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Evaluation of Testicular Growth Percentage Ratio after Orchidopexy in Different Age Group in Unilateral Palpable Undescended Testis

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Abstract

Original Research Article

***Background*:** Undescended testis (UDT) means absent of testis in the scrotum but present its normal path of descend. In recent decades, the recommended age for orchiopexy for undescended testis has decreased, in the expectation that this might improve subsequent fertility. Currently recommended age for Orchidopexy between 6-12 and 6-18 months. Whatever the underlying cause UDT deserves treatment early in life to prevent loss of spermatogenic potential and to allow early detection of malignancy. The accurate measurement of testicular size and determination of testicular volume has a great importance in assessing the testicular functional status in children. Ultrasonograpically measured testicular volume is standard and more accurate than obtained by non-radiological clinical method. ***Objective*:** To evaluate the testicular growth after orchidopexy in different age group in unilateral palpable undescended testis. ***Materials and Methods*:** This Quasi Experimental study was carried in the Department of Pediatric Surgery, BSMMU, Dhaka, Bangladesh without interrupting standard care practiced in the department during October 2020 to September 2022.A total of 30 pediatric patients with unilateral palpable undescended testis. Proper clinical history, physical examinations, and initial investigation reports were recorded in a standard data sheet. All the patients were categorized according to age at operation as ≤2years and >2years. Unilateral palpable undescended testes from 6 months to 12 years were enrolled in this study. Ultrasonography of both inguino scrotal region were performed for every sample to see the length, width and location of testis. Ultrasonography was done before and after orchiopexy by single experienced radiologist. Statistical analyses of the results were obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-22). ***Results*:** A total of 30 patients with unilateral palpable undescended testis underwent regular ultrasonography follow up at preoperative and postoperative periods of 3months, 6months and 9months.In this study it was observed that 15(50.0%) were age at orchiopexy ≤2 years and 15(50.0%) age at orchiopexy>2 years. Right and left side involvement was 14(46.7%) and 16(53.3%) respectively. The mean growth percentage ratio (UDT/NDT) of 3 months was 0.99±0.19 in age at orchiopexy (≤2 years) and 0.83±0.25 in age at orchiopexy (>2 years). The mean growth percentage ratio (UDT/NDT) of 6 months was 1.09±0.2 in age at orchiopexy (≤2 years) and 0.99±0.14 in age at orchiopexy (>2 years). In this study it was observed that the growth percentage ratio (UDT/NDT) in post-operative follow up of 3 months and 6 months were almost similar between age at orchiopexy (≤2 years) and age at orchiopexy (>2 years), no statistical significant (p>0.05) difference was observed between two groups. However at 9 months follow-up the growth percentage ratio (UDT/NDT) was 1.24±0.2 in age at orchiopexy (≤2 years) and 0.86±0.11 in age at orchiopexy (>2 years).The differences of growth percentage ratio (UDT/NDT) at 9 months was statistically significant (p<0.05) between two groups. ***Conclusion*:** Orchiopexy performed within 2 years of age significantly improves testicular volume as well as growth and development of undescended testis.

Keywords: Undescended testis, USG, Orchidopexy, testicular volume, growth percentage ratio.

INTRODUCTION

Undescended testis is the most common congenital anomaly in boys. The incidence of Undescended Testis (UDT) occurs about 3% of term male infant and 33-45% of premature and / or low birth weight male infants (Holcomb *et al.*, n.d.). The testes are the primary male sex organs responsible for production of male gametes and sex hormone. Early testicular descent into the corresponding scrotal sac is an essential prerequisite for its development and function. During embryonic life, the testes form beside the mesonephric kidneys and descend via the inguinal canal to the scrotum. Testicular descend is necessary for normal spermatogenesis which requires 2 to 3 degree cooler scrotal environment [1]. The majority descends within 6 months of age. Failure of testicular descent results in impaired spermatogenesis and can lead to infertility & malignancy in adulthood and those can be significantly reduced by early [2].

UDT in paediatric age group is mostly diagnosed by paediatrician and paediatric surgeons on the basis of history (given by the parents) and clinical examination of the child. Investigations are mainly when it is nonpalpable.UDT is differentiated between congenital and acquired; palpable and nonpalpable; unilateral or bilateral. About 80% of UDT are palpable and 20% are non-palpable [3]. The mainstay of therapy for the palpable UDT is orchiopexy with creation of a subdartospouch. This may be performed through a standard two-incision (inguinal and scrotal) approach, or a single-incision high scrotal approach. With the standard inguinal method, the success rate is as high as 95 % [4].

