Staged laparoscopic-traction orchiopexy versus Fowler–Stephen technique for abdominal testes: a comparative study

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Introduction
Undescended testis (UDT) is a frequent disease that affects 3–5% of full-term newborns and more than one-third of preterm babies.
Most UDT at different levels of inguinal canal, about 10%, are impalpable and are present in the abdomen.
Several techniques have been described for the management of UDT, of which laparoscopic orchiopexy is considered the gold-standard-met staged laparoscopic-traction technique (Shehata approach) that is a two-stage technique based on lengthening testicular vessels, which facilitates repositioning the testis down to scrotum without division of the testicular vessels.
Aim
The results of stepwise laparoscopic-traction orchiopexy (Shehata method) and Fowler–Stephens laparoscopic orchiopexy (FSLO) in patients with intra-abdominal testes are compared in this research.
Patients and methods
Between January 2017 and December 2020, we conducted a retrospective cohort study. During this time, 61 patients had laparoscopic exploration, with 51 of them having their testes visualized as intra-abdominal and undergoing laparoscopic orchiopexy.
If the testis could be moved to the opposite internal inguinal ring without putting strain on the testicular vasculature, a single-stage vessel-intact orchiopexy (VILO, *n*=10) was done.
We used a two-stage approach (*N*=38) since the vessels were discovered to be short and the testis requires mild-to-severe stress to reach the opposite internal ring.
Results
There was no age difference between the two groups. The first stage operating time was considerably shorter in FSLO (*P*=0.001). The testes were able to reach the lower part of the scrotum in 15 (83.3%) of the FSLO patients, while the testes occupied the upper scrotum in three individuals (16.7%).
The testis filled the lower half of the scrotum in 13 (65%) individuals, and the upper part of the scrotum in seven (35%) patients, who had the Shehata approach.
There was no testicular atrophy in Shehata technique, while it occurred in two (11.1%) patients in FSLO.
Conclusion
Staged laparoscopic-traction orchiopexy (Shehata technique) is a safe and effective procedure that could be done when testicular vessels are relatively short that one-stage orchiopexy cannot be applied.

Keywords:
laparoscopy, orchidopexy, Shehata technique, staged traction

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Introduction

Undescended testis (UDT) is a frequent disease that affects 3–5% of full-term newborns and more than one-third of preterm babies [1].

Most UDT at different levels of inguinal canal, about 10%, are impalpable and are present in the abdomen [2].

Forty percent of intra-abdominal testes are relatively normal sized, the rest are 'vanished' or atrophic testes [3]. A clinical examination confirms the diagnosis of UDT, which is then validated by imaging. Laparoscopy is required for the diagnosis and treatment of individuals with impalpable testes [4]. Managing patients with impalpable testes might be difficult due to the length of the testicular vessels, which can make mobility difficult [5].

For the treatment of UDT, several procedures have been reported, with laparoscopic orchiopexy being the gold standard. One or two phases of Fowler–Stephens laparoscopic orchiopexy (FSLO) are possible. The testicular arteries are divided in the first step of FSLO to facilitate appropriate testis mobility into the scrotum [6,7].

The second-stage FSLO is done 6–9 months after vessel ligation to allow collateral vessels supplying the testis to be developed to allow adequate mobilization to the scrotum [2].

Staged laparoscopic-traction technique (Shehata approach) is a two-stage technique based on lengthening testicular vessels, which facilitates reposition of the testis down to the scrotum without division of the testicular vessels [2].

Aim

The results of stepwise laparoscopic-traction orchiopexy (Shehata method) and FSLO in patients with intra-abdominal testes are compared in this research.

Patients and methods

During the period between January 2017 and December 2020, we conducted a retrospective-cohort research. During this time, 61 patients had laparoscopic exploration, with 51 of them having their testis visualized as intra-abdominal and undergoing laparoscopic orchiopexy.

Ethical approval: institutional approval obtained. Informed consent was obtained from all patients' parents.

If the testis could be moved to the opposite internal inguinal ring without putting strain on the testicular vasculature, a single-stage vessel-intact orchiopexy (VILO, *n*=10) was done.

