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Boaz Karmazyn
Ran Steinberg
Liora Kornreich
Enrique Freud
Sylvia Grozovski
Michael Schwarz
Nitza Ziv
Pinchas Livne

Clinical and sonographic criteria of acute scrotum in children: a retrospective study of 172 boys

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B. Karmazyn · L. Kornreich
S. Grozovski · M. Schwarz · N. Ziv
Department of Pediatric Radiology,
Schneider Children's Medical Center
of Israel, Petah-Tiqva,
Sackler Faculty of Medicine,
Tel Aviv University, Tel Aviv, Israel

R. Steinberg · E. Freud
Department of Pediatric Surgery,
Schneider Children's Medical Center
of Israel, Petah-Tiqva,
Sackler Faculty of Medicine, Tel Aviv
University, Tel Aviv, Israel

P. Livne
Department of Urology,
Rabin Medical Center, Beilinson Campus,
Petah Tiqva, Sackler Faculty of Medicine,
Tel Aviv University, Tel Aviv, Israel

Present address: B. Karmazyn (✉)
Department of Pediatric Radiology,
Riley Hospital for Children,
702 Barnhill Drive, Room 1053,
Indianapolis, IN 46202, USA
E-mail: bkarmazy@iupui.edu
Tel.: +1-317-2748786
Fax: +1-317-2742920

Abstract ***Background***: Diagnosis of testicular torsion in children is challenging, as clinical presentation and findings may overlap with other diagnoses. ***Objective***: To define the clinical and ultrasound criteria that best predict testicular torsion. ***Materials and methods***: The records of children hospitalized for acute scrotum from 1997 to 2002 were reviewed. The clinical and ultrasound findings of children who had a final diagnosis of testicular torsion were compared with those of children who had other diagnoses (torsion of the testicular appendix, epididymitis, and epididymo-orchitis). ***Results***: Forty-one children had testicular torsion; 131 had other diagnoses. Stepwise regression analysis yielded three factors that were significantly associated with testicular torsion: duration of pain ≤ 6 h; absent or decreased cremasteric reflex; and diffuse testicular tenderness. When the children were scored by final diagnosis for the presence of these factors (0–3), none of the children with a score of 0 had testicular torsion, whereas 87% with a score of 3 did. The ultrasound finding of decreased or absent testicular flow had a sensitivity of 63% and a specificity of 99%. Eight of ten children with testicular torsion and normal or increased testicular flow had a coiled spermatic cord on ultrasound. ***Conclusion***: We suggest that all children with acute scrotal pain and a clinical score of 3 should undergo testicular exploration, and children with a lower probability of testicular torsion (score 1 or 2) should first undergo diagnostic ultrasound. Because the presence of testicular flow does not exclude torsion, the spermatic cord should be meticulously evaluated in all children with acute scrotum and normal or increased testicular blood flow.

Keywords Acute scrotal pain · Testicular torsion · Physical examination · Ultrasound · Duplex color · Doppler

Introduction

Testicular torsion usually presents as acute scrotal pain. Prompt surgery is required to save the testis [1]. However, the diagnosis of testicular torsion in children poses a challenge to pediatric surgeons, urologists and radiologists [1–5], because the clinical presentation and findings may overlap with epididymitis and torsion of the testicular appendix [1, 5]. Duplex US is the main imaging modality used for the evaluation of acute scrotum [2–11]. The most important finding is decreased or absent testicular blood flow [2–11]. Nevertheless, the presence of testicular flow does not definitely exclude testicular torsion [4]. Recent reports emphasize the crucial role of direct visualization of the spermatic cord [12, 13].

We describe our 5-year experience with state-of-the-art duplex US evaluation of acute scrotum in children. The aim of the study was to analyze the clinical and US findings in a large group of children in order to define simple criteria for the diagnosis of testicular torsion.

Materials and methods

Clinical examination

Computerized medical and surgical records at a tertiary care referral center were reviewed to identify patients with a diagnosis of testicular torsion, torsion of the testicular appendix, or epididymitis who were hospitalized between July 1997 and June 2002. IRB approval was not needed for retrospective studies in our institution. Children with acute scrotum who were discharged from the emergency room were not included in the study. Records were reviewed for the following: duration of symptoms before medical attention was sought, fever, presence of palpable nodule or visible blue dot at the upper pole of the scrotum, scrotal tenderness, edema or erythema, orientation and location of the testis, and cremasteric reflex. This reflex is elicited by stroking the superior and medial part of the thigh in a downward direction. The response is a contraction of the cremasteric muscle that pulls up the scrotum and testis on the side stroked.

