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VOLUME ALTERATION IN UNDESCENDED TESTES BEFORE AND AFTER ORCHIOPEXY

Dr. Shah Muhammad Khosa[*1], Dr. Mohyuddin Kakar[2], Dr. Inayat Ullah Shahwani[3], Dr. Rizwan Elahi[4], Dr. Ahmad Shah[5], Dr. Muhammad Idrees Achakzai[6]

*[*1]MBBS, MS (Resident Pediatric Surgery), Department of Pediatric Surgery Ward Unit 1, Post-Graduate Medical Institute Sandeman Provincial Hospital Quetta.*
[2]HOD Pediatric Surgery Department, Sandeman Provincial Hospital, Quetta.
[3]Consultant Pediatric Surgeon, Sandeman Provincial Hospital, Quetta.
[4]MBBS, Resident Pediatric Surgery, Sandeman Provincial Hospital, Quetta.
[5]Assistant Professor, Department of General Surgery, Sandeman Provincial Hospital, Quetta.
[6]Associate Professor of Surgery, PGMI, SKZBZ Alnayan Hospital, Quetta.

[2]Mohyuddinkakar1@gmail.com, [5]ahmadqta@yahoo.com, [6]Idreesach@gmail.com

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Corresponding Author: *

Abstract

Background: *Undescended testes (cryptorchidism) is a common condition that can lead to fertility issues and increased cancer risk if untreated. While causes are not fully understood, genetic, hormonal, and environmental factors may play a role. Treatment typically involves orchiopexy. However, local studies on testicular volume changes after surgery are scarce, and international data is limited. This study was designed to evaluate the impact of orchiopexy on testicular volume alteration.*

Objective: *To evaluate testicular volume alterations before and after orchiopexy and determination of mean change in testicular volume.*

Duration: *Duration of this study was 6 months, w.e.f September 2024 to Feb 2025.*

Methodology: *This prospective comparative study, conducted at Sandeman Provisional Hospital in Quetta, aimed to assess the impact of orchiopexy on testicular volume in children with cryptorchidism. A total of 31 participants, selected from Civil Hospital Quetta and Bolan Medical Complex, underwent ultrasound imaging before and after surgery, with follow-up between 3 to 6 months. Ultrasonography provided accurate measurements of testicular volume, helping evaluate the efficacy of orchiopexy. Ethical approval was granted, and informed consent was obtained from parents/guardians.*

Results: *The study included 31 participants with a mean age of 7.10 ± 3.29 years. Among them, 45.2% were aged ≤6 years, and 54.8% were 7-12 years old. The undescended testes were located in various positions: above the internal ring (22.6%), at the external ring (64.5%), and prescrotal (12.9%). Paired analysis revealed a significant increase in testicular volume, from 0.387 ± 0.054 ml pre-treatment to 0.567 ± 0.082 ml post-treatment (mean difference: 0.179 ± 0.038 ml, $p = 0.000$).*

Conclusion: *In conclusion, the study showed a significant increase in testicular volume after orchiopexy (mean change: 0.179 ± 0.038 mL, p = 0.000). The paired samples analysis confirmed treatment efficacy, with no significant subgroup differences, highlighting the treatment's success across all participants.*

INTRODUCTION

Cryptorchidism, also known as undescended testis (UDT), is a common congenital condition in pediatric urology, where one or both testes fail to descend into the scrotum.[1] It is typically classified into two categories: palpable testis, which accounts for over 80% of cases, and non-palpable testis (NPT).[2,3] UDT is associated with an increased risk of testicular malignancies and hernias, highlighting the need for timely medical intervention.[3]

Testicular descent generally occurs between 25 and 35 weeks of gestation, and UDT is diagnosed at birth in approximately 1%–4% of term infants and up to 45% of preterm infants. While many undescended testes spontaneously descend into the scrotum by 3 months of age, the likelihood of this decreases with age, particularly for preterm infants.[4] When UDT persists beyond 6 months, the chances of spontaneous descent become minimal, and surgical intervention is required.[5] Orchidopexy, the procedure to surgically reposition the undescended testis into the scrotum, is most effective when performed before the first year of life, reducing the risk of complications such as infertility and testicular cancer.[6,7]

Testicular volume is an important indicator of testicular function, as 80-90% of the testes consist of seminiferous tubules responsible for spermatogenesis.[9] Testicular size correlates closely with spermatogenesis, testosterone production, and semen quality, making it a key measure of testicular health.[9] Despite its significance, there is limited local research specifically examining the impact of orchiopexy on testicular volume. While some studies have compared testicular volume before and after surgery, most of these focus on international populations, leaving a gap in evidence that is specific to local populations. This study aimed to fill that gap by evaluating the change in testicular volume before and after orchiopexy in a cohort of children with cryptorchidism in our local population.

