J Ultrasound (2014) 17:313–315
DOI 10.1007/s40477-014-0095-4

LETTER TO THE EDITOR

The "whirlpool sign", a US finding in partial torsion of the spermatic cord: 4 cases

Francesco Esposito · Marco Di Serafino · Carmela Mercogliano · Valerio Vitale · Paolo Sgambati · Gianfranco Vallone

Received: 25 October 2013 / Accepted: 15 November 2013 / Published online: 3 July 2014

Four children aged 3 to 6 were referred to our department due to acute testicular pain (3 in the right testicle and 1 in the left testicle) associated with slight hyperemia of the scrotal wall and pain in the lower quadrants of the abdomen. Three patients reported a sudden onset of pain 3–5 h earlier and one patient had felt pain for more than 6 h. None of the patients reported a medical history of previous trauma. Scrotal US imaging and color Doppler US were performed in all four patients using a linear 18–6 MHz probe (Esaote My Lab Twice); the testicles, the epididymis and the spermatic cord throughout its course were evaluated bilaterally on longitudinal and transverse scans.

In three patients, the two testicles presented the same volume; only the patient who had felt pain for more than 6 h, presented a globular shape and mild hydrocele (Fig. 1).

Color Doppler US performed with parameters adjusted to slow blood flow detected testicular vascularization in all four patients. However, it was mildly decreased and presented poststenotic characteristics, i.e. low velocity blood flow, low resistive index (RI) values and slowed systolic acceleration (pulsus parvus et tardus) (Fig. 2a).

Evaluation of the spermatic cord throughout its course showed a spiral pattern in all four patients, i.e. the so-called "whirlpool sign" (Fig. 3a, b). This finding and the presence of poststenotic flow characteristics led us to suspect partial testicular torsion (<360 °). This diagnosis was later confirmed by surgical exploration, which showed that the spermatic cord was twisted in the affected testicle in all four patients. At US imaging performed after surgical detorsion of the testicle, the "whirlpool sign" and the poststenotic flow signals were absent (Fig. 2b).

Testicular torsion is one of the most common causes of acute scrotal pain in children. This condition usually requires an emergency operation in order to avoid infarction and consequent necrosis of the testicle [1].

There are two types of testicular torsion: intravaginal and extravaginal torsion. Extravaginal torsion is typically found in newborn infants; the condition may be congenital or it may develop soon after birth. The intravaginal form is more common. It occurs in 65 % of adolescents between 12 and 18 years of age and is caused by a congenital malformation of the tunica vaginalis that surrounds not only the testicle and the epididymis, but also the spermatic cord, thereby allowing the testicle to rotate freely within the tunica vaginalis ("bell clapper deformity") [2].

The main objective in case of acute scrotal pain is therefore to diagnose or exclude testicular torsion as this condition requires prompt surgical intervention in order to avoid irreversible testicular damage [3, 4].

However, clinical differentiation between testicular torsion and other causes of acute testicular pain (epididymitis, orchitis) may be problematic, as pain and swelling often make it difficult to perform physical examination [3–5].

F. Esposito (✉)
Department of Radiology, Santobono Children's Hospital, Via Mario Fiore 6, 80123, Naples, Italy
e-mail: fra.in@libero.it

M. Di Serafino · P. Sgambati
Department of Radiology, Santa Maria alla Gruccia Hospital, Azienda USL8 Arezzo, Montevarchi, AR, Italy

C. Mercogliano
Department of Pediatrics, University Hospital Federico II, Naples, Italy

V. Vitale · G. Vallone
Department of Radiology, University Hospital Federico II, Naples, Italy
e-mail: valevit83@gmail.com

Table 1 Testicular torsion: recovery related to the time elapsed between onset of symptoms and surgical treatment, expressed in percentage

Time elapsed between onset symptoms and surgical treatment (h)	5	6–12	>12
% Recovery	80–90	70	20

US imaging and color Doppler US have proven particularly useful in the differential diagnosis [6, 7].

In case of testicular torsion, the probability of saving the testicle is reduced in direct proportion to the time elapsed between the onset of symptoms and surgical detorsion [8]. Surgical detorsion performed within the first 5 h from the onset of symptoms permits saving of the testicle in 80–100 % of the cases; in 70 % of the cases if detorsion is performed from 6 to 12 h from onset and in 20 % only if surgery is performed 12 h after the onset of symptoms [3] (Table 1).

