

Is it possible to distinguish testicular torsion from other causes of acute scrotum in patients who underwent scrotal exploration? A multi-center clinical trial

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Introduction To assess the clinical presentation of patients who underwent surgical exploration for acute scrotum and to investigate the potentially related factors for differential diagnosis.

Material and methods We retrospectively analyzed the medical records of 97 patients who underwent surgical exploration for acute scrotum between May 2007 and July 2013. The patients were divided into two groups as follows: Group 1 included patients with testicular torsion (TT) and Group 2 contained patients with acute scrotal pathologies other than TT, including torsion of the testicular appendage, epididymo-orchitis, trauma and Henoch-Schönlein purpura. The physical examination findings, colour Doppler ultrasound (CDUS) and laboratory findings for the groups were compared.

Results In total, 97 scrotal explorations were carried out for acute scrotum. Group 1 included 72 patients (74.2%) and Group 2 included 25 patients (25.8%). Group 2 was comprised of patients with torsion of the testicular appendage (n = 13), epididymo-orchitis (n = 8), testicular trauma (n = 2) and Henoch-Schönlein purpura (n = 2). In Group 1, 32 cases (44.4%) presented to a hospital less than 6 hours after onset of pain. More than half (64%) of Group 2's cases presented more than 24 hours after pain onset. Fever and pyuria appeared more frequently in Group 2 than in Group 1 and the results reached statistical significance (p = 0.001 and p = 0.044, respectively). Group 1 had more testicular tenderness than Group 2 (p < 0.001). Our testicular salvage rate was 59.7%, and 40.3% of patients underwent orchiectomy.

Conclusions CDUS predicted the diagnosis of TT (sensitivity 98.6%). Furthermore, clinical findings may also play a substantial role in the differential diagnosis of acute scrotum.

Key Words: acute scrotum ↔ testicular torsion ↔ torsion of testicular appendages ↔ epididymo-orchitis

INTRODUCTION

Scrotal pain in a child or teenage boy should always be treated as an emergent condition whether or not it is accompanied by swelling. Although the majority of these conditions are non-emergent, torsion of the spermatic cord is dangerous and should be diagnosed and treated immediately. Otherwise, the

testicle may be subject to permanent ischemic damage [1]. The most common causes of acute scrotum in young people are testicular torsion (TT), epididymo-orchitis (EO) and torsion of the testicular appendage (TTA) [2, 3, 4]. Due to the possible risk of permanent damage to the testicle, it is important to determine whether the acute scrotal pain is caused by testicular torsion or something else.

Sonography and clinical findings were used to diagnose these pathologies [5, 6].

The aim of the current study is to examine the results of scrotal exploration, the symptoms and signs of acute scrotum, and the relationship between these findings and the differential diagnosis of acute scrotum in young patients.

MATERIALS AND METHODS

A total of 97 patients, who were up to 25 years old and underwent scrotal exploration for acute scrotal pain between May 2007 and July 2013, were included. We created two groups as follows: Group 1, patients with testicular torsion (TT), and Group 2, patients with acute scrotal pathologies other than TT, including torsion of the testicular appendage, epididymo-orchitis, testicular trauma and Henoch-Schönlein purpura. Data was obtained retrospectively from the medical records of all patients who underwent scrotal exploration in five tertiary referral centres (Süleyman Demirel University Faculty of Medicine, Isparta; Haydarpaşa Training and Research Hospital, Istanbul; Tepecik Training and Research Hospital, Izmir; Fatih Sultan Mehmet Training and Research Hospital, Istanbul, and Dumlupınar University Faculty of Medicine, Kütahya).

Patient selection

The case notes of all the operated patients with acute scrotum were evaluated. All participants were examined physically by a urology resident and an attending physician. The physical findings included scrotal erythema, swelling and tender scrotum. Patient age, clinical findings, affected side, pain duration, fever ($>38^{\circ}\text{C}$), nausea-vomiting, final diagnosis and type of surgery were determined. A complete blood count, including a white blood cell (WBC) count and urinalysis (pyuria), was performed for all subjects. Patients with a history of recent surgery on the external genitalia, incarcerated hernia, tumor or extravaginal spermatic cord torsion were excluded from the study.

Colour doppler ultrasonography (CDUS) was performed in all patients. In the presence of suspicious clinical findings, surgical exploration was mainly based on these clinical findings rather than CDUS results. Torsion of the testis was managed by either orchidopexy or orchidectomy. The contralateral testis was also fixed. Torsion of the appendix testis was treated via excision. In cases of epididymo-orchitis, only the ipsilateral testis was fixed. Orchiectomy was performed in two patients with testicular rupture and hematoma after trauma. HSP patients with-

out torsion underwent bilateral testicular fixation. This study was approved by the Local Ethics Committee of the Süleyman Demirel University Faculty of Medicine.