The optimal age for surgical treatment remains controversial. Histopathological studies of cryptorchid testicular tissue have shown that degenerative changes are already present by 18 months of age [5]. Neonatal genocyte transforms into type A spermatogonium at 3-12months of age ("minipuberty"), a step that is now crucial for subsequent fertility, as the stem cells responsible for spermatogenesis. This step may be blocked in undescended testis. Cyrptorchid patients harbour germ cells in the testis at the time of birth but from about 15 months of age germ cells may lack [6].

Currently recommended age for Orchidopexy between 6-12 and 6-18 months [2]. Whatever the underlying cause UDT deserves treatment early in life to prevent loss of spermatogenic potential and to allow early detection of malignancy [1].

The testes at birth remain very small which undergo rapid enlargement at puberty. In pre-pubertile children testicular volume of 1-3ml is regarded as normal; less than1ml as reduced size and less than 1ml with non-palpable testicular tissue as atretic. In pubertal boys testicular size of 4ml and above is regarded as normal, 2-3ml as reduced size and less than 2ml and soft testis is regarded as atretic [7].

The accurate measurement of testicular size and determination of testicular volume has a great importance in assessing the testicular functional status in children. As the seminiferous tubules comprise 80-90% of the testicular mass .Testicular volume is largely a reflection of spermatogenesis or semen profile [8]. So we measured the testicular volume repeatedly, because there is good correlation between the spermatogenic activity of testis and testicular volume. Several measurement methods are used for the assessment of testicular volume, including orchidometry, rulers, calipers, and ultrasonography (USG).

Ultrasonograpically measured testicular volume is standard and more accurate than obtained by non-radiological clinical method. It is affordable, readily available and non-ionizing. Whereas the orchidometer and calipers overestimate the testicular volume. CT scan, MRI are more accurate but their high cost, relative non-availability and ionizing radiation in CT scan make their use in testicular routine assessment in challenging [9]. We want to estimate the size of undescended testis and contralateral normally descended testes to establish the growth and development. Testicular Growth percentage ratio was defined as growth percentage of the undescended testis (UDT) divided by growth percentage of the contra lateral normally descended testis (NDT). Growth percentage of testis was defined as postoperative testicular volume divided by preoperative testicular volume x 100% [2].

Different studies have shown satisfactory testicular growth achieved as orchiopexy was performed before two years of age [2]. To address this issue we were conducted a Quasi Experimental study to evaluate testicular growth percentage ratio after orchiopexy at our institution.

OBJECTIVE

- To evaluate the testicular growth after orchidopexy in different age group in Unilateral Palpable Undescended Testis.

MATERIALS AND METHODS

This Quasi Experimental study was carried in the Department of Pediatric Surgery, BSMMU, Dhaka, Bangladesh without interrupting standard care practiced in the department during October 2020 to September 2022. A total of 30 pediatric patients with unilateral palpable undescended testis. Proper clinical history, physical examinations, and initial investigation reports were recorded in a standard data sheet. All the patients were categorized according to age at operation as ≤2years and >2years. Unilateral palpable undescended testes from 6 months to 12 years were enrolled in this study. UDT with syndromic children, UDT associated

with other pathology e.g. trauma, torsion, tumor, Iatrogenic UDT (e.g. After Herniotomy) and parents unwilling to participate were excluded from this study.

Ultrasonography of both inguino scrotal region were performed for every sample to see the length, width and location of testis. Ultrasonography was done before and after orchiopexy by single experienced radiologist. Statistical analyses of the results were obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-22).

Study Procedure

Pediatric patients (1-12 years) presented with unilateral UDT was came in pediatric surgery outpatient department. In Outpatient department detailed antenatal and postnatal history was taken and thorough clinical examinations were done. Then the findings will be recorded in pretested data collection sheet. All the patients were categorized according to age at operation as Group 1 (≤2years),Group 2(>2years).Evaluation of both inguino scrotal regions was done by a single experienced senior radiologist using a Philips Affiniti 30 with a 7.5 MHz linear transducer ultrasound machine at the Department of Radiology and Imaging, BSMMU, Dhaka. The ultrasonic examination was done both in rest and during straining by linear-array 7.5 MHz transducer to measure the length, width and location of testicles. Testicular volume was calculated by using the Hansen formula: Testicular volume =0.52 x Length(L) x Width(W)2.After that Pre anesthetic checkup was done and unilateral standard orchiopexy was performed under direct supervision of guide. After orchidopexy ultrasonographic examination was done again at 3 months, 6 months and 9 months to measure the testicular volume.

