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Original Article

Effectiveness of Testicular Workup for Ischemia and Suspected Torsion Score in Diagnosis of Testicular Torsion in Children

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Abstract

Background: Testicular torsion is a surgical emergency mandating immediate intervention and is commonly seen in children presenting with acute scrotum. The likelihood of testicular salvage increases with early diagnosis and exploration. Color doppler is frequently recommended for diagnosis. Enhancing the probabilities of testicular viability can be achieved by minimizing the waiting time by the implementation of a judicial doppler requisition before proceeding with exploration. The testicular workup for ischemia and suspected torsion (TWIST) score has been developed and validated specifically for the assessment of this condition in the pediatric population.

Objective: To diagnose testicular torsion using TWIST score.

Methods: This study included a cohort of 108 pediatric patients with acute scrotum between September 2022 to August 2025. Everyone who participated underwent assessment and were classified into low-risk (1-2 points), intermediate-risk (3-4 points), or high-risk (5-7 points) categories based on their TWIST score. Color dopplerof testes were conducted in each case and data was documented. Statistical analysis was performed by SPSS version 27.

Results: Forty-two, (38.88%), 12 (11.11%), and 54 boys (50%) were categorized into low, intermediate, and high-risk categories respectively, based on the score they received. No torsion cases were present in the low-risk group. Two patients of intermediate risk group were diagnosed as torsion where 50 patients of the 54 high-risk children were diagnosed with torsion, and 1 had epididymo-orchitis and the other 3 were torsion of testicular appendages confirmed by doppler. The sensitivity, specificity, positive predictive value and negative predictive value of this study were 100%, 91.30%, 92.59 % and 100% respectively.

Conclusion: The TWIST score is a highly effective clinical tool utilized for the diagnosis of testicular torsion in pediatric patients. The utilization of this technique has the potential to decrease the incidence of acute scrotum-related morbidity, particularly in cases of torsion, by prompt detection and the prevention of unnecessary delays in performing doppler imaging.

Key words: acute scrotum, paediatric, testicular torsion, TWIST score

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Introduction:

Acute scrotum is an important cause that drives the parents to hospital emergencies. Exact incidence of acute scrotum in children is unknown. Common causes include testicular torsion, epididymo-orchitis, torsion of testicular appendages, idiopathic scrotal edema, abscess, trauma, strangulated inguinal hernia, epididymal cyst, testicular tumor [13].Among these, testicular torsion is more common in adolescents with slight neonatal peak and needs to be treated with priority [19].

Approximately 38% of boys with acute scrotum are diagnosed as testicular torsion. One per four thousand under 25 years aged male with acute scrotum is testicular torsion. But patients younger than 18 years has an incidence of 3.8/100000 males which is surgically confirmed. Orchidectomy is the most encountered surgical outcome with an incidence of 28% -76% [11,13,20].

Testicular torsion has bimodal distribution in pediatric patients. One peak is observed within the first year and another one around 12 years. This matches with the concept of extravaginal torsion in neonate and intravaginal torsion in older children [20].

Children with testicular torsion usually present with unilateral or bilateral testicular pain, lower abdominal or groin pain, associated with nausea and vomiting. Some patients complain of lower abdominal or inguinal pain that settles in the scrotum. Clinically cremasteric reflex is absent in testicular torsion. Torsion is unlikely if cremasteric reflex is present in the effected side[4,,14]. High riding, tender, swollen testis lies transversely and is larger than its counterpart in case of early torsion. But boys who present earlier and are diagnosed as epididymo-orchitis have normally lied testes with negligible size disparity [6].

Testicular salvage is possible if surgical exploration is done early. Patients reporting and intervention within 6 hours has 97.2 % chance for salvaging the testis. Delay in diagnosis and surgical intervention endangers testicular viability leading to testicular loss. The more the reporting and management time, the more chance to lose the testis. Beyond 24 hours of presentation there is an 18.1% chance that the testis will survive [12].

Color doppler ultrasound is a gold standard imaging modality for assessment of testicular vascularity with high sensitivity (96.8%), specificity (97.9%), positive predictive value (92.1%) and negative predictive value (99.1%). However, in case of non-compliant, fearsome anxious boys, color doppler study is difficult to perform[18].