We used a two-stage approach (*N*=38) since the vessels were discovered to be short and the testis requires mild-to-severe stress to reach the opposite internal ring.

FSLO was done in 18 testes.

Shehata technique was done for 20 testes.

The research excluded patients who had vanished testes or who had open orchiopexy or a single-stage VILO.

Three cases with intra-abdominal testes that have very short vessels that cannot be mobilized toward the contralateral ring were operated in two-stage FSLO and excluded from the study.

So, inclusion criteria were visible intra-abdominal testes that can reach the contralateral internal ring under mild-to-severe tension.

Exclusion criteria were:

(1) Vanished testis.
(2) Testes with long vessels that can reach the contralateral ring without tension or with minimal tension.
(3) Testes with very short vessels that cannot be mobilized toward the contralateral ring.

Patients undergoing two-stage operations were divided into two groups based on the method used: FSLO (*n*=18) and Shehata (*n*=20).

Over the course of a 12-month follow-up, operative complications, as well as the location, size, and consistency of the operated testes, were recorded and statistically analyzed.

Operative techniques

The patient was placed in a Trendelenburg posture with the ipsilateral side raised to move the bowel out of the surgery field.

By open method, a 5-mm telescope was put via the umbilical port, and if the testis was found, two more 5-mm working ports were implanted in the midclavicular lines at the level of the umbilicus.

To determine the location and size of the testis, the peritoneal cavity and inguinal area were examined. After that, the testis' motility and distance from the contralateral internal inguinal ring were assessed.

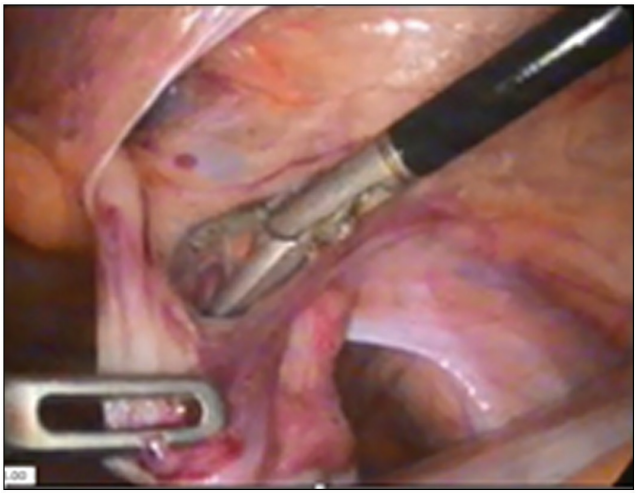
Single-stage laparoscopic orchidopexy was performed on all patients whose testis was at or within 1 cm of the ring and was able to reach the opposite internal inguinal ring smoothly.

Patients with testes that protruded 1 cm or more above the ring had a two-stage treatment using either the Fowler–Stephens or Shehata techniques, depending on the surgeon's preference and skill. The FSLO was carried out in two stages.

The testicular vessels were ligated and separated at a distance away from the testis using bipolar diathermy in the first step, and any color change was noticed immediately.

After 6 months, the second step was scheduled, which included a large peritoneal dissection surrounding the

Figure 1



Mobilization of the testis.

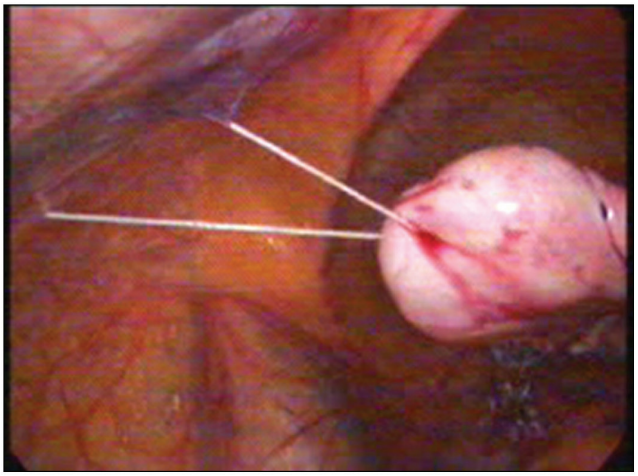
testis, beginning at the location of ligated vessels with hook-tipped cautery, with division of the gubernaculum as far as possible, and the testis is extracted down to the scrotum through suprapubic blunt stab avoiding injury to the urinary bladder.

