoses including testicular torsion (TT), epididymo-orchitis (EO), torsion of testicular appendages (TTA), trauma, hernia, and idiopathic scrotal edema^[1,2]. TT is a true urologic emergency, which results from twisting of the spermatic cord, compromising testicular blood supply^[2,3]. The extent of torsion varies from 180° to 720° and may be even 1080° in orchiectomy cases^[4,5]. TT can result in testicular infarction, testicular loss, and infertility for patients and malpractice lawsuits for the ED doctors^[6].

Studies have shown that infarction occurs within 2 hours, and 6 hours is the upper limit for irreversible damage of torsed testis^[7,8]. Therefore, TT must be quickly differentiated from other etiologies and promptly diagnosed, followed by urgent treatment, without any delays^[2,5].

The annual incidence of TT is 4.5 in every 100,000 among males aged 25 years^[5,7]. TT can occur at any age but is most common among young adult males, with a bimodal incidence in the pediatric population^[5,8,9]. The left testis is more frequently affected than the right one^[8]. Concomitant bilateral TT is a rare finding that requires urgent exploration^[5].

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A diagnosis of acute TT is based on a physical examination, followed by adjuvant colored Doppler ultrasonography (CDUS) to confirm the diagnosis^[1]. The classic clinical presentation of acute torsion is sudden onset of severe, unilateral pain, often followed by nausea, vomiting, and a low-grade fever^[2]. The physical examination reveals a swollen, tender, and inflamed hemiscrotum. The cremasteric reflex is usually absent, and elevating the testicle does not provide pain relief (the so-called Prehn's sign)^[9]. The latter is used to distinguish epididymitis from torsion^[3]. On physical examination, a patient with TT usually has a swollen, diffusely tender testis, with the dwelling dependent on the degree of erythema or scrotal edema. The testis may also be lying in a transversal orientation in the scrotum.

Currently, in most EDs, CDUS is the most popular imaging modality to diagnose and differentiate TT from other etiologies. Recent studies showed that in experienced hands, the sensitivity and specificity of CDUS were 89–100% and 80–100%, respectively, and the positive predictive and negative predictive values were 92.3% and 99.1%, respectively^[2,3,5,7,9]. Some authors have suggested that imaging studies are not mandatory if the patient has a typical history and signs of torsion^[10]. Early diagnosis and urgent exploration are required to save the testis. Thus, some recommend that experienced clinicians should perform manual detorsion, which is a rapid, easy, and noninvasive technique^[9].

The purpose of this study was to evaluate the TT diagnostic and management skills of ED doctors, including their use of CDUS.

SUBJECTS AND METHODS

The study group consisted of patients who presented to the ED of an affiliated hospital with complaints of acute scrotal or testicular pain and whose presumptive diagnosis was recorded as TT on patient charts, followed by confirmation of the diagnosis using CDUS. This retrospective cross-sectional study was conducted between January 2012 and December 2015. The medical records of 255 patients were reviewed, including their medical histories, physical examination notes, and CDUS reports. Finally, 225 men who were eligible for the study were selected for further review. The inclusion and exclusion criteria are given in Table 1. Data on each patient's chief complaints, past medical history, physical examination, presumptive diagnosis, and management were obtained from the patient's records. The information from the physical examination included the side of the involved testis, presence of erythema, swelling, tenderness over the testis and epididymis, position of the testis, presence of the blue

Table 1: Inclusion and exclusion criteria for selecting eligible patients

Inclusion criteria	Exclusion criteria
The patients with prediagnosis of testicular torsion (TT) on the patient's chart, and followed up by colored Doppler ultrasonography (CDUS) to confirm TT	<ul style="list-style-type: none"> • Subjects with incomplete or missing data, such as clinical and radiological reports • A history of presenting to the emergency department (ED) with similar complaints at any time • Patients with trauma, infectious diseases, any malignancies, inguinal hernias, and prior urologic operations • Patients with a fever at presentation

dot sign, urethral discharge, and presence or absence of a normal cremasteric reflex.

Statistical analysis

The numeric data are expressed as the mean± standard deviation (SD) or median (interquartile range [IQR]), where applicable. Categorical data are expressed as percentages. The categorical data were compared using Pearson's chi-square test and Fisher's exact test, where applicable. The statistical analyses were performed with the Statistical Package for Social Sciences (SPSS, version 17.0) program. Statistical significance was defined as $p < 0.05$.