Scrotal US examination

Scrotal US examinations were performed on 120 patients (70%) by four pediatric radiologists (BK, SG, MS, NZ) using a high-resolution device equipped with a digital broad-band linear 5–12-MHz transducer with the following characteristics: minimal pulse repetition frequency 1,250 Hz, wall filtration 50 Hz, Doppler gain 75% (ATL 3000, ATL 5000, or ATL SONOCT, Bothell, Wash., USA). The lowest velocity threshold without background artifacts was chosen. Patients were scanned in the supine position, and multiple longitudinal and transverse gray-scale images of the scrotal wall, testis, and epididymis were obtained. Color Doppler and point-spectral analyses of the testicular vessels were performed. Power Doppler was used when color Doppler failed to identify testicular blood flow. Both testicles were examined. In children with a decreased or absent testicular flow, which is highly suggestive of testicular torsion, the spermatic cord was not always evaluated. In all other cases, the spermatic cord was evaluated from the inguinal canal to the scrotal sac (Fig. 1).

All US reports were reviewed for scrotal wall edema, hydrocele, extratesticular nodule situated between the head of the epididymis and the upper pole of the testis, size of the epididymis and testis, testicular parenchymal architecture, testicular blood flow, and coiled or tortuous spermatic cord. The studies were reviewed for information that was not reported.

Testicular flow was compared to the contralateral testis and was considered normal when both peripheral and central testicular flow was identified and symmetric.

Coiled spermatic cord was defined as a spermatic cord in which a twist was identified in both longitudinal and transverse views. Tortuous spermatic cord was defined as a redundant spermatic cord that could be followed, with no evidence of interruption, from the inguinal canal to the scrotum.

Hydrocele with echogenic fluid, septations, or debris was considered complex hydrocele.

Statistical analysis

The patients were divided into two groups by diagnosis: testicular torsion (group 1), and acute torsion of the

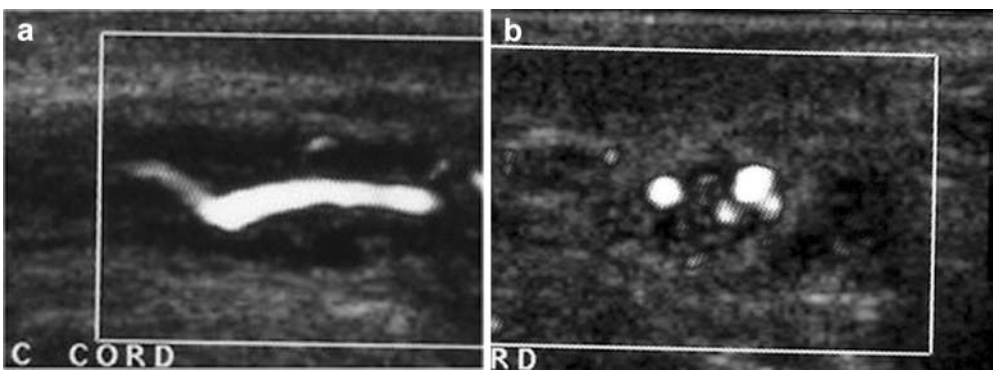

Fig. 1 Longitudinal and transverse color Doppler US images of a normal spermatic cord. **a** Longitudinal view demonstrates straight spermatic cord vessels in the distal inguinal canal. **b** Transverse view demonstrates dot-like appearance of the vessels with no evidence of spiraling

testicular appendix, epididymitis, or epididymo-orchitis (group 2). The groups were compared for clinical signs and symptoms and US findings using Pearson's χ^2-test or Fisher's exact test, as appropriate, for discrete variables. Continuous variables were compared with analysis of variance (ANOVA). Logistic regression was performed to determine which variables were most significantly associated with torsion of the testis. Statistical software (BMDP statistical software, Ind., USA) was used for all analyses.

Results

Study population

Review of the medical records yielded 177 children with the diagnosis of testicular torsion, torsion of the testicular appendix, or epididymitis during the study period. Five children in whom the diagnosis was not definite after testicular exploration were later excluded, for a final study population of 172. The final diagnosis was testicular torsion in 41 patients (all by scrotal exploration), torsion of the testicular appendix in 116 (59 by clinical and/or US examination, 57 by surgical exploration), and epididymitis or epididymo-orchitis in 15 (four by clinical and/or US examination, 11 by surgical exploration).

Age at presentation ranged from birth to 17.9 years (mean 9.3 years); there was only one case of perinatal testicular torsion. The mean (standard deviation) for children with testicular torsion (group 1) was 10.4 (5.5) years, and the mean for children with other diagnoses (group 2) was 9.0 (3.7) years ($P=0.07$). Peak age was 13–14 years in group 1 and 10–11 years in group 2.

Clinical examination

Duration of pain before seeking medical help, absence of scrotal erythema, diffuse tenderness, abnormal orientation of the testis, absence of cremasteric reflex, and absence of blue dot sign or tender nodule in the upper pole of the scrotum were all significantly associated with testicular torsion (Table 1).

