

## Validation of the Testicular Workup for Ischemia and Suspected Torsion (TWIST) Score in the Diagnosis of Testicular Torsion in Children With Acute Scrotum

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**Objective:** To validate the Testicular Workup for Ischemia and Suspected Torsion (TWIST) score for the evaluation of children presenting with acute scrotum. **Methods:** This prospective study calculated TWIST score in patients of acute scrotum admitted to a pediatric surgery unit. The scoring system consisted of testicular swelling (2 points), hard testicle (2), absent cremasteric reflex (1), nausea/vomiting (1) and high-riding testis (1). All the patients were examined by a pediatric surgeon. **Results:** Among 96 children with acute scrotum, 68 (70.8%) patients had testicular torsion. In the testicular torsion group, the mean (SD) TWIST score was 5.7 (1.2) and in no torsion group, it was 1.46 (0.67). In the testicular torsion group, the number of patients with low, intermediate, and high risk was 0, 13, and 55, respectively and in without testicular torsion these were 21, 7, and 0, respectively. **Conclusions:** TWIST score has high predictive value for testicular torsion, and can be used for clinical diagnosis of testicular torsion.

**Keywords:** Color doppler, Management, Orchidectomy, Spermatic cord torsion.

Testicular torsion is the most common pediatric urological emergency, affecting 3.8 per 100,000 males younger than 18 years annually [1]. Around 10-5% of these are children with acute scrotal disease [2], and results in a 42% orchietomy rate for boys undergoing testicular torsion surgery. Testicular salvage requires timely detection and treatment, and torsion should be excluded in all patients with acute scrotum. Doppler ultrasound (DUS) has been considered as the primary imaging method for the assessment of testicular torsion with high sensitivity and specificity [3]. However, for those with testicular torsion, the use of DUS can prolong the time in testicular ischemia and delay surgery. The availability of radiological imaging and the expertise of its operators and evaluators are also limited in many settings. Barbosa, *et al.* [4] developed a Testicular Workup for Ischemia and Suspected Torsion (TWIST) score based on clinical parameters [4]. Typically, there is a 4-8 hour window before permanent ischemic damage to testes occurs. Treatment delays may be associated with reduced fertility or may require orchietomy. The purpose of this study is to study the utility of the TWIST scoring system for testicular torsion in boys presenting to the emergency room (ER) with an acute scrotum.

### METHODS

This observational study was carried over a period of two

years (May, 2017 to April, 2019) in a tertiary referral centre. Institutional review board and ethical committee approval were obtained. Participants included were males aged 0 days to 18 years, presenting to ER with chief complaint of testicular pain and/or swelling. Patients were excluded if their pain was due to trauma, if symptoms were present for greater than one week, there was a history of testicular disease or surgery, and if a diagnosis of testicular torsion had already been confirmed or excluded.

The TWIST score is based on the sum (ranging from 0 to 7) of the following findings: testicular swelling (2 points), hard testicle (2 points), absent cremasteric reflex (1 point), nausea or vomiting (1 point), and high riding testicle (1 point) [4]. The risk stratifying scores for those at low risk for testicular torsion is 0 to 2 points, intermediate risk was 3 to 4 points, and high risk for testicular torsion is 5 to 7 points [4]. The primary conclusion was a diagnosis of testicular torsion by TWIST score, confirmed by surgical exploration as the final diagnosis. Testicular loss was defined as either surgical orchietomy or determination of significant atrophy at 6 months post-operative ultrasound. A more than 50% difference in volume compared with the contralateral testis or absence of blood flow on Doppler was considered to represent testicular loss [5].

The TWIST score was performed by a single pediatric

surgeon in all patients, and surgery was carried out by the same surgeon. The same sonologist did the DUS evaluation in all patients. Indication of surgery was impaired blood flow in DUS, and inability to rule out testicular torsion in the presence of intermediate TWIST score. All patients for whom surgery was indicated were immediately transferred to the operating room for scrotal exploration. All patients who underwent surgical exploration had confirmed diagnoses of testicular torsion.

**RESULTS**

A cohort of 96 males with acute scrotum was studied. The mean age of the patients in the study group was 10.1 (3.8) years (range 1 month-16 year). The TWIST score component and other clinical features are shown in **Table I**.

In the testicular torsion group, the mean TWIST score was 5.7 (1.2 ) (range 3-7), and in no torsion group, it was 1.46 (0.67 ) (range 0-4). In testicular torsion group, the number of patients with low, intermediate, and high risk was 0, 13, and 55, respectively, while the number of patients without testicular torsion was 21, 7, and 0 in low, intermediate, and high-risk groups, respectively (**Table II**). Doppler ultrasound was obtained in all study subjects, which diagnosed testicular torsion in 65 patients. Three patients had equivocal ultrasound, showing no definite torsion with a lack of vascular flow, and neither increased blood flow to the epididymis. These patients were surgically proven to have testicular torsion on exploration. Thus, 68 (70.8%) patients were found to have testicular torsion. The 6-month follow-up DUS showed 46 equal sized and normal blood flow testes on both sides, with a salvage rate of 67.6% (**Fig. 1**).