Statistical Analysis

All the data was compiled and sorted properly. Data input was given to the computer with the help of an excel sheet. Statistical analysis was performed by using SPSS version 22 for Windows. All categorical variables were expressed as frequency, percentage and continuous variables were expressed as mean, SD. This result was presented in tabulated form. Chi square test was done for categorical variables and the nonparametric test (Mann-Whitney U test) was used to analyze the continuous variables, shown in cross tabulation. P values < 0.05 were considered as statistically significant.

RESULTS

A total of 30 patients who met the required criteria were registered for the study. Table 1 the shows distribution of the study patients by age at orchidopexy (n=30) 15 (50.0%) of patients were age at orchidopexy ≤2 years and 15(50.0%) age at orchidopexy>2 years.

Table 1: Distribution of the study patients by age at orchidopexy (n=30)

Age at orchiopexy	Number of patients (n)	Percentage (%)
Age at orchiopexy (≤ 2 years)	15	50.0
Age at orchiopexy (>2 years)	15	50.0

In figure 1: It was observed that more than half 16 (53.3%) of patients had left side involvement and 14(46.7%) in right side involvement.

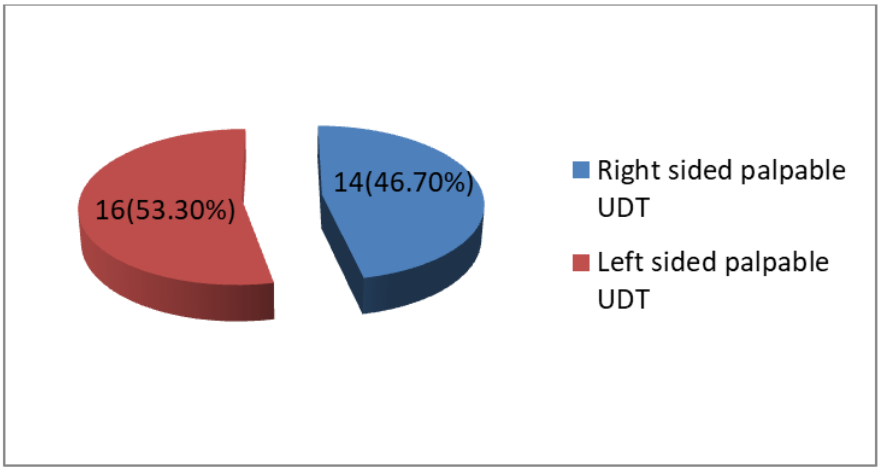

Figure 1: Distribution of the study patients by side involvement (n=30)

In table 2: It was observed that majority 12(80.0%) of patients location found superficial inguinal ring in age at orchidopexy (≤2 years) and 9(60.0%) in age at orchidopexy (>2 years). The difference was no statistically significant (p>0.05) between two groups.

Table 2: Distribution of the study patients by location of testis (n=30)

Location of testis	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	n	%	n	%	
Superficial inguinal ring	12	80.0	9	60.0	0.381^{ns}
Inguinal canal	3	20.0	5	33.3	
Near the deep ring	0	0.0	1	6.7	

Table 3 show distribution of the study patients by testicular length of UDT according to USG findings. The mean difference of testicular length of UDT evaluated by USG findings at post-operative 3 months was not statistically significant (p<0.05) between two groups. The mean difference of testicular length of UDT evaluated by USG findings at post-operative 6 and 9 months were statistically significant (p<0.05) between two groups.

Table 3: Distribution of the study patients by testicular length (L) of UDT according to USG findings (n=30)

Length (L)	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
Pre-operative USG findings of UDT	1.63	±0.29	1.40	±0.54	0.071^{ns}
Post-operative USG findings of UDT (3 Months)	1.60	±0.25	1.42	±0.50	0.068^{ns}
Post-operative USG findings of UDT (6 Months)	1.85	±0.25	1.57	±0.47	0.031^{s}
Post-operative USG findings of UDT (9 Months)	1.96	±0.24	1.69	±0.44	0.046^{s}

Table 4 show distribution of the study patients by testicular width of UDT according to USG findings. The mean difference of testicular width of UDT evaluated by USG findings at postoperative 3, 6 and 9 months were not statistically significant (p<0.05) between two groups.

