Mid- To Long-Term Evaluation of Hormonal Function, Testicular Ultrasonographic Features, and Erectile Function in Children with A History of Testicular Torsion

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Purpose: Testicular torsion is an emergency, and its long-term effects on fertility, hormonal function, and sexual function remain uncertain. We aimed to evaluate the long-term effects of surgical treatment for testicular torsion on hormonal function, testicular ultrasonographic features, and erectile function.

Materials and Methods: This retrospective cohort study included patients surgically treated for testicular torsion at Labbafinejad Hospital, Tehran, Iran, from 2014 to 2022. Semen analysis and Doppler testicular ultrasonography were performed, and serum samples were collected to measure testosterone, follicle-stimulating hormone, and luteinizing hormone. Erectile function was assessed using the International Index of Erectile Function questionnaire. A *P* value less than 0.05 was considered statistically significant.

Results: Seventy-two patients were assessed. Fifty-four patients (75.0%) underwent orchiopexy, and 18 (25.0%) underwent orchiectomy. Patients in the orchiectomy group had higher luteinizing hormone ($P < 0.001$) and follicle-stimulating hormone ($P = 0.009$) levels and lower testosterone levels ($P = 0.008$), sperm counts ($P < 0.001$), progressive sperm motility ($P = 0.002$), and normal sperm morphology ($P = 0.001$) than patients who underwent orchiopexy. International Index of Erectile Function scores did not differ significantly between the groups ($P = 0.730$). In the orchiopexy group, 32 patients (59.3%) had small testes.

Conclusion: Surgical treatment for testicular torsion affects hormonal and ultrasonographic testicular findings; however, it does not appear to have a remarkable effect on erectile function.

Keywords: testicular torsion; pediatrics; sex hormones; ultrasonography

INTRODUCTION

Testicular torsion occurs due to spontaneous twisting of the testis around the spermatic cord, leading to ischemia. It affects approximately 1 in 4,000 males younger than 25 years and constitutes a urological emergency. Immediate surgical intervention is necessary in patients with suspected testicular torsion and involves detorsion and fixation or possible removal of the affected testis. To minimize the risk of severe injury, surgery should be performed within 6 to 8 hours after symptom onset.[(1-3)]

Permanent impairment of testicular function is thought to result from ischemia at the time of testicular torsion. The primary endocrine function of the testis, testosterone production, appears to remain largely unaffected by testicular torsion. However, reduced testosterone levels, along with increased follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels, have been reported after testicular torsion, with some subjects exhibiting elevated testosterone levels compared with controls.[(4-6)]

Impairment of exocrine testicular function has been reported, including alterations in sperm morphology and decreases in sperm motility and count. Although the implications of impaired semen quality have not been specifically addressed, pregnancy rates among men after testicular torsion remain comparable to those in the general male population. There is a lack of extensive long-term data concerning the effects of testicular function after testicular torsion on erectile function, and limited studies have evaluated long-term outcomes after testicular torsion.[(7-9)] Therefore, in this study, we aimed to assess the long-term effects of testicular torsion and its treatment on hormonal function, testicular ultrasonographic features, and erectile function in children with a history of testicular torsion.

MATERIALS AND METHODS

This retrospective cohort study was conducted on patients who were surgically treated with a diagnosis of testicular torsion at Labbafinejad Hospital, Tehran, Iran, from 2014 to 2022. All patient files from this period were reviewed.

The inclusion criteria were age younger than 18 years at the time of surgery, current age older than 18 years, and surgery performed at the hospital with a diagnosis of testicular torsion. The exclusion criteria were incomplete medical records and testicular surgery performed for other causes.

