

# Pediatric Trauma-Induced Testicular Torsion: A Surgical Emergency

Haijun Zhong Yunli Bi

Department of Pediatric Urology, Children's Hospital of Fudan University, Shanghai, China

## Keywords

Children · Testicular torsion · Trauma

## Abstract

**Objective:** To evaluate the features of testicular torsion (TT) resulting from minor groin trauma and to raise the awareness of trauma-induced testicular torsion (TITT). **Methods:** This is a retrospective chart review of patients presenting with TT resulting from minor genital trauma that was performed from January 2010 to December 2018 at a single tertiary care institution. The demographic, clinical, and perioperative characteristics, as well as data on follow-up and complications, were analyzed. **Results:** Of the 155 patients treated for TT, 15 were included in this study. The average age of the patients was 10.3 years (range: 3.2–13.3 years). All patients experienced a direct scrotal trauma and subsequently presented with an ipsilateral scrotal or testicular pain secondary to the twisted testicle. Six patients were misdiagnosed as having scrotal inflammation or hematoma, and all were initially treated at local hospitals. The mean duration of symptoms before hospitalization was 138 h (range: 5–504 h). The mean degree of torsion was 390° (range: 180–720°). The testicular salvage rate, at 33%, was poor. No serious postoperative complications or recurrences of TT was observed. **Conclusions:** TITT is a rare entity and still has delayed diagnosis. This may subsequently lead to a low testicu-

lar salvage rate. Emergency surgeons, especially in local hospitals, should be aware of the possibility of TT following testicular trauma in pediatric patients. Improving the parents' awareness regarding TT is also important.

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## Introduction

Testicular torsion (TT) is a urological emergency that refers to the twisting of the spermatic cord and its contents. The annual incidence of TT is 3.8 cases per 100,000 males younger than 18 years of age [1]. Most studies have reported that the proportion of trauma-induced TT (TITT) represents 4–10% of the TT cases [2–4]. TITT may often be misdiagnosed as traumatic scrotal hematoma or inflammation, and physicians may easily miss the four to eight hour window of therapeutic salvage, resulting in significant ischemic damage that may require an orchidectomy. Most studies on TITT are in the form of case reports, and information on its treatment and outcomes is limited by the small number of cases. Furthermore, the testicular salvage rate for TITT varies across case reports. Therefore, we aimed to assess the features of TT resulting from minor groin trauma and to raise the awareness regarding this pediatric emergency. We have reported our clinical experience regarding the features,

**Table 1.** Characteristics, operative findings, and outcomes in patients with TITT

Case	Age, years	Side	Type of trauma	First-visit hospital	Initially presented symptoms	Duration of symptoms before hospitalization, h	Mis-diagnosed	Torsion degree, °	Outcome	Follow-up, months
1	13	Right	Exercising	Our hospital	Scrotal pain	5	No	360	Salvaged	120
2	12.2	Right	Fighting	Local hospital	Scrotal pain	168	Yes	180	Salvaged	86
3	13.3	Left	Kick	Local hospital	Scrotal pain	288	Yes	540	Orchidectomy	123
4	3.2	Left	Straddle	Our hospital	Testicular pain	10	No	360	Salvaged	107
5	3.7	Left	Kick	Local hospital	Scrotal pain	48	No	720	Orchidectomy	52
6	7.7	Right	Fighting	Our hospital	Scrotal pain	48	No	360	Orchidectomy	57
7	7.5	Left	Fighting	Local hospital	Scrotal pain	216	Yes	360	Orchidectomy	64
8	8.7	Left	Kick	Local hospital	Scrotal pain	504	Yes	360	Orchidectomy	77
9	12	Left	Kick	Local hospital	Scrotal pain	10	No	360	Salvaged	44
10	13.3	Right	Exercising	Our hospital	Testicular pain	168	No	540	Orchidectomy	39
11	12.7	Left	Fighting	Local hospital	Scrotal pain	29	No	360	Orchidectomy	32
12	11.8	Left	Bicycling	Local hospital	Scrotal pain	96	Yes	360	Orchidectomy	21
13	13.3	Left	Exercising	Our hospital	Scrotal pain	240	No	360	Salvaged	103
14	12.4	Right	Exercising	Our hospital	Scrotal pain	172	No	270	Orchidectomy	30
15	10.3	Left	Fighting	Local hospital	Scrotal pain	72	Yes	360	Orchidectomy	62

TITT, trauma-induced testicular torsion.

outcomes, and management of pediatric TITT; based on the literature reviewed, this may be the largest number of cases reported.

## Materials and Methods

Around 155 patients with TT were treated at our tertiary pediatric center, from January 2010 to December 2018. Of these, only 15 pediatric patients presenting with TT resulting from minor genital trauma were enrolled in this study and retrospectively analyzed after obtaining the Ethics Committee approval. The clinical data including the patient's age, medical history, scrotal trauma type, mean duration of symptoms before hospitalization, type of pain, external genital examination findings, emergency ultrasound manifestations, operative findings, complications, and follow-up information were collected. Depending upon the testicular blood flow after detorsion, either orchiopepy or orchidectomy was performed [5]; patients with contralateral testes routinely underwent an orchiopepy.

