Late hormonal function after testicular torsion

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Abstract

Introduction: Testicular torsion may be an important cause of male infertility. We aimed to investigate the late hormonal function in patients with testicular ischemia/reperfusion injury of the testis after orchidectomy or detorsion.

Methods: Twenty patients (mean age, 13.6 years) were prospectively evaluated at a mean of 5 years after testicular torsion. The serum follicle-stimulating hormone, luteinizing hormone (before and after gonadotropin-releasing hormone stimulation), testosterone, and inhibin B were measured. Fifteen age-matched adolescents without evidence of endocrine disease were used as controls for inhibin B values. Data are quoted as mean ± SEM.

Results: Twelve patients were treated with detorsion and orchidopexy, and 8 underwent orchidectomy. Serum follicle-stimulating hormone, luteinizing hormone, and testosterone were all within the reference range. Inhibin B levels were significantly reduced in the 2 groups compared with the controls (34.5 ± 5.2 vs 63.9 ± 12.8 pg/mL, \( P = .02 \)), but were not significantly different between the orchidectomy group and the group that underwent detorsion (41.3 ± 9.7 vs 30.4 ± 5.9 pg/mL, \( P = .41 \)).

Conclusion: Hormonal testicular function can be compromised after testicular torsion, although the type of surgery (orchidectomy or orchidopexy) does not seem to change the effect of this ischemia/reperfusion injury.

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Testicular torsion is a urologic emergency that may be an important cause of male infertility [1], with seminal analysis being normal in less than 50% of cases in the long term [2]. It is possible that temporary reduction of blood flow could affect the contralateral testis, and a variety of different mechanisms have been described [2]. Previous studies have focused on the exocrine function after detorsion and/or orchidectomy, as this has been reported to be more vulnerable than endocrine function [3–5].

Recently, new hormones associated with testis function have been described such as inhibin B; and this is considered a reliable marker of Sertoli cell function and spermatogenesis in both adults and adolescents [6,7]. Such hormonal profiling

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has not been described previously in the follow-up of boys who have sustained an episode of testicular torsion.

Our aim was to investigate this late hormonal function in adolescents with a history of torsion whether treated by orchidectomy or detorsion and orchidopexy.

1. Methods

Patients with a history of surgically treated testicular torsion were identified from hospital records. They were divided into 2 groups according to the type of treatment: group 1 (orchidectomy) and group 2 (detorsion and orchidopexy). All had testicular ultrasonography, semen analysis, and a hormonal profile. Testicular size was calculated using the ellipsoid formula \((0.52 \times \text{length} \times \text{width} \times \text{depth})\). A seminal sample (obtained in the hospital by masturbation after at least 3 days of abstinence) was requested from patients aged at least 18 years. Samples were evaluated for ejaculated volume, sperm concentration, morphology, motility, and fertility index. The hormonal profile was evaluated using blood obtained between 8:00 and 9:00 AM. Serum follicle-stimulating hormone (FSH), luteinizing hormone (LH) (both before and after gonadotropin-releasing hormone stimulation), and testosterone were measured by standard radioimmunoassay.

Serum inhibin B was measured using an enzyme-linked immunosorbent assay kit (DSL-1084100; Diagnostic System Laboratories Inc, Webster, TX). This is a quantitative measurement of dimeric inhibin B in human serum. The inhibin B enzyme-linked immunosorbent assay is an enzymatically amplified 2-site, 2-step sandwich-type immunoassay. In the assay, standards, controls, and unknown serum samples were incubated in microtitration wells coated with anti-inhibin \(\beta_B\) subunit antibody.

Fifteen age-matched adolescents with similar pubertal development and without any endocrine disease were used as controls for inhibin B values.

Results are reported as mean (SEM). Groups were analyzed and compared using an unpaired \(t\) test. A Spearman coefficient was used to express correlation. \(P < .05\) was considered statistically significant.

2. Results

Twenty male subjects (mean age at time of study, 13.6 years) were evaluated prospectively at a mean of 5 years after an episode of testicular torsion. Eight had been treated with orchidectomy for necrosis (group 1). Twelve were considered viable at the time of surgery and subjected to orchidopexy after detorsion (group 2). Our usual practice is not to fix the contralateral testis in either situation. Subsequently, testicular atrophy was noted in 6 patients (50%), with the atrophic remnant removed in 2.

The serum basal FSH, LH, testosterone, and the gonadotropin-releasing hormone stimulation values were normal in all subjects (Table 1). However, inhibin B levels were significantly reduced in the 2 groups compared with the controls (34.5 ± 5.2 vs 63.9 ± 12.8 pg/mL, \(P = .02\)), whereas inhibin B values were not significantly different between group 1 and group 2 (41.3 ± 9.7 vs 30.4 ± 5.9 pg/mL, \(P = .41\)) (Table 1). There was a significant correlation between inhibin B and both testosterone levels \((r = 0.66, P = .02)\) (Fig. 1) and testis volume \((r = 0.57, P = .03)\) in both groups (Fig. 2).

