



ELSEVIER

Testicular torsion: Orchiectomy or orchiopexy?

Seppo Taskinen ^{a,*}, Mervi Taskinen ^b, Risto Rintala ^a

^a Division of Surgery, Hospital for Children and Adolescents, University of Helsinki, Stenbäckinkatu 11, 00290 Helsinki, Finland

^b Division of Pediatrics, Hospital for Children and Adolescents, University of Helsinki, Stenbäckinkatu 11, 00290 Helsinki, Finland

Received 24 June 2007; accepted 9 November 2007
Available online 11 January 2008

KEYWORDS

Testis;
Testicular torsion;
FSH;
Inhibin B;
Fertility

Abstract *Objective:* To evaluate the impact on testicular function of the surgical approach used to treat testicular torsion.

Patients and methods: Seventeen males operated on for testicular torsion at a median age of 14 years were investigated. Serum follicle-stimulating hormone (FSH), testosterone and inhibin B as well as testicular volume were measured early (median 36 days) and/or late (median 1.1 years) after operation.

Results: Orchiectomy was performed in six, and testicular detorsion and orchiopexy in 11 patients. The duration of the preoperative symptoms in the detorsion group was 15 h (range 6–168) and in the orchiectomy group 42 h (range 24–96) ($P = 0.03$). Preoperative colour Doppler ultrasonography showed some circulation in 40% of the patients. At 1 month the median serum inhibin B level was significantly higher after preserving surgery ($P = 0.01$). At 1 year postoperatively, the median serum FSH level tended to be lower after testicular preservation ($P = 0.09$). Abnormal inhibin B or FSH values were observed in 35% of the patients. *Conclusions:* Testicular function is often compromised in patients with testicular torsion. Testis-preserving surgery yields better testicular function than orchiectomy in the short term if the testis is not obviously necrotic. Testicular torsion does not necessarily cause the circulation to cease completely, and preserving surgery can also sometimes be attempted after delayed diagnosis.

© 2007 Journal of Pediatric Urology Company. Published by Elsevier Ltd. All rights reserved.

Introduction

Testicular torsion is a rare but severe event with an annual incidence of 4.5/100,000 in males aged 1–25 years [1]. Delay in the treatment of torsion results in substantial tissue damage or even complete necrosis of the testicle. In unilateral torsion also the contralateral testicle may be damaged, most probably by ischaemia–reperfusion injury [2].

* Corresponding author. Tel.: +358 50 4272542; fax: +358 9 47175314.

E-mail addresses: seppo.taskinen@hus.fi, seppo.taskinen@gmail.com (S. Taskinen).

Based on experimental models, the mode of surgery plays an important role in respect of the fate of the contralateral testis. Preserving surgery of the affected testis may be even more harmful to the contralateral testis than orchiectomy [2]. Clinical data comparing testicular function after orchiectomy and detorsion and orchiopexy is still pending.

Infertility would be the ultimate long-term consequence of testicular torsion. Surprisingly few follow-up studies have reported on sperm analyses and fertility issues in humans after testicular torsion. It appears that testicular torsion may lead to reduced semen quality [3–6]. Hormonal measurements, including assessment of follicle-stimulating hormone (FSH) and inhibin B, are useful for screening patients with decreased fertility potential [7,8]. Level of inhibin B in particular bears a close relationship to the amount of germ cells [9].

The purpose of this study was to evaluate the effect of the surgical approach to testicular torsion on testicular function, as assessed by hormonal surrogates.

Patients and method

The patients were 17 consecutive males referred to the Hospital for Children and Adolescents, University of Helsinki, Finland, between 1997 and 2004. Patient age, duration of symptoms and the type of the operation were recorded. All 17 patients had their serum FSH measured. Serum testosterone and inhibin B were assessed at least once after the operation in 16 and 15 patients, respectively. The institutional normal range of serum FSH is 0.5–3 IU/L in prepubertal and 1–7 IU/L in older males. The normal range of testosterone in prepubertal, pubertal and postpubertal males is 0.1–1.1 nmol/L, 2–13 nmol/L and 10–38 nmol/L, respectively. The serum inhibin B levels at different ages were evaluated according to Crofton et al. [10].

Testicular size was measured by ultrasonography (US) and the volume was calculated by using an ellipsoid formula: $0.52 \times \text{length} \times \text{width} \times \text{depth}$. Hormonal assessment and testicular ultrasonography were performed at an early follow-up visit (median 36, range 25–119 days) in 16 and later (median 1.1, range 0.6–4.9 years) in 10 patients.

