Original Article

A comparative study between two techniques of laparoscopic orchiopexy for intra-abdominal testis

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ABSTRACT

Introduction: Several techniques have been described for laparoscopic orchidopexy in patients with intra-abdominal testes. We aimed to report our experience with the staged laparoscopic traction orchiopexy (Shehata technique) and to compare it to the Fowler-Stephens orchidopexy (FSLO).

Methods: We conducted a retrospective cohort study at two pediatric surgery departments from 2017 to 2020. Fifty-six patients underwent laparoscopic exploration and the testis was intra-abdominal in 41 of them. Patients with vanished testis or those who underwent open orchidopexy or vessel-intact laparoscopic orchidopexy were excluded. Those who underwent FSLO (n = 18), or Shehata laparoscopic orchidopexy (n = 11) were compared.

Results: Preoperative data were comparable between both the groups. FSLO had a significantly shorter first-stage operative time (34.61 ± 6.43 vs. 58 ± 9.39 min, P < 0.001), with no difference in the second stage. There was no difference in the initial position of the testes between both the techniques. The testis dropped from the fixation position in three patients in the Shehata group (27.27%), and consequently, the cord did not increase in length by the second stage, and these testes barely reached the scrotum. At 12 months' follow-up, the testes' size, position, and consistency were comparable between the two groups.

Conclusion: Staged laparoscopic traction orchidopexy is feasible for the management of intra-abdominal testes, especially in the low-lying testes.

INTRODUCTION

Cryptorchidism or undescended testis (UDT) is a common condition, reported in 3%–5% of the full-term newborns and more than one-third of the premature babies. The prevalence decreases to 1% by the age of 3 months. The UDT is impalpable in 20% of the patients, and about 50% of these impalpable testes are either vanished or atrophic.[1-3]

The diagnosis of UDT is established by clinical examination, and is supplemented by imaging modalities. In patients with impalpable testes, laparoscopy is essential for the localization and exclusion of the vanished testes.[4]

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The management of the patients with impalpable testes is demanding, as the length of the testicular vessels may hinder their adequate mobilization into the scrotum.[5] Several techniques have been described for laparoscopic orchidopexy. Fowler-Stephens laparoscopic orchidopexy (FSLO) can be performed in one or two stages. In FSLO, the testicular vessels are divided to allow adequate mobilization of the testis into the scrotum. However, in the testicular traction technique, the testicular vessels are left intact, which is an advantage of this technique.[6,7]

In this study, we compared the outcomes of the staged laparoscopic traction orchiopexy (Shehata technique) and FSLO in patients with intra-abdominal testes.

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PATIENTS AND METHODS

Design and patients

We conducted a retrospective cohort study in two pediatric surgery departments during the period from February 2017 to February 2020. In this period, 56 patients underwent laparoscopic exploration, and the testis was visualized as intra-abdominal in 41 of them who further underwent laparoscopic orchidopexy. Intra-operatively, if it was possible to take the testis to the opposite internal inguinal ring, then a single-stage vessel-intact orchidopexy (VILO; $n = 12$) was performed. However, if the vessels were found to be short and the testis was unable reach the opposite internal ring, we opted for a two-stage technique. Either of the two-staged orchidopexy techniques were used; FSLO ($n = 18$), or Shehata technique ($n = 11$). Patients with vanished testis or those who underwent either open orchidopexy or a single-stage VILO were excluded from the analysis. The study flowchart is presented in Figure 1. Both the surgical techniques were performed at both the participating centers.

The Ethics Committee approved the study (Approval No. (HAPO-02-K-012-2020-04-377)), and it was carried out in compliance with the Helsinki Declaration. The need of consent by the patients' guardians was waived due to the retrospective nature of the study.

Data and protocol

The patients were examined preoperatively to confirm the diagnosis, and a repeat examination was performed in the operating room under general anesthesia. If the testis was palpable on any occasion, the patient underwent open orchidopexy. The preoperative workup included ultrasound examination which failed to localize the testis in all the patients. Magnetic nuclear resonance imaging was not utilized for this purpose. There was no age limit to undergo the laparoscopic procedure.

