



# Standardized process to improve patient flow from the Emergency Room to the Operating Room for pediatric patients with testicular torsion

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## Keywords

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## Summary

### Background

Testicular torsion (TT) remains one of the most common urological emergencies. The length of time from onset of symptoms to detorsion and degree of spermatic cord twisting are usually the most important factors for testicular damage. Therefore early presentation, accurate diagnosis, and prompt treatment are important factors for optimizing the testicular salvage rate. While delay in seeking medical attention is a common cause of testicular loss in pediatric patients with testicular torsion, delays in diagnosis and treatment can be preventable causes of testicular loss.

### Objective

In this study, we aimed to develop a standardized process to improve the patient flow from the Emergency Room (ER) to Operating Room (OR) for TT patients in an academic children's hospital.

### Study design

Thirty consecutive pediatric patients with acute testicular torsion between November 2013 and July 2014 served as the control group. A scrotal pain checklist was implemented in July 2014, and 30 consecutive patients from July 2014 until April 2015 served as the study group. Perioperative parameters including times, ultrasound (US) findings, and surgical results were reviewed.

## Results

The mean ages of the control group and the study group were similar ( $12.3 \pm 4.9$  years and  $11.5 \pm 5$  years, respectively) ( $p = 0.575$ ). ER arrival to OR time, triage completion to OR time, and scrotal US to OR time were significantly decreased in the study group ( $p < 0.001$ ) (Table). Although triage time and ER arrival to scrotal US times were decreased in the study group, the differences were not significant ( $p = 0.071$ ,  $p = 0.112$ , respectively).

## Discussion

Utilizing scoring tools during the triage of patients with scrotal pain can help identify high-risk patients earlier and prevent unnecessary use of resources in an ER serving a large pediatric population. Limitations of this pilot study include the limited number of patients and the potential for the Hawthorne effect (staff awareness of the study). Additionally, we did not examine scrotal pain checklist scores for other acute scrotal diseases. This study focused on a quality improvement process for TT patients, in order to reduce ER to OR times.

## Conclusion

A standardized process with use of a scrotal pain checklist and prompt communication between the ER, Urology, and Radiology teams led to significantly reduced times from the ER to the OR. Standardized processes for pediatric patients with testicular torsion may help to improve testicular survival rates.

**Table** Patient demographics and time flow.

	Control group, mean $\pm$ SD (min–max)	Study group, mean $\pm$ SD (min–max)	* <i>p</i>
Age (years)	12.3 $\pm$ 4.9 (0.1–17.9)	11.5 $\pm$ 5 (0.1–18)	0.575
Triage time (h:min)	0:14 $\pm$ 0:12 (0:02–0:55)	0:09 $\pm$ 0:07 (0:03–0:29)	0.071
ER arrival to OR Time (h:min)	3:18 $\pm$ 1:16 (1:03–7:23)	2:05 $\pm$ 0:45 (0:55–3:26)	<b>&lt;0.001</b>
Triage completion to OR time (h:min)	3:03 $\pm$ 1:16 (0:55–7:18)	1:55 $\pm$ 0:43 (0:50–3:12)	<b>&lt;0.001</b>
ER arrival to Scrotal Doppler US Time (h:min)	0:52 $\pm$ 0:36 (0:11–2:44)	0:39 $\pm$ 0:20 (0:13–1:33)	0.112
Scrotal Doppler US to OR time (h:min)	2:26 $\pm$ 1:04 (0:36–5:54)	1:26 $\pm$ 0:39 (0:19–3:01)	<b>&lt;0.001</b>

ER = Emergency Room; OR = Operating Room; US = ultrasonography.

\*Student *t* test.

The bold *p* values are the statistically significant ones (<0.05).

## Introduction

Testicular torsion (TT) remains one of the most common urological emergencies with an incidence of 1 in 1,500 males under the age of 18 years [1,2]. Rates of testis loss have been reported as high as 42% following TT [2,3]. Future sub-fertility or infertility, and psychological trauma are common consequences of TT [4]. The length of time from onset of symptoms to detorsion and degree of spermatic cord twisting are usually the most important factors for testicular damage [5]. Therefore early presentation, accurate diagnosis, and prompt treatment are important factors for optimizing the testicular salvage rate [2,6].