METHODOLOGY

This was a prospective comparative study conducted at the Department of Pediatric Surgery, Sandeman Provisional Hospital (SPH), Quetta, over a six-month period. The study aimed to evaluate the effects of orchiopexy on testicular volume in children with cryptorchidism. Participants were selected from the outpatient departments (OPD) of Civil Hospital Quetta and Bolan Medical Complex Hospital (BMCH), Quetta. A total of 31 patients were included, following approval from the PGMI Quetta and the ethical review committee. Non-probability convenience sampling was employed. Inclusion criteria consisted of children under 13 years of age diagnosed with isolated cryptorchidism, undergoing orchiopexy, and without other systemic conditions. Children over 13 years of age, those with additional medical conditions, or incomplete data (including the absence of pre-treatment ultrasound) were excluded from the study. Data collection involved ultrasonography to measure testicular volume pre- and post-treatment, with follow-up imaging performed between 3 to 6 months after surgery. Informed consent was obtained from the parents or guardians of all participants prior to and after the surgical intervention. Data were collected using printed questionnaires, requiring approximately 10-15 minutes per participant, and reviewed to ensure completeness before being entered into SPSS software, version 27, for analysis. Statistical analysis was performed on both numerical and categorical variables. Numerical data, such as age, BMI, birth weight, and testicular volume measurements (pre- and post-treatment), were presented as mean ± standard deviation (SD). Categorical variables, including testicular location, parental education level, dietary habits, and laterality of cryptorchidism, were expressed as frequencies and percentages. A paired sample t-test was employed to assess the significance of the mean change in testicular volume before and after treatment. Additionally, stratified analyses were

performed to examine the impact of age, BMI, location, parental education, dietary habits, and laterality on the change in testicular volume. A p-value of ≤ 0.05 was considered statistically significant for all analyses.

RESULTS

The study included 31 participants, with a mean age of 7.10 ± 3.29 years. Of these, 45.2% were aged 6 years or younger, and 54.8% were between 7 and 12 years old. Regarding the location of the undescended testes, 22.6% had them above the internal ring, 64.5% at the external ring, and 12.9% in the prescrotal position. The mean BMI was 24.62 ± 2.06 kg/m², with 48.4% classified as normal weight and 51.6% as overweight or obese. Parental education levels showed that 58.1% of parents had education up to the 10th grade, while 41.9% had attended college or university. In terms of nutrition, 41.9% of participants were well-nourished, and 58.1% were malnourished. The lateral side of the undescended testes was right-sided in 41.9%, left-sided in 38.7%, and bilateral in 19.4%. The mean birth weight was 2690.71 ± 120.55 grams. Data is given in Table 1.0. The mean testicular volume pre-treatment was 0.387 ± 0.054 ml, while post-treatment, the mean volume increased to 0.567 ± 0.082 ml. This represents a change in volume of 0.179 ± 0.038 ml following treatment. Data is given in Table 2.0. The paired sample analysis in Table 4.3 highlights the significant increase in testicular volume following treatment. The mean testicular volume rose from 0.3877 ± 0.05427 ml pre-treatment to 0.5671 ± 0.08243 ml post-treatment, with a mean difference of 0.17932 ± 0.03787 ml. A strong correlation (0.928, p = 0.000) was observed between the pre- and post-treatment volumes, and the paired sample t-test yielded a highly significant result (t = 26.366, p = 0.000). Data is given in Table 3.0. Stratification of mean change in testicular volume on the basis of sub groups of age, BMI, location, parental education, diet habit and lateral side produced significant difference for all the sub groups. Data is given in Table 4.0.