Mann–Whitney test was used to compare continuous variables and Fisher's exact test to compare categorical variables (Statview[®] 5.0.1, SAS Institute Inc.). A *P*-value of <0.05 was considered significant.

Results

Eleven out of the 17 patients had undergone testicular detorsion and orchiopexy, and six patients orchiectomy. The median age at operation in the detorsion group was 14 years (range 5–16) and in the orchiectomy group 13 years (range 8–15) (*P* = 0.6). The median duration of preoperative symptoms was 15 h (range 6–168) in patients with detorsion and orchiopexy, and 42 h (range 24–96) (*P* = 0.03) in those with orchiectomy. Three (18%) patients had suffered previous episodes of sudden ipsilateral testicular pain, possibly due to intermittent testicular torsion. One patient with testicular preservation had undergone contralateral orchiopexy for cryptorchidism. Another patient in

the orchiectomy group had received hormonal treatment because of bilateral cryptorchidism.

Preoperative colour Doppler ultrasonography was performed in 10 patients. Ultrasound suggested testicular torsion in 6/10 (60%) patients. In the remaining four patients some blood flow could be seen inside the testis. Accordingly, the ultrasonographic diagnosis was epididymitis in three and torsion of the appendix testis in one patient.

In 13 cases the degree of twisting was registered during the operation and ranged from 180 to 900 degrees (median 360 degrees). In one case the testis looked fully viable during the operation, despite 96-h pain history and 180 degrees of twisting.

The median serum inhibin B level at the early follow-up visit was higher after testicular detorsion than after orchiectomy (*P* < 0.01) (Table 1). The median serum FSH level tended to be lower after testicular preservation (*P* = 0.07) (Table 1). Taken together, abnormal serum FSH or inhibin B was detected in 2/11 (18%) patients after testicular preserving surgery and in 4/6 (67%) patients after orchiectomy (*P* = 0.11) either at early or late control. Age at operation or duration of preoperative symptoms was not associated with abnormal FSH or inhibin B values.

At the early follow-up visit the median testicular volume measured by ultrasound was 7 mL (range 1–16) on the contralateral side and 6 mL (range 2–14) on the side of torsion. At the late control visit the median testicular volume was 11 mL (range 1–16) on the contralateral side and 6 mL (range 0–12) on the side of torsion. The median volume of the twisted testis was 100% (range 26–267) of the contralateral testis at 1 month and 50% (range 2–112) at 1 year after torsion. Three testes were considered atrophic after detorsion with volumes of 2%, 12% and 23% of the contralateral testis. All three patients with atrophied testes had normal levels of serum FSH. One had a low inhibin B level. The duration of the symptoms did not correlate with the volume of the twisted testis at 1-year follow-up (*r* = 0.03, *P* = 0.43). In 12 patients the volume of the contralateral testis had been registered at the time of torsion; none of them was shrinking at the 1-year follow-up.

Total testicular volume was not associated with serum inhibin B, FSH or testosterone concentration at either the 1-month or 1-year control. The patient in the detorsion group who had been operated on for contralateral cryptorchidism had normal testicular function, but the patient in the orchiectomy group who had received hormonal treatment because of bilateral cryptorchidism had abnormal FSH and inhibin B values.

Discussion

In a recent multicentre study testicular torsion was found in 22.6% of the patients with acute scrotum [11]. Testicular torsion leads to orchiectomy in 23–34% of cases [1,12]. Duration of symptoms for more than 12 h [12,13] and a higher age of patients are found to be risk factors for orchiectomy [1]. Duration of symptoms for more than 8 h has been detected to cause reduced testicular volume [3]. In the present study we could not confirm this risk factor for testis size reduction. In one case a reduced testicular volume was

Table 1 Hormonal levels at early (25–119 days) and late (0.6–4.9 years) controls after testicular torsion in 17 patients

	Detorsion		Orchiectomy		P-value
	Abnormal/total (n)	Median (range)	Abnormal/total (n)	Median (range)	
<i>Early control</i>					
Inhibin B (nmol/L)	0/8	144 (73–249)	3/4	54 (16–60)	0.01
FSH (IU/L)	1/10	3.4 (0.7–9.7)	3/5	14.5 (1.1–18.1)	0.11
Testosterone (nmol/L)	0/10	9.5 (0.2–15.6)	0/4	11.4 (4.4–23.5)	0.6
<i>Late control</i>					
Inhibin B (nmol/L)	1/6	146 (40–174)	2/3	46 (16–129)	0.12
FSH (IU/L)	0/6	5.3 (1.2–7.0)	3/4	12.7 (2.9–14.5)	0.09
Testosterone (nmol/L)	0/6	5.3 (0.2–14.6)	0/3	9.8 (2.6–13.6)	0.7

Eleven patients had undergone testicular detorsion and orchiopexy, and six orchiectomy.

detected at the affected side only after 6 h of symptoms, and in another case a normal testicular volume was detected after 96 h of symptoms.

