

Original Research Article

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

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ABSTRACT

Background: This study compares Fowler-Stephens and Shehata techniques for intra-abdominal testes, evaluating outcomes in testicular viability, positioning, and size to guide optimal surgical management.

Methods: This retrospective study analyzed patients undergoing two-stage Shehata or Fowler-Stephens laparoscopic orchiopexy (FSLO) for intra-abdominal testis (August 2016-September 2019), collecting baseline characteristics and postoperative outcomes for comparison.

Results: A total of 20 patients who underwent two-stage laparoscopic orchiopexy were included in this study. The patients were divided into two groups based on the technique used: the Shehata group (n=11) and the FSLO group (n=9), with each group including one case of bilateral intra-abdominal testes. In the FSLO group, testicular atrophy was observed in 30% (3/10) of the cases, whereas in the Shehata group, no testicular atrophy was observed (p=0.011). In the Shehata group, 75% (9/12) of the testes achieved a normal scrotal position, whereas in the FSLO group, 60% (6/10) achieved a normal scrotal position (p=0.001). 75% of the testes had a normal size in the Shehata group, whereas only 30% had a normal size in the FSLO group (p=0.001). In the FSLO group, the scrotal position was more successfully achieved in children over 4 years (p=0.006).

Conclusions: The Shehata technique better preserves vascularity and achieves scrotal positioning in children under 4 years, while FSLO shows superior outcomes in older children, making age a key factor in technique selection for intra-abdominal testis.

Keywords: Intra-abdominal testis, Shehata technique, Fowler-Stephens laparoscopic orchiopexy

INTRODUCTION

Undescended testis is a common condition that affects 3-5% of full-term newborn males. Undescended testis is impalpable in 20% of cases, and up to 10% of these impalpable testes are either vanished or atrophic.^{1,2}

The diagnosis of an undescended testis is made through clinical examination. Laparoscopy is essential for localization and decisions regarding further surgical

management in patients with impalpable testes.³ Managing patients with impalpable testes is challenging, particularly in older children, because of the length of the testicular vessels, which is a limiting factor for adequate mobilization and fixation into normal anatomical positions within the scrotum.⁴ The two-stage laparoscopic traction orchiopexy (Shehata) and the two-stage FLSO technique are well-established techniques for managing intra-abdominal testes. In the FSLO technique, the testicular vessels are divided to allow adequate

mobilization of the testis on a vasal pedicle into the scrotum. In the Shehata technique, the testicular vessels are kept intact while fixing the testis to the anterior abdominal wall and using the gravity of the intestine to gently and continuously provide traction to the testicular blood vessels along with the irregular movement of the abdominal wall musculature.⁵ However, neither of these techniques has achieved supremacy in the clinical paradigm.^{6,7} Therefore, this study aimed to compare the outcomes of the Shehata and FSLO techniques in patients with intra-abdominal testes.

METHODS

This was a retrospective study including all children (<12 years old) who underwent laparoscopy for intra-abdominal testes in the pediatric surgery department at King Saud Medical City from August 2016 to September 2020. A total of 61 patients were initially enrolled in this study. However, only 20 patients who were operated on by two-stage laparoscopic orchidopexy procedures (Shehata and FSLO) were included in the final analysis. The remaining cases that were excluded from the study, were operated on by other methods, such as single-stage orchidopexy, conventional open orchiopexy, or where a testis was found atrophied or vanished. One patient who was waiting for the second stage of laparoscopic orchiopexy was also excluded. All surgeries were performed by five different surgeons using either the Shehata or FLSO technique as per their preference. This study was approved by the ethics committee of the hospital.

A retrospective chart review was performed to collect data, including age at presentation, laterality of the undescended testis, age at the time of surgery, surgical method, intraoperative findings, and outpatient follow-up of all patients who had passed more than 6 months from completing the final stage of surgery for clinical assessment regarding testicular size, position, and consistency of the testis. At the last follow-up, all patients were examined by one examiner who was blinded to the type of procedure performed. Ultrasound was performed to verify the findings and assess vascularity using Doppler ultrasound. Follow-up data, including size, location, and consistency of the testes on palpation and ultrasound findings, were documented. A testis was considered atrophied when it was palpated as a firm nubbin of tissue on clinical assessment and followed by a Doppler ultrasound confirming the absence of blood flow.

Data analysis was performed using SPSS Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA) and R version 4.1.3 (The R foundation for statistical computing, Vienna, Austria, <https://www.R-project.org/>). Quantitative variables, including age at presentation, stage 1, and stage 2, were presented as mean \pm SD and compared between the two procedures using the Kolmogorov-Smirnov test due to the non-normal

distribution of the data. Age at presentation and stage 2 were grouped and presented as frequency and percentage. The chi-square test for equality of proportions between the two procedures was performed in R software. The mean (mean \pm SD) and median follow-up period, i.e., median (interquartile range), were compared between the two surgical procedures using Student's t test and median test, respectively, with the p value determined for each test. P values for the outcome variables, position, size, and presence or absence of testicular atrophy, were calculated using the independent sample proportion test (Wald test), and the statistical significance level was set at 5%.