After applying the inclusion and exclusion criteria, the patients' parents were contacted and asked to refer to the hospital for new evaluations. If the parents could not be contacted, the patients were excluded from the study. All patient records were retrieved from the archive

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Table 1. Demographic Data, Ultrasonographic Findings, Laboratory Test Results, and International Index of Erectile Function Scores of Patients

Variable Number	**Total** 72	**Orchiopexy Group** 54	**Orchiectomy Group** 18	***P* Value**
Age, mean ± SD	15.5 ± 1.43	15.89 ± 1.23	14.33 ± 1.37	0.062
Mean follow-up	48.68 (2-10)	49.83	46.50	0.813
Testis volume, cc Mean ± SD Small, n (%)	10.06 ± 6.44 32 (59.3)	10.06 ± 6.44 32 (59.3)		
Contralateral testis, cc Mean volume ± SD	18.56 ± 2.10	18.78 ± 1.52	18.25 ± 3.31	0.355
FSH, mIU/mL Mean ± SD High FSH, n (%)	8.50 ± 4.33 18 (25.0)	7.75 ± 4.26 10 (18.5)	10.77 ± 3.81 8 (44.4)	0.009 0.035
LH, mIU/mL Mean ± SD High LH, n (%)	6.28 ± 3.08 20 (27.77)	5.61 ± 2.88 11 (20.3)	8.32 ± 2.83 9 (50.0)	< 0.001 0.074
Testosterone, ng/dL Mean ± SDLow testosterone, n (%)	522.89 ± 151.61 8 (11.1)	556.16 ± 128.64 4 (7.4)	423.11 ± 181.37 4 (22.2)	0.008 0.083
Sperm count, million/mL Mean ± SD Low count, n (%)	25.89 ± 16.81 26 (38.9)	30.22 ± 17.21 16 (29.6)	15.89 ± 4.40 10 (55.5)	< 0.001 0.012
Progressive sperm motility, % Mean ± SD	32.25 ± 13.64	35.11 ± 14.31	23.67 ± 5.90	0.002
Low progressive motility, n (%)	30 (41.7)	18 (33.3)	12 (66.67)	0.027
Normal morphology, % Mean ± SD Low morphology, n (%)	6.29 ± 2.48 19 (26.3)	6.92 ± 3.51 11 (20.3)	4.38 ± 0.96 8 (44.4)	0.001 0.026
IIEF score, mean ± SD	18.57 ± 5.03	16.57 ± 4.83	0.635	
Severe ED	1 (1.4)	1 (2.0)	0 (1.2)	0.730
Moderate ED	11 (15.3)	7 (14.0)	4 (17.2)	
Mild to moderate ED	10 (13.9)	8 (16.0)	2 (15.6)	
Mild ED	18 (25.0)	14 (28.0)	4 (28.6)	
No ED	24 (33.3)	20 (40.0)	4 (28.6)	

*Variables with a mean/standard deviation ratio less than 2, including testis volume, follicle-stimulating hormone, and sperm count, are presented as median (interquartile range); all others are presented as mean ± standard deviation.

within the specified time period, and patients were contacted and invited to participate in this research project. Patients who met the inclusion criteria and did not meet the exclusion criteria were included in the study. This study used a census sampling approach: approximately 800 patients underwent surgery for testicular torsion during the study period, and all patients who met the eligibility criteria and provided informed consent were included. Because of the lower prevalence of orchiectomy compared with orchiopexy, the orchiectomy group was smaller (n = 18). No formal sample size calculation was performed because this was a descriptive-analytical study using all available eligible cases.

Semen analysis and testicular ultrasonography were performed for the patients. Semen analysis was performed according to the World Health Organization laboratory manual for the examination of human semen, 6th edition. Doppler ultrasonography was used for testicular evaluation. Standard laboratory kits were used for hormonal tests, including FSH, LH, and testosterone. Serum samples were collected to measure testosterone, FSH, and LH concentrations. The International Index of Erectile Function (IIEF) questionnaire[10] was used to assess erectile function, and patients were guided if they had any questions while completing the questionnaire. Demographic data were also recorded. Before completing the IIEF questionnaire, all patients received a detailed explanation of the concept of erectile dysfunction. Patients often completed the questionnaire by telephone, and any questions they raised were fully explained by the research team to ensure accurate and informed responses.

The patients were then divided into 2 groups: patients who underwent orchiectomy (group 1) and patients who underwent orchiopexy (group 2). Data were compared between the groups. Patients were divided into 2 groups according to the surgical procedure recorded in their files: the orchiectomy group included all patients whose torsed testis was removed during surgery, whereas the orchiopexy group included all patients whose torsed testis was retained and fixed during surgery.