RESULTS

Two hundred and twenty-five male patients whose presumptive diagnosis was TT according to their medical records prior to performing CDUS were included in the study. The mean age of the participants was 24.1 ± 17.6 (range: 0 - 69 years). A female doctor examined 18 (8%) of the patients prior to CDUS, and a male doctor examined 207 (92%) of the patients. A female radiological operator examined 24 (10.7%) of the CDUS images, and a male operator examined 201 (89.3%) of the images. Two hundred and four (90.7%) of the CDUS exams occurred during dayshifts, and 21 (9.3%) took place during nightshifts ($p < 0.001$). The median (IQR) and mean (SD) waiting times for the CDUS examinations were 23 (4 - 44) min and 49.2 ± 76.3 (range: 0-286 min), respectively. The demographic data and variables of the patients are summarized in Table 2.

The CDUS radiological reports showed that 9 (4%) patients had TT. The most prevalent radiologic diagnosis was EO ($n = 87, 38.7\%$; $p < 0.001$), and the least common were hydroceles and testicular masses (both $n = 3, 1.3\%$; $p < 0.001$). The gender of the doctor and radiological operator, and performed time of the CDUS (day or night shift) did not influence the diagnosis of TT ($p > 0.05$, each one). The diagnoses of the patients according to the CDUS and their clinical characteristics are presented in Table 3.

Table 2: Demographical characteristics and variables of the patients

Variables	N = 225	p-value
Age (years), (mean±SD (min-max))	24.1±17.6 (0-69)	
The number of patients evaluated, according to the gender of the primary physician n (%)		p < 0.001
Female	18 (8%)	
Male	207 (92%)	
The number of patients evaluated, according to the gender of the operator performing the CDUS, n (%)		p < 0.001
Female	24 (10.7%)	
Male	201 (89.3%)	
Shift (hours)		p < 0.001
08.00-16.00	204 (90.7%)	
16.00-24.00	21 (9.3%)	
00.00-08.00	-	
Waiting time, minutes (median (IQR))	23 (4 - 44)	
Waiting time, minutes (mean)	49.2 ± 76.3 (range 0-286)	

CDUS: Colored Doppler ultrasonography; SD: standard deviation; min: minimum; max: maximum; IQR: interquartile range; n: number of cases.

A complete genital exam was performed only in three (1.3%) of the patients, with the remaining undergoing no examination or an incomplete examination. The most common recorded physical examination note was Prehn's sign (*i.e.*, when elevation of the testes does not decrease or relieve the pain in the affected testicle). This test was performed in 54 (24%) patients, of whom 24 (10.6%) had a positive sign, and 30 (13.3%) had a negative sign. The position of the testis and blue dot sign were checked only in 6 (2.6%) of the patients. Among the 225 patients, 59 (26.2%) were admitted to clinics: 27 (12%) to urology and 32 (14.2%) to pediatric surgery. The remaining 166 (73.8%) patients were discharged; 153 (68%) by the ED doctors and 13 (5.8%) by consultant physicians.

Table 3: Colored Doppler ultrasonography (CDUS) diagnosis and clinical characteristics of the patients

Clinical characteristics	N (%)	p - value
Normal testes	36 (16)	
Testicular torsion (TT)	9 (4)	
Epididymo-orchitis	87 (38.7)	
Hydrocele	3 (1.3)	
Varicocele	39 (17.3)	
Mass	3 (1.3)	p < 0.001
Epididymal cysts	9 (4)	
Scrotal edema	15 (6.7)	
Infection	6 (2.7)	
Other	18 (8)	

DISCUSSION

The results suggested that the doctors in the ED did not perform an adequate initial genital assessment of patients who presented with testicular or scrotal

pain, regardless of the practitioner's gender, and that the patients were directed to the radiology unit for CDUS with insufficient genital exam notes.

TT is a real urologic emergency, which is encountered mainly in young males. It is a relatively common condition and is found in 10 – 54% of cases who present with an acute scrotum^[4]. As it is potentially associated with a high risk of infertility, prompt treatment is essential, without any delays^[5]. The misdiagnosis of TT is not a recent problem and is not solely due to a lack of diagnostic skills among physicians in the ED^[8]. However, the misdiagnosis of TT is avoidable^[8].

The etiology of TT is unclear, but it was reported that trauma and physical activity, such as cycling, were frequent causes of torsion (4 - 8% of TT cases)^[5]. Heritability is also suspected to play a role in TT^[5]. Some authors suggested that a careful physical exam and patient history could facilitate the differential diagnosis and detection of TT^[11]. A definitive diagnosis of TT is confirmed by scrotal exploration^[5,8]. According to the results of the present study, the doctors in the ED performed a complete genital exam in only 3 (1.3%) patients, with the others having no examinations or incomplete examinations. This was lower than expected. It may be explained by practitioners being unfamiliar with TT or with insufficient training in the diagnosis of TT. The re-evaluation of the CDUS images of the patients revealed TT in 9 (4%) of the patients. This ratio is lower than that recorded in the literature^[4,5,7].