Table 1.0 Baseline Characteristics of Study Sample

Characteristics	Participants n=31
Age (<13 years)	7.10±3.29
• upto 6 years	14 (45.2%)
• 7-12 years	17 (54.8%)
Location	
• Internal Ring & Above	7 (22.6%)
• External Ring	20 (64.5%)
• Prescrotal	4 (12.9%)
BMI (kg/m^2)	24.62±2.06
• Normal Weight	15 (48.4%)
• Overweight/Obese	16 (51.6%)
Parental Education	
• Upto 10th Grade	18 (58.1%)
• College/University	13 (41.9%)
Diet Habits	
• Well Nourished	13 (41.9%)
• Malnourished	18 (58.1%)
Lateral Side	
• Right	13 (41.9%)
• Left	12 (38.7%)
• Bilateral	6 (19.4%)

Birth Weight (g)	2690.71±120.55

Table 2.0 Pretreatment, Post Treatment Testicular Volume and Mean Change

Time Interval	Testicular Volume (ml)	
	Mean	SD
Pre treatment	0.387	0.054
Post treatment	0.567	0.082
Change	0.179	0.038

Table 3.0 Paired Sample Analysis to Determine Significance of Mean Change in Testicular Volume

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Testicular_Volume_Post	.5671	31	.08243	.01481
	Testicular_Volume_Pre	.3877	31	.05427	.00975

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Testicular_Volume_Post & Testicular_Volume_Pre	31	.928	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Testicular Volume Post Treatment / Testicular Volume Pre Treatment	.17932	.03787	.00680	.16543	.19321	26.366	30	.000

Paired Sample t test, Observed difference was significant with p-value=0.000

Table 4.0 Comparison of Mean Change in Testicular Volume Stratified for Various Subgroups

Group	Sub Group	N	Mean	Std. Dev.	p-value
Age	upto 6 years	14	0.1864	0.038	0.331
	7-12 years	17	0.1729	0.037	
BMI	Normal Weight	15	0.1740	0.035	0.482
	Overweight/Obese	16	0.1838	0.040	
Location	Internal Ring & Above	7	0.1700	0.027	0.306
	External Ring	20	0.1875	0.040	
	Prescrotal	4	0.1525	0.023	
Parental Education	Upto 10th Grade	18	0.1739	0.034	0.382
	College / University	13	0.1862	0.042	
Die Habit	Well Nourished	13	0.1738	0.035	0.525
	Malnourished	18	0.1828	0.039	
Lateral Side	Right	13	0.1908	0.370	0.084
	Left	12	0.1633	0.034	

Group	Sub Group	N	Mean	Std. Dev.	p-value
Age	upto 6 years	14	0.1864	0.038	0.331
	Bilateral	6	0.1850	0.403	

Independent Sample t test, Observed difference was insignificant with p-value>0.05

DISCUSSION

Undescended testes, or cryptorchidism, is a prevalent condition in pediatric patients that can lead to long-term complications such as fertility problems, testicular cancer, and hormonal imbalances if not properly addressed.[10] While the precise causes are not fully understood, potential factors include genetic influences, hormonal disturbances during fetal development, and environmental exposures.[11,12] The standard treatment for this condition is orchiopexy, a surgical procedure aimed at moving the testes into the scrotum.[13] Despite the widespread use of this procedure, there is a lack of local research on how orchiopexy affects testicular volume, with international studies also remaining limited. This study aims to fill this research gap by evaluating changes in testicular volume before and after orchiopexy, offering important insights into the effectiveness of this treatment.

In this study, the mean age of participants was 7.10 ± 3.29 years. Comparatively, studies conducted in different regions have reported varying ages for participants with undescended testes. Tseng et al. (2016) in Taiwan observed a mean age of 9.2 months (range 7.2-11.6 months), while Tseng et al. (2019) reported a mean age of 14.1 months (range 11.3-28.1 months).[9,14] In China, Huang et al. (2023) found a mean age of 9.15 ± 1.59 months.[15] In contrast, studies in Sweden by Selin et al. (2024) and in South Africa by Vilgoen et al. (2020) reported significantly older mean ages of 63.7 ± 48.2 months and 21.7 years, respectively.[16,6] These variations highlight the differences in patient populations and treatment contexts across regions.