US imaging of patients with acute scrotal pain should be focused on evaluation of the testis, epididymis and scrotal wall, and color Doppler US analysis of the intratesticular vascularity should be carried out [2].

Diagnosis of testicular torsion is based on the absence of intratesticular blood flow or significantly reduced flow in the affected testicle [3]. However, a definitive diagnosis of partial or intermittent testicular torsion may be difficult to make, as ischemic damage is evidenced late [7]. The presence of preserved intratesticular blood flow, which is often observed in these cases, may lead to a false negative

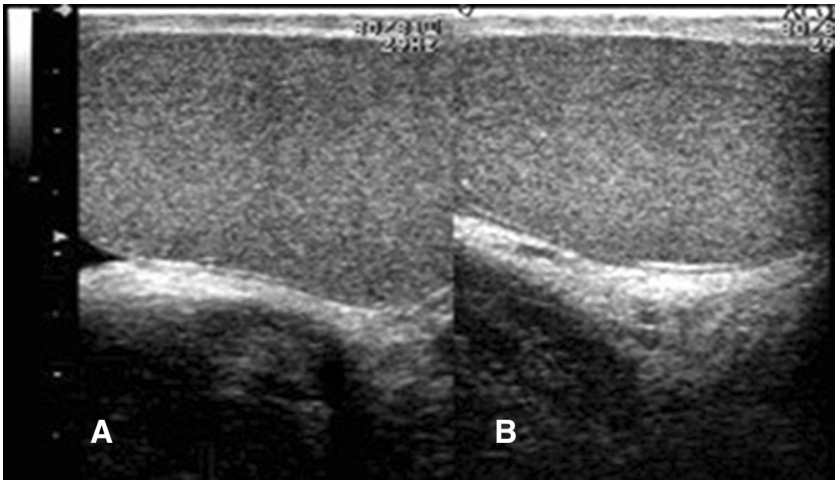

Fig. 1 Increased volume and globular shape of the twisted testicle (**a**) compared with the contralateral testicle (**b**)

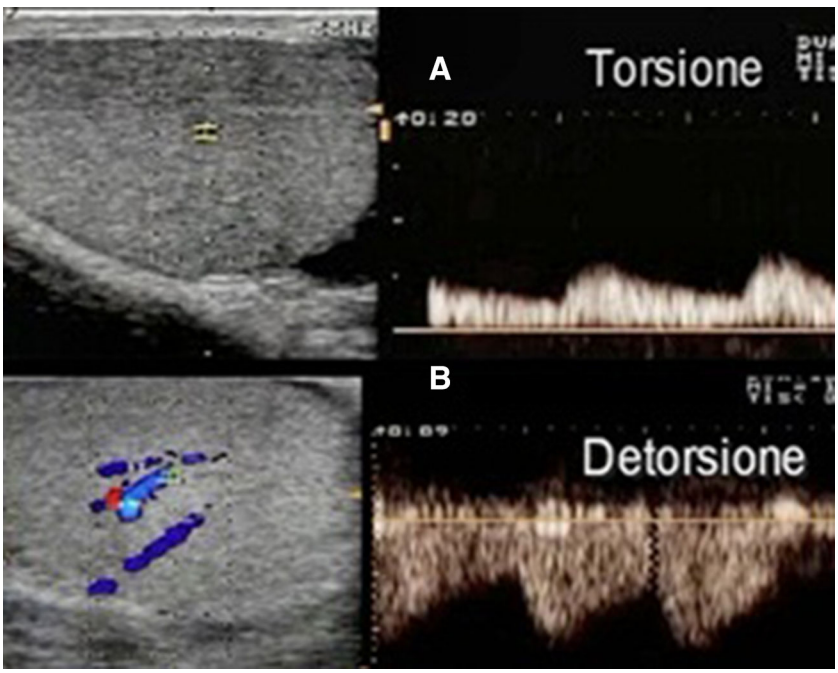

Fig. 2 Blood flow within the twisted testis showing a lower RI value and the presence of "pulsus tardus et parvus" (**a**). Normalization of this pattern after manual detorsion (**b**)

