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## Transient testicular torsion: from early diagnosis to appropriate therapeutic intervention (a prospective clinical study)

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**Abstract:** Transient testicular torsion (TTT) occurs when the torsion of the spermatic cord is reversed automatically within few minutes, with subsequent restoration of the blood flow to the suffering testis. The main clinical manifestation is acute scrotal pain, which resolves within a short period of time, usually few minutes. In 25% of patients suffer from nausea and vomiting, besides the scrotal discomfort. Episodes of torsion can be repeated 1–30 times, leading progressively to development of ischemic trauma of the testis, while in 30–61% of all cases they constitute a precursor of testicular torsion.

From January, 2016 to December, 2016, 11 patients in total were admitted to the Emergency Department due to acute scrotal pain that lasted a few minutes (1–5 minutes in most), which had already elapsed at the time of their admission, accompanied with nausea in all patients and vomiting in 5 of them. No swelling or rubor of the scrotum was revealed during physical examination, while in 9 patients it was observed that the suffering testis had transverse orientation. Ultrasonography was negative for pseudotumor or Whirlpool sign, while transverse orientation of the testis was confirmed in 9 patients. All the patients underwent surgical investigation of the suffering hemiscrotum, while Bell Clapper Deformity was found

in 9 patients. Fixation of the suffering testis to the mesoscrotal diaphragm with 3 separate sutures by using non-absorbable suture followed. By the same surgical approach, the contralateral hemiscrotum was also investigated. Bilateral high adhesion of the tunica vaginalis was found in 8 out of 9 patients, in whom preventive unilateral orchidopexy was performed. All the patients are followed-up on a 6-month basis, without report of a similar, transient episode of acute scrotal pain.

TTT should always be included in differential diagnosis in cases of acute scrotal pain in the past, with transverse orientation of the suffering testis. Prompt diagnosis and early treatment of the subject anatomic deformity (Bell Clapper Deformity) prevents the ischemic consequences on testicular parenchyma due to either recurrent episode of TTT or as a consequence of intravaginal testicular torsion.

**Key words:** transient testicular torsion (TTT), Bell Clapper Deformity, Whirlpool sign, pseudotumor sign, boy.

## Introduction

Incidence of testicular torsion (TT) in boys of school age and adolescence is estimated at 4.5 new cases/100,000 patients [1–3]. Prompt diagnosis and early therapeutic intervention are the key points not only for the survival of the testis, but also for the maintenance of reproductive capacity. After comprehensive and systematic research of the current relevant literature, dozens of studies regarding to the prevention of the effects of oxidative stress both on the suffering and on the unilateral testis have been published. However, prevention of TT has not been studied and evaluated to a similar extent.

TT is divided into the following subtypes: intravaginal or extravaginal torsion of the spermatic cord and torsion of the mesorchium. In 96% of mesorchium's torsion type I and type II (anatomic variants of abnormal adhesion of epididymis to the posterior surface of the testis) coexist [4].

Extravaginal torsion of the spermatic cord usually occurs during the perinatal period and in boys with cryptorchidism, due to the non-fixation of testicular envelopes to the scrotum, as well. Martin AD studied retrospectively the anatomical data of 50 neonates with extravaginal torsion of the spermatic cord and confirmed the high adhesion of the spermatic cord only in one patient [5]. Predisposing factors for intravaginal torsion of the spermatic cord are the rapid increase in testicular size during preadolescence, potential testicular malignancy, injuries, physical activity and exposure to cold [6]. The factors mentioned above are responsible for the intense contraction of the cremasteric muscle, which should occur asymmetrically, in order to lead to the development of testicular torsion [7, 8]. According to studies of A. Shteynshlyuger and J. Cubillos *et al.*, hereditary predisposition for development of testicular torsion is confirmed in 11.4% of all cases [9, 10].

Aim of the present retrospective study through the description of the TTT is:

- a) sensitization of primary care physicians, in order the diagnosis of TTT to be made promptly or at least not being mistaken, with emphasis upon the medical history of one or more episodes of acute scrotal pain that resolved automatically within a few minutes.
- b) awareness of practitioners that prompt diagnosis and early treatment of the subject anatomic deformity (Bell Clapper Deformity) are crucial, in order to prevent the effects on testicular parenchyma due to either recurrent episode of TTT or as a consequence of intravaginal testicular torsion.

