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Clinical Evaluation of the Testicular Size Post Stephens Fowler's Operation in High Intra-Abdominal Testicle

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ABSTRACT

Background: Cryptorchidism, or undescended testis (UDT), is a common congenital anomaly affecting 2–8% of full-term boys. Surgical intervention, specifically the two-stage Fowler-Stephens orchidopexy, is the preferred treatment for intra-abdominal testis. **Objectives:** This study aimed to evaluate testicular size post-Fowler-Stephens operation in boys with abdominal cryptorchidism.

Patients and Methods: A prospective cohort study was conducted on 24 patients aged 6 months to 16 years with UDT requiring orchidopexy using the two-stage Fowler-Stephens procedure at Menoufia University Hospitals. Demographic data, clinical history, and laboratory tests were collected, and testicular size and volume were assessed preoperatively, post-first stage, post-second stage, and at 3 months follow-up.

Results: Patients had a mean age of 35.2 ± 47.09 months, with 54.17% having right impalpable UDT. Preoperative testicular size was 1.70 × 1.42 cm, and post-operative sizes were 1.70 × 1.46 cm at both stages and remained 1.70 × 1.46 cm at 3 months. Testicular volume increased from 0.23 ± 0.11 ml at the first stage to 0.29 ± 0.14 ml at 3 months ($p < 0.05$).

Conclusion: Management of high intra-abdominal testes with the two-stage laparoscopic Fowler-Stephens approach has been shown to support testicular growth and normalization in size.

Keywords: Cryptorchidism; Undescended testis; Two-stage Fowler-Stephens orchidopexy; Intra-abdominal testis.

INTRODUCTION

Cryptorchidism, also known as undescended testis (UDT), is the most frequent congenital anomaly of the male urogenital tract, affecting approximately 2% to 8% of full-term male infants. UDT may be located anywhere along its normal path of descent and can be detected as either palpable or non-palpable upon clinical examination. A non-palpable UDT generally indicates that the testis is intra-abdominal (IAT) or entirely absent due to agenesis or a vanishing testis [1,2].

While both hormonal and surgical treatments have been explored, surgical intervention through orchidopexy is regarded as the first-line management for boys presenting with UDT [3]. Since its first clinical application in 1976, laparoscopy has become a cornerstone in diagnosing impalpable testes [4]. This technique provides direct visualization, allowing the testis to be accurately identified and managed during the same procedure. Due to its high sensitivity and specificity for detecting IAT, laparoscopy is widely recommended in current practice [5]. Among the complications of orchidopexy, testicular atrophy is the most concerning, often resulting from injury to the testicular vessels. The treatment of IAT is technically demanding, primarily because of the considerable distance between the internal inguinal ring and the scrotal position. Over time, surgical strategies have evolved. A notable breakthrough was the Fowler and Stephens maneuver, which introduced the concept of testicular vessel ligation to facilitate successful orchidopexy in cases of high UDT [6].

Approximately thirty years later, Bloom further developed this approach by reporting his initial experience with laparoscopic vessel ligation, followed by a staged open orchidopexy, offering improved outcomes for challenging intra-abdominal cases [7].

At present, the two-stage laparoscopic Fowler-Stephens operation (2SLF-SO) has become a standard technique for managing IAT, as supported by national expert consensus and clinical guidelines [8].

The purpose of this study was to evaluate testicular size post Fowler-Stephens' operation in boys with abdominal cryptorchidism.

PATIENTS AND METHODS

Patients:

This prospective cohort study was conducted on twenty-four patients with UDT who needed orchidopexy using 2 stages Fowler-Stephens procedure at the age between 6 months and 16 years and were admitted at the Menoufia University Hospitals.

Inclusion criteria were patients with UDT at age between 6 months and 16 years, fit for anesthesia with no underlying gross morbidity and guardians giving consent for photography and publishing literature. **Exclusion criteria were** patients with palpable undescended testis or with retractile testis.

Patients underwent demographic data collection (name, age, sex, residence, occupation, marital status, education) and detailed clinical history, including

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gestational and birth history, symptoms, and scrotal changes. A complete general and local clinical examination was conducted, including weight, height, BMI, and scrotal region assessment. Laboratory tests (CBC, liver/kidney function, coagulation profile, RBS) were performed. Radiological evaluations used Phillips iU22 ultrasound to assess testicular structure, volume, and echogenicity, with scans performed by an experienced radiologist.