Although pain duration of 24 h was found by logistic regression to be the best cut-point to predict testicular torsion, we used 6 h, which is considered the time to which ischemia of the testis in testicular torsion is still reversible. Twenty of 41 children with testicular torsion (48.8%) had pain for 6 h or less (including one of the 18 patients for whom pain "of a few hours" was recorded at admission) as compared to 22 of 131 children with other diagnoses (16.8%) ($P \le 0.001$).

In three children, torsion was noted in an undescended testis, and in two children the affected testis was retracted to an open inguinal canal.

On stepwise logistic regression analysis, pain for 6 h or less, decreased or absent cremasteric reflex, diffuse tenderness, and absence of erythema were significant independent predictors of testicular torsion (Table 2). On the basis of these results, we created a four-point clinical scale for the prediction of testicular torsion. The score ranged from 0 to 3, depending on the number of factors (one point for each), as follows: duration of pain ≤ 6 h, absence of cremasteric reflex, and diffuse tenderness (Table 3). We did not include absence of erythema in the scoring system, as it is more subjective than the other criteria and more difficult to rule out.

In our series, none of the children with a score of 0 had testicular torsion, whereas 85.7% of the children with a score of 3 did. Testicular torsion was diagnosed in

Table 1 Clinical findings in boys with testicular torsion and in boys with acute scrotum with no testicular torsion

	Testicular torsion	Other diagnoses[a]	Significance of difference (*P*-value)
Duration of pain ≤ 6 h[b]	20/41 (48.8)	22/131 (16.8)	< 0.001
Erythema	15/40 (37.5)	93/127 (73.2)	< 0.001
Tenderness			
Diffuse	38/41 (92.7)	88/131 (67.2)	
Upper pole	3/41 (7.3)	43/131 (32.8)	0.0048
Abnormal orientation	21/41 (52.5)	20/131 (15.3)	< 0.001
Decreased or absent cremasteric reflex	28/31 (90.3)	30/122 (24.6)	< 0.001
Blue dot or tender nodule	0/41 (0)	15/131 (11.5)	0.0232
Swelling	31/40 (77.5)	104/131 (79.4)	0.650
Side of testis			
Right	13/41 (31.7)	64/131 (48.9)	
Left	27/41 (65.9)	65/131 (49.6)	
Bilateral	1/41 (2.4)	2/131 (1.5)	0.154
Fever	2/41 (4.9)	21/130 (16.2)	0.0708
Recurrence	0/41 (0)	10/131 (7.6)	0.1198

Values are *n* (%)
[a]Torsion of testicular appendix or epididymitis or epididymo-orchitis
[b]Duration was "a few hours" ($n=18$); these were classified as "≤ 6 h"

Table 2 Clinical findings that best predict testicular torsion

Criteria	Odds ratio	Range
Pain ≤ 6 h	5.85	2.38–14.66
Absent or decreased cremasteric reflex	7.79	3.24–18.7
Diffuse tenderness	6.10	1.53–24.15

Table 3 Clinical scoring system

Type	Score[a]			
	0	1	2	3
Torsion of testicular appendix or epididymitis (%)	30/30 (100)	64/72 (88.9)	35/56 (62.5)	2/14 (14.3)
Testicular torsion (%)	0/30 (0)	8/72 (11.1)	21/56 (37.5)	12/14 (85.7)

Values are *n* (%)
[a]Findings of pain ≤ 6 h, absent or decreased cremasteric reflex and diffuse scrotal tenderness each added 1 point to the score

11.1% of children with a score of 1 and in 37.5% of those with a score of 2.

Receiver-operating characteristic (ROC) analysis of the clinical score yielded an area under the polygon of 82%.

Ultrasound (Figs. 2, 3, 4, 5 and 6)

US findings of absence of scrotal wall edema, swollen testis, non-homogeneous testicular echotexture, normal epididymis, and absence of extratesticular nodules were significantly associated with testicular torsion (Table 4).

Coiled spermatic cord was found in 18 children. Sixteen (88.8%) of the 18 had testicular torsion ($P \leq 0.001$) and only two children had other diagnoses ($P \leq 0.001$). In one of the latter children, US demonstrated a normal testis and epididymis and a coiled spermatic cord (Fig. 5). On testicular exploration, only the epididymis was swollen, and there was no evidence of spermatic cord torsion. The other child had bilateral mumps epididymo-orchitis. On US, the spermatic cord appeared very tortuous, so coiled spermatic cord could not be excluded (Fig. 6). It was confirmed on surgical exploration.