We grouped the patients who underwent two-stage procedures into two groups according to the technique; FSLO ($n = 18$) and Shehata technique ($n = 11$). Operative complications and the position, size, and consistency of the operated testis were analyzed at 12 months.

Operative technique

The patient was positioned in the supine or the Trendelenburg position, and the ipsilateral side was elevated to move the bowel away from the surgical field. The telescope was inserted through the umbilical port; then, if the testis was identified, two 5/3 mm working ports were placed in the midclavicular line. The peritoneal cavity was inspected and the inguinal region was examined to assess the site and size of the testis. After that, the mobility and the distance of the testis from the internal inguinal ring was assessed. All the patients, in whom the testis was at the ring or within 1 cm of the ring and was able to reach the opposite internal inguinal ring smoothly, underwent VILO. The patients in whom the testes was 1 cm or higher above the ring, underwent two-staged procedure with either Fowler-Stephens or Shehata technique, depending on the surgeon's preference and experience. If the testis was within 1 cm of the ring, the final decision to perform an alternate procedure was made after the mobilization of the vessels, depending on the quality of the testis and its vascularity. If the vessels were deemed to be of inadequate caliber, a staged procedure was undertaken.

FSLO was performed in two stages. In the first stage, the testicular vessels were doubly clipped away from the testis, and any immediate colour change was observed. The second stage was scheduled after 6 months.

The Shehata technique was started by freeing the testis using diathermy and sharp dissection. If the testis was unable to reach the contralateral internal ring without tension it meant its vessels were short, mandating preliminary traction to lengthen the testicular vessels as the 1st stage. We did not preserve the peritoneal window as it helps with cord elongation. Also, we dissected as high as we could reach (just behind the lower part of the descending colon or above the colosigmoid junction on the left side and at the level of the cecum on the right side).

Then the testis was fixed to the anterior abdominal wall, one inch above and medial to the contralateral anterior superior iliac spine. A non-absorbable suture (polypropylene) was passed through the abdominal wall after making a small 2 mm incision with a number 11 blade, which was received inside the abdomen under laparoscopic vision by a 5-mm needle holder. The suture was passed through the testis and returned through the abdominal wall via the same incision, either with a back throw with the needle holder or brought out by a retrieval needle suture, and was tied outside making sure that the testis was not subjected to tension inside the abdominal cavity [Figure 2]. This traction knot was buried under the skin, and the wound was closed. A second stage laparoscopic-assisted orchiopexy was planned after 12 weeks. In this stage, the abdominal cavity was inspected for adhesions, slippage of the suture or internal herniation, and the position of the intestine in relation to the gonadal vessels (bowel weight over the gonadal vessels cause gradual lengthening of the vessels). Then, the fixation stitch was divided, and the adhesions, if any, were lysed. The testis was tested for the descent to the bottom of the scrotum by resting the testis at the contralateral internal ring. No additional dissection was required at the second stage. We fixed the testis in the scrotum with a tunica suture in the dartos pouch [Figure 3].

Statistical analysis

Quantitative data were presented as mean and standard deviation, and qualitative data as number and percent.