The decision between single-stage laparoscopic orchiopexy and two-staged Fowler-Stephens orchiopexy was based on whether the testis was more than 2.5 cm from the deep inguinal ring. For distances greater than 2.5 cm, a two-stage Fowler-Stephens procedure was performed, with the second stage occurring 6 months later. Laparoscopic diagnostic and operative steps were performed to locate and assess the testis, dividing testicular vessels and using gentle handling techniques. A second-stage procedure was planned after 12 weeks to check for adhesions and testicular descent. Testis was fixed in a subdartos pouch if sufficiently descended; otherwise, traction was redone for another 12 weeks.

Patients were monitored for 2 hours post-surgery, received nonsteroidal anti-inflammatory drugs for pain, and resumed fluids after 2 hours, with a normal diet allowed by evening. Discharge occurred 2 hours post-operation. Follow-up evaluations were conducted at one week, one month, and three months, with inguinoscrotal ultrasound performed at 3 months to assess the size and position of the testes in the scrotum.

Ethical Considerations

This study was conducted after obtaining approval from the Research Ethics Committee of the Faculty of Medicine, Menoufia University. Written informed consent was obtained from the guardians of all participating patients prior to enrollment. The consent form clearly stated agreement to participate in the study and to allow the use of anonymized data for publication purposes, with full assurance of confidentiality and privacy protection. Every patient's guardian received an explanation of the purpose of the study and had a secret code number. All procedures were performed in accordance with the ethical standards of the institutional and national research committee and with the Declaration of Helsinki for studies involving human subjects.

Statistical analysis

Statistical analysis was performed using SPSS v28 (IBM Inc., Armonk, NY, USA). Normality of data distribution was assessed with the Shapiro-Wilks test and histograms. All the quantitative data were reported as mean, standard deviation (SD), and range. Non-parametric quantitative data were also reported as median and interquartile range (IQR), and qualitative variables were reported as frequency and percentage.

RESULTS

The demographic data of the patients showed mean age of 35.2 ± 47.09 years, mean weight of 14.0 ± 10.34 kg, mean height of 86.1 ± 29.11 cm, and mean BMI of 16.98 ± 1.31 kg/m² **(Table 1)**.

Table 1: Demographic data of the studied patients

		Total (n=24)
Age (years)	**Mean± SD**	35.2 ± 47.09
	Range	6 m– 16 years
	Median (IQR)	8 (6 - 54)
Weight (kg)	**Mean± SD**	14.0 ± 10.34
	Range	7 - 39
	Median (IQR)	8 (8 - 17.25)
Height (cm)	**Mean± SD**	86.1 ± 29.11
	Range	66 - 149
	Median (IQR)	68 (66.75 - 106)
BMI (Kg/m^2)	**Mean± SD**	16.98 ± 1.31
	Range	15.08 - 19.46
	Median (IQR)	17.3 (15.6 - 17.96)

BMI: body mass index, IQR: interquartile range.

Regarding diagnosis of the studied patients, 54.17% of the patients were found to have right impalpable UDT **(Table 2, Figure 1)**.

Table 2: Diagnosis of the studied patients

	Total (n=24)
Right impalpable UDT	13 (54.17%)
Left impalpable UDT	11 (45.83%)

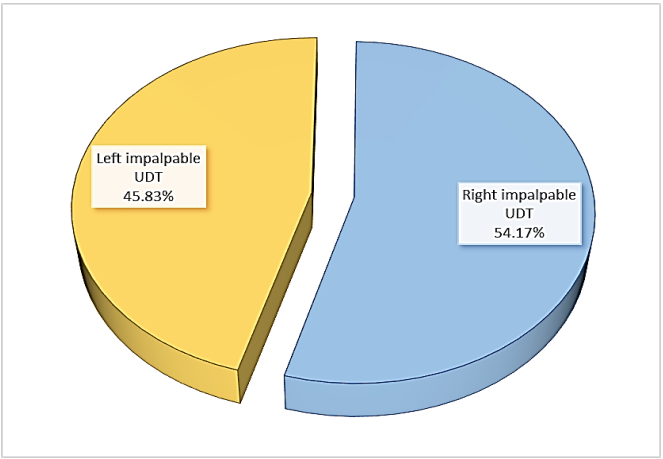

Figure 1: Diagnosis of the studied patients.