Normal or increased flow was noted on US in ten children with testicular torsion. The testicular arterial resistance index was measured in five children and ranged from 0.2 to 0.6 (mean 0.5). In two children, the spermatic cord appeared normal, but was found at surgery to be twisted 90° in one of them. In the other eight children, the spermatic cord appeared coiled on US (Figs. 2 and 3). At surgery, three children had a 180° twist and two had complete spermatic cord detorsion. In the other three children, all diagnosed within the first year of the study, testicular exploration was delayed by more than 12 h, and the spermatic cord was twisted from 540° to 1,440°. One child had normal testicular flow, with resolution of the scrotal pain and normal physical examination; the second had increased testicular flow with epididymal enlargement suggesting epididymitis (Fig. 4). In the third case, the testis appeared normal and testicular flow was normal. The diagnosis was extratesticular mass. However, on review, the mass appeared to represent a coiled spermatic cord.

Color Doppler sonography failed in only 1 of the 120 children on whom it was used. This was a newborn with congenital testicular torsion in whom we could not demonstrate flow in the normal contralateral testis.

On stepwise logistic regression analysis, decreased or absent testicular blood flow and presence of a coiled

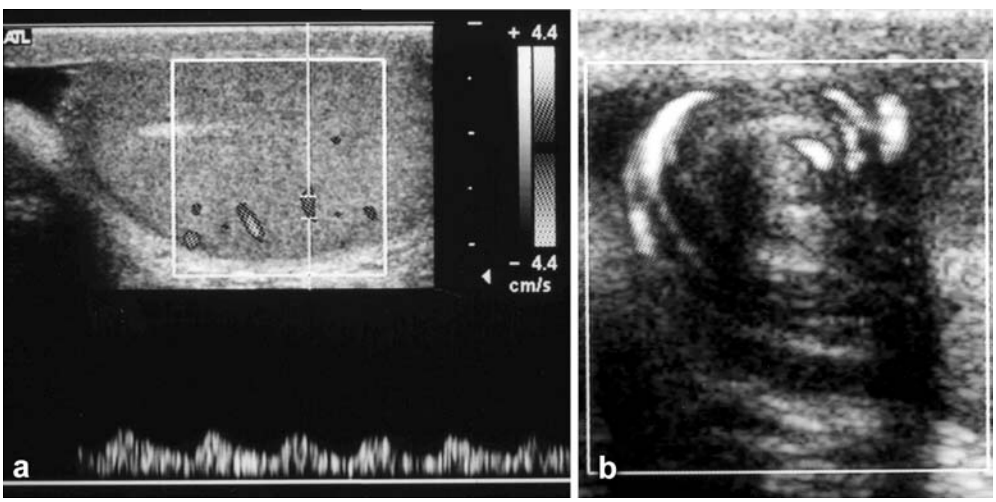

Fig. 2 Longitudinal color Doppler US images of the left scrotum in a 14.7-year-old boy with 180° testicular torsion. **a** Doppler signal of intratesticular vessels is normal. **b** Note coiled spermatic cord in the upper pole of the scrotum. Minimal hydrocele is also demonstrated

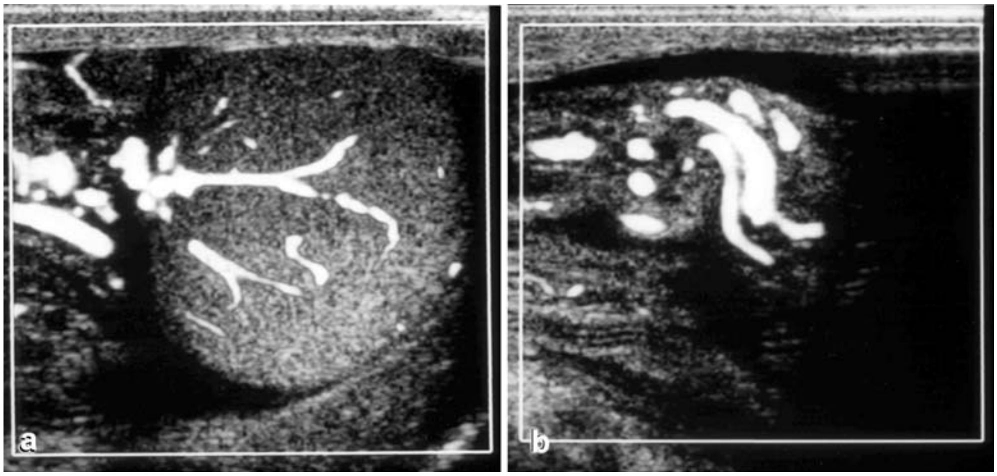

Fig. 3 Longitudinal color Doppler US images in a 5.4-year-old boy with 180° right testicular torsion. **a** Doppler signal of intratesticular vessels is increased. **b** Note coiled spermatic cord in the inguinal canal just at the entrance to the scrotum. The spermatic cord is swollen

spermatic cord were the best independent predictors of testicular torsion. ROC analysis yielded a 95% area under the polygon. When absent or decreased testicular blood flow was used as the only diagnostic criterion, US sensitivity was 63%, specificity 99%, and accuracy 91%. When both factors were used, sensitivity was 93%, specificity 97%, and accuracy 96%.