In Shehata technique, the gubernaculum was divided as far as possible from the testis using a hook on monopolar diathermy, and maintaining the gonadal vascular pedicle (Fig. 1). Once properly mobilized, it reached toward the contralateral anterior abdominal wall without exerting excessive force.

The testis was then attached to the anterior abdominal wall, one inch above, and medial to the contralateral anterior–superior iliac spine. A 2/0 nonabsorbable suture (polyester) was inserted through the abdominal wall after a tiny 2-mm incision was made with a number-11 blade and received inside the abdomen by a 5-mm needle holder under laparoscopic vision. The suture was passed through the lower pole of the testis and returned through the abdominal wall via the same incision, either with a backthrow with the needle holder or a retrieval-needle suture, and was tied outside to ensure that the testis was not subjected to severe tension inside the abdominal cavity (Figs 2, 3). This traction knot was buried under the skin, and the wound was closed.

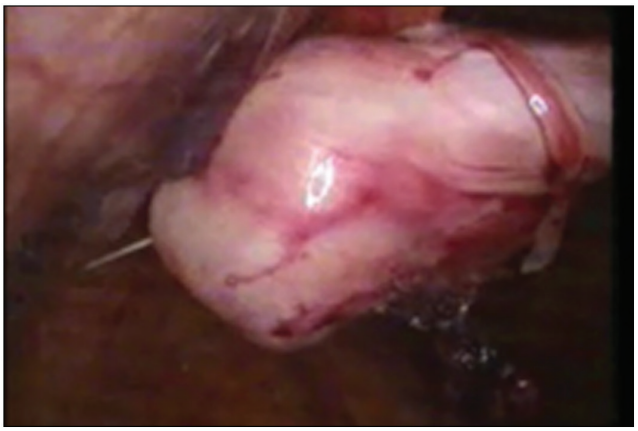
After 12 weeks, a second-stage laparoscopic-aided orchiopexy was planned. The abdominal cavity was examined for adhesions, suture slippage, or internal herniation, and the location of the intestine in respect to the gonadal arteries at this stage (bowel weight over the gonadal vessels causes gradual lengthening of the vessels) (Fig. 4). The fixation stitch was then divided with scissors, and any adhesions were lysed. By resting

Figure 2



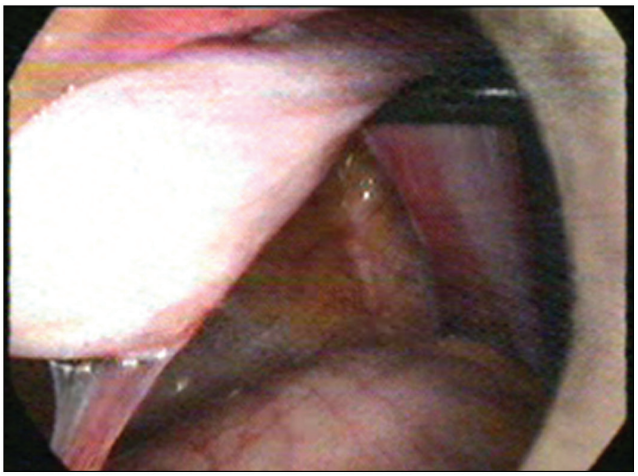
Fixation of the testis to the anterior abdominal wall.

Figure 3



Fixation of the testis to the anterior abdominal wall.

Figure 4



Excessive elongation of the cord after traction.

the testis on the contralateral internal ring, the testis was checked for descent to the scrotum's bottom. At the second step, no more dissection was necessary. We

used a tunica suture in the Dartos pouch to secure the testis in the scrotum (Fig. 5).

Statistical analysis

The mean and standard deviation were used to represent quantitative data, whereas the number and percent were used to represent qualitative data.

The quantitative data were compared using the Wilcoxon rank-sum test, while qualitative data were compared using the χ^2 or Fisher's exact test. The analyses were carried out using Stata 16.1 (Stata Corp., College Station, Texas, USA), with a statistical significance of *P* value of 0.05.

