Original Article

Acute Scrotum Management: The Significance of Color Doppler Ultrasound

Hayder Neamah Hassan[1], Aysar Hameed Oraibi[2], Amier Ejrish Alkafaji[2]

[1]Department of Surgery, Faculty of Medicine, University of Kufa, Kufa, Iraq, [2]Department of Surgery, College of Medicine, University of Babylon, Babylon, Iraq

Abstract

Background: It is important to distinguish with certainty between surgical and nonsurgical treatments for acute scrotal pain. It is widely recognized that early surgery for testicular salvage in ischemic disease, particularly torsion of the testis, offers advantages. The objective is to diagnose testicular torsion early so that prompt surgery can rescue the testis and rule out the condition to avoid unnecessary surgery. **Materials and Methods:** This is a cross-sectional research of 41 pediatric patients with acute scrotal conditions collected data from January 2021 to February 2022, excluding scrotal trauma. Patient data includes age, disease duration, diagnosis, and ultrasound diagnostic—the positive or negative result of the patient. **Results:** About 100% of individuals with calcified testes and scrotal edema are under 1 year old. About 50% of testicular torsion patients were above 5 years old, whereas 40% of epididymo-orchitis patients were under 5 years Substantial relationship between final diagnosis and prognosis, with 100% of calcified testes, strangulated hernia, and testicular torsion patients needing surgery. Epididymo-orchitis and scrotal edema require only medical therapy for 100% of individuals. There was an insignificant correlation between the ultimate diagnosis and the onset. **Conclusion:** Severe anomalies, including calcified testes and scrotal edema, mainly affect children under 1 year old, with age strongly correlated with diagnosis. Calcified testes, strangulated hernia, and testicular torsion require surgery, whereas epididymo-orchitis and scrotal edema are treatable medically. It appears that the scrotal disorder's type determines the therapy, as the onset does not alter the diagnosis. This study emphasizes the importance of age-specific pediatric scrotal illness diagnosis and treatment.

Keywords: Acute, color, Doppler, management, scrotum, ultrasound

Introduction

It is important to distinguish with certainty between surgical and nonsurgical treatments for acute scrotal pain. It is widely recognized that early surgery for testicular salvage in ischemic disease, particularly torsion of the testis, offers advantages. However, these benefits must be weighed against the expenses incurred from unnecessary operations on a significant number of patients with nonsurgical conditions, predominantly acute epididymo-orchitis.

Acute pain, with or without scrotal edema, is the definition of acute scrotum. It may be accompanied by local or general symptoms.[1,2] Among the most frequent differential diagnoses of acute scrotum are (i) spermatic cord torsion and (ii) acute epididymitis or epididymo-orchitis. Strangulated hernia, segmental testicular infarction, testicular tumor, and idiopathic scrotal edema are uncommon diagnoses.[3] However, this pertinent discourse will be restricted to individuals presenting with acute pain who do not have a medical history of trauma or a mass present before the onset of the pain. However, the clinical manifestations of the various etiologies of acute scrotal pain overlap.

In cases of clinical ambiguity, imaging may facilitate an early detection of testicular torsion, thereby reducing the incidence of avoidable surgical procedures. A definitive protocol for acute scrotal screening does not exist for

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Address for correspondence: Dr. Hayder Neamah Hassan, Faculty of Medicine, University of Kufa, Kufa 1245, Iraq.
E-mail: haidern.alkhayat@uokufa.edu.iq

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primary care physicians to adhere to.[4,5] Utilizing color Doppler ultrasound (US) for early detection of testicular torsion is the sole method by which the morbidity burden can be diminished. Comparing primary scrotal exploration and initial US examination with exploration for positive US results or a high clinical suspicion of torsion, one study found that in many patients, the US shortened hospital stays by obviating the need for exploration.[6] The goal is to identify testicular torsion as early as possible so that immediate surgery can be conducted to salvage the testis, while also ruling out testicular torsion to prevent the need for unnecessary surgery.

Materials and Methods

In a cross-sectional study of 41 pediatrics has acute scrotum, the data collected from Al-Zahraa Teaching Hospital in Al-Najaf from the period January 2021 to February 2022, cases of scrotal trauma were excluded from this study. The data collected from patients included age, duration since onset of disease, diagnosis, ultrasonic findings regarding the diagnosis as positive or negative, and the outcome of the patient.

Statistical analysis

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 23.0 (SPSS, IBM Company, Chicago, IL, USA). SPSS used frequency and percentage for categorical data, whereas the mean and standard deviation for continuous data. The chi-square test was used to examine the relationship between categorical variables, with a *P* value of 0.05 or below indicating statistical significance.