US was performed in 10 of the 14 children with a clinical score of 3. Eight of them had testicular torsion. US missed the diagnosis of testicular torsion in one boy.

Testicular exploration

One hundred nine children underwent testicular exploration; 57 had torsion of the testicular appendix, 11 had epididymitis, and 41 had testicular torsion. Sixty-two percent of testicular explorations did not reveal testicular torsion.

A spermatic cord torsion was confirmed in 33 of 41 children with testicular torsion (80%); it was complete in 21 (360 to 1440°) and partial in 12 (90° in 1 child and 180° in 11).

Complete spermatic cord detorsion was found in eight children (20%); the testis was necrotic ($n=3$), ischemic ($n=3$), or the spermatic cord and testis were swollen with no discoloration ($n=2$). (One of these children underwent preoperative US-guided manual reduction.)

In 12 of 41 children with testicular torsion, the testis had a normal color or returned to normal color after surgical detorsion. In 4 children, the testis was infarcted and orchiectomy was performed. In the other 25 children, the testis appeared ischemic. Twenty children were followed for at least 1 month after surgery. At the last visit, the testis was normal in 12 children and atrophic in 8.

Discussion

Rapid, noninvasive exclusion of testicular torsion as the cause of acute scrotal pain is a challenge for clinicians and radiologists [1]. The rate of successful treatment of testicular torsion correlates inversely with its duration, and any delay in diagnosis increases the chance of

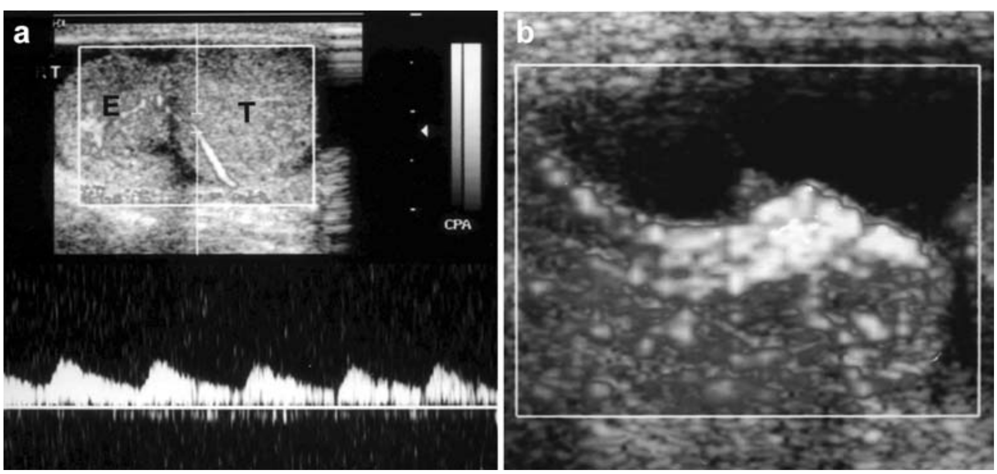

Fig. 4 Longitudinal color Doppler US images of the left scrotum in a 9.4-year-old child with testicular torsion. Findings led to erroneous diagnosis of epididymo-orchitis. **a** Color and spectral Doppler US demonstrate increased Doppler signals in epididymal and testicular vessels. There is a normal pulsed flow pattern in the intratesticular artery, with a resistance index of 0.6. The epididymis (*E*) is markedly enlarged. *T* testis. **b** Note coiled spermatic cord in the upper pole of the scrotum. There is a small hydrocele