Statistical Analysis: Data were analyzed using SPSS. Continuous variables were compared using the independent t test or Mann-Whitney U test, and categorical variables were compared using the chi-square test or Fisher exact test. A *P* value less than 0.05 was considered statistically significant. For continuous variables with a mean/standard deviation ratio less than 2, indicating a skewed distribution, median and interquartile range were reported instead of mean ± standard deviation. Effect sizes with 95% confidence intervals were also reported to assess clinical importance. Multivariable regression analysis was performed with adjustment for age, testis volume, and follow-up duration, and adjusted mean differences for continuous outcomes and adjusted odds ratios for binary outcomes with 95% confidence intervals are reported.

Ethical Considerations: This study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.MSP.REC.1404.231).

RESULTS

After assessment of the inclusion and exclusion criteria, 72 patients were included in the study: 54 patients (75.0%) in the orchiopexy group and 18 (25.0%) in the orchiectomy group. LH and FSH levels were significantly higher, whereas testosterone levels and semen analysis parameters were significantly lower in the orchiectomy group (all *P* values < 0.05). There were no significant differences between the groups regarding age, contralateral testis volume, or IIEF score (P values > 0.05). The results are presented in **Table 1**.

DISCUSSION

In this study, we assessed the results of surgical treatment for testicular torsion. We found that patients who underwent orchiectomy had higher LH and FSH levels and lower levels of testosterone, sperm count, progressive sperm motility, and normal sperm morphology compared with patients who underwent orchiopexy. Although the test results differed between the groups, the patients' IIEF scores were similar between the groups. It should be noted that the severity of testicular torsion differed between the 2 groups at the time of initial intervention. Patients who underwent orchiectomy likely had longer ischemic time and more severe torsion because orchiectomy is performed when testicular circulation is completely impaired, whereas orchiopexy is performed when testicular viability appears possible. This fundamental difference in baseline severity should be considered when interpreting comparisons between the 2 groups.

Testicular torsion predominantly affects young men who may desire future fertility. A prior study indicated that testicular torsion was identified as a potential contributor to infertility in only 0.5% of involved cases.[2,11] The duration and extent of spermatic cord torsion significantly influence testicular tissue survival after hypoxia due to arterial constriction.[12] A systematic review indicated that surgical intervention within 0 to 6 hours after torsion results in a 97.2% survival rate for testes, whereas survival declines to 24.4% when torsion persists for 25 to 48 hours. This suggests that either testicular blood flow remains partially intact or intermittent torsion occurs, highlighting the relevance of torsion severity.[13]

Yang et al. found that patients who underwent orchiopexy had a mean torsion of 360 degrees and 12 hours of pain, whereas those requiring orchiectomy had a mean torsion of 540 degrees and 90 hours of pain. The choice of surgery is based on the intraoperative condition of the testis.[4,14] Necrotic testes are typically removed by orchiectomy, whereas salvageable testes are detorsed and fixed through orchiopexy. The likelihood of successful salvage correlates with torsion duration and ischemic time. Contralateral orchiopexy is also recommended because an estimated 60% to 80% of boys with a bell-clapper deformity may have a similar risk on the contralateral side.[15,16] In the current study, we did not assess the degree of testicular circulation, but we found that contralateral testis volume did not differ between patients who underwent orchiopexy and those who underwent orchiectomy. This issue may highlight that involvement of one testis has no effect on the other testis; however, this issue should be investigated in further studies. As shown in **Table 1**, the testicular volume of the affected side was compared with the contralateral unaffected testis volume. The mean contralateral testis volume was 18.78 cc in the orchiopexy group and 18.25 cc in the orchiectomy group, with no statistically significant difference between the groups (P = 0.355). The affected testis volume, with a mean of 10.06 cc, was notably smaller than the contralateral side, further supporting the high rate of atrophy observed.