Ethical approval

All individuals involved in this study were informed, and consent was obtained verbally from parents before the collection of samples. The study was approved by the Committee on Publication Ethics at the Babylon Health Directorate under reference number 0899 on December 14, 2021.

Results

Table 1 shows that 34.15% of patients were at an age <1 year, and 26.83% of them were at a age of 1–5 years. About 43.9% of patients were diagnosed with epididymo-orchitis, whereas 17.07% of them were diagnosed with strangulated hernia. About 78.05% of patients had an onset time of <24 h. About 75.6% of patients had a positive hernia diagnosis on US. About 43.9% of them needed surgery, and 56.1% were treated medically.

Table 2 shows a significant association between final diagnosis and age groups of patients. About 100% of patients with calcified testes and scrotal edema are at an age of <1 year. 40% of patients have epididymo-orchitis are at the age group of 1–5 years, and 50% of patients with testicular torsion are at the age more than 5–10 years.

Table 1: Distribution of patients according to variables of the study (total 41)

Variables	*N*	%
Age (years)		
<1	14	34.15
1–5	11	26.83
6–10	9	21.95
>10	7	17.07
Diagnosis		
Calcification of the testis	2	4.88
Epididymo-orchitis	18	43.9
Scrotal edema	5	12.2
Strangulated inguinal hernia	7	17.07
Testicular torsion	5	12.2
Torsion of the appendix testis	4	9.76
Onset time (h)		
<24	32	78.05
24–48	7	17.07
>48	2	4.88
Diagnosis by ultrasound		
Normal	10	24.4
Positive	31	75.6
Final outcome		
Surgery	18	43.9
Treatment	23	56.1

Table 3 shows a significant association between the final diagnosis and the Doppler US diagnosis. About 100% of patients with calcified testis and set hernia have positive results on US, whereas 83.3% of patients with testicular torsion have positive results on US, and 80% of patients with epididymo-orchitis have positive results on US.

Table 4 shows a significant association between final diagnosis and outcome. About 100% of patients with calcified testes, inguinal set hernia, and testicular torsion need surgical correction. While 100% of patients with epididymo-orchitis and scrotal edema need just medical treatment.

Table 5 shows no significant association between final diagnosis and time of onset.

Discussion

Acute scrotal pain constitutes an urgent medical condition. Management varies drastically depending on the underlying cause. Hernia strangulation and testicular torsion are surgical emergencies, whereas epididymo-orchitis is a condition that can be managed with medication. Distinguishing between obstructed hernia and testicular trauma requires obtaining a medical

Table 2: Association between final diagnosis and age groups of patients (total 41)

Variables	Age (years)				*P* value
	<1	1–5	6–10	>10	
Diagnosis					
Calcification of the testis	2	0	0	0	
Epididymo-orchitis	100.0%	0.0%	0.0%	0.0%	
	1	8	4	7	
Strangulated inguinal hernia	5.0%	40.0%	20.0%	35.0%	0.0001
	4	0	0	0	
Testicular torsion	100.0%	0.0%	0.0%	0.0%	
	7	1	0	1	
Torsion of the appendix testis	77.8%	11.1%	0.0%	11.1%	
	0	2	3	1	
	0.0%	33.3%	50.0%	16.7%	

$P \leq 0.05$ is statistically significant

Table 3: Association between final diagnosis and Doppler ultrasound diagnosis (total 41)

Variables	Doppler ultrasound		*P* value
	Normal	Positive	
Diagnosis			
Calcification of the testis	0	2	
Epididymo-orchitis	0.0%	100.0%	
	4	16	
Strangulated inguinal hernia	20.0%	80.0%	0.002
	4	0	
Testicular torsion	100.0%	0.0%	
	0	9	
Torsion of the appendix testis	0.0%	100.0%	
	1	5	
	16.7%	83.3%	

$P \leq 0.05$ is statistically significant

Table 4: Association between final diagnosis and treatment type (total 41)

Variables	Outcome		*P* value
	Surgery	Non-operative treatment	
Diagnosis			
Calcification of the testis	2	0	
Epididymo-orchitis	100.0%	0.0%	
	0	20	
Strangulated inguinal hernia	0.0%	100.0%	0.0001
	0	4	
Testicular torsion	0.0%	100.0%	
	9	0	
Torsion of the appendix testis	100.0%	0.0%	
	6	0	
	100.0%	0.0%	

$P \leq 0.05$ is statistically significant

history from the patient.[1] Even though scrotal contents are the most amenable to clinical examination, significant complications can arise. The physical examination provides minimal additional information and is further constrained by the patient's acute pain and distress, which further impede its effectiveness. In such circumstances, US with color Doppler is beneficial for distinguishing between medically treatable and surgical emergency scrotal emergencies and preventing needless, catastrophic surgical exploration.[3] Presently, for the evaluation of acute scrotum, US with a high-frequency transducer in conjunction with color Doppler US has emerged as the imaging modality of preference. The current study finding suggested that all patients diagnosed with calcified testes and scrotal edema are <1 year old is significant, as it is occurring due to congenital factors, maternal factors during pregnancy, or perinatal problems.