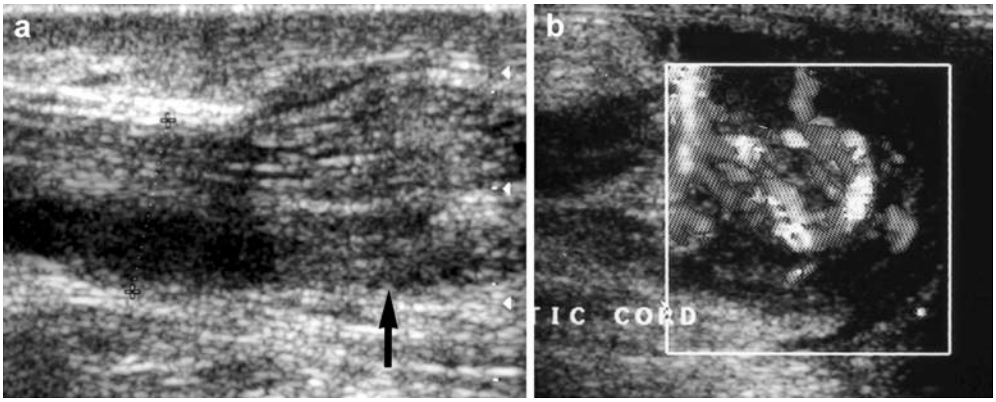

Fig. 5 Longitudinal color Doppler images of the left spermatic cord in a 12.9-year-old boy in whom epididymal edema was found on testicular exploration. **a** US view of the inguinal canal demonstrates focal thickening distally (*arrow*). **b** Color Doppler image where the cord is thickened demonstrates coiled appearance of the vessels

infarction [1]. In recent years, duplex US has served as the imaging modality of choice for the evaluation of acute scrotum in children at low risk for testicular torsion [2–13]. The purpose of our study was to assess both clinical and state-of-the-art sonographic evaluation of acute scrotum to determine simple criteria for the need for testicular exploration. Therefore, our sample included only children with acute scrotum who were admitted to the hospital for testicular exploration or observation for possible testicular torsion.

Testicular torsion typically presents as an acute excruciating scrotal pain of short duration before the patient arrives at the emergency room, and physical examination typically reveals diffuse tenderness, abnormal position of the testis, and absence of the cremasteric reflex [1]. All these findings were highly associated with testicular torsion in our study. Shorter duration of pain is the only historical feature reported to be statistically significantly associated with testicular torsion [5, 14]. We found that the best cut-point was 24 h or less, in agreement with the study of Knight and Vassay [14]. However, we used 6 h because that is the interval within which the ischemia of the testis may still be reversible.

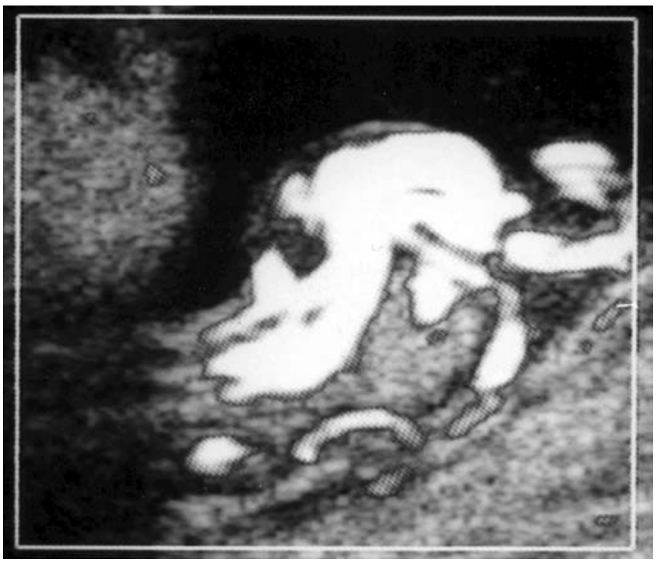

Fig. 6 Longitudinal view of the right testis in a 7.8-year-old child with bilateral mumps epididymo-orchitis demonstrates tortuous spermatic cord in the upper pole of the scrotum

The most sensitive and specific sign of testicular torsion on physical examination is an absent or decreased cremasteric reflex [1, 5]. Rabinowitz [15] and Kadish and Bolte [5] found that no patients with a normal cremasteric reflex had testicular torsion. In our study, decreased or absent cremasteric reflex was also the best clinical predictor of testicular torsion (odds ratio = 7.79), noted in 90% of children with testicular torsion compared to 25% of those in children with torsion of the testicular appendix or epididymo-orchitis ($P \leq 0.001$).

Three of the children with testicular torsion had undescended testis, and in two children the testis retracted to an open inguinal canal. Only few such cases have been reported [16–18]. A tender lump in the inguinal canal may be misinterpreted as incarcerated inguinal hernia, but absence of the testis in the scrotal sac should lead to the diagnosis. In these cases, duplex US is not necessary, and the child should be operated on without delay.

Because most children with acute scrotum do not have testicular torsion, and the clinical signs of testicular torsion overlap with torsion of the testicular appendix and epididymo-orchitics, clinical evaluation of acute scrotum is often imprecise, and an aggressive policy is implemented. However, this has been associated with negative findings of testicular torsion at surgery in 70–88% of cases [1, 19, 20]. In our study, 62% of the testicular explorations did not reveal testicular torsion. This rate is biased by our inclusion in the study of only hospitalized children with a high suspicion of testicular torsion.