Diagnostic work up in acute scrotum is sometimes demanding. The sensitivity of ultrasound has been shown to vary from 57% to 100% [12,14]. In the present study, ultrasound gave a correct diagnosis in 60% of the investigated patients; however, 41% of patients were considered to have testicular torsion because of the clinical picture and did not undergo ultrasound examination.

In unilateral testicular torsion the contralateral testis is also in danger. According to experimental studies, contralateral testicular damage most probably results from ischaemia–reperfusion injury [2]. Apparently, unilateral torsion decreases also the blood flow in the contralateral testis. It has been suggested that, after a prolonged period of torsion, preservation of the testis is especially harmful to the contralateral testis when compared to orchiectomy of the affected testis [2]. It has also been suggested that the alterations to the contralateral testis may be caused by congenital dysgenesis, because already at the time of torsion in up to 88% of patients pathological histological findings have been described in the contralateral testis [6,15]. On the other hand, increased apoptosis has been detected in the contralateral testis following unilateral testicular torsion [16]. Testicular autoantibodies, with unclear significance, have also been detected after testicular torsion [6,17]. It has also been suggested that fertility potential is decreased after unilateral orchiectomy, for whatever reason [5].

Semen analysis is undoubtedly one of the best methods to evaluate the long-term consequences of testicular torsion. FSH measurements have also turned out to be useful in the determination of fertility potential [8]. Serum FSH has a negative relation to the testicular volume and to the amount of spermatozoa [18]. Serum inhibin B determination is an excellent marker of spermatogenesis [7,19,20]; it has a negative relationship to serum FSH and positive relationship to testicular volume [20,21]. Inhibin B has also a positive relationship to the amount of germ cells [9]. In contrast, serum testosterone may remain at a normal level despite significant testicular damage [20,22].

According to previous studies, fertility has been reduced in patients with unilateral testicular torsion and normal semen has been reported in 13–77% [3–6]. Also, in the present study, six out of 17 patients (35%) had some degree of testicular dysfunction according to hormonal analyses.

Previously, semen analysis has revealed better results after testicular preservation than after orchiectomy [23]. Similarly, in the present study, better FSH and inhibin B values were detected after preservation of both testicles, although some patients with detorsion had a rather long preoperative pain history and most patients had a reduced volume of the preserved testis at follow-up.

Although testicular ischaemia undoubtedly leads to testicular atrophy, we could not find an association between the duration of symptoms and the degree of testicular atrophy. Apparently, in clinical situations, the onset of symptoms is not necessarily caused by total blockage of circulation. This was well demonstrated in one patient who had a fully viable testis despite a 3-day history of pain and 180 degrees of torsion. The preservation of some circulation could also be detected in the four (36%) patients who were incorrectly diagnosed by the preoperative ultrasonography. Similarly, in a recent study, 26% of the patients were detected to have some intratesticular circulation despite clinical testicular torsion [11]. In testicular volume measurements the degree of atrophy could not be determined reliably at the 1-month control postoperatively, but required a half-year follow-up. The volume of the contralateral testis had not reduced in any patients at follow-up, contraindicating severe contralateral reperfusion injury.

Conclusions

In this retrospective study one third of patients with testicular torsion were found to have a reduced fertility potential according to inhibin B and FSH analyses. It seems that the fertility prognosis is better after testis preservation than after orchiectomy if the testis is not obviously necrotic. The onset of symptoms does not necessarily cause complete ischaemia and sometimes the testis can survive despite a long history of symptoms.

References

- [1] Mansbach JM, Forbes P, Peters C. Testicular torsion and risk factors for orchiectomy. *Arch Pediatr Adolesc Med* 2005;159:1167–71.
- [2] Filho DW, Torres MA, Bordin AL, Crezcynski-Pasa TB, Boveris A. Spermatic cord torsion, reactive oxygen and nitrogen species