The differential diagnosis of TT, TTA, and EO in the physical examination is easier in the first 12 hours after symptom onset. After 24 hours, significant erythema and thickening of the hemiscrotum will result in the loss of the anatomic landmarks of the testis^[4]. In the physical examination, the common recorded findings are a negative Prehn's sign. The position of the testes can indicate torsion, with a high, horizontal position (Brunzel's sign) rather than a vertical position suggestive of TT. However, this finding was observed only in 50% of patients with TT^[4]. A tender and swollen testis, with one larger than the other, as well as swelling and erythema of the scrotal sac or retraction of the scrotal skin, may also be present in TT (Ger's sign)^[5]. The latter is usually present in cases of bell clapper deformity. The absence of a cremasteric reflex is almost always a sensitive sign^[4,5,8] that is highly specific for TT^[4]. In previous reports, 51 - 100% of patients with TT lacked a cremasteric reflex^[4]. Although no single clinical finding has 100% sensitivity for the presence of TT, all patients with TT have one of four identified risk factors: the presence of nausea or vomiting, pain duration of 24 hours, a high position of the testis, and

the absence of the ipsilateral cremasteric reflex^[1,4]. The aforementioned should alert the care provider of the near certainty of TT, and management should be expedited in these patients. In the present study, the re-evaluation of the data showed that Prehn's test was the most common recorded physical examination note. However, the latter was performed only in 54 patients, of whom 33 had a positive sign and 21 had a negative sign. The least checked findings were the position of the testis and blue dot sign, with these indicators assessed only in six patients.

Although the complaints and symptoms of TT may be similar to those found in other urologic conditions, there are also differences. For example, TT usually presents with testicular pain and swelling. The pain usually begins abruptly and without a precipitating event^[5,8]. The presence of systemic symptoms, such as lower abdominal pain and nausea or vomiting, is associated with TT and should alert practitioners to the possibility of TT^[4]. In the event of TTA, the blue dot sign can be observed, and TTA is often present at an earlier age than in the case of TT. A history of trauma is also more common in TTA. In EO, the main finding is epididymal tenderness with palpation. Fever and dysuria are also usually present in EO^[6]. The symptoms appear significantly earlier in TT than in EO or TTA. There are also many other potential differential diagnoses of acute scrotum, such as hydroceles, hematoceles, varicoceles, scrotal hernias, tumors, and trauma^[5].

CDUS, complemented by a clinical evaluation, is a reliable aid to the identification of TT^[7]. It can improve the accuracy and reduce the incidence of negative surgical exploration in cases where the diagnosis is uncertain^[1,8]. In our clinic, the patients were sent directly to the radiology department for CDUS. As shown in the present study, this protocol is problematic if CDUS is used as a substitute for an accurate medical history and complete physical examination. The current literature recommends CDUS as a valuable diagnostic modality in the diagnosis of acute scrotum^[11,12]. In the case of TT, the diagnostic accuracy of CDUS was reported to be 95%, similar to that obtained with radionuclide testicular scanning^[10,11], and the sensitivity in diagnosing scrotal inflammation was found to be equal to 100%, when used in conjunction with a physical exam. Thus, CDUS is the best way to distinguish EO from TT^[9,11]. However, some studies have reported controversial results on the diagnostic accuracy of CDUS. For example, in a study of 42 patients who had a presumptive diagnosis of TT, the diagnostic efficiency of a physical exam versus that of CDUS was 70% and 67.4%, respectively^[11]. Kalfa *et*

al^[13] reported that among surgically proven TT, CDUS showed a positive result only in 70% of patients. The pitfalls of CDUS are its dependence on the experience of the technician and some factors that can mislead the operator^[5]. Various studies demonstrated that peripheral perfusion did not compromise twisted testicles until the torsion reached 360° and that misinterpretation was responsible for most false negative results in previous studies^[7,14]. As apparently normal CDUS findings do not exclude TT, when the patient history and physical examination are suggestive of TT, urgent surgical exploration is mandatory, without any delays^[5,11,15]. In the present study, all of the 225 patients were sent to radiology department for CDUS imaging based on a presumptive diagnosis of TT, and 59 of these were admitted to urology or pediatric surgery with different reasons. This may have led to some cases of TT being overlooked. The failure to recognize TT may be due to a lack of familiarity among doctors in the ED with how to perform a genital exam and a lack of knowledge of the management of TT.