Most researchers agree that if the clinical history and physical examinations are highly suspicious for torsion, immediate testicular exploration should be performed [1, 5, 19, 20]. In children with a low risk of testicular

Table 4 Results of duplex US evaluation

	Testicular torsion	Other diagnoses[a]	Significance of difference (*P*-value)
Scrotal wall edema	3/27 (11.1)	53/86 (61.6)	< 0.001
Abnormal testicular texture	19/28 (67.9)	8/92 (8.7)	< 0.001
Swollen testis	16/28 (57.1)	17/92 (18.5)	< 0.001
Enlarged epididymis	12/28 (42.9)	71/92 (77.2)	< 0.001
Extratesticular nodule	0/29 (0)	34/92 (37)	< 0.001
Coiled spermatic cord	16/28 (57.1)	2/92 (4.4)	< 0.001
Hydrocele			
Simple	18/28 (67.9)	62/92 (67.4)	0.3477
Complex	0/28 (0)	6/92 (6.5)	
Blood flow in testis			
Normal	5/27 (18.5)	17/92 (18.5)	
Increased	5/27 (18.5)	74/92 (80.4)	< 0.001
Decreased or absent	17/27 (63)	1/92 (1.1)	

Values are *n* (%)
[a]Torsion of testicular appendix, or epididymitis, or epididymo-orchitis

torsion, US should be used to make the diagnosis. To help the clinician determine the risk of testicular torsion, we used a stepwise logistic regression analysis to identify predictive criteria: duration of pain of 6 h or less, decreased or absent cremasteric reflex; and diffuse testicular tenderness. We then assigned each child a score of 0 to 3, depending on the number of criteria present. Fourteen children were found to have a score of 3, of whom 12 (85.7%) had surgically proven testicular torsion. Accordingly, none of the 30 children with a clinical score of 0 had testicular torsion. US missed the diagnosis of testicular torsion in only one child with a score of 3. Indeed, in these cases, the use of US can delay the scrotal exploration and thereby increase the risk of testicular infarction. Therefore, we recommend that all children in whom all three criteria are present on clinical examination be referred for prompt testicular exploration. Most children with a clinical score of 0 can be released from the emergency room after short observation, with instructions to return immediately if the scrotal pain worsens or recurs. The majority of our sample (74%) had a clinical score of 1 or 2, with corresponding rates of 11.1 and 37.5% of testicular torsion. Ideally, these children should undergo US examination as soon as possible. In some institutions, including ours, the staff radiologist is on call during night shifts. In these instances, the clinician should weigh the risk of testicular torsion against the risk of delaying surgery.

On stepwise logistic regression analysis, the US findings that best predicted testicular torsion were decreased or absent testicular flow and a coiled spermatic cord. Others have reported that the most important criterion for diagnosis of testicular torsion is decreased or absent testicular blood flow [2–11]. Nowadays, with improved US equipment, testicular blood flow can be depicted in almost all normal children [21, 22]. In our study, the only US failure occurred in an infant in whom US could not detect testicular flow in the contralateral (normal) testis. The finding of absent or decreased testicular blood flow on duplex US in our study had a high specificity of 99% but a sensitivity of only 63%, which is considerably lower than the 82–89% reported in other studies [2–11]. This discrepancy is probably a result of our inclusion of children with low clinical suspicion for testicular torsion who were hospitalized for observation, some with partial spontaneous testicular detorsion. Inclusion of children with torsion–detorsion in the study of Baud et al. [12] yielded comparable results: in only 14 of their 26 children (54%) could a reliable diagnosis of testicular torsion be made on the basis of the testicular blood flow evaluation. Experimental studies have shown that spermatic cord torsion of less than 360° may not compromise testicular flow [23–25]. In partial or complete spontaneous detorsion, testicular blood flow may be normal or even increased.

Some researchers claim that resistance index evaluation has a place in the work-up of children with acute scrotum [22, 26], as a low resistance index might be a sign of epididymo-orchitis [26]. This was not substantiated in our study, in which five children with complete or partial spontaneous testicular detorsion had a low resistance index (mean 0.5). With the restoration of blood flow in complete or partial spontaneous detorsion, arterial impedance may decrease compared to the contralateral testis, as the capillaries dilate in response to ischemia.