Table 4: Distribution of the study patients by testicular width (W) of UDT according to USG findings (n=30)

Width (W)	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
Preoperative USG findings of UDT	0.67	±0.12	0.73	±0.15	0.319^{ns}
Postoperative USG findings of UDT (3 Months)	0.71	±0.14	0.73	±0.13	0.418^{ns}
Postoperative USG findings of UDT (6 Months)	0.79	±0.14	0.79	±0.12	0.901^{ns}
Postoperative USG findings of UDT (9 Months)	0.87	±0.08	0.84	±0.10	0.372^{ns}

Table 5 show distribution of the study patients by testicular volume of UDT according to USG findings. The mean difference of testicular volume of UDT evaluated by USG findings at 3 months and 6 months were not statistically significant (p<0.05) between two groups. The mean difference of testicular volume of UDT evaluated by USG findings at 9 months was statistically significant (p<0.05) between two groups.

Table 5: Distribution of the study patients by testicular volume (TV) of UDT according to USG findings (n=30)

Testicular volume (TV) (ml)	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
Preoperative USG findings of UDT	0.38	±0.16	0.40	±0.14	0.280^{ns}
Postoperative USG findings of UDT (3 Months)	0.43	±0.18	0.40	±0.15	0.158^{ns}
Postoperative USG findings of UDT (6 Months)	0.62	±0.14	0.62	±0.12	0.115^{ns}
Postoperative USG findings of UDT (9 Months)	0.77	±0.12	0.67	±0.11	0.024^{s}

Table 6 show distribution of the study patients by testicular length of contralateral NDT according to USG findings. The mean difference of testicular length of contralateral NDT evaluated by USG findings at 3 months and 6 months were not statistically significant ($p<0.05$) between two groups. The mean difference of testicular length of contralateral NDT evaluated by USG findings at 9 months was statistically significant ($p<0.05$) between two groups.

Table 6: Distribution of the study patients by testicular length (L) of contralateral NDT according to USG findings (n=30)

Length (L)	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
Preoperative USG findings of contralateral NDT	2.03	±0.39	1.84	±0.48	0.109^{ns}
USG findings of contralateral NDT (at 3 Months)	2.15	±0.41	1.91	±0.48	0.074^{ns}
USG findings of contralateral NDT (at 6 Months)	2.37	±0.42	2.11	±0.45	0.120^{ns}
USG findings of contralateral NDT (at 9 Months)	2.45	±0.27	2.25	±0.26	0.048^{s}

Table 7 show distribution of the study patients by testicular width of NDT according to USG findings. The mean difference of testicular width of contra lateral NDT evaluated by USG findings at 3 months and 6 months were not statistically significant ($p<0.05$) between two groups. The mean difference of testicular width of contralateral NDT evaluated by USG findings at 9 months was statistically significant ($p<0.05$) between two groups.

Table 7: Distribution of the study patients by testicular width (W) of contralateral NDT according to USG findings (n=30)

Width (W)	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
Preoperative USG findings of contralateral NDT	0.74	±0.15	0.75	±0.15	0.740^{ns}
USG findings of contralateral NDT (at 3 Month)	0.77	±0.11	0.81	±0.14	0.467^{ns}
USG findings of contralateral NDT (at 6 Month)	0.84	±0.11	0.89	±0.13	0.372^{ns}
USG findings of contralateral NDT (at 9 Month)	0.86	±0.11	0.97	±0.12	0.014^{s}

Table 8 show distribution of the study patients by testicular volume of contralateral NDT according to USG findings. The mean difference of testicular volume of contralateral NDT evaluated by USG findings at 3 months and 6 months were not statistically significant ($p<0.05$) between two groups. The mean difference of testicular volume of contralateral NDT evaluated by USG findings at 9 months was statistically significant ($p<0.05$) between two groups.