Similar studies have indicated that calcifications occur due to a variety of reasons like infection, trauma, or torsion events that may not be clinically apparent at the time of the incident. This is very important in the assessment of neonates and infants presenting with scrotal anomalies, as these insights necessitate a careful evaluation of neonates and infants presenting with scrotal anomalies, highlighting the important role of ultrasonography as a valuable diagnostic instrument in this age group.[7]

In the current study, 40% of patients with epididymo-orchitis in the 1–5 years age group had a higher incidence of urinary tract infections (UTIs) and associated postinfectious problems in early childhood. Young children presenting with scrotal pain or swelling possibly designate an essential need for investigating underlying UTIs or anatomical anomalies.[8]

The results of this study also showed that the prevalence of testicular torsion in 50% of patients aged >5–10 years mirrors results from other studies that have recognized a higher incidence of torsion in pre-pubertal and adolescent males. This age group's activity level and testicular growth spurts may contribute to the higher torsion risk. It is

Table 5: Association between Doppler ultrasound findings in association with time (total 41)

Variables	Time of onset			*P* value
	<24	24–48	>48	
Diagnosis				
Calcification of the testis	2	0	0	
Epididymo-orchitis	100.0%	0.0%	0.0%	
	11	7	2	
Strangulated inguinal hernia	55.0%	35.0%	10.0%	0.5
	4	0	0	
Testicular torsion	100.0%	0.0%	0.0%	
	8	1	0	
Torsion of the appendix testis	88.9%	11.1%	0.0%	
	5	1	0	
	83.3%	16.7%	0.0%	

urgent to identify and diagnose torsion in this age group, which requires rapid assessment and surgical intervention to preserve testicular function.[9,10]

The current study shows the high sensitivity of Doppler US imaging in detecting these conditions. This is similar to previous studies that have tinted the effectiveness of US in identifying testicular calcifications and hernias, which support clinical diagnoses.[11] The study also shows that 83.3% of testicular torsion patients had positive results on Doppler US indicating its sensitivity in detecting this emergency condition. However, there is a limitation in US sensitivity in interpretation, a testicular torsion is a surgical emergency requiring fast intervention to recover testicular function. Previous studies have designated that the "whirlpool sign" on Doppler US is a very specific indicator of torsion.[12] The studies show 80% epididymo-orchitis through Doppler US revealing the usefulness of US in diagnosing inflammatory disorders of the scrotum. This detection rate is supported by Doppler US to recognize increased blood flow in epididymo-orchitis, thereby differentiating it from other scrotal pathologies.[13]

Testicular torsion is considered a urological emergency, requiring immediate surgical interference to rescue the testicle and preserve future fertility.[14] Similarly, hernias often require surgical repair to prevent complications like bowel obstruction or strangulation.[15] Calcified testes require only a surgical or physical examination to determine the underlying reason for calcification, which could include previous torsion or trauma, and to alleviate possible problems.

The study shows that patients with epididymo-orchitis and scrotal edema were managed medically, reproducing the mainly inflammatory or infectious epididymo-orchitis, frequently caused by bacterial infection, is usually treated with antibiotics, painkillers, and supportive care.[16] Scrotal edema, which is caused by trauma, infection, or systemic illnesses, is also chiefly managed with medical treatment.[17]

Several researchers in Iraq employed three-dimensional ultrasound and Doppler Imaging for detection of different lesions thereby reducing the incidence of avoidable surgical procedures.[18,19]

Conclusion

The data shows a strong correlation between age and scrotal problem diagnosis, with severe abnormalities including calcified testes and scrotal edema primarily affecting children under 1 year old. In addition, calcified testes, inguinal hernia, and testicular torsion always necessitate surgery, although epididymo-orchitis and scrotal edema can be treated medically. Interestingly, the timing of commencement does not greatly affect the ultimate diagnosis, suggesting that the scrotal disorder's nature governs treatment. This study emphasizes the importance of age-specific diagnosis and treatment of pediatric scrotal diseases.

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Conflicts of interest

There are no conflicts of interest.

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