While delay in seeking medical attention is a common cause of testicular loss in pediatric patients with testicular torsion, delays in diagnosis and treatment can be preventable causes of testicular loss. In this study, we aimed to develop a standardized process to improve the patient flow from the Emergency Room (ER) to Operating Room (OR) for TT patients in an academic children's hospital.

## Materials and methods

We met with ER, OR, and Radiology Department leaders to improve the flow of patients with acute testicular pain from ER arrival to the OR. After obtaining institutional review board (IRB) approval (Protocol H-33575), patient charts were reviewed by billing codes to identify patients who underwent surgical treatment for testicular torsion. While patients with acute testicular torsion initially presenting to the ER were included in this study, those presenting to outpatient clinics (pediatric urology or pediatric surgery clinics), perinatal testicular torsion patients or patients operated for other acute scrotal pathologies were excluded from the study. For baseline data, 30 consecutive pediatric patients with acute torsion between November 2013 and July 2014 served as the control group. Starting in July 2014, we implemented a scrotal pain checklist score with five criteria (Fig. 1) adapted from Shah et al. [1] for patients presenting with acute scrotal pain. Thirty consecutive acute TT patients from July 2014 until April 2015 served as the study group. If four or more criteria were positive or index of TT suspicion was high despite not meeting the four or more criteria, the urology team was notified prior to the ultrasound (US). Patient demographics, clinical notes, and perioperative parameters including times, US findings, and surgical results for each group were reviewed. For the purposes of this manuscript, we defined all testes that were not removed at the time of orchiectomy as "immediately salvaged."

Version 13.0 of the Statistical Package for Social Sciences for Windows software (SPSS, Inc., Chicago, IL) was used for statistical analysis. Continuous parameters were expressed as mean  $\pm$  SD with ranges and analyzed with the Student *t* test. Categorical variables were analyzed with the chi-square test, or where appropriate, Fisher's exact test. A *p* value  $<0.05$  was considered to be statistically significant.

### Scrotal pain checklist<sup>a</sup>

- Horizontal or inguinal testicular lie
- Nausea or vomiting
- Age between 11 and 21 years old
- Absent cremasteric reflex
- Scrotal edema

<sup>a</sup> Adapted from Shah, M.I., et al. [1]

**Figure 1** The five criteria monitored by Emergency Room physicians in the study group.

## Results

The final cohort included 28 patients in the control group, and 29 patients in the study group. Two patients in the control group and one in the study group had a history of an extended period of pain with presumed non-viability of the affected testicle, and hence their surgical intervention was purposely delayed to allow for elective scheduling of their surgeries. Hence, these patients were excluded from the study, as they had purposely-delayed ER to OR time values.

Patient demographics and the time flow are shown in the [Summary table](#). The age distribution of the patients was similar in each group ( $p = 0.575$ ). The ER arrival to OR time (Fig. 2), triage completion to OR time, and scrotal Doppler US to OR time were significantly decreased in the study group ( $p < 0.001$ ). Although triage times and ER arrival to scrotal Doppler US times were decreased in the study group, the differences were not statistically significant ( $p = 0.071$ ,  $p = 0.112$ , respectively).

Overall scrotal pain checklist scores in the study group ranged between 3 and 5. Detorsion patients had higher scores than orchiectomy patients in the study group ( $p = 0.003$ ). All testes associated with a score of 5 were salvaged (Fig. 3).

Orchiectomy rates were 58.6% ( $n = 17$ ) and 41.4% ( $n = 12$ ) in the control and study groups, respectively, and the overall orchiectomy rate was reduced 17.2% in the study group, but the difference was not statistically significant ( $p = 0.144$ ).

## Discussion

Testicular torsion is a true surgical emergency, and accurate diagnosis and prompt treatment needs to occur in a timely manner. In order to reduce misdiagnosis and delay in treatment, a standardized process may be helpful, with the

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