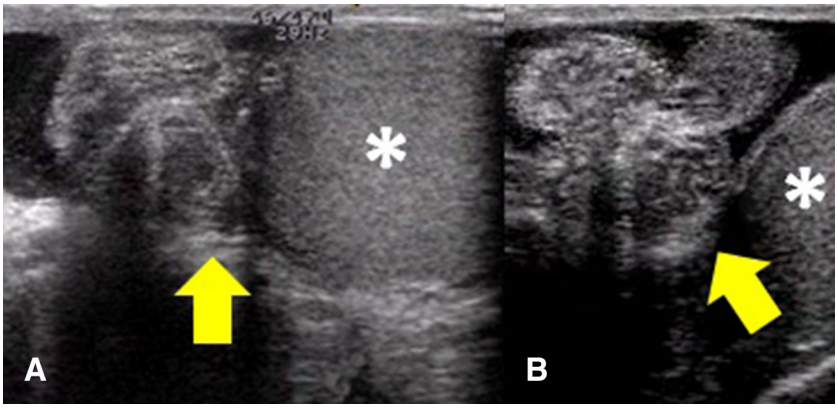

Fig. 3 Longitudinal (**a**) and oblique (**b**) scan of the upper portion of the scrotum. Whirlpool sign representing the spiral twist of the spermatic cord (*arrow*), well defined by the presence of hydrocele. The affected testicle is partially visible (*asterisk*)

diagnosis [1, 2]. In the early stages of complete and partial torsion, color Doppler US may sometimes reveal normal perfusion of the affected testis. In such cases, the US operator should carefully evaluate the spermatic cord throughout its course, including also the inguinal canal [9].

Baud et al. and Kalfa et al. [9, 10] have studied diagnostic imaging in testicular torsion and described a specific US finding (the whirlpool sign). It is caused by spiral twist of the spermatic cord and is highly suggestive of testicular torsion, regardless of color Doppler US findings. This finding may appear in different locations: at the external inguinal canal, superiorly or posteriorly to the testis or within the inguinal canal in the case of an undescended testis [10].

In the cases reported in this paper, detection of spiral cord twist and color Doppler US evidence of poststenotic blood flow suggested the correct diagnosis, which was later confirmed by surgical exploration.

In conclusion, we believe that a careful examination of the spermatic cord throughout its course should always be included in the US study in patients with suspected testicular torsion.

In acute scrotal pain, a careful evaluation of the spermatic cord and detection of the whirlpool sign, if any, are essential, particularly in pediatric patients in whom the presence of low-velocity blood flow makes it difficult to assess intratesticular vascularization at color Doppler US [7].

Follow up should include assessment of normalized vascularity and disappearance of the whirlpool sign to confirm detorsion.

Conflict of interest Francesco Esposito, Marco Di Serafino, Carmela Mercogliano, Valerio Vitale, Paolo Sgambati and Gianfranco Vallone declare that they have no conflict of interest related to this paper.

Informed consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. The patients' parents/legal guardians provided written informed consent to enrolment in the study and to the inclusion in this article of information that might potentially lead to their identification. This article does not contain any studies involving animal subjects performed by any of the authors.

Human and animal studies This article does not contain any studies involving animal subjects performed by any of the authors.

References

1. Prando D (2009) Torsion of the spermatic cord: the main gray-scale and Doppler sonographic signs. Abdom Imaging 34:648–661
2. Boopathy Vijayaraghavan S (2006) Sonographic differential diagnosis of acute scrotum. Real-time whirlpool sign, a key sign of torsion. J Ultrasound Med 25:563–574
3. Hormann M, Balassay C, Philipp MO et al (2004) Imaging of the scrotum in children. Eur Radiol 14:974–983
4. Dunne PJ, O'Loughlin BS (2000) Testicular torsion: time is the enemy. ANZ J Surg 70:441–442
5. Al-Terki A, Al-Qaoud T (2011) Spermatic cord knot: a clinical finding in patients with spermatic cord torsion. Adv Urol 2011:310123
6. Gunter P, Schenk JP, Wunsch R et al (2006) Acute testicular torsion in children: the role of sonography in the diagnostic workup. Eur Radiol 16:2527–2532
7. Kravchick S, Cytron S, Leibovici O et al (2001) Color Doppler sonography: its real role in the evaluation of children with highly suspected testicular torsion. Eur Radiol 11:1000–1005
8. Patriquin HB, Yazbeck S, Trinh B et al (1993) Testicular torsion in infants and children: diagnosis with Doppler sonography. Radiology 188:781–785
9. Baud C, Veyrac C, Couture C, Ferran JL (1998) Spiral twist of the spermatic cord: a reliable sign of testicular torsion. Pediatr Radiol 28:950–954
10. Kalfa N, Veyrac C, Baud C et al (2004) Ultrasonography of the spermatic cord in children with testicular torsion: impact on the surgical strategy. J Urol 72:1692–1695