### **Material and methods**

From January, 2016 to December, 2016, 11 patients aged from 8 to 14 years old (average 10.27 y.o.) suffering from TTT were treated in the 1<sup>st</sup> Department of Pediatric Surgery, Aristotle University of Thessaloniki. Right sided TTT was found in 7 patients, while in the rest was left sided. For seven out of eleven patients it was the first episode of TTT, while for 3 it was the second and for 1 the third similar episode, till admission.

All the patients were admitted to the Emergency Department due to acute scrotal pain that lasted a few minutes (1–5 minutes in most), which had already elapsed at the time of their admission, accompanied with nausea in all patients and vomiting in 5 of them. Time interval between pain recession and physical examination ranged from 2 to 16 hours (average 7.54 hours). Medical history of all patients was free for injury or preexisting pathology of the scrotal anatomic structures. No swelling or rubor of the scrotum was revealed during physical examination, while in 9 patients it was observed that the suffering testis had transverse orientation. Main findings of physical examination were that the testicle: a) was found on the basis of the affected hemiscrotum in all patients (11/11), b) had normal turgidity in 10/11 patients, c) was mild sensitive during palpation in 3/11 patients and d) was mild painful and swollen in 2/11 patients. Reflex of cremasteric muscle was normally performed in 11/11 patients, while Prehn sign and Blue Dot sign were negative in all patients. None patient complained of pain during palpation of the epididymis and the upper pole of the affected testis. Transverse orientation of the testicle with the epididymis on its upper surface was revealed during physical examination in 9/11 patients. In 2/11 patients, testicle exhibited vertical orientation, with the epididymis found on its posterior surface (Table 1).

Ultrasonography was performed in all patients of the study group. Blood perfusion was normal in 8/11 patients and relatively increased in 3/11 patients. Concomitant pathology was not depicted in any patient. Testicular parenchyma was homogenous in 10/11 patients, while heterogeneous in 1 patient (Fig. 1).

**Table 1.** Clinical data of the study group consisting of 11 patients.

No.	Age	Affected testicle	Nr. of episodes	Time elapsed from episode and admission (h)	Nausea	Transverse orientation of the affected testis	Swelling and pain during palpation	Indication of atrophy of the affected testicle
1	9	R	1	2	Yes	Yes	Yes	No
2	8	L	2	5	Yes	Yes	No	No
3	8	R	3	4	Yes	No	Mild sensitivity	Yes
4	9	L	1	2	No	Yes	Yes	No
5	12	R	1	12	No	Yes	No	No
6	12	L	1	5	No	Yes	Mild sensitivity	No
7	14	R	1	4	No	Yes	Mild sensitivity	No
8	11	R	2	16	Yes	No	No	No
9	8	L	1	12	Yes	Yes	No	No
10	9	R	2	9	No	Yes	No	No
11	13	R	1	7	No	Yes	No	No

**Fig. 1.** Heterogeneous testicular parenchyma, as depicted in ultrasonography (3<sup>rd</sup> patient, Table 1).

In the latter patient, it was also found that the affected testis was 25% smaller in volume, in comparison with the contralateral. Pseudotumor sign or Whirlpool sign was not depicted in any patient. Finally, transverse orientation of the affected testis was confirmed in 9/11 patients.

## Results

All the patients early after the diagnosis of TTT underwent surgical investigation of the affected hemiscrotum, under general endotracheal anesthesia. After a vertical section along the middle scrotal raphe, extraction of the affected testis into the surgical field

followed. Macroscopic features of the intrascrotal anatomic structures were normal. Non-twisted testicular appendix (Morgagni's cyst) was found in 10/11 patients, which was resected by using diathermocoagulation. Bell Clapper Deformity was confirmed in 9/11 patients (Fig. 2).



Fig. 2. Bell Clapper Deformity (intraoperative image, 7<sup>th</sup> patient, Table 1).