Table 8: Distribution of the study patients by testicular volume (TV) of contralateral NDT according to USG findings (n=30)

Testicular volume (TV)	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
Preoperative USG findings of contralateral NDT	0.58	±0.19	0.56	±0.31	0.372^{ns}
USG findings of contralateral NDT (at 3 Months)	0.66	±0.18	0.67	±0.33	0.330^{ns}
USG findings of contralateral NDT (at 6 Months)	0.87	±0.21	0.88	±0.32	0.395^{ns}
USG findings of contralateral NDT (at 9 Months)	0.95	±0.17	1.10	±0.20	0.035^{s}

Table 9 shows distribution of the study patients by growth percentage of UDT. The mean growth percentage of UDT at 3 months and 6 months were not statistically significant ($p<0.05$) between two

groups. The mean differences of growth percentage of UDT at 9 months was statistically significant (p<0.05) between two groups.

Table 9: Distribution of the study patients by growth percentage of UDT (n=30)

Growth percentage of UDT	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
3 months	1.13	±0.22	1.00	±0.25	0.253^{ns}
6 months	1.63	±0.2	1.55	±0.28	0.158^{ns}
9 months	2.03	±0.16	1.68	±0.13	0.001^{s}

Table 10 shows distribution of the study patients by growth percentage of contralateral NDT. The mean growth percentage of contralateral NDT at 3 months and 6 months were not statistically significant (p<0.05) between two groups. The differences of growth percentage of contralateral NDT at 9 months was statistically significant (p<0.05) between two groups.

Table 10: Distribution of the study patients by growth percentage of contralateral NDT (n=30)

Growth percentage of contralateral NDT	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
3 months	1.14	±0.11	1.20	±0.09	0.271^{ns}
6 months	1.50	±0.25	1.57	±0.24	0.709^{ns}
9 months	1.64	±0.17	1.96	±0.16	0.001^{s}

Table 11 show distribution of the study patients by growth percentage ratio (UDT/NDT). The mean growth percentage ratio (UDT/NDT) of 3 months, 6 months were not statistically significant (p<0.05) between two groups. The differences of growth percentage ratio (UDT/NDT) at 9 months was statistically significant (p<0.05) between two groups.

Table 11: Distribution of the study patients by growth percentage Ratio (UDT/NDT) (n=30)

Growth percentage Ratio (UDT/NDT)	AGE AT ORCHIOPEXY (≤ 2YEARS)		AGE AT ORCHIOPEXY (>2YEARS)		p value
	Mean	±SD	Mean	±SD	
3 months	0.99	±0.19	0.83	±0.25	0.198^{ns}
6 months	1.09	±0.2	0.99	±0.14	0.125^{ns}
9 months	1.24	±0.2	0.86	±0.11	0.001^{s}

DISCUSSION

This Quasi Experimental study was carried out with an aim to measure testicular volume of undescended testes (UDT) preoperatively and it determined post operatively at 3 months, 6 months and 9 months as well as to evaluate the growth percentage at 3 months, 6 months and 9 months of undescended testis. These studies also to measure testicular volume of contralateral normally descended testes (NDT) preoperatively and assess post operatively at 3 months, 6 months and 9 months as well as evaluate the growth percentage ratio (UDT/NDT) of testis at 3months, 6months and 9 months of postoperative period.

A total of 30 pediatric patients with unilateral palpable undescended testis in the pediatric Surgery department of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, during October 2020 to September 2022, were included in this study. Unilateral palpable undescended testes from 6 months to 12years were enrolled in this study. They were classified as age at orchiopexy ≤2years and age at orchiopexy>2years. Unilateral non-palpable undescended testis, UDT with syndromic children, UDT associated with other pathology e.g. trauma, torsion, tumor, Iatrogenic UDT, parents unwilling to participate were excluded from the study. The present study findings were discussed and compared with previously published relevant studies.

In this study it was observed that 15(50.0%) were age at orchiopexy ≤2 years and 15(50.0%) age at orchiopexy>2 years. Right and left side involvement was 46.7% and 53.3% respectively in this present study.