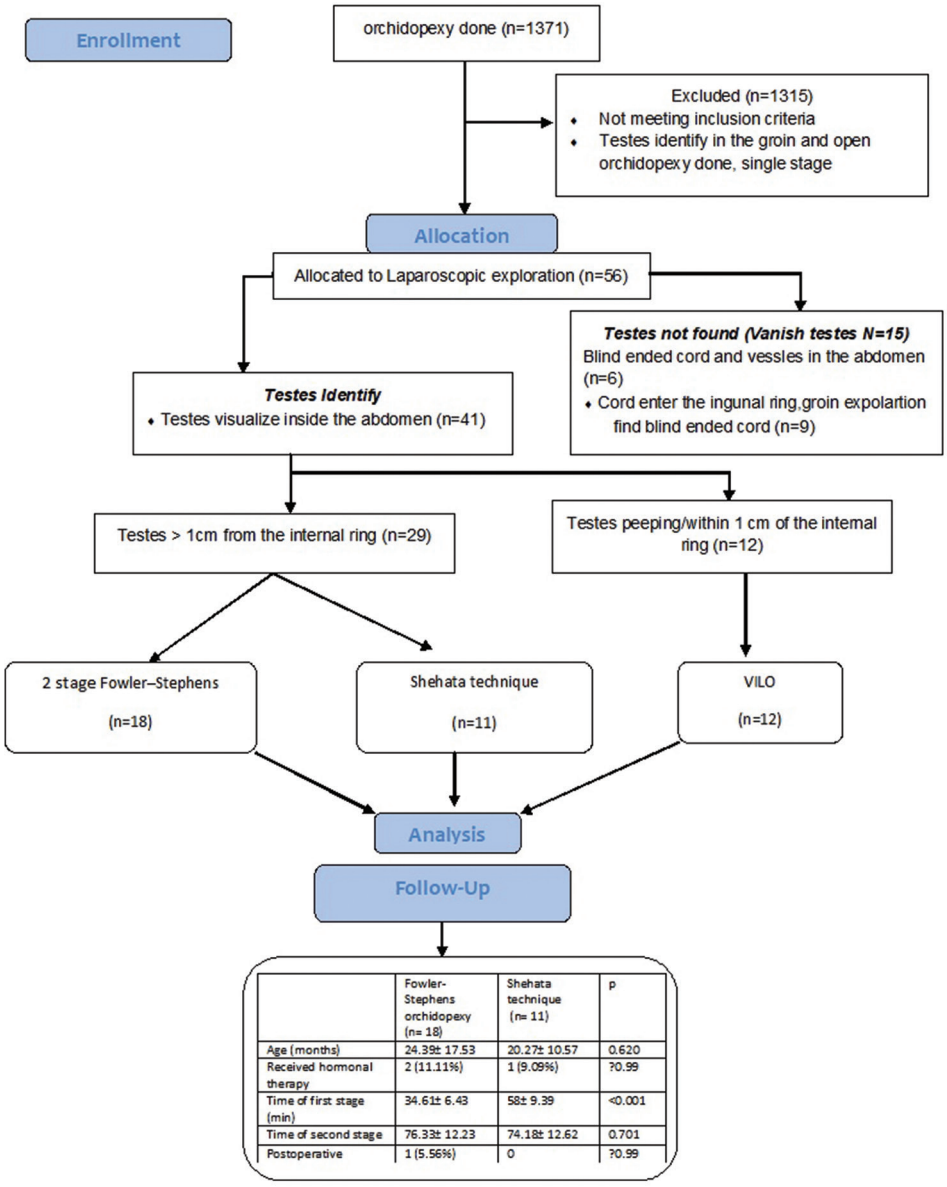

Figure 1: The study flowchart

The Wilcoxon rank-sum test was applied to compare the quantitative data and Chi-square or Fisher's exact test was used the qualitative data. Stata 16.1 was used to perform the analyses (Stata Corp-College Station-Texas, USA), and a $P < 0.05$ was considered statistically significant.

RESULTS

There was no difference in the age or hormonal therapy between both the groups [Table 1]. Testis was identified in all the patients. FSLO had a significantly shorter first-stage operative time ($P < 0.001$), with no difference in the second stage. There was no difference in the initial position of the testis between both the techniques. One patient who underwent FSLO developed postoperative hematoma [Table 1]. In patients who underwent staged Stephen Fowler procedure, the testis was on the iliac vessels in one patient and was >4 cm from the internal ring in the second patient.

The testis dropped from the fixation position in three patients in the Shehata group (27.27%), and consequently, by the 2nd stage the cord had not elongated, and the testis could barely reach the scrotum. One patient was subjected to 2nd stage after 12 weeks, and the testis was able to reach the scrotum.

At 12 months' follow-up, the testis' size, position, and consistency were comparable between the two groups. In the FSLO group, the testis was able to reach the lower part of the scrotum in 11 patients (61.11%), and in 5 patients the tests occupied the upper scrotum (27.78%). In patients