**Table I Clinical Features of Children With Acute Scrotum (N=96)**

Characteristic	Torsion (n=68)	Non torsion (n=28)
Testicular pain	65 (95.6)	26 (92.9)
Nausea and vomiting	65 (95.6)	26 (92.9)
Abdominal pain	21 (30.9)	9 (32.2)
Tenderness	29 (42.7)	7 (25.0)
Testicular swelling	27 (39.7)	7 (25.0)
High riding testes	55 (80.9)	0
Absent cremasteric reflex	65 (95.6)	0
Hard testicle	41 (60.3)	6 (21.4)
Erythema	16 (23.5)	1 (3.6)

All values in no. (%); \*P<0.01, #P<0.01, ‡P=0.02.

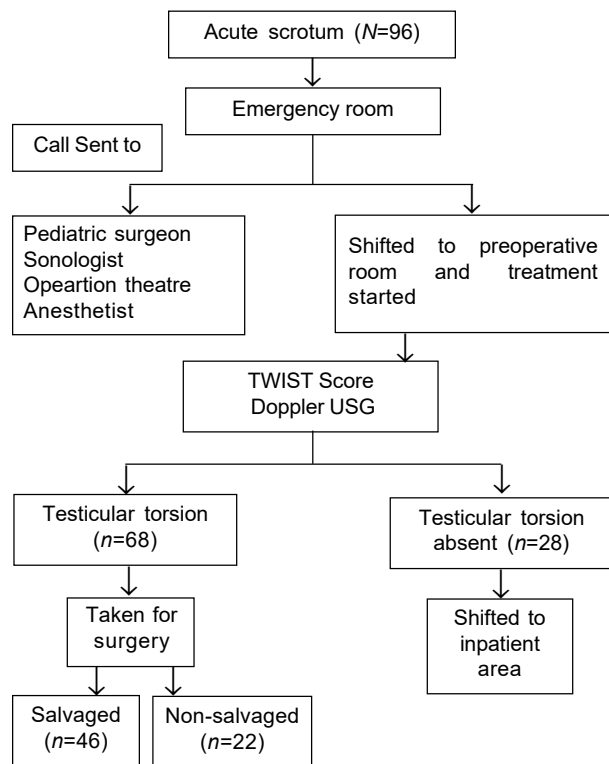
**Table II Testicular Workup for Ischemia and Suspected Torsion (TWIST) Score in Children With Acute Scrotum (N=96)**

Risk group	Twist score	Testicular torsion (n=68)	No testicular torsion (n=28)
Low	0-2	0	21 (75)
Intermediate	3-4	13 (19.2)	7 (25)
High	5-7	55 (80.8)	0

All values in no. (%).

**DISCUSSION**

This current study validates the TWIST score, which risk stratifies patients presenting with an acute scrotum for testicular torsion. There were no patients with torsion in the low-risk category (0-2 twist score), and 100% of patients in the high-risk category (5-7 twist score) had torsion. In this analysis, the TWIST score was found to be an excellent diagnostic tool in the diagnosis of testicular torsion, which is comparable to other studies [4,6,7]. In this study, all low-risk and high-risk patients (73.9 %) could have avoided the use of an ultrasound scan.



**Fig. 1** Flowchart of patients with acute scrotum enrolled in the study.

### WHAT THIS STUDY ADDS?

- TWIST score categorizes the patient with acute scrotum, and may be useful in situations where ultrasound facility is not available.

The original TWIST study included no patients with torsion (0/51) in the low-risk category and all 22 patients with torsion in the high-risk category [4]. Barbosa, *et al.* [4] found that only 20% of patients are in the intermediate-risk group and recommended that DUS is required only in this group. The testicular torsion scoring systems are now being tested in non-urologic medical providers [8] and reducing time delays, costs and reliance on DUS [9]. The TWIST score is intended to categorize patients requiring an ultrasound. This score is not designed to substitute doppler sonography [4]. Sheth, *et al.* [6] assessed TWIST score in non-pediatric surgery-trained emergency room caregivers diagnosing testicular torsion and found it equally effective. The absence of cremasteric reflex and high riding rotated testes are sufficiently reliable for the diagnosis of testicular torsion, as also reported by other authors [10,11].

In this analysis, the main limitations were the small number of cases observed. The TWIST score was evaluated by a single examiner. At least two examiners should have performed the physical examination, thus providing information on inter-observer variation.

In conclusion, this study has demonstrated that the TWIST score is reliable to identify testicular torsion in patients with acute scrotum. Since this study was conducted in one hospital, studies in multiple settings will support the internal validity of this method.

*Ethics clearance:* Institutional Ethics Committee; No. 17/ASH/ Study 03/2017, dated January 01, 2017.

*Contributors:* PP: developed the concept and designed the study, collected and analyzed the data, drafted the manuscript.

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