In a study two main concerns in persistent UDT are the risks of testicular malignancy and infertility in adulthood. Performing orchiopexy in all prepubertal boys reduces the relative risk of testicular cancer. In this present study it was observed that preoperative mean testicular volume of UDT was 0.38±0.16ml in age at orchiopexy (≤2 years) and 0.40±0.14ml in age at orchiopexy (>2 years). In post-operative follow up at 3 months the mean testicular volume of UDT was 0.43±0.18ml in age at orchiopexy

(≤2 years) and 0.40±0.15ml in age at orchiopexy (>2 years). In post- operative follow up at 6 months the mean testicular volume of UDT was 0.62±0.14ml in age at orchiopexy (≤2 years) and 0.62±0.12ml in age at orchiopexy (>2 years). The mean testicular volume of UDT in preoperative, post-operative follow up of 3 months and 6 months were almost matching between age at orchiopexy (≤2 years) and age at orchiopexy (>2 years), no statistical significant (p>0.05) difference was observed between two groups. In contrast during post-operative follow up at 9 months the mean testicular volume of UDT was 0.77±0.12ml in age at orchiopexy (≤2 years) and 0.67±0.11ml in age at orchiopexy (>2 years). The mean testicular volume of UDT evaluated by USG findings at 9 months was significantly (p<0.05) increased in age at orchiopexy (≤2 years) with compared age at orchiopexy (>2 years). The primary location of UDTs actually had an impact on the testicular volume and testicular atrophy (TA) rates [2]. Although the primary locations have an impact on testicular volume after orchiopexy, the growth ratio in all the UDT types was high. Another study's findings also reveal that unilateral undescended testis volume increased after hormonal, surgical and combined therapy in all studied age groups. At the 9 to 12 months' time point, TV was found to be significantly higher following hCG administration than after surgical treatment or combined therapy. The change in testicular volume peaked 9 to 12 months after treatment [3]. Another study evaluated TV in 18-year-old patients treated in childhood for unilateral or bilateral UDT and found similar findings. The volume of the unilaterally undescended testis was significantly higher in patients who had undergone hCG treatment compared to those who had been operated on after failure of hormonal therapy and those who had undergone primary surgery [10]. In a study by another researcher, orchiopexy by the age of 10 to 12 years resulted in a 2 to 6-fold decrease of the relative risk compared with orchiopexy after the age of 12 years or no orchiopexy at all. The mean testicular volume at postoperative of UDT was 0.306 ± 0.027ml in ≤2 years and 1.253 ± 0.371ml in age > 2 years, that was significantly (p<0.05) higher in age > 2 years, which differ with the present study. This may due to the preoperative mean testicular volume of UDT was higher in age > 2 years in their study. This study also showed better volume outcomes after orchiopexy at any age, although the UDT volume remained below the normal values [12]. Similar observations regarding the mean testicular volume of the undescended testes showed highly significant increases when reviewed at 9 months were also observed in some other studies [2, 13-15].

In this present study it was observed that the mean testicular volume of contralateral NDT in preoperative, postoperative follow up of 3 months and 6 months were almost identical between age at orchiopexy (≤2 years) and age at orchiopexy (>2 years), nostatistical significant (p>0.05) difference were observed between two groups. No explanation was found regarding these findings, may be due to unknown cause. On the otherhand in postoperative follow up at 9 months the mean testicular volume of contralateral NDT was 0.95±0.17ml in age at orchiopexy (≤2 years) and 1.10±0.20ml in age at orchiopexy (>2 years). The mean testicular volume of contralateral NDT evaluated by USG findings at 9 months was significantly (p<0.05) elevated in age at orchiopexy (>2 years) with compared age at orchiopexy (≤2 years). Tseng *et al.,* (2017) study found the mean testicular volume of contralateral NDT was 0.517±0.031ml and 2.364 ± 0.662ml in age ≤2 years and >2 years respectively (p<0.01), which is comparable with the current study.

In this present series it was observed that the mean growth percentage UDT in postoperative follow up of 3 months and 6 months were almost comparable between age at orchiopexy (≤2 years) and age at orchiopexy (>2 years), no statistical significant (p>0.05) difference was observed between two groups. On the contrary, at 9 months follow-up the mean growth percentage UDT was 203±16.0% and 168±13.0% in age at orchiopexy (≤2 years) and age at orchiopexy (>2 years) respectively. The mean growth percentage UDT differences at 9 months was significantly (p<0.05) higher in age at orchiopexy (≤2 years) with compared to age at orchiopexy (>2 years). Similarly, Tseng *et al.,* (2017) study found that the mean growth percentage of UDT was 163.8 ± 18.4% in age ≤2 years and 257.2 ± 61.8% in age > 2 years, the difference was statistically significant between two groups. Kim *et al.,* (2011) study mentioned that early surgical treatment at 9 months resulted in partial catch-up of testicular growth until at least the age of 4 years compared with surgery at 3 years. The authors clearly indicated that early surgery has a positive effect on testicular growth. They also noted the complete absence of growth of testes that are still undescended until the age of 3 years. The investigators suggested that the growth of these testes could not be salvaged by surgery at 3 years because no resumed growth was noted until the end of the follow-up at the age of 4 years.