Figure 5

Exteriorized testis through scrotal incision.

Results

There was no age difference between the two groups (Table 1). The operating time for FSLO was considerably shorter in the first stage (*P*=0.001), while there was no significant difference in the second stage. The starting location of the testis did not differ between the two procedures. After undergoing FSLO, one patient developed a postoperative hematoma (Table 1).

One (5%) patient in the Shehata group had the testis fall out of the fixation position, and the chord had not extended by the second stage, therefore, refixation was done and the second stage was postponed for another 12 weeks.

The size, location, and consistency of the testis were compared between the two groups after a 12-month follow-up. The testes were able to reach the lower part of the scrotum in 15 (83.3%) of the FSLO patients, while the testes occupied the upper scrotum in three (16.7%) individuals.

The testis filled the lower half of the scrotum in 13 (65%) individuals, and the upper part of the scrotum in seven (35%) patients, who had the Shehata approach (Table 2).

In the Shehata method, there was no testicular atrophy, however, in the FSLO approach, it happened in two (11.1%) patients.

Table 1 Preoperative data

	Fowler–Stephens	Shehata technique	*P* value
Age (years)	2.5 ± 1.9	2.7 ± 0.4	NS
Time of the first stage (months)	35.71 ± 14.6	62.19 ± 33.8	<0.05
Time of the second stage (months)	81.42 ± 11.3	74 ± 06.21	NS

Table 2 Postoperative follow-up

	FSLO (*N*=18) [*n* (%)]	Shehata technique (*N*=20) [*n* (%)]	*P* value
Initial testicular position			
Low scrotum	15 (83.3)	13 (65)	NS
High scrotum	3 (17.6)	7 (35)	
Testicular position 12 m			
Low scrotum	15 (83.3)	18 (90)	<0.05
High scrotum	3 (16.6)	2 (10)	
Testicular consistency			
Soft	12 (66.7)	16 (80)	<0.05
Firm	4 (22.2)	4 (20)	
Atrophic	2 (11.1)	0	
Testicular size			
Normal	12 (66.7)	16 (80)	<0.05
Small	4 (22.2)	4 (20)	
Atrophic	2 (11.1)	0	

FSLO, Fowler–Stephens laparoscopic orchiopexy.

Discussion

Because of the short testicular vessels, surgical treatment of nonpalpable testis is difficult, yet, laparoscopy is the gold-standard procedure for treating intra-abdominal testis.

For surgical care of intra-abdominal testis, many surgical methods have been reported, such as laparoscopic single or staged orchiopexy [8] using multiple or single ports [9], or microvascular procedures [10]. The majority of intra-abdominal testes cases, however, are treated with a two-stage FSLO.

Testicular atrophy and testicular ascent are the most prevalent side effects of laparoscopic orchiopexy [11,12].

Colon injury, ileus, volvulus, infection, and herniation have all been documented as side effects of laparoscopic orchiopexy [13]. In addition, according to certain research, bladder injury occurs in 3% of instances during the formation of a transperitoneal tunnel [14]. Because the patent processus vaginalis is not ligated in the laparoscopic method, the probability of an indirect inguinal hernia has been reported to be 1% [15].

In FSLO, the major testicular artery is ligated, allowing collateral blood supply from the gubernaculum, vas, and cremasteric arteries to grow. The gubernaculum is separated and the testis is transported into the scrotum on vessels of the vas, causing up to 20% of testes to atrophy after the second stage [16]. That is why the gubernaculum-sparing strategies have been outlined in various studies [17].

The success rate of FSLO (a testis in the scrotum) has been reported to be 66.7–92% [18,19].

FSLO has an overall success rate of 85%, according to a systematic study [20]. However, as compared with the contralateral, typically descending testis, several investigations have found considerably reduced postoperative testicular sizes [21].

Shehata *et al.* [22] reported a traction-suture slippage rate of 11% in a cohort of 140 instances undergoing staged laparoscopic-traction orchiopexy (SLTO) for intra-abdominal testes. At the follow-up, Doppler ultrasonography revealed that 100% of the fixed testes were effectively vascularized.

Suture slippage was found to be 9% in certain investigations, with 0% atrophy [23].