RESULTS

Of the 61 patients who underwent laparoscopy for impalpable testes, 21 were operated on by two staged procedures and were included in the study. One patient was excluded because stage 2 was not performed. Finally, 20 patients were included in the final analysis. The patients were categorized into two groups based on the technique used: the Shehata group (n=11) and the FSLO group (n=9). Each group included one patient with bilateral impalpable testes. The laparoscopic assessment revealed that 18 testes were intra-abdominal and operated on by single-stage laparoscopic-assisted orchiopexy. In 24 cases, the vas and vessels crossed deep rings, necessitating inguinal exploration. Of the 24 cases, 17 were found to be atrophic/vanishing, and the remaining underwent conventional orchiopexy. Table 1 shows the baseline characteristics of the 20 children and their average age at presentation and stage of the procedure.

Of the 20 patients, 2 had bilateral impalpable testes, and 18 had unilateral impalpable testes. Of the 18 patients, 13 had an impalpable testis on the left side and 5 on the right side. Figure 1 shows the procedures performed on 22 testes. In the follow-up assessment, all the testes of patients in the Shehata group were viable (100%), whereas testicular atrophy was observed in 3 (30%) patients in the FSLO group (Table 2). This clinical significance is more relevant for practice, which was also statistically significant. Furthermore, in the Shehata group, 75% of the cases achieved a normal scrotal position, whereas in the FSLO group, this was possible in 60% of cases. However, no statistically significant difference was observed ($p>0.05$). Additionally, the testicular size was normal in 75% and 30% of the cases in the Shehata and FSLO groups, respectively ($p=0.019$). The Shehata procedure was more successful in achieving a viable, normal-sized testis with a scrotal position in children under the age of 4 years (Table 3). The Wald test for independent sample proportions for each outcome, including no atrophy, scrotal position, and normal size, between the Shehata and FSLO groups was found to be statistically significant with $p=0.011$, 0.001 , and 0.001 , respectively, for children under the age of 4 years. In children aged more than 4 years, a non-significant difference in testicular atrophy and size was observed

between the procedures ($p=1.000$ and 0.445 , respectively). However, it was significant for achieving a scrotal position in favor of FSLO ($p=0.006$). In the FSLO group, three testes were atrophied and palpated as firm nubbins of tissue in the prepubic area. The clinical findings of testicular atrophy were confirmed by Doppler ultrasound. Furthermore, in this group, 7 testes were of children aged 4 years or less. Among them, 3 achieved a

scrotal position (42.9%), whereas in children aged 4 years and above, the scrotal position was achieved in all cases ($n=3$, 100%). With the Shehata procedure, detachment of the testis from the point of fixation at the abdominal wall occurred in 2 of the 12 testes (16.66%). On the follow-up assessment, one testis was supra scrotal in position, and the other had a normal position in the scrotum. Both cases had normal-sized testes and vascularity.

Table 1: Baseline characteristics of pediatric patients who underwent Shehata and FSLO (n=20) at the stage, two of the procedures.

| Variables | Total | Procedure | |
|--|--------------|---------------|-------------|
| | | Shehata group | FSLO group |
| N | 20 | 11 | 9 |
| Age at presentation (in years) (mean±SD) | 2.28±1.96 | 3.07±2.31 | 1.31±0.74 |
| Age at stage 2 (in years) (mean±SD) | 3.51±2.08 | 3.78±2.54 | 3.17±1.42 |
| Age at stage 2 (in years) (n, %) for 22 testes | | | |
| <4 | 12 (60.0%) | 6 (54.54%) | 6 (66.67%) |
| ≥4 | 8 (40.0%) | 5 (45.45%) | 3 (33.33%) |
| Follow-up period (months) (mean±SD) | 44.15±24.13 | 49.36±20.57 | 37.78±26.53 |
| Follow-up period (months) median (IQR) | 38 (61-28.5) | 44 (62-36) | 29 (54-20) |

Table 2: Comparison of outcomes among 22 testes between the Shehata and FSLO procedures.

| Outcome | No atrophy | | Position (scrotum) | | Size (normal) | |
|---|---------------|------------|--------------------|------------|---------------|------------|
| | Shehata group | FSLO group | Shehata group | FSLO group | Shehata group | FSLO group |
| Observed | 12 | 7 | 9 | 6 | 9 | 3 |
| Total | 12 | 10 | 12 | 10 | 12 | 10 |
| Proportion | 100% | 70% | 75% | 60% | 75% | 30% |
| Independent sample proportion test (Wald) (p value) | 0.038* | | 0.451 | | 0.019* | |

*Statistically significant at a 5% level.