Table 1 Mean (SEM) of FSH, LH, testosterone, and inhibin B serum levels from patients with orchidectomy (n = 8) and patients with detorsion (n = 12)

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>(P)</th>
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<tbody>
<tr>
<td></td>
<td>Orchidectomy (n = 8)</td>
<td>Detorsion (n = 12)</td>
<td></td>
</tr>
<tr>
<td>FSH (basal) (mIU/mL)</td>
<td>6.2 ± 1.2</td>
<td>2.9 ± 0.6</td>
<td>.04</td>
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<tr>
<td>FSH (peak) (mIU/mL)</td>
<td>11.4 ± 3.2</td>
<td>7.8 ± 1.4</td>
<td>.5</td>
</tr>
<tr>
<td>LH (basal) (mIU/mL)</td>
<td>5.6 ± 1.4</td>
<td>2.2 ± 0.56</td>
<td>.06</td>
</tr>
<tr>
<td>LH (peak) (mIU/mL)</td>
<td>27.1 ± 9.2</td>
<td>17.3 ± 3.8</td>
<td>.43</td>
</tr>
<tr>
<td>Testosterone (ng/dL)</td>
<td>505 ± 129</td>
<td>417 ± 107</td>
<td>.43</td>
</tr>
<tr>
<td>Inhibin B (pg/mL)</td>
<td>41.3 ± 9.7</td>
<td>30.4 ± 5.9</td>
<td>.41</td>
</tr>
</tbody>
</table>
Seminal analysis showed a significantly reduced fertility index (according to World Health Organization criteria) in both groups. In particular, after detorsion, only 1 patient out of 4 had a fertility index of 60 (>50 is considered normal), the other 3 being frankly abnormal. Similar results were identified in those who had undergone orchidectomy (all 3 patients had a negative fertility index).

3. Discussion

The initial degree of testicular ischemia largely depends on its duration. Surgical detorsion allows reperfusion but may be in itself responsible for an ischemia/reperfusion type of injury that could further damage the testis [8,9]. After detorsion, if there is bleeding from incision of the albuginea, then typically, the testis is fixed to the scrotum; and only if it appears frankly necrotic will it be removed. Salvage rates have been reported in 30% to 50% of cases [2,10].

Longer-term effects may be observed in adulthood in terms of reduced fertility and impairment of spermatogenesis and seem to indicate that other mechanisms may be involved in testicular damage. For instance, preexisting congenital dysplasia in the contralateral testis may explain some disturbances of spermatogenesis [2]. Other postulated mechanisms include an autoimmune response, triggered by blood-testis barrier breakdown, secondary to ischemic damage leading to exposition of antigenic material and formation of antibodies against testicular elements [11]. Finally, one theory suggests that there is a reflex vasoconstriction in contralateral testicular vessels mediated by sympathetic nerves. This reflex vasoconstriction causes bilateral testicular hypoxia and subsequent damage [12].

The present study confirms previous data showing subfertility after unilateral testicular torsion [2,3], possibly owing to germinal epithelium being more prone to damage after ischemia/reperfusion injury. The endocrine profile seems to be more resistant to ischemia, and previous results have been contradictory. Generally, serum levels of LH, prolactin, testosterone, and FSH have been reported to be within the reference range [3,5]. Recently inhibin B has been described as a marker of Sertoli cell function, with high sensitivity in predicting the quality of spermatogenesis in adults [13]. In prepubertal boys, inhibin B levels seem to predict the testosterone response to human chorionic gonadotropin, giving reliable information about the function of the testes [7]. Inhibin B secretion depends on the interaction between Sertoli cells and germ cells. In particular, it is known that spermatoids influence inhibin production and that these cells are sensitive to hyperthermia. Reduced inhibin B serum levels have been described in adolescents with known causes of subfertility such as varicocele. In this group, reduction of inhibin B has been ascribed to an early arrest of spermatogenesis or a depletion of germ cells and associated with a reduced testicular volume on the affected side [14]. Reduced levels of inhibin B have been recently described in adolescent patients after testicular torsion, particularly after orchidectomy [15].

Our study has shown that both exocrine and endocrine functions can be compromised in the late follow-up after torsion. We could not demonstrate any significant variation between the group treated with detorsion and fixation and the group treated with orchidectomy in terms of fertility index or inhibin values. We confirmed the role of inhibin B as a marker of Sertoli cell and germinal function because it is significantly reduced and correlates with testis volume and testosterone production. We observed no difference in terms of fertility index between the 2 treatment groups.

Testicular torsion is responsible for late impairment of both exocrine and endocrine functions. Inhibin B is a reliable marker of testis function and can be correlated with testis volume and testosterone production. Although the best treatment option remains controversial, late follow-up seems to be indicated to define its natural history.

References