During the initial step of SLTO, we employed the approach outlined by Shehata to take smaller 'bites' through the lower pole of the testis using the fixation stitch. The testis may be less damaged as a result of this. However, the study was hampered by a small sample size and a short follow-up period.

One testis slipped among the patients who underwent the Shehata procedure, which might be explained by the novel technique's learning curve. The average percentage of slippage throughout the three trials is 11% [24].

Some mild postoperative problems, such as hematoma, were seen in our research and disappeared spontaneously.

None of the patients experienced postoperative problems after the first step of the Shehata procedure, such as internal hernia behind the testicular arteries or adhesive intestinal blockage. We discovered adhesions of the intestine to the cord during the second stage, which were lysed without difficulties. These adhesions were caused by excessive dissection of the peritoneum, which was avoided in subsequent cases.

There was no testicular atrophy in any of the patients, and there were no laparoscopic problems during the procedure. The testicular location and size were employed as success criteria in our investigation. The standard is a scrotal testis that is in the low or mid scrotal position.

Although Esposito *et al.* [21] used ultrasound for volumetric measurement of the testis and Radmayr *et al.* [25] used Doppler flow, Sijstermans *et al.* [26], who documented a strong correlation between ultrasound measurements of the testis and palpation, support the value of clinical assessment in the judgment of testicular size.

The effectiveness of the traction approach is due to the steady elongation of the testicular vessels over the course of 12-weeks' traction period. This is in contrast to the previously reported treatments' increased sudden stress on the testicular arteries, which may have resulted in greater atrophy rates. The stretch induced by the intestinal weight and the frequent movement of the abdominal wall during breathing are the most likely causes of testicular vascular-pedicle elongation. When compared with the FSLO, the preservation of the testicular vessels may be a contributing element in maintaining the viability of the relocated testis, reducing the likelihood of testicular atrophy.

The retrospective aspect of our study has various limitations, including the testicular size being assessed subjectively by the physician and compared with the

contralateral side, which is a subjective assessment of the testicular size. A more appropriate outcome measure would have been to quantify the change in testicular size rather than comparing it with the contralateral side. Furthermore, due to the small sample size, the study is constrained.

To measure the long-term effectiveness of SLTO, an ultrasound examination of testicular volumes is indicated, and preferably, an assessment of semen quality should be conducted when the patient achieves pubertal maturity. To compare the results of SLTO with FSLO and eliminate surgeon-selection bias, a randomized-controlled study would be beneficial.