Table 3: Outcomes observed between age groups (<4 and ≥4 years).

| Outcomes | No atrophy | | Independent sample proportion test (Wald) | Position (scrotum) | | Independent sample proportion test (Wald) | Size (normal) | | Independent sample proportion test (Wald) |
|------------------------|---------------|------------|---|--------------------|------------|---|---------------|------------|---|
| | Shehata group | FSLO group | | Shehata group | FSLO group | | Shehata group | FSLO group | |
| | P value | | | P value | | | P value | | |
| Age (in years): <4 (n) | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | |
| Observed for <4 (n, %) | 7 (100) | 4 (57.1) | 0.011* | 7 (100) | 3 (42.9) | 0.001* | 7 (100) | 1 (14.3) | 0.001* |
| Age (in years): ≥4 (n) | 5 | 3 | 5 | 3 | 5 | 3 | 5 | 3 | |
| Observed for ≥4 (n, %) | 5 (100) | 3 (100) | 1.000 | 2 (40) | 3 (100) | 0.006* | 2 (40) | 2 (66.7) | 0.445 |

*Statistically significant at a 5% level.



Figure 1: Surgical procedures on 22 testes at stage two in 20 children.

DISCUSSION

Orchiopexy is essential for maintaining fertility and facilitating the surveillance of testicular masses.^{7,8} The success of orchiopexy depends on the fixation of the testis into its normal position in the scrotum without compromising its vascularity.⁹ Laparoscopy is essential for the management of impalpable testes.¹⁰

The length of the testicular vessels is the main obstacle preventing adequate mobilization and fixation of the testis in its normal position.^{11,12} The Shehata procedure has gained popularity due to its concept of vessel lengthening by slow, sustained traction without compromising the blood supply.¹³ In this study, it was observed that the Shehata procedure was more successful in achieving viable, normal-sized testes with a scrotal position than the FSLO procedure. Previous studies have shown that children in older age groups have poor outcomes in terms of achieving testicular scrotal position and ensuring viability due to the longer length of vessels required to bring the testis to the desired anatomical position.^{14,15} Therefore, undescended testis treatment should be performed within 6-12 months after birth and not be delayed beyond 18 months.¹⁶ These findings are similar to those of our study, which showed that the success rate of achieving viable and normal-sized testes placed in the scrotum using the Shehata technique was 100% in children aged 4 years or less. Although no atrophy was observed in the older age group, achieving a normal size and scrotal position was possible in only 40% of cases. Furthermore, Shehata et al reported that the success rate of traction was more than 90% in children younger than 2 years and only 64% in children older than 6 years due to the above-explained factor.¹⁴

The FSLO technique requires ligation of the testicular vessels and relies on the collateral blood supply. Therefore, it has a high risk of testicular atrophy.¹⁷ Additionally, concerns have been raised about the possibility of histological damage and a reduction in the number of spermatogonia and seminiferous tubules 6 months after ligation and division of the testicular vessels.¹⁸ In this study, three cases of testicular atrophy were reported, which were documented clinically and confirmed by ultrasound. This atrophy was observed in children under the age of 4 years. Nevertheless, no incidence of testicular atrophy was observed in patients who underwent FSLO after 4 years of age. The most plausible explanation for this is the better-developed collateral blood supply in the testes in older children compared with younger children.¹⁶

Intra-abdominal testes are inherently smaller than contralateral descended testes. Therefore, a relatively small postoperative testicular size should not be considered a surgical complication.¹⁹ However, studies have shown an increase in testicular size after orchiopexy due to a more favorable surrounding temperature.²⁰ In this study, postoperative testicular size assessment revealed that patients treated with the FSLO technique

had a smaller testicular size than those treated with the Shehata technique. This may be due to the sparing of testicular vascularity in the latter group and a more favorable temperature.

The detachment of traction sutures from the abdominal wall after stage one, which has been reported in up to 11% of cases in some studies, is another complication unique to be associated with the Shehata technique. This may lead to insufficient elongation of testicular vessels and inappropriate scrotal position.²¹ In this study, 2 cases were observed. However, the follow-up results were acceptable in both cases. Our experience shows that taking stitches well into the body of the testis rather than superficially through the tunica albuginea can be very effective in achieving the testicular vessels' lengthening by keeping the testis fixed to the abdominal wall.

This study has some limitations. First, this was a single-center study with a small sample size. Second, this was a retrospective study, and the choice of stage procedure type for all patients with non-palpable testes was dependent on the surgeon's preference. Therefore, there may be bias in the research results. Third, the initial distance between the testes and the internal ring was not measured. Finally, the long-term effects of the two types of surgery on testicular size, position, and fertility are difficult to predict.

CONCLUSION

The study results showed that the Shehata technique is superior to FSLO in bringing the testis down into the scrotum and retaining the vascularity of the testes in children aged less than 4 years. However, the FSLO technique yields more favorable results in children older than 4 years.

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