The mean Hb concentration among the studied patients was of 12.2 ± 1.12 g/dL. Platelet averaged 354.9 ± 52.67 ×10⁹/L. Mean WBC count was 11.4 ± 4.78 ×10⁹/L. For the coagulation profile, mean PT was 14.24 ± 0.78 seconds, PTT was 30.21 ± 3.64 seconds, and INR was 0.86 ± 0.08 **(Table 3)**.

Table 3: Laboratory investigations of the studied patients

		Total (n=24)
Hb (g/dL)	**Mean ± SD**	12.2 ± 1.12
PLT (*10^9/L)	**Mean ± SD**	354.9 ± 52.67
WBCs (*10^9/L)	**Mean ± SD**	11.4 ± 2.78
PT (sec)	**Mean ± SD**	14.24 ± 0.78
PTT (sec)	**Mean ± SD**	30.21 ± 3.64
INR	**Mean ± SD**	0.86 ± 0.08

Hb: haemoglobin, PLT: platelets, WBCs: white blood cells, PT: prothrombin time, PTT: partial prothrombin time, INR: international normalized ratio, IQR: interquartile range.

At the 1st stage, the mean testicular size was 1.70 × 1.42 cm. At the 2nd stage, the mean size was 1.70 × 1.46 cm. Three months post-orchidopexy, the mean testicular size remained the same. For testicular volume, the mean was 0.23 ± 0.11 ml at the 1st stage, 0.24 ± 0.17 ml at the 2nd stage, and 0.29 ± 0.14 ml at 3 months post-orchidopexy **(Table 4)**.

At the 1st stage the mean testicular volume was 0.23 ± 0.11 ml. At the 2nd stage, the mean testicular volume was 0.24 ± 0.171 ml. At 3 months post orchiopexy, the mean testicular volume was 0.29 ± 0.14 ml **(Table 4)**.

Table 4: Evaluation of the testicular size and volume in the 1st and 2nd stages laparoscopic Fowler-Stephens and at 3 months post orchiopexy of the studied patients.

	Total (n=24)	
	Testicular size	
	Mean	**Range**
1st stage	1.70 x 1.42	1.1 - 2.3 x 0.9 - 2
2nd stage	1.70 x 1.46	1.1 - 2.3 x 0.9 - 2.6
3 months post orchidopexy	1.70 x 1.46	1.1 - 2.3 x 0.9 - 2.6
	Testicular volume	
	Mean ± SD	**Range**
1st stage	0.23 ± 0.11	0.11-70
2nd stage	0.24 ± 0.171	0.11-0.72
3 months post orchidopexy	0.29 ± 0.14	0.12-0.75

DISCUSSION

Cryptorchidism, the most common congenital male genital abnormality, involves the absence of at least one testicle from the scrotum, affecting about 3% of full-term and 30% of premature infants. While most undescended testes descend within the first three months after birth, about 20-30% remain non-palpable, often located in the inguinal canal or abdomen. If a testis hasn't descended by six months, surgical intervention (orchidopexy) is recommended between 6-18 months to mitigate infertility risks. Although hormone therapy (e.g., hCG) is a less invasive option, recent studies indicate it is no more effective than a placebo. Staged Fowler-Stephens orchiopexy is the preferred surgical method for high intra-abdominal testes, achieving a success rate of 80-86%, though it carries risks of vascular complications [9-14].

The aim of this study was to evaluate the testicular size post Fowler-Stephens operation in boys with abdominal cryptorchidism.

This prospective study involved 24 patients with impalpable undescended testis (IUT) requiring orchidopexy via the two-stage Fowler-Stephens procedure, with ages ranging from 6 to 144 months (mean: 35.2 ± 47.09 months). Patients' weights varied from 7 to 39 kg (mean: 14.0 ± 10.34 kg), heights from 66 to 149 cm (mean: 86.1 ± 29.11 cm), and BMIs from 15.08 to 19.46 kg/m² (mean: 16.98 ± 1.31 kg/m²). In line with our findings, some authors conducted a prospective analysis involving 28 patients who underwent single-stage and two-stage Fowler-Stephens laparoscopic orchidopexy for intra-abdominal high testis, reporting a mean age of 1.7 ± 0.40 years in the two-stage group [15].