In this study it was observed that the mean growth percentage of contralateral NDT in postoperative follow up of 3 months and 6 months were almost alike between age at orchiopexy (≤2 years) and age at orchiopexy (>2 years), no statistical significant (p>0.05) difference was observed between two groups. Conversely, at 9 months follow-up the mean growth percentage of contralateral NDT was 1.64±0.17 and 1.96±0.16 in age at orchiopexy (≤2 years) and age at orchiopexy (>2 years) respectively. The mean growth percentage of contralateral NDT differences at 9 months was significantly (p<0.05) higher in age at orchiopexy (>2 years) with compared to age at orchiopexy (≤2 years). In a study observed that the mean growth percentage of contralateral NDT was 148.2±10.8% in age ≤2 years and 240.1±59.1% in Age

> 2 years. Nevertheless, the UDT grew faster than NDT in all the age groups after orchiopexy, which is consistent with the current study [2]. Another study showed that the testes of the group of subjects who underwent early surgery within 2 years of age showed rapid catch-up growth compared with testes operated on at the age of 2 years or older [16].

The ratio of postoperative and preoperative testicular volume was defined as the testicular growth rate. The final growth rate of testes was different in the unilateral and bilateral UDT groups. However, the final growth rates of UDT (combined unilateral and bilateral) and contralateral NDT were similar [12]. In this present study it was observed that the mean growth percentage ratio (UDT/NDT) in postoperative follow up of 3 months and 6 months were almost similar between age at orchiopexy (≤2 years) and age at orchiopexy (>2 years), no statistical significant ($p>0.05$) difference was observed between two groups. However at 9 months follow-up the mean growth percentage ratio (UDT/NDT) was 1.24±0.2 in age at orchiopexy (≤2 years) and 0.86±0.11 in age at orchiopexy (>2 years). The mean growth percentage ratio (UDT/NDT) differences at 9 months was significantly ($p<0.05$) higher in age at orchiopexy (≤2 years) with compared to age at orchiopexy (>2 years). Tseng *et al.,* (2017) study found in the early orchiopexy group (age ≤ 1 year), UDT to NDT ratio increased significantly ($p<0.05$) from 47.2% at 9.2 months old to 67.1% at 44 months old. In their study the UDT to NDT ratio or the alleged retained-to-scrotal testis ratio is used for direct comparison of the two testicles in a single individual [16, 17]. These ratios represent the comparative size of the UDT at a particular time, either pre-operatively or post-operatively. The UDT to NDT ratio improved after orchiopexy in all age groups in their study. This improvement was especially significant when orchiopexy was done before one year of age. Tseng *et al.,* (2016) study also showed better volume outcomes after orchiopexy at any age, although the UDT volume remained below the normal values. An increase in the UDT to NDT ratio from 68 to 81% in the early orchiopexy group treated at 9 months of age, whereas the ratio decreased in the late orchiopexy group treated at three years old from 68 to 56% [17]. The postoperative UDT to NDT ratio depends on orchiopexy time and patient age. Although calculating the annual testicular growth rate can be used to eliminate the effect of follow-up duration, this method is impractical since the testicles grow very slowly in early childhood [2]. The investigators used the growth percentage ratio (GPR) is advantageous when comparing testicular growth before and after orchiopexy regardless of the follow-up duration. The GPR in the group of youngest children (age ≤ 1 year) was significantly greater than the GPR in children between one and two years of age and in those older than two years. Nevertheless, the UDT grew faster than NDT in all the age groups after orchiopexy. Kim *et al.,* (2011) study obtained that the ratio between the previously retained testis and its scrotal counterpart showed a significant increase after early surgery, whereas in the late-treated group, this ratio showed a significant decrease even after surgery. These results strongly suggest that surgery at the age of 9 months, rather than 3 years, is beneficial for testicular growth. This present study can be concluded that orchidopexy performed within 2years of age significantly improve testicular growth rather than >2years.

CONCLUSION

Orchidopexy performed before two years of age significantly improves testicular volume as well as growth and development of the undescended testis.

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