Statistical analysis

Statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) for Windows, Version 19.0. A significance value of $p < 0.05$ was accepted as indicating statistical significance. Data was expressed as mean \pm standard deviation for continuous variables and as a number and percentage for categorical variables. Categorical data between the groups was compared using the χ^2 test or Fisher's exact test, while continuously distributed data was compared using either a Mann-Whitney U test or an analysis of variance.

RESULTS

Group 1 included 72 patients with TT (74.2%) and Group 2 included 25 patients who had other acute scrotal pathologies (25.8%). The distribution of other pathologies was as follows: torsion of the testicular appendage ($n = 3$), epididymo-orchitis ($n = 8$), testicular trauma ($n = 2$) and Henoch-Schönlein purpura ($n = 2$). Table 1 presents final diagnoses after exploration.

The characteristics of the two groups are presented in Table 2. The mean ages of patients in Groups 1

Table 1. Final diagnoses after scrotal exploration

Diagnosis	Patients (n=97)
Testicular torsion	72 (74.2%)
Other causes of acute scrotum	
– Torsion of testicular appendage	13
– Epididymo-orchitis	8
– Testicular trauma	2
– Henoch-Schönlein purpura	2
	25 (25.8%)

Table 2. Characteristics of both groups

	Group 1 (n=72)	Group 2 (n=25)	p
Age (yr)	17.9 \pm 4.5	16.6 \pm 7.3	0.707
Location			0.02
Right	30 (41.7%)	11 (44%)	
Left	42 (58.3%)	14 (56%)	
Duration of pain (hr)			0.003
≤ 6	32 (44.4%)	2 (8%)	
6-12	8 (11.1%)	2 (8%)	
12-24	12 (16.7%)	5 (20%)	
>24	20 (27.8%)	16 (64%)	

and 2 were comparable (17.9 ± 4.5 and 16.6 ± 7.3 years old, respectively, $p = 0.707$). In Group 1, the left testicle was affected more often than the right one (58.3% vs. 41.7%). In fact, the left testicle was more often affected in both groups. In terms of pain duration, there was a significant difference between the groups ($p = 0.003$, Table 2). In Group 1, 32 cases (44.4%) presented to the hospital less than 6 hours after pain onset, while more than half (64%) of the cases in Group 2 presented more than 24 hours after pain onset.

The clinical features and physical examination findings are presented in Table 3. Fever and pyuria appeared more frequently in Group 2 than in Group 1, and the results reached statistical significance ($p < 0.05$). Patients with TT had more testicular tenderness than those in Group 2 ($p < 0.001$). The prevalences of nausea/vomiting, scrotal erythema and swelling were not significantly different between the

groups. Patients in Group 2 had a higher WBC count than those in Group 1, but this was not statistically significant.

Scrotal exploration was performed in all patients (100%). Testis viability was found in 43 of 72 patients in Group 1 during the operation. The detorsion and fixation of the testes was performed. The other 29 patients received orchiectomy for non-viable testes and orchiopexy for contralateral testis to prevent further TT. The salvage rate was 59.7% in Group 1 (Table 4). We performed manual detorsion before scrotal exploration and fixation in only one case. CDUS findings are presented in Table 5, and 71 of 72 TT cases (98.6%) were correctly identified as torsion via CDUS.

DISCUSSION

For young people, the most common causes of acute scrotum are TT, EO and TTA [2, 3, 4, 7]. TT is the cause of 25-35% of acute pediatric scrotal disease and is found in 0.025% of males under 25 years of age [8]. In our study, the prevalences of TT, TTA and EO were found to be 74.2%, 13.4% and 8.2%, respectively. This result is compatible not only with clinical studies [6-10] in which only scrotal exploration was evaluated, but also with clinical studies [11-15] in which surgical and medical treatments were evaluated in terms of three clinical entities. The most common reason for acute scrotum was found to be TT in five of the studies [6, 7, 9, 12, 15], TTA in three of studies [8, 11, 13] and EO in two of studies [10, 14]. Interestingly, some studies have shown strangulated inguinal hernia to be the most common clinical condition [16]. In our study, TT was found to be the most common cause of acute scrotum.