A complete incision of tunica vaginalis was performed, up to the roof of tunica vaginalis cavity, and then its layers were reversed. Fixation of the suffering testis to the mesoscrotal diaphragm with 3 separate sutures by using non-absorbable stitches (prolene 6/0) followed. By the same approach the other hemiscrotum was also investigated. Bilateral Bell Clapper Deformity was confirmed in 8 out of 9 patients, in whom preventive bilateral orchidopexy was performed.

Postoperative course was uneventful. All the patients were discharged home on the 1<sup>st</sup> postoperative day. All the patients are followed-up on a 6-month basis, without report of a similar, transient episode of acute scrotal pain until today.

## Discussion

Transient testicular torsion (TTT) occurs when the torsion of the spermatic cord is restored automatically within few minutes, with subsequent restoration of the blood flow to the suffering testis. The main clinical manifestation is acute scrotal pain, which resolves within a short period of time, usually few minutes. In all patients of our study group, recession of pain was reported within the first 5 minutes after the onset of the symptom. Nausea and vomiting are the main accompanying symptoms in 25% of all patients [11–13]. In our study group, 11/11 patients complained of nausea (100%), while 5/11 patients reported one or more episodes of vomiting (45.45%). Transient swelling of the affected hemiscrotum is often noticed during physical examination, as found in 2/11 patients, who were admitted soon after the onset of the symptoms, within the first 2 hours [14].

Episodes of TTT can be repeated up to 30 times (average 4–5 times), before clinical assessment by the pediatric surgeon [11, 15]. In our study group, 4/11 patients (36.36%) reported more than one such episodes. According to Agahaji, Cass, Chapman, Knight *et al.*, and Krarup, 30–61% of boys suffering from testicular torsion had experienced one or more episodes of TTT, which can lead to permanent ischemic trauma of the testis [15–19]. In such cases of repeated episodes of TTT, physician can confirm during physical examination signs such as smaller size or induration of the affected testis, effects of the ischemic trauma, or even indication of testicular atrophy, as in one patient of our study group, who had experienced 3 episodes of TTT. It is obvious that in recurrent episodes of TTT, ischemic damage of the testicular tissue is cumulative. Agahaji encountered with 42 patients suffering from one or more episodes of TTT, taking intraoperative biopsy from all the affected testes. Histologic examination was normal in 38% of all cases, while peritubular fibrosis was found in 46% of all patients and testicular atrophy in 16% of them [15].

The affected testis is located intrascrotally, may be slightly swollen, has normal turgidity, while cremasteric muscle reflex is normally performed. In the context of clinical evaluation, acute epididymitis (swelling and painful palpation of the epididymis, positive Prehn sign) and appendiceal torsion (painful palpation of the upper testicular pole, positive blue dot sign) should be excluded. Diagnostic approach was the same in all patients of our study group.

Medical history and physical examination are crucial for the prompt diagnosis of TTT. Mild sensitivity of the affected testis during palpation usually remains in 56% of all patients [11, 15]. We believe that this clinical sign is of significant diagnostic value, when the patient is examined early after the clinical manifestation of an episode of TTT. Transverse orientation of the affected testis, which corresponds to Bell Clapper Deformity as found in 9/11 patients of our study group, constitutes a pathognomonic finding [11, 15].

Bell Clapper Deformity is the major etiologic factor for TTT. Normally the posterolateral surface of the testis and the epididymis are attached to the parietal lamina of tunica vaginalis. This adhesion significantly restricts testicular motility within tunica vaginalis. However, the high adhesion allows a wide range of testicular movement within tunica vaginalis, resulting to possible intravaginal torsion. This anatomic variant is observed in 12% of boys in pre-adolescence stage, while in 40–78% of all cases is bilateral [6, 20, 21]. Agahaji AE encountered with 42 patients suffering from more than one episodes of TTT, confirming the presence of Bell Clapper Deformity unilaterally in 76% of those patients and contralaterally in 62% of the same study group [15]. In our study group, bilateral high adhesion of the tunica vaginalis was found in 8 out of 9 patients (88.9%), finding consistent with the relevant literature [6, 15, 20, 21].