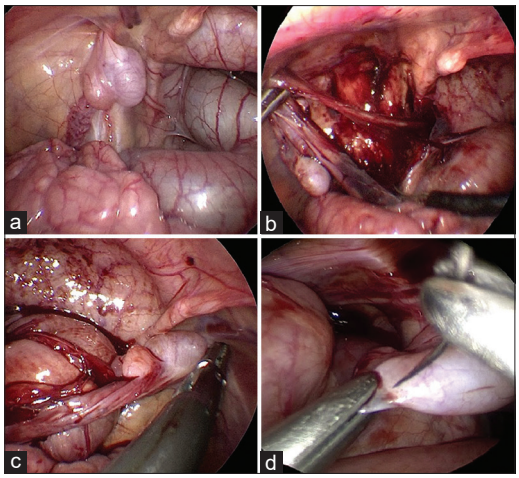

Figure 2: Laparoscopic view during Shehata technique: (a) The intra-abdominal testis. (b) Dissection of the testis. (c) Traction on the testis. (d) Fixation of the testis

who underwent the Shehata approach, in 8 patients the testis occupied the lower part of the scrotum (72.73%), and in 1 patient it was in the upper scrotum (9.09%) [Table 2].

DISCUSSION

Orchidopexy is essential to maintain fertility and to facilitate surveillance for testicular masses.[8] Laparoscopy is an important component of the armamentarium to manage intra-abdominal testis, and is utilized to visualize and localize nonpalpable testes.[9] The laparoscopic orchidopexy is an appealing option, which can be either a single or a two-stage procedure depending on the location of the testis and the length of the testicular vessels.[10]

The success of orchidopexy depends on the ability to mobilize the testis into its normal position in the scrotum, without damaging its blood supply. In patients with sufficient length of the testicular vessels, primary orchiopexy is feasible with a high success rate. However, technical challenges are faced in patients with intra-abdominal testis and short vessels.

In patients with a high intra-abdominal testis, the optimal surgical approach is controversial. The main obstacle preventing adequate mobilization of the testis in these cases is the testicular vessels. Fowler-Stephens technique advocated ligation of the testicular vessels in a single-stage to aid mobilization. The testis solely relied on the collateral blood supply running along the vas deferens; therefore, the reported testicular atrophy rate with this approach was around 50%.[11]

The technique was later modified to tackle this dreaded complication by performing the procedure in two-stages. The first stage of the modified procedure consists of testicular vessels ligation without mobilization, which is performed in the second stage after the development of collaterals, which

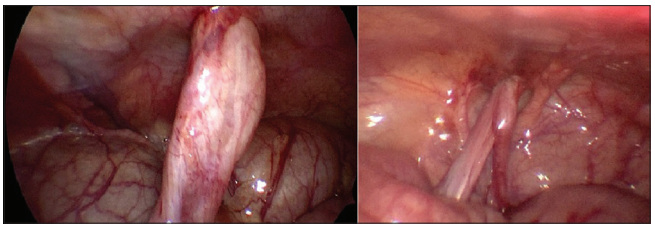

Figure 3: Laparoscopic view during the second stage of the Shehata technique showing elongation of the cord

may take up to 6 months.[12] The rate of testicular atrophy, with this modification, has reduced to 8.8%.[13]

Traction, to achieve organ growth or stretch, has been a fascinating surgical concept employed by general surgeons to lengthen the esophagus after resection. Kimura and Fokker described two different techniques depending on the traction to lengthen the esophagus in the treatment of pure long gap esophageal atresia.[14] Keeley and Terek have separately proposed techniques to lengthen the short spermatic vessels in patients with abdominal testes based on the traction by fixation of the testes to the thigh. However, these and many other techniques had to be abandoned as many of the fixed testes were lost, probably to sudden and uncontrolled tension on the testicular vessels.[15] In a landmark paper by Shehata in 2008, he proposed a new staged laparoscopic-assisted technique for bringing down an abdominal testis with minimal complications while maintaining the viability.[11] He proposed that the weight of the intestine can cause gradual traction and stretch the testicular vessels. In his preliminary report, adequate elongation and scrotal relocation of the testis was achieved in 9 patients (90%).