## Results

Fifteen pediatric patients (9.7%) with TITT were enrolled in this study (shown in Table 1). The average age at admission was 10.3 years (range: 3.2–13.3 years). All patients experienced a direct scrotal trauma prior to TT and presented with an ipsilateral scrotal or testicular pain due to a twisted testicle; in 10 cases, TITT occurred on the left

side, while in 5 cases, it occurred on the right side. The causes of trauma included a kick to the groin, fighting, bicycling, exercising, and straddling a slide in 4, 5, 1, 4, and 1 patient, respectively. All patients underwent an external genital examination at the emergency department or the outpatient clinic. One patient presented with nausea and vomiting, 1 with fever, and 1 with fever and abdominal pain; however, the remaining patients did not present with any of these symptoms. The misdiagnosis rate in local hospitals was as high as 66.7%, with 6 patients being misdiagnosed with scrotal inflammation or hematoma; all were initially treated with anti-inflammatory drugs. Among these patients, at initial visits, 5 did not undergo an emergency ultrasound, while 1 underwent an ultrasound examination but was not diagnosed with testicular torsion. The mean duration of symptoms before hospitalization was 138 h (range: 5–504 h); however, in 3 patients, the duration was of less than 24 h. Emergency color Doppler ultrasound revealed that all affected testes lacked blood flow signals; therefore, a surgical exploration was undertaken. The mean degree of torsion was 390° (range: 180–720°). The mean duration of TT prior to hospitalization was 86.6 h (range: 5–240 h) in 5 patients whose testes were successfully salvaged and 164.1 h (range: 29–504 h) in 10 patients whose testes were necrotic after torsion. The mean degrees of torsion in the 5 salvaged and 10 excised testes were 324° (range 180–360°) and 423° (range: 270–720°), respectively.

Patients were followed up for a mean of 67.8 months. The testicular salvage rate was 33.3% and no serious postoperative complications or incidence of testicular atrophy was observed.

## Discussion

The classical symptom of TT is a severe, unilateral scrotal and testicular pain having a sudden onset. Other presentations include scrotal and testicular swelling or erythema, testicular tenderness, absence of the cremasteric reflex, and nausea and vomiting caused by reflex stimulation of the celiac ganglion. Usually, TT can be diagnosed by an external genital examination and color Doppler ultrasound. However, these patients are often initially evaluated by non-urologists who know little about TT; therefore, the diagnosis is delayed or mistaken [5]. TITT may especially be misdiagnosed as acute scrotitis or epididymo-orchitis and traumatic scrotal hematoma [2]. In our study, 6 patients were misdiagnosed at local hospitals, resulting in a delayed operation, because no ultrasound was performed or no diagnosis was correctly made by ultrasound at the time of the initial visit; 5 of these subsequently underwent an orchiectomy. However, another 3 patients were diagnosed by ultrasound at local hospitals. An additional 5 patients underwent an orchiectomy because of their own or their parents' negligence, which delayed presentation and treatment. In 1 study, more than half of the parents delayed their children from receiving medical attention by more than 24 h although some parents were aware of their children's symptoms or history of recent external genital injuries [6]. Adolescent patients and their parents are generally unaware of both, TT unique to their age-group and the necessity of emergency medical attention for painful and painless testicular swelling [7–9].

The age distribution of TT is bimodal with peaks in the neonatal period and adolescence. Extravaginal torsion is predominant in neonates, while intravaginal torsion usually occurs around puberty [1]. However, in our study, most of the patients were adolescents with an average age of 10.3 years. The scrotum in these patients was likely to suffer a collision during activities and sports. The most important risk factor for TT is the bell clapper deformity; it refers to an abnormal anatomy in which the testis and the epididymis are abnormally fixed to the scrotum, thereby moving freely in the tunica vaginalis [2, 10]. The cremasteric muscle circles around the spermatic cord in a spiral fashion and exerts a rotational effect on the tes-

ticle while contracting. Therefore, a forceful contraction of this muscle plays an important role in the mechanism of TT [2, 11]. A sudden cremasteric muscle spasm, induced by even minor trauma such as a projectile, hit, direct kick, or straddle injury, can trigger intravaginal TT [2].

Testicular activity and the time of testicular ischemia are negatively correlated with each other. When the medical history or physical examination suggests TT, an emergency surgical exploration is indicated, which should not be delayed for imaging examinations [12]. It is commonly believed that TT is best treated within 6 h from the onset of symptoms [13]. Testicular salvage rates are 90–100% if TT is treated within 6 h of onset; rates decrease to 50% if the symptoms last for 6–12 h and are only up to 10% if surgical exploration is performed within 12–24 h [13–15]. Orchiectomy is performed more commonly in TITT cases [6]. The testicular salvage rate of TT is 58%, while that of TITT is 40% [1, 2]. In this study, the testicular salvage rate (33%) was poor because of the higher mean duration (138 h) of symptoms before hospitalization.

To improve the prognosis of patients with TT, timely diagnosis and operation are very important. However, even if TT is treated within 5 h, there is a risk of testicular atrophy after detorsion and orchiopexy [16]. One study reported that testicular atrophy occurred in 50% of the patients with TT who underwent a salvage surgery [17]. While the endocrine function of the testes appears to be normal, the semen quality is more frequently affected after TT [18–20].

The study's limitations include its retrospective design and the small number of TITT cases because of its low morbidity. In the future, a multicenter study will be more useful in improving awareness regarding TITT.

## Conclusion

TITT is a urological emergency in pediatric patients, which is often diagnosed late, leading to low testicular salvage rates. Emergency surgeons, especially in local hospitals, should be aware of the possibility of TT after scrotal trauma. The authors highlight that external genital and ultrasonic examinations are important for the early diagnosis and management of pediatric TITT. Furthermore, improving the parents' awareness about TT is also important to avoid a delay in presentation.

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## Statement of Ethics

This study was approved by the Ethics Committee of the Children's Hospital of Fudan University, and was performed in accordance with the principles laid down in the Declaration of Helsinki.

## Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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## Author Contributions

H. Zhong: project design, data acquisition and analysis, and manuscript writing. Y. Bi: project design, data analysis, and manuscript editing.