Testicular workup for ischemia and suspected torsion (TWIST) score is developed to orient the physicians with an acceptable clinical tool for the evaluation of the patients of acute scrotum. This score helps to plan about the appropriateness of prescribing color doppler study, reduction of preventable delay after hospital access. This scoring system stratifies the patients into different risk groups- low, intermediate, and high. It is a valuable tool for clinical diagnosis and in centers with limited color doppler ultrasound availability. This score is based on history and clinical examination. Two (2) points are assigned if the testis is swollen, hard testis adds two (2) points. If the cremasteric reflex is absent, testis is high in position and there is history about presence of nausea and vomiting, 1 point is added for each clinical finding. Total points are 7. TWIST score of 2 or less indicates low- risk of torsion and color doppler study is easily avoidable in this risk group. A sum of 3 to 4 TWIST scores includes thepatients in intermediate- risk group and color doppler study is required to rule out torsion. High- risk group patients are those with score of 5 to 7 and surgical exploration is justifiable without color doppler study. The purpose of this scoring is not to replace the necessity of color doppler, rather it identifies the justified use of color doppler in appropriate situations. Employing this score is not an alternate for sonographic substantiation of this diagnosis for legitimate reasons[1]. This score predicts no torsion in low-risk group and torsion in high-risk group with more accuracy. As much as 75 percent of cases do not need color doppler for diagnosis in both risk groups. Particularly boys of high-risk group are more benefited with early diagnosis and intervention[16]

Management of intermediate risk group is difficult, as this scoring does not confirm the presence of torsion and several other studies have testicular torsion in this group. To avoid the marginal error of color doppler study, it is advisable to explore this group[2].

This study is conducted to evaluate the effectiveness of this scoring system in the paediatric surgery ward having 80 beds providing surgical care in more than4000 children and more than 17000 children as

outdoor basis per yearina tertiary medical college hospital.

Materials and methods:

Institutional ethical review committee authorized the authorized to conduct this cross-sectional analytical study in the paediatric surgery department that started in 2022. Consecutive sampling was done to include boys up to 12 years of age presenting with acute scrotum. Post traumatic or post operative cases or symptoms lasting over 7 days were excluded. All of them were examined by paediatric surgeons/ paediatric surgery residents. Swollen and hard testis added 2 points for each finding, high riding of testis, absent cremasteric reflex and positive history of nausea and vomiting added 1 point for each. On the other hand, if testis was in normal position, firm, not swollen, cremasteric reflex present in ipsilateral side with no history of nausea and vomiting, 0 point was assigned.Risk stratification was done by TWIST scoring as follows- Low risk group- 0 to 2 points, Intermediate risk group- 3 to 4 points and High-risk group- 5 to 7 points. Color doppler was considered as a gold standard and performed in all cases.Children of low and intermediate risk groups with normal or increased blood flow on color doppler were managed conservatively. Children with equivocal, reduced, or absent blood flow on color doppler were explored irrespective of risk group for surgical confirmation of torsion. Those who were in the high-risk group but color doppler study was normal, they were explored too for the confirmed exclusion of testicular torsion.Statistical analysis was done with SPSS, version 27.Sensitivity,specificity, PPV,& NPV were calculated as diagnostic tests. Chi-square test was done to determine the significance and P-value <0.05 was considered significant. Receiver operator curve (ROC) was constructed with SPSS and area under the curve (AUC), and its p-value prescribed its validity (if AUC ≥ 0.9 means excellent test, 0.8-0.89 means good test, 0.7-0.79 fair test otherwise unacceptable).

Results:

While conducting the study, 112 patients were enrolled. Among them, 3 patients were excluded due to late presentation and 1 patient due to traumatic acute scrotum. 108 remaining patients met the study criteria. Most common cause of acute scrotum was observed testicular torsion (51) followed by acute epididymo-orchitis.Mean, median and interquartile range (IQR) was 79.13,74 and 96 months respectively. Torsion was found bimodal distribution in age during the period