The laparoscopic orchidopexy is increasingly being utilized in the pediatric population, and the staged Fowler-Stephens approach performed laparoscopically is the standard of care, with a success rate of about 80%–85%.[16] Orchidopexy can also be performed in a single-stage vessel-intact laparoscopic orchidopexy; however, this technique is challenging in patients with high testis and short vessels, a problem that can be managed with FSLO. The success rate of FSLO in our series was 83% which is comparable to the literature.[5,17]

The most feared complications of laparoscopic orchiopexy are complete or relative testicular atrophy and testicular ascent.[18,19] The intra-abdominal testis is usually smaller than the contralateral descended testis, and should not be considered a complication of the surgery. The other reported complications of laparoscopic orchidopexy are colon injury, ileus, volvulus, infection or herniation.[20] Bladder injury has been reported in 3% of the cases during the creation of a transperitoneal tunnel.[21] The risk of having an indirect inguinal hernia is 1%, since the patent processus vaginalis is not ligated in the laparoscopic approach.[22]

Table 1: Preoperative and operative data

Preoperative and operative data	Fowler-Stephens orchidopexy (*n*=18), *n* (%)	Shehata technique (*n*=11), *n* (%)	*P*
Age (months)	24.39±17.53	20.27±10.57	0.620
Received hormonal therapy	2 (11.11)	1 (9.09)	>0.99
Time of first stage (min)	34.61±6.43	58±9.39	<0.001
Time of second stage	76.33±12.23	74.18±12.62	0.701
Postoperative hematoma (no other complications)	1 (5.56)	0	>0.99

Continuous data were presented as mean and standard deviation and categorical variables as number and percent

Table 2: Comparison of the location, size, and consistency of the testes between groups

Location, size, and consistency of the testes	Fowler-Stephens orchidopexy (*n*=18), *n* (%)	Shehata technique, (*n*=11), *n* (%)	*P*
Initial testis position			
Low scrotum	15 (83.33)	8 (72.73)	0.646
High scrotum	3 (16.67)	3 (27.27)	
Testis position (12 months)			
Low scrotum	11 (61.11)	8 (72.73)	0.527
High scrotum	5 (27.78)	1 (9.09)	
Inguinal	2 (11.11)	2 (18.18)	
Testis consistency (12 months)			
Atrophic	3 (16.67)	0	0.406
Firm	12 (66.67)	9 (81.82)	
Soft	3 (16.67)	2 (18.18)	
Testis size (12 months)			
Normal	11 (61.11)	8 (72.73)	0.453
Small	4 (22.22)	3 (27.27)	
Atrophic	3 (16.6)	0	

Categorical data were presented as number and percentage

In the patients who underwent the Shehata technique, we had three slipped testes, which may be explained by the learning curve of this new technique. The average slippage rate from the 3 reported studies is 11%.[18,23]

In our study, we noted minor postoperative complications, such as hematoma, which resolved spontaneously. After the first stage of Shehata technique, none had postoperative complications, specifically internal hernia behind the testicular vessels or adhesive intestinal obstruction. During the second stage, we encountered adhesions to the abdominal wall, which were managed without complications. No patients had testicular atrophy, and no intra-operative laparoscopic complications were noted.

In our study, the testicular position and size were used as the parameters of success. A scrotal testis, either at low or mid scrotal position, which is at least 75% in the size as compared to the contralateral side, is considered the standard.

The gradual elongation of the testicular vessels during the 12 weeks' traction period is the cause of traction technique's success. This is in contrast to the excessive abrupt tension which was placed on the testicular vessels by the previously described methods that may have led to the higher atrophy rates. The probable reason for the testicular vascular pedicle elongation is the stretch caused by the intestine's weight and the regular movement of the abdominal wall during the respiration. The preservation of the testicular vessels may be a contributing factor to maintain the viability of the fixed testis which reduces the chances of testicular atrophy as compared to the FSLO.

Our study had several limitations, including the retrospective nature with its inherent selection and referral biases. The testicular size was measured subjectively by the clinician and was compared to the contralateral side, which is a subjective appraisal of the testicular size. Measuring the change in the testicular size, rather than comparing it to the contralateral side, would have been a more accurate outcome measure. Additionally, the study is limited with the small sample size. Moreover, we did not evaluate factors that may have affected the outcome, and the initial distance between the testes and the internal ring was also not measured.

CONCLUSION

Staged laparoscopic traction orchidopexy could be feasible option for the management of intra-abdominal testes, especially in patients with low-lying testes. The Shehata and FSLO were found to be similar in regard to the position, size, and consistency of the testes during the follow-up.

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