- and ischemia–reperfusion injury. *Mol Aspects Med* 2004;25:199–210.
- [3] Bartsch G, Frank S, Marberger H, Mikuz G. Testicular torsion: late results with special regard to fertility and endocrine function. *J Urol* 1980;124:375–8.
- [4] Puri P, Barton D, O'Donnell B. Prepubertal testicular torsion: subsequent fertility. *J Pediatr Surg* 1985;20:598–601.
- [5] Ferreira U, Netto Jr NR, Esteves SC, Rivero MA, Schirren C. Comparative study of the fertility potential of men with only one testis. *Scand J Urol Nephrol* 1991;25:255–9.
- [6] Hagen P, Buchholz MM, Eigenmann J, Bandhauer K. Testicular dysplasia causing disturbance of spermiogenesis in patients with unilateral torsion of the testis. *Urol Int* 1992;49:154–7.
- [7] Kumanov P, Nandipati K, Tomova A, Agarwal A. Inhibin B is a better marker of spermatogenesis than other hormones in the evaluation of male factor infertility. *Fertil Steril* 2006;86:332–8.
- [8] Zitzmann M, Nordhoff V, von Schonfeld V, Nordsiek-Mengede A, Kliesch S, Schuring AN, et al. Elevated follicle-stimulating hormone levels and the chances for azoospermic men to become fathers after retrieval of elongated spermatids from cryopreserved testicular tissue. *Fertil Steril* 2006;86:339–47.
- [9] Cortes D, Thorup J, Hogdall E, Norgaard-Pedersen B, Petersen BL, Hogdall C. The relation of germ cells per tubule in testes, serum inhibin B and FSH in cryptorchid boys. *Pediatr Surg Int* 2007;23:163–9.
- [10] Crofton PM, Evans AEM, Groome NP, Taylor MRH, Holland CV, Kelnar CJH. Inhibin B in boys from birth to adulthood: relationship with age, pubertal stage, FSH and testosterone. *Clin Endocrinol* 2002;56:215–21.
- [11] Kalfa N, Veyrac C, Lopez M, Lopez C, Maurel A, Kaselas C, et al. Multicenter assessment of ultrasound of the spermatic cord in children with acute scrotum. *J Urol* 2007;177:297–301.
- [12] Dunne PJ, O'Loughlin BS. Testicular torsion: time is the enemy. *Aust N Z J Surg* 2000;70:441–2.
- [13] Anderson JB, Williamson RCN. Testicular torsion in Bristol: a 25 year review. *Br J Surg* 1988;75:988–92.
- [14] Schalamon J, Ainoedhofer H, Schleef J, Singer G, Haxhija EQ, Hollwarth ME. Management of acute scrotum in children—the impact of Doppler ultrasound. *J Pediatr Surg* 2006;41:1377–80.
- [15] Dominguez C, Martinez Verduch M, Estornell F, Garcia F, Hernandez M, Garcia-Ibarra F. Histological study in contralateral testis of prepubertal children following unilateral testicular torsion. *Eur Urol* 1994;26:160–3.
- [16] Hadziselimovic F, Geneto R, Emmons LR. Increased apoptosis in the contralateral testes of patients with testicular torsion as a factor for infertility. *J Urol* 1998;160:1158–60.
- [17] Sinisi AA, Di Finizio B, Lettieri F, Pasquali D, Scurini C, De Bellis A, et al. Late gonadal function and autoimmunization in familial testicular torsion. *Arch Androl* 1993;30:147–52.
- [18] Kojima Y, Hayashi Y, Mizuno K, Kurokawa S, Sasaki S, Kohri K. Assessment of serum follicle-stimulating hormone level and testicular volume for prediction of paternity potential in pubertal boys who underwent bilateral orchiopexy in childhood. *J Urol* 2006;175:2290–4.
- [19] Irkilata HC, Yildirim I, Onguru O, Aydur E, Musabak U, Dayanc M. The influence of orchiopexy on serum inhibin B level: relationship with histology. *J Urol* 2004;172:2402–5.
- [20] Cicognani A, Cacciari E, Pasini A, Burnelli R, De lasio R, Pirazzoli P, et al. Low serum inhibin B levels as a marker of testicular damage after treatment for a childhood malignancy. *Eur J Pediatr* 2000;159:103–7.
- [21] Raivio T, Saukkonen S, Jääskeläinen J, Komulainen J, Dunkel L. Signaling between the pituitary gland and the testes: inverse relationship between serum FSH and inhibin B concentrations in boys in early puberty. *Eur J Endocrinol* 2000;142:150–6.
- [22] Taskinen S, Hovatta O, Wikstrom S. Early treatment of cryptorchidism, semen quality and testicular endocrinology. *J Urol* 1996;156:82–4.
- [23] Anderson MJ, Dunn JK, Lipschultz LI, Coburn M. Semen quality and endocrine parameters after acute testicular torsion. *J Urol* 1992;147:1545–50.