CONCLUSION

Limitations

Due to the retrospective nature of this study, it has several limitations. Data extraction from hospital records has a limited ability to accurately identify health conditions and suffers from a substantial amount of missing data. We do not know the actual diagnoses of the patients who were discharged from the ED based on the CDUS findings and records were inadequate. Therefore, we could not discuss how many missed diagnosis of TT by CDUS was present in this study. Another limitation is that the operative outcomes of the patients who underwent surgery for torsion of the testis are unknown.

In conclusion, there are many differential diagnoses of torsion of the testis, most of which are not urgent. An accurate history and physical examination, combined with adjunctive imaging, can usually correctly identify TT. In the present study, most patients with testicular pain were referred to the radiology unit with an incomplete patient history and incomplete physical exam notes, regardless of the gender of the doctor. We assume that ED doctors are not adequately familiar or willing to perform genital examinations, potentially leading to unnecessary delays, and missed diagnoses of TT. CDUS alone cannot reliably exclude TT. In the presence of concerns based on the patient's medical history or physical examination findings, even when testicular blood flow appears to be preserved, the emergency doctors should decide together with

urology or pediatric surgeon to discharge of these patients in the ED.

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Conflict of interest: The authors declare no conflict of interest

REFERENCES

1. Srinivasan A, Cinman N, Feber KM, Gitlin J, Palmer LS. History and physical examination findings predictive of testicular torsion: an attempt to promote clinical diagnosis by house staff. *J Pediatr Urol* 2011; 7:470-474.
2. Gatti JM, Patrick Murphy J. Current management of the acute scrotum. *Semin Pediatr Surg* 2007; 16:58-63.
3. Yin S, Trainor JL. Diagnosis and management of testicular torsion, torsion of the appendix testis, and epididymitis. *Clin Ped Emerg Med* 2009; 10:38-44.
4. Boettcher M, Bergholz R, Krebs TF, Wenke K, Aronson DC. Clinical predictors of testicular torsion in children. *Urology* 2012; 79:670-674.
5. Feher AM, Bajory Z. A review of main controversial aspects of acute testicular torsion. *Journal of Acute Disease* 2016; 5:1-8.
6. Boettcher M, Bergholz R, Krebs TF, *et al.* Differentiation of epididymitis and appendix testis torsion by clinical and ultrasound signs in children. *Urology* 2013; 82:899-904.
7. Waldert M, Klatte T, Schmidbauer J, Remzi M, Lackner J, Marberger M. Color Doppler sonography reliably identifies testicular torsion in boys. *Urology* 2010; 75:1170-1174.
8. Pogorelić Z, Mrklić I, Jurić I. Do not forget to include testicular torsion in differential diagnosis of lower acute abdominal pain in young males. *J Pediatr Urol* 2013; 9:1161-1165.
9. Shen CY, Gueng MK, Su YC, Lee T, Lee SK. Role of grayscale and color Doppler ultrasonography in the diagnosis and outcome analysis of testicular torsion. *J Med Ultrasound* 2005; 13:26-31.
10. Gronski M, Hollman AS. The acute paediatric scrotum: the role of colour doppler ultrasound. *Eur J Radiol* 1998; 26:183-193.
11. Pepe P, Panella P, Pennisi M, Aragona F. Does color Doppler sonography improve the clinical assessment of patients with acute scrotum? *Eur J Radiol* 2006; 60:120-124.
12. Selim YARM, Albroumi SA. Acute torsion of the testis in children and young adults: Role of high resolution and Color Doppler ultrasonography. *The Egyptian Journal of Radiology and Nuclear Medicine* 2015; 46:151-157.
13. Kalfa N, Veyrac C, Baud C, Couture A, Averous M, Galifer RB. Ultrasonography of the spermatic cord in children with testicular torsion: impact on the surgical strategy. *J Urol* 2004; 172:1692-1695.
14. Schalamon J, Ainoedhofer H, Schleef J, Singer G, Haxhija EQ, Höllwarth ME. Management of acute scrotum in children--the impact of Doppler ultrasound. *J Pediatr Surg* 2006; 41:1377-1380.
15. Karmazyn B, Steinberg R, Livne P, *et al.* Duplex sonographic findings in children with torsion of the testicular appendages: overlap with epididymitis and epididymoorchitis. *J Pediatr Surg* 2006 41:500-504.