Conclusion

SLTO (Shehata technique) is a safe and effective procedure that could be done when testicular vessels are relatively short that one-stage orchiopexy cannot be applied.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Vikraman J, Hutson JM, Li R, Thorup J. The undescended testis: clinical management and scientific advances. Semin Pediatr Surg 2016; 25:241–248.
2 Holocomb IIIGW, Shehata S. Laparoscopic orchiopexy pediatric laparoscopy and thoracoscopy. 2nd ed. Cambridge, MA: Elsevier; 2022. 147–156.
3 Sepúlveda X, Egaña PL. Current management of non-palpable testes: a literature review and clinical results. Transl Pediatr 2016; 5:233–239.
4 Mahziyar K, Khazaeli D, Mombeini H, Asadinia P, Bahadoram M. Laparoscopic two stage Fowler-Stephens orchiopexy: a single center experience. J Med Sci 2016; 3:137–141.
5 Ismail K, Ashour M, El-Afifi M, Hashish A, El-Dosouky N, Nagm M, *et al*. Laparoscopy in the management of impalpable testis: series of 64 cases. World J Surg 2009; 33:1514–1519.
6 Wayne C, Chan E, Nasr A. Canadian Association of Paediatric Surgeons Evidence-Based Resource. What is the ideal surgical approach for intra-abdominal testes? A systematic review. Pediatr Surg Int 2015; 31: 327–338.
7 Castillo-Ortiz J, Muñiz-Colon L, Escudero K, Perez-Brayfield M. Laparoscopy in the surgical management of the non-palpable testis. Front Pediatr 2014; 2:28.
8 Shehata SM. Laparoscopically assisted gradual controlled traction on the testicular vessels: a new concept in the management of abdominal testis. A preliminary report. Eur J Pediatr Surg 2008; 18:402–406.
9 Noh PH, Vinson MA, Bansal D. Laparoendoscopic single site orchiopexy for intra-abdominal testes in the pediatric population with a multichannel single port and flexible tip laparoscope. J Endourol 2013; 27:1381–1383.
10 Bianchi A. Microvascular orchiopexy for high undescended testes. Br J Urol 1984; 56:521–524.
11. Bracho-Blanchet E, Unda-Haro S, Ordorica-Flores R, Nieto-Zermeño J, Zalles-Vidal C, Fernandez-Portilla E, *et al*. Laparoscopic treatment of nonpalpable testicle. Factors predictive for diminished size. J Pediatr Surg 2016; 51:1201–1206.
12. Alam A, Delto JC, Blachman-Braun R, Wayne G, Mittal AG, Castellan M, *et al*. Staged Fowler-Stephens and single-stage laparoscopic orchiopexy for intra-abdominal testes: is there a difference? A single institution experience. Urology 2017; 101:104–1020.
13. Baker LA, Docimo SG, Surer I, Peters C, Cisek L, Diamond DA, *et al*. A multi-institutional analysis of laparoscopic orchidopexy. BJU Int 2001; 87:484–489.
14. Hsieh MH, Bayne A, Cisek LJ, Jones EA, Roth DR. Bladder injuries during laparoscopic orchiopexy: incidence and lessons learned. J Urol 2009; 182:280–284.
15 Metwalli AR, Cheng EY. Inguinal hernia after laparoscopic orchiopexy. J Urol 2002; 168:2163.
16 Yu C, Long C, Wei Y, Tang X, Liu B, Shen L, *et al*. Evaluation of Fowler–Stephens orchiopexy for high-level intra-abdominal cryptorchidism: a systematic review and meta-analysis. Int J Surg 2018; 60:74–87.
17 Braga LH, Farrokhyar F, McGrath M, Lorenzo AJ. Gubernaculum testis and cremasteric vessel preservation during laparoscopic orchiopexy for intra-abdominal testes: effect on testicular atrophy rates. J Urol 2019; 201:378–385.
18 Baillie CT, Fearns G, Kitteringham L, Turnock RR. Management of the impalpable testis: the role of laparoscopy. Arch Dis Child 1998; 79:419–422.
19 Elder JS. Two-stage Fowler–Stephens orchiopexy in the management of intra-abdominal testes. J Urol 1992; 148:1239–1241.
20 Elyas R, Guerra LA, Pike J, DeCarli C, Betolli M, Bass J, *et al*. Is staging beneficial for Fowler–Stephens orchiopexy? A systematic review. J Urol 2010; 183:2012–2018.
21 Esposito C, Vallone G, Savanelli A, Settimi A. Long-term outcome of laparoscopic Fowler–Stephens orchiopexy in boys with intra-abdominal testis. J Urol 2009; 181:1851–1856.
22 Shehata S, Shalaby R, Ismail M, Abouheba M, Elrouby A. Staged laparoscopic traction-orchiopexy for intraabdominal testis (Shehata technique) stretching the limits for preservation of testicular vasculature. J Pediatr Surg 2016; 51:211–215.
23 Abouheba MAS, Younis W, Elsokary A, Roshdy W, Waheeb S. Early clinical outcome of staged laparoscopic tractio orchiopexy for abdominal testes. J Laparoendosc Adv Surg Tech 2019; 29:531–5371.
24 Elsherbeny M, Abdallah A, Abouzeid A, Ghanem W, Zaki A. Staged laparoscopic traction orchiopexy for intra-abdominal testis: is it always feasible?. J Pediatr Surg 2018; 14:267-e4.
25 Radmayr C, Oswald J, Schwentner C, Neururer R, Peschel R, Bartsch G. Long-term outcome of laparoscopically managed nonpalpable testes. J Urol 2003; 170:2409e11.
26 Sijstermans K, Hack WW, van der Voort-Doedens LM, Meijer RW. Long-term testicular growth and position after orchidopexy for congenital undescended testis. Urol Int 2009; 83:438e45.