Ultrasonography is substantial for diagnostic documentation of TTT. It is essential to exclude the presence of testicular torsion. Depiction of discontinuation

of blood perfusion to the affected testis is not always a safe diagnostic criterion. Wadert *et al.* [22] refer to 2 patients in a total of 62 (3.22%), in whom diagnosis of testicular torsion was overlooked. The latter was attributed to the fact that was a 90° testicular torsion, with venous congestion in the affected testis, but without complete interruption of the arterial blood flow. Several authors express the opinion that presence of arterial blood flow should not exclude the diagnosis of testicular torsion [23–27]. Kalfa *et al.* [28] encountered 208 patients with testicular torsion and observed presence of arterial blood flow in 50 of those patients (24%). The authors conclude that incidence of testicular torsion at the level of microcirculation depends on the number of torsions and of the degrees of spermatic cord's torsion. Thus, depiction of snail shell shaped mass in high resolution ultrasonography (10–12 MHz) is the major radiologic feature, consistent with testicular torsion [28, 29]. High resolution ultrasonography features 96% sensitivity compared with color flow Doppler, which has 76% sensitivity [28, 29].

Ultrasonographic findings indicative for TTT are the transverse orientation of the testis, hyperaemia and edema of the affected testis [12, 13]. Munden *et al.* evaluated in their retrospective study the ultrasonographic findings in 15 patients facing 19 episodes of TTT in total (average 1.26 episodes each patient). Normal or increased arterial blood flow after an episode of TTT was confirmed in 12 patients (63%), while normal arterial blood flow was observed in 5 patients (26%) and decreased blood flow in 2 patients (11%) [14]. Whirlpool sign or pseudotumor sign was observed in 15 patients (79%), enlarged spermatic cord in 2 patients, while ultrasonography did not reveal any pathological sign in the affected hemiscrotum in 2 patients [14]. Pseudotumor sign results from the vascular congestion of the epididymis and the proximal spermatic duct. Similar ultrasonographic findings can be observed in acute epididymitis and in cases of twisted testicular appendix (Morgagni's cyst) which affects directly the epididymis [14].

Main differences of ultrasonographic findings in TTT and the other major causes of acute hemiscrotum are presented in Table 2.

Table 2. Comparison of ultrasonographic findings in each cause of acute hemiscrotum.

Disease	Arterial blood flow	Whirlpool sign	Pseudotumor sign	Impermanence of the findings
Testicular torsion	Decreased or absent	Yes	Yes	No
Epididymitis	Increased	No	No	No
Torsion of Morgagni's cyst	Normal or increased	No	No	No
Transient testicular torsion	Normal or increased or decreased	Yes	Yes	Yes

Based on the above, we point out that in cases of clinical evaluation of a boy with an episode of transient acute painful hemiscrotum, even if ultrasonography reveals the presence of arterial blood flow to the affected testis, the clinician should always include TTT in differential diagnosis. Imaging documentation of arterial blood flow to the affected testis should not be misinterpreted by the radiologist as a diagnostic clue of a non-surgical clinical condition.

If the diagnosis of TTT is documented, then conduction of bilateral orchidopexy soon after diagnosis is recommended [30–32]. We believe that performance of a cross section along with the perineal raphe facilitates bilateral orchidopexy. We emphasize also on the necessity of bilateral orchidopexy when Bell Clapper Deformity is found on the affected testis, because it may be present in the “healthy” contralateral testis as well, as in 88.9% of all patients in our study group. After conduction of orchidopexy, similar symptomatology is not expected post-operatively, as observed in our study group during the follow up period, while the possibility of recurrence of TTT episodes or manifestation of testicular torsion is nil [15].

## Conclusion

TTT should always be included in differential diagnosis, during physical examination of a boy with an episode of acute hemiscrotum, even when symptomatology has recessed at the time of examination. Diagnosis of TTT is difficult, troubling but also crucial. Usually, physical examination is not indicative of a disease that requires prompt surgical investigation, as pathognomonic findings of acute hemiscrotum are absent. Detailed medical history with emphasis on the episode, physical examination, with the transverse testicular orientation being the major clinical finding, exclusion of other main causes of acute hemiscrotum and collaboration between the pediatric surgeon and the radiologist, in order not to be misinterpreted the ultrasonographic findings, lead to diagnosis. When the diagnosis of TTT is documented, then conduction of orchidopexy soon after the diagnosis is recommended.

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## Conflict of interest

None declared.



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