Ideally, there should be a distinction between TT and other causes of acute scrotum not requiring surgery, though this is sometimes impossible in practice [17]. Current studies in this topic are focused on differential diagnosis by combining physical examination and CDUS [17-24]. These studies have been able to distinguish TT from other acute scrotal pathologies and reduce the negative exploration rate. Clinical findings such as a pain duration < 24 h, nausea/vomiting, a high position of the testis and an abnormal cremasteric reflex were found to be predictive of TT [18, 19]. In the current study, only two patients actually required surgical intervention due to testicular trauma and underwent orchiectomy in consequence of testicular rupture. We did not find a statistically significant difference between the two groups in terms of scrotal erythema/swelling, nausea/vomiting and other clinical presentations. However, testicular tenderness was found to be higher

Table 3. Clinical findings and laboratory data both of two patient groups

	Group 1 (n=72)	Group 2 (n=25)	p
Clinical findings			
Fever	1 (1.4%)	8 (32.0%)	<0.001
Scrotal erythema/swelling	19 (26.4%)	19 (76 %)	0.52
Testicular tenderness	63 (87.5%)	12 (48.0%)	<0.001
Nausea/vomiting	11 (15.3%)	3 (12.0%)	0.487
Laboratory data			
WBC counts (μ L)	10.590 \pm 3.173	11.396 \pm 3.387	0.455
Pyuria	8 (11.1%)	7 (28%)	0.044

WBC – White blood cell

Table 4. Treatment types and salvage rate of patients with testicular torsion

Treatment options	TT(n)
Detorsion and fixation	43
Orchiectomy	29
Total	72
Salvage rate	59.7%

TT – testicular torsion

Table 5. Results of color Doppler ultrasonography for both groups

	Group 1 (n=72)	Group 2 (n=25)	p
CDUS			
Absent/decreased flow	71 (98.6%)	9 (36%)	<0.001
Increased/normal flow	1 (1.4%)	16 (64%)	

CDUS – color Doppler ultrasonography

in Group 1, and pyuria and fever were higher in Group 2, both to a statistically significant degree. These differences regarding pyuria and fever may be related to urinary system infections, which usually accompany EO [20].

Over the past 20 years, CDUS has frequently been used to determine the presence and extent of TT. This examination is helpful in determining when surgical exploration of the scrotum is unnecessary, and thus reduces the unnecessary exploration rate [21]. Nevertheless, user-based discrepancies may occur, so the medical history of the patient and the results of a physical exam should be compared with the CDUS findings [22]. In the diagnosis of TT, CDUS is reported to have a 69.2-100% sensitivity ratio and a 87-100% specificity ratio [23, 24]. In our study, a false negative result was achieved in the diagnosis of TT in only one patient, and CDUS sensitivity was found to be 98.6%. It is known that CDUS complicates the diagnosis of AIT and EO cases and causes the over-diagnosis of EO [20]. Although it is reported that CDUS does not deviate in cases of HSP, which is a nonsurgical cause of acute scrotum, asymmetrically reduced blood flow and the absence of blood flow in CDUS cannot be clinically differentiated from TT due to scrotal hyperemia and edema [25]. Therefore, we performed scrotal exploration and bilateral testicular fixation in these cases. Although scrotal trauma is usually taken care of with minimal intervention, when the testis is ruptured traumatically, this is a signal that immediate surgical exploration is necessary [21]. We performed orchiectomy in two trauma cases due to hematoma and traumatic rupture.

The success rate of preserving the testicle in TT greatly depends on early presentation to the hospi-

tal. Cimador et al. [25] reported that testicular infarction initiates after the second hour of ischemia, complete necrosis occurs in 6 hours and the irreversible loss of the testicle occurs in 24 hours. Also, it has been reported that the viability of the testes is very common in patients who present to the hospital after more than 10 hours, and that this requires orchiectomy in almost all cases. In these studies, testis preservation rates vary between 37 and 88% [9, 10, 13, 14, 15]. In the present study, we observed that the TT group presented significantly earlier (55.5% <12 h) than Group 2 ($p = 0.003$). In accordance with that, the rate of preserving the testicle was found to be 59.7% (43/72) in Group 1. This result suggests that the sudden onset of pain in relation to TT alerts patients to seek medical care earlier.

In our study, non-TT acute scrotal pathologies are used for the comparison group. The small sample size in Group 2 and trauma cases leading to a non-homogeneous distribution in this group can be counted as study restrictions.

CONCLUSIONS

In order to avoid the loss of the testicle and unnecessary surgical interventions, it is important to distinguish TT from other acute scrotal pathologies. Thus, CDUS, which presents more specific findings regarding TT, and clinical findings such as testicular tenderness, fever and pyuria may be helpful in performing differential diagnosis. Again, it should be remembered that TT causes earlier hospital admission due to the sudden onset of pain.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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