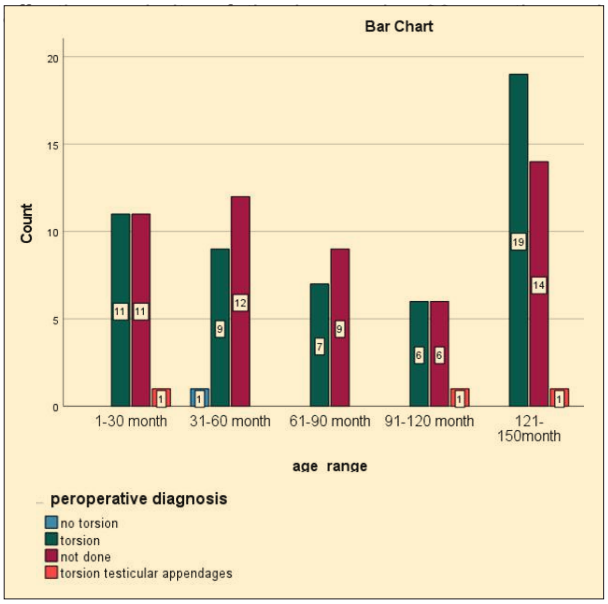

Figure 1: Age distribution of patients presenting with acute scrotum (n=108)

Among the 108 patients presented with acute scrotum, 54 cases were fallen in high-riskgroup. All of them were explored andper-operatively 3 patients were found to have torsion of testicular appendages, and 1 patient had no torsion. On the hand 52 patients of low-risk group had no torsion and 2 patients out of 12 intermediate risk group patients had torsion

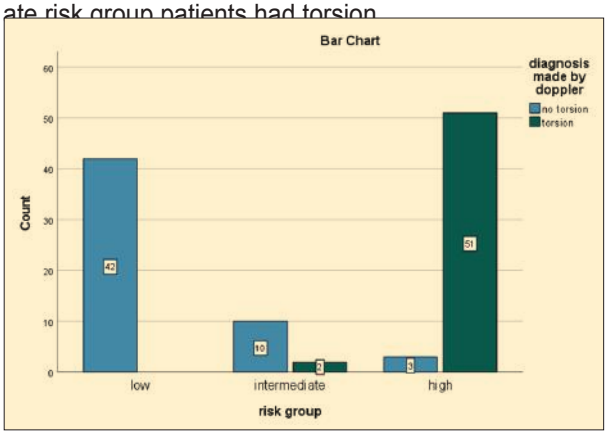

Figure 2: Distribution of testicular torsion cases in different risk groups

Different diagnostic tests performed to evaluate the scoring in diagnosing testicular torsion cases showed sensitivity, specificity, NPV, PPV and AUC 100%, 91.30%, 100%, 92.59% and 0.998 respectively, (table

AUC	Cut-off	Sensitivity	Specificity	PPV	NPV	Accuracy
0.988	>5	100%	91.30%	92.59%	100%	85.18%

AUC: area under the curve,
PPV: positive predictive value,
NPV: negative predictive value

Table 1: Diagnostic test performed of TWIST score in (figure 3).

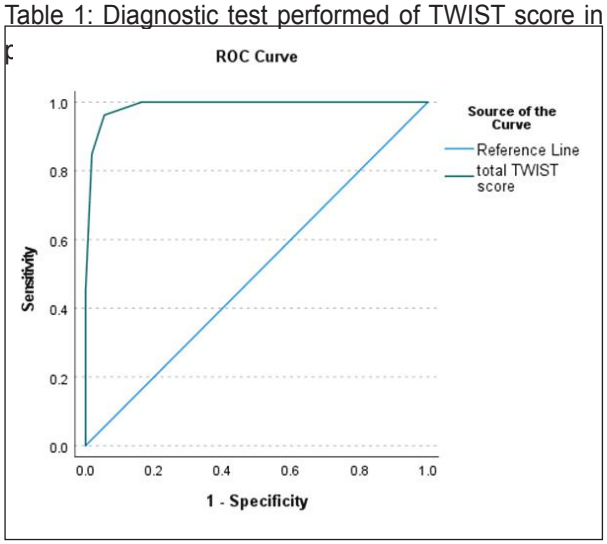

Figure 3: ROC curve analysis of TWIST score

The patients who were explored with clinical diagnosis of testicular torsion, in majority cases (43) orchidectomy had to be done. In 9 cases testes were spared.

Discussion:

Patients presenting with acute scrotum need to be assessed to exclude the torsion. Any dilemma or undue time wasting in the face of evaluation with color doppler increases the ischemia time. To reduce the testicular loss with prompt diagnosis, TWIST score was assessed in this study for early diagnosis of these torsion cases.