Two studies reported that direct visualization of the spermatic cord is reliable for the diagnosis of testicular torsion [12, 13]. In our study, the presence of a coiled spermatic cord had a sensitivity of 57% and specificity of 98%. The low sensitivity may have been the result of our inclusion of all children, even those with decreased or absent testicular flow, in whom the spermatic cord was not routinely evaluated. High-resolution US should

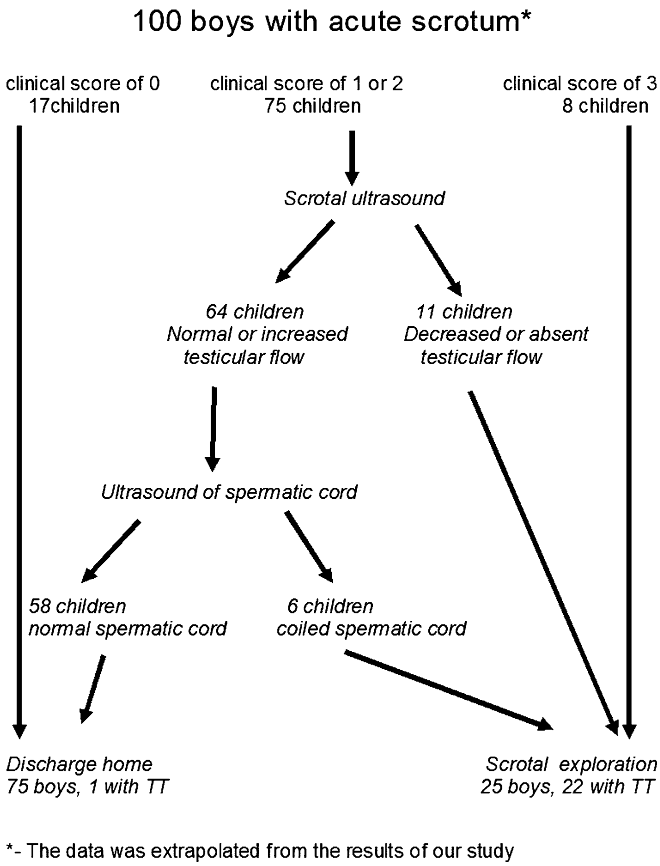

Fig. 7 Algorithm of clinical and sonographic diagnosis of testicular torsion in 100 boys with acute scrotum (*TT* testicular torsion)

follow the course of the spermatic cord from the inguinal canal to the scrotal sac. In the studies of Baud et al. [12] and Arce et al. [13], a coiled spermatic cord was the only sign of testicular torsion in children with testicular flow. Our study supports the added value of this finding, which was the only sonographic sign of testicular torsion in eight of the ten affected children with normal or increased testicular blood flow and coiled spermatic cord. Because there are several case reports of a missed diagnosis of testicular torsion when testicular blood flow was normal or increased [27–31], all children with acute scrotum and normal or increased testicular blood flow should undergo meticulous evaluation of the spermatic cord. However, clinicians should be aware that when there is testicular torsion–detorsion, the spermatic cord could appear normal. This was true in three children with torsion–detorsion in the study of Baud et al. [12]: two had normal testicular flow and one had increased testicular flow. In our study, one child with increased flow and one with normal flow had a normal-appearing spermatic cord on US. However, surgical exploration revealed complete spontaneous detorsion of the spermatic cord in the first and a twist of 90° in the second. It is also noteworthy that in two children with epididymitis, a tortuous spermatic cord could not be differentiated confidently from a coiled spermatic cord.

Our suggested diagnostic approach in boys with acute scrotum is to combine the clinical score with duplex US evaluation of testicular flow and spermatic cord. We illustrate an algorithm of the clinical and sonographic diagnosis of 100 boys with acute scrotum (Fig. 7). As illustrated, children with high clinical suspicion for testicular torsion should have prompt scrotal exploration without the expected delay from US examination. However, in most children the clinical evaluation is not specific enough, and it is in this group of children that US examination of the scrotum is most useful. This would reduce the rate of negative scrotal exploration to 12%. There would still be 1% of patients with missed testicular torsion because of equivocal findings on clinical evaluation (score 1 or 2) and negative duplex US study.

An enlarged epididymis in children with testicular torsion may lead to a misdiagnosis of epididymitis, especially in cases of partial or intermittent torsion and normal or increased testicular blood flow [28, 29]. In our study, a swollen epididymis was noted in 43% of the children with testicular torsion compared to 77% of the children with epididymitis and torsion of the testicular appendix. One child had testicular torsion, enlarged epididymitis, and increased testicular flow. He was our first case of testicular torsion with increased testicular flow, and therefore, in spite of an apparent spermatic cord twist, our initial diagnosis was epididymitis.

In conclusion, the diagnosis of testicular torsion is challenging, as most cases of acute scrotum are a result of other causes, and there is an overlap of clinical presentations and findings. A clinical and US approach is suggested for diagnosis. Ultrasound is a highly sensitive and specific imaging modality for the diagnosis of testicular torsion when performed by a skilled radiologist. It should be used in all children at low risk for testicular torsion. Normal and even increased testicular flow does not exclude testicular torsion. Therefore, the spermatic cord should be evaluated in every child with acute scrotum and normal or increased testicular blood flow. Our study was retrospective; further prospective studies would be needed to support the results.

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