In contrast to our findings, a study assessed testicular growth and atrophy risk over time in 27 boys (35 testes) with intra-abdominal cryptorchidism, reporting a mean patient age of 7.1 ± 5.1 months and a median of 6.0 months [8]. Additionally, a study reported on 21 patients who underwent a modified two-stage laparoscopic Fowler-Stephens orchidopexy. The mean age at the first stage was 36 months (range 11–68 months), and at the second stage, it was 44 months (range 15–95 months). The first follow-up occurred at a mean age of 51 months (median 6 months post-second stage), while the second follow-up was at a mean age of 64 months (median 12 months after the first follow-up) [16].

In the current study, diagnosis revealed that 13 patients (54.17%) had right impalpable undescended testes (UDT), while 11 patients (45.83%) had left impalpable UDT.

In line with our findings, some authors studied laterality in 28 patients undergoing single-stage and two-stage Fowler-Stephens laparoscopic orchidopexy, reporting 8 patients with right undescended testes (UDT), 4 with left UDT, and 1 with bilateral UDT in the two-stage group [15]. In contrast to our findings, a study investigated laterality in 27 boys with intra-abdominal cryptorchidism (35 testes total) and reported that 10 boys (37%) were treated for left non-palpable UDT, 9 boys (33.3%) for right UDT, and 8 boys (29.7%) for bilateral UDT [8].

These findings align with some authors, who studied laterality in 24 patients undergoing laparoscopic orchiopexy with the two-stage Fowler-Stephen method. They reported that 20 patients had right UDT, 4 had left UDT, and none had bilateral UDT [17].

In line with our findings, a study examined laterality in 27 patients who underwent primary and two-stage laparoscopic orchiopexy. They reported that 4 patients had right UDT, 9 had left UDT, and none had bilateral UDT in the two-stage group [18].

In contrast to our findings, some authors studied laterality in 62 patients who underwent two-stage Fowler-Stephens orchidopexy. They found that 19 (30.6%) had right UDT, 24 (38.7%) had left UDT, and 19 (30.6%) had bilateral UDT. This discrepancy may be attributed to the larger sample size used in their study [19]. In the present study, the Hb concentration of patients ranged from 10.5 to 14 g/dL, with a mean of 12.2 ± 1.12 g/dL. Platelet counts ranged from 254 to 440 × 10^9/L, and WBC counts ranged from 5 to 19 × 10^9/L. Regarding the coagulation profile, PT ranged from 12.6 to 15.5 seconds, PTT ranged from 25 to 35 seconds, and INR ranged from 0.8 to 1. At the first stage, the mean testicular size was 1.70 × 1.42 cm. At the second stage, the mean size was 1.70 × 1.46 cm (same range), and at 3 months post-orchiopexy, the mean size remained 1.70 × 1.46 cm.

These findings align with another trial studied testicular size in 24 patients (24 testes) undergoing laparoscopic orchiopexy using the two-stage Fowler-Stephen method. They reported a mean testicular size of 1.7 ± 0.3 cm for normally sized testes, with a mean length of 0.6 ± 0.2 cm, while patients with complete testicular atrophy had a mean size of 1.2 ± 0.2 cm and a mean length of 0.4 ± 0.2 cm [17]. In agreement with our findings, one research studied 27 boys with intra-abdominal cryptorchidism (35 testes total) and assessed testicular volume through ultrasound at six time points. They reported median testicular volumes of 0.22 ml before treatment, increasing to 0.28 ml at 3 months, 0.28 ml at 9-12 months after laparoscopic Fowler-Stephens operation, 0.31 ml at 3 months post-inguinal orchidopexy, 0.40 ml at ages 3–6, and 0.48 ml at ages 7–9 [8].

Despite the promising findings, this study has several limitations as relatively small sample size inevitably lowered the statistical power of the analysis, The short-term follow up period limits the detection of the long-term possible complications and being single center study, The incidence of testicular atrophy was not evaluated, No control group to compare the growth rate of the testicles in patients with that of the normal healthy children, and No assessment of hormonal levels, hence no accurate detection of testicular function.

CONCLUSION

The 2SLF-SO has demonstrated high efficacy in the surgical management of high IAT. Following the procedure, the affected UDT showed significant potential for growth, frequently achieving size comparable to the contralateral testis, supporting its role in promoting testicular viability and symmetry.

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