Aggarwal et al. assessed the long-term effects of surgical treatment for testicular torsion. That study compared 2 patient groups: group 1, comprising 44 patients who underwent orchiectomy, and group 2, consisting of 23 patients who underwent orchiopexy. The follow-up duration was 42 ± 12 months. Approximately 47% of the orchiopexy group developed testicular atrophy. Significantly lower serum testosterone levels were observed in group 1 and in those with atrophy, whereas other hormonal parameters, semen analysis results, and erectile function remained comparable between the groups.[17] In the current study, we observed that patients who underwent orchiectomy had higher LH and FSH levels and lower levels of testosterone, sperm count, progressive sperm motility, and normal sperm morphology than patients who underwent orchiopexy. Erectile function scores were comparable between the groups. The mean follow-up in the current study was 48.6 months. Regarding erectile dysfunction, the results of the studies were similar, and orchiopexy showed no difference compared with orchiectomy. In terms of sex hormones, we observed that testosterone levels were lower in the orchiectomy group, similar to the findings of Aggarwal et al., and LH and FSH levels were higher in the orchiectomy group, contrary to their findings. The differences between the studies illustrate the need for further studies regarding the effect of testicular torsion treatment on subsequent hormonal status.

Regarding erectile dysfunction rates, the distribution in our study was as follows: severe erectile dysfunction, 2% versus 1.2%; moderate erectile dysfunction, 14% versus 17.2%; mild to moderate erectile dysfunction, 16% versus 15.6%; mild erectile dysfunction, 28% versus 28.6%; and no erectile dysfunction, 40% versus 28.6% in the orchiopexy and orchiectomy groups, respectively. Most patients were in the no-problem to mild-problem category. It should be noted that the prevalence of erectile dysfunction in the general young male population is reported to be approximately 8% to 30%, depending on the study and age group. Therefore, the rates observed in our study are not markedly different from the expected background rates in this age group, and testicular torsion treatment does not appear to significantly worsen erectile function beyond what is expected in the general population.

Boscaini et al. assessed patients treated for testicular torsion from 1997 to 2017, involving a total of 22 patients. Ultrasonographic evaluations indicated a reduction in the volume of the affected testis, along with microcalcifications and heterogeneous echogenicity. Recovery of morphovolumetric characteristics was more closely associated with age at onset than with the severity of torsion.[18] We observed that small testes were present in 32 patients (59.3%) who underwent orchiopexy; in other words, more than half of the patients with testicular torsion had small testes after orchiopexy. This finding was similar to the finding of Boscaini et al. We did not find any relationship between age at disease onset and type of treatment. If orchiectomy is considered a treatment for severe cases, we did not find any relationship between age and severity of testicular torsion. The high rate of testicular atrophy (59.3%) in the orchiopexy group suggests that testicular development may still be impaired even when the testis is preserved. However, it is important to note that most measured parameters in the orchiopexy group were better than those in the orchiectomy group; therefore, this high atrophy rate should not be interpreted as justification for increasing the rate of orchiectomies. Testicular preservation remains the primary surgical goal whenever feasible.

In another study, Zvizdic et al. concluded that symptom duration is the only predictor of successful treatment for testicular torsion, which carries a significant risk of testicular loss and atrophy.[19] We did not assess the predictors of testicular torsion treatment outcomes, but it seems that the duration of symptoms is a rational predictor of the treatment outcome because symptom duration is the main factor indicating the time of testicular hypoxia.[20]

CONCLUSIONS

Orchiectomy significantly affects hormonal levels and semen parameters. Although we found a significant difference between the groups regarding semen analysis, these results should be interpreted cautiously because semen analysis and hormonal test results in the orchiectomy group were within normal limits, and patients' fertility cannot be easily discussed based on these findings. Patients' erectile function was comparable between the treatment methods, and most patients had mild erectile dysfunction or no erectile dysfunction. Limitations of this study include the relatively small sample size, especially in the orchiectomy group (n = 18); the retrospective design, which may introduce selection bias; the lack of a healthy control group; performance of semen analysis only once, which may be affected by various factors; and the lack of assessment of key predictors, such as the specific degree of torsion and ischemia time at the time of surgery. The unequal group sizes, with 54 patients in the orchiopexy group and 18 in the orchiectomy group, reflect the real-world distribution of surgical outcomes rather than a design flaw; orchiectomy is inherently less common because surgeons prefer testicular preservation whenever possible. This imbalance limits direct statistical comparison between the groups and should be considered when interpreting the results. Future studies with larger orchiectomy cohorts or matched controls are recommended.

SUMMARY

After childhood testicular torsion, orchiectomy was associated with worse hormonal and semen findings than orchiopexy, but erectile function was similar between groups.

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