In this study, regarding the location of the undescended testes, 7 participants (22.6%) had testes located at the internal ring or above, 20 participants (64.5%) had them at the external ring, and 4 participants (12.9%) had prescrotal undescended testes. Tseng et al. (2017) reported slightly different distribution, with 8.9% of cases at the internal ring or above, 84.3% at the external ring, and 2.9% prescrotal.[17] These differences may reflect variations in patient populations, clinical practices, and the criteria used for categorizing testicular location across studies.

In this study, regarding the lateral side of the undescended testes, 13 participants (41.9%) had right-sided undescended testes, 12 participants (38.7%) had left-sided undescended testes, and 6 participants (19.4%) had bilateral undescended testes. Tseng et al. (2017) reported a similar distribution, with 39.5% of cases right-sided, 34.1% left-sided, and 26.4% bilateral. In contrast, Vilgoen et al. (2020) found a higher prevalence of unilateral cases (54.1%) compared to bilateral cases (45.9%), suggesting possible regional differences in the occurrence of unilateral versus bilateral undescended testes.[6]

In this study, the mean testicular volume prior to treatment was 0.387 ± 0.054 mL, and after treatment, the mean volume increased to 0.567 ± 0.082 mL, representing a mean increase of 0.179 ± 0.038 mL. In comparison, Tseng et al. (2016) reported a pre-treatment mean volume of 0.238 mL, which significantly increased to 1.492 mL after orchiopexy. However, Huang et al. (2023) found a much smaller change, with pre-treatment values of 0.49 ± 0.07 mL and post-treatment values of 0.51 ± 0.006 mL (p = 0.990), showing a non-significant increase.[15] You et al. (2020) in China also reported a significant increase in testicular volume across all age groups included in their study.[18] Furthermore, in a study by Tseng et al. (2017), 134 boys with unilateral undescended testicles underwent regular ultrasonographic follow-up for a mean of 3.9 years. Of these, 33.4% underwent orchiopexy before the age of one. Orchiopexy performed before one year resulted in a significantly higher growth percentage ratio (GPR) of 2.02 ± 0.40 compared to the second (1.25 ± 0.13, p = 0.004) and third (1.24 ± 0.14, p = 0.008) age groups, emphasizing the benefit of early intervention for optimal testicular growth.[17]

In this study, a paired samples analysis was conducted to evaluate the significance of the change in testicular volume before and after treatment. The mean testicular volume after treatment was 0.5671 ± 0.08243 mL, compared to 0.3877 ± 0.05427 mL

before treatment. A strong positive correlation was found between pre- and post-treatment volumes ($r = 0.928$, $p = 0.000$). The paired samples t-test revealed a significant difference, with a mean increase of 0.17932 ± 0.03787 mL (95% CI: 0.16543 to 0.19321 mL), and a t-value of 26.366 ($df = 30$), confirming the statistical significance ($p = 0.000$) of the increase in testicular volume post-treatment. Furthermore, the mean change in testicular volume was stratified across various subgroups, and no significant differences were observed between them, suggesting that the treatment was equally effective across all subgroups.

CONCLUSION

In conclusion, the study demonstrated a significant increase in testicular volume following orchiopexy, with a mean change of 0.179 ± 0.038 mL ($p = 0.000$). The paired samples analysis confirmed the efficacy of the treatment, showing a strong positive correlation between pre- and post-treatment volumes. Furthermore, no significant differences in the mean change of testicular volume were found across various subgroups, suggesting that the treatment was effective across all participant categories. These findings highlight the successful impact of orchiopexy on undescended testes thus recommended in future practice.

LIMITATIONS & RECOMMENDATIONS

The strengths of this study include its focus on a specific clinical issue, robust data collection methods, and the use of statistical tools to analyze testicular volume changes. However, limitations include the potential for selection bias and the lack of long-term follow-up data on fertility or cancer risks. Future studies could explore these aspects, incorporate larger sample sizes, and consider the long-term effects of orchiopexy to provide more comprehensive insights into its impact on patient outcomes.

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Contribution:

Author 1,2: Substantial contributions to study design, data acquisition, interpretation of data, manuscript writing, final approval, and accountability for the work's accuracy and integrity.

Author 3,4: Contributed to concept and study design, interpretation of data, provided critical review, and gave final approval for publication. Ensures accountability for the work's accuracy and integrity.

Author 5,6: Contributed to data analysis, interpretation of data, write up, and final approval. Ensures accountability for the work's accuracy and integrity.

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