In this prospective study, the mean age of presentation with the diagnosis of acute scrotum was 6.5 years. A previous study done by Barbosa et al. [1] found mean age of presentation was 11.6 years and Roberts et al. [16] reported 9.24 years,which was more than this study. This was most likely due to other studies included the population from 1 month to 18 years. Wherever neonates were included and boys up to 12 years of age were included in this study. Though pediatric age group is up to 18 years in Bangladesh, patients up to 12 years of age are managed by the Pediatric Surgery Department of this institute. In this study, boys who were presented with history of trauma were excluded, as trauma may cause torsion as well as hematoma or testicular injury along with scrotal injury may mask the physical findings and create biasness.

TWIST score had been formulated keeping the controversy in mind of using color doppler in every case of acute scrotum. This clinical assessment tool was proposed as a screening for doing color doppler. In this study, the population was distributed as 48.14%, 11.11%, and 40.7 % between low, intermediate, and high-risk groups respectively. Previously published reports done by Manohar et al. [11]; Roberts et al. [16]also found similar results.

In this study, 54 patients were identified as high-risk for torsion, among them 51 patients were confirmed to have testicular torsion (p-value <0.001). This result contradicted with the original study done by Barbosa et al. [1] where all the patients sorted to high-risk group had testicular torsion. This disagreement might be due to inability to assess the clinical findings and score properly. Even this disagreement, this scoring was able to diagnose the torsion cases with significant P-value. These results agreed with several other reports done by Manohar et al. [11] ; Sheth et al. [17] that stated the high predicting value of torsion.

Sensitivity and NPV were 100% in this study, while specificity, PPV was 91.3% and 92.59% respectively. In ROC curve, the AUC was 0.988. These findings suggest that this score could rule out the presence of testicular torsion in low-risk group. On the other hand, patients who fell in high-risk group, it was likely that they had testicular torsion. There was less chance of missing the diagnosis and subsequent testicular loss. This means that TWIST score might be a useful clinical tool while evaluating children with acute scrotum, because there is an issue of testicular loss intermingled with accurate diagnosis and prompt intervention, where deemed necessary. Barbosa et al. [1] found in their study NPV, PPV was 100% in cutoff score 2 & 5, with 97% specificity and 54 % sensitivity, which was higher than this study. Another study done by Roberts et al. [16], found low sensitivity (60%), but high specificity (100%), PPV (100%), and NPV (91.22%) during evaluation of cut off value for high-risk patients. Equivalent results were observed in a different study done by Jabbar et al. [9]. During this study, all the patients were evaluated by assessors who were oriented to manage the pediatric surgical patients, where in the study conducted by Barbosa et al. [1], patients were evaluated by urologists.

This might be the cause of this disagreement in sensitivity, specificity, and PPV between these two studies. Both studies agreed regarding NPV, which suggests that this scoring might be helpful to exclude the possibility of presence of testicular torsion.

During the study period, the observed rate of testicular loss was 84.31% that needs to be addressed with care. This high rate might be due to failure of diagnosis in time, unavailability of a tool that can help with most acceptable diagnosis and undue wastage of time for confirming the diagnosis with color doppler and in most cases unavailability of the color doppler. This result was consistent with that of Manohar et al. [11], where they sacrificed 76% of affected testis. They also concluded that delayed presentation was the cause behind this outcome. This high orchidectomy rate was not consistent with the results reported by Pogorelić et al. [13], where they mentioned that this rate can be reduced up to 28% by early diagnosis. This disagreement between these two might be due to late reporting of the patients to parents, ignorance of symptoms, finally delayed intervention in the institution. In this study 88.88% of patients were in the low & high-risk group. Diagnostic uncertainty was present only in 11.12% patients. It suggests that this scoring could help in reduction of color doppler requisition in 88% cases while evaluating and managing the children with acute scrotum. This result agreed with the finding reported by Barbosa et al. [1]. This scoring was not evaluated to replace the color doppler, rather it was proposed for rational use of color doppler in selected cases and reduction of morbidity in pediatric testicular torsion.

Conclusion:

TWIST score evaluated in this study is an excellent tool to avoid testicular loss by prompt diagnosis and earlier intervention. Patients of each group will be benefited by implicating this score and appropriate management could be executed in time. It can be adopted as an institutional protocol for the management of torsion cases and by performing surgery without color doppler. Conversely, low group patients can be safely managed by the conservative approach without color doppler confirmation.

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