



Evaluation of staged laparoscopic assisted orchidopexy for intra-abdominal testis with spermatic and gubernacular artery sparing

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Abstract

Background and Objectives: The optimal approach for placing intra-abdominal undescended testes (IAT) in the scrotum remains controversial. Prioritizing testicular location and viability are key to successful orchiopexy. This single-arm clinical trial explored a novel staged laparoscopic technique for intra-abdominal undescended testis (UDT) treatment, employing gradual spermatic cord lengthening and gubernacular vessel preservation. **Aim:** The aim of this study is to evaluate the benefit of staged procedure for intra-abdominal testis. The first stage is laparoscopic assisted, with lengthening of the spermatic cord intra abdominally, the next stage is inguinal approach by further elongation of the spermatic cord extra abdominally. With preservation of the spermatic vessels by gradual lengthening. **Methods:** forty pediatric patients with 44 impalpable UDT underwent laparoscopic-assisted cord lengthening with inguinal traction (Stage 1), followed by open inguinal cord elongation and gubernacular vessel separation (Stage 2). **Results:** Laparoscopy confirmed 44 intra-abdominal testes: 40 pelvic

(90.9%) and 3 high infrarenal (9.1%). Successful scrotal descent was achieved in 33 testes after two stages. Four testes required a third stage for descent. And seven testes were left inguinal for further follow up. The average time between stages was 3.5-6.11 months. **Conclusion:** Staged laparoscopic inguinal traction orchiopexy with spermatic and gubernacular artery sparing proved safe and effective for intra-abdominal UDT treatment.

1. Introduction:

Undescended testis (UDT) is a significant congenital abnormality affecting approximately 3% of full-term male infants and up to 35-45% of premature infants. If left untreated, it carries serious consequences, including testicular atrophy, infertility, and even malignancy. ^[1] Early diagnosis and intervention are crucial in preserving fertility and preventing testicular cancer. ^[2]

Surgical repositioning into the scrotum remains the primary treatment for UDT. While straight forward for testes located in the inguinal area, intra-abdominal testes pose a challenge due to limited spermatic vessel length. Excessive traction during scrotal transposition can jeopardize blood flow and compromise testicular function. ^[3]

Imaging techniques like ultrasound, CT, and MRI lack definitive accuracy in locating impalpable testes. Hence, laparoscopy has emerged as the preferred diagnostic tool for

pinpointing their exact anatomical position. Combined with its minimally invasive nature, laparoscopy also facilitates treatment in many cases. ^[4]

Currently, there is the consensus of opinion that laparoscopy is ideal for both diagnosis and treatment of non-palpable testis ^[5]. However, laparoscopic assisted orchiopexy faces limitations for high-riding abdominal testes. Gradual testicular traction for vessel elongation offers a promising alternative. This technique, pioneered by the team, involves controlled stretching of the testicular vessels to enable scrotal placement of the undescended testis. ^[6] While traction-based vessel elongation has historical precedent, earlier attempts often led to excessive tension and testicular atrophy. Our approach incorporates controlled and incremental traction, minimizing complications and improving potential for successful scrotal repositioning. ^[7] The use

of traction for elongation of the testicular vessels is not new. Franz Torek in 1909 published on the elongation of the testicular vessels using traction by fixation to the thigh. However, these techniques fell into disfavor possibly because of excessive traction, which led to a high and unacceptable rate of testicular atrophy.^[8]

2. Patients And Methods:

Study Design and Setting:

Non-randomized uncontrolled clinical trial conducted at the surgery department of Beni-Suef University Hospital from February 2022 to August 2023 (extended due to incomplete stages). Evaluated the outcome of staged laparoscopic assisted orchidopexy with preservation of spermatic and gubernacular vessels for intra-abdominal undescended testes. Sample size: 36 patients enrolled, based on ClinCalc sample size calculator considering 95% confidence level, 80% power, and Mohammed A et al., 2012 findings.

Inclusion criteria:

Unilateral or bilateral intra-abdominal UDT, age 6 months to 18 years.

Exclusion criteria:

Blind-ended vas and testicular vessels, testicular atrophy during laparoscopy, vas and vessels through internal inguinal ring,

recurrent cases or prior intervention interrupting testis vasculature, peeping testis.

Methods and Tools:

-Preoperative assessments including History taking: associated anomalies, hormonal therapy, past surgeries, family history.

-General examination: overall health assessment.

-Local examination: scrotal development, hypospadias, swellings, scars, palpation of testes, ectopic sites, squatting to reveal retractile testes.

-Radiological evaluation: Pelvi-abdominal ultrasound for testis location and upper urinary system anomalies.

Laboratory tests: routine laboratory investigations.

-Informed consent: Obtained from legal guardian after explanation of benefits, risks, and study requirements.

-Ethical considerations: Protocol adhering to Helsinki Declaration and approved by Faculty of Medicine Beni-Suef University Research Ethics Committee. **Approval no: FMBSUREC/09012022/Korany**

Operative technique:

1st stage: Laparoscopic assisted orchidopexy with vessel preservation. Positioning: Supine, general anesthesia with endotracheal intubation. Patient positioning and skin preparation: Povidone-Iodine used from

subcostal margin to mid-thigh, laterally to posterior axillary lines. Ergonomics: Camera man at head, surgeon on counter side of operated testicle (bilateral: camera man right/left, surgeon at head). Procedure: Umbilical port (5mm/10mm), CO2 insufflation (10-12 mm Hg), abdominal and pelvic visualization, identification of IIRs and undescended testis. Testicle held with atraumatic grasper, dissection around spermatic vessels and vas deferens with scissor. Widening of vaginoperitoneal canal with small inguinal incision, testicle grasping to exit abdomen without gubernacular vessel separation. Scrotum neck incision, canal creation between neck and incision, 4/0 vicryl stitch through tunica albuginea, gentle testis pull. Another stitch at scrotum neck on dartos muscle, gradual tightening towards tunica albuginea stitch to bring testis closer to scrotum without tension. Port withdrawal, camera port removal, and closure of all incisions.



Patient position and port insertion



Dissection around the testis



Testis fixation to the lowest point



Successful extraction outside the abdomen

2nd stage: The second stage of the staged laparoscopic traction orchiopexy procedure

typically occurred 3-6 months after the first stage, guided by post-operative ultrasound and duplex examinations. An inguinal incision was made at the same site as the first stage. Dissection of the testis and spermatic cord commenced distally and progressed proximally towards the internal inguinal ring, meticulously preserving the testicular pedicle and separating the gubernaculum. This meticulous dissection minimized the risk of vascular compromise to the vas deferens and testicular vessels.

A dartos pouch was created within the scrotum through the existing incision and a small scrotal incision was made, and a mosquito clamp was introduced through the scrotum and connected to the inguinal incision, creating a tunnel for the testis. The tunica albuginea was grasped, ensuring the pedicle remained detorted, with the vas deferens positioned medially and the vessels laterally. The testis was gently descended, aiming to reach the bottom of the dartos pouch in the scrotum. If full scrotal placement proved unattainable, the testis was secured at the lowest possible point, including the neck of the scrotum or even the inguinal canal for potential further intervention. The third stage, if required, was performed through an inguinal crease incision at the same site as previous stages. Dissection followed the same protocol as the

second stage, aiming for further cord lengthening to reach the desired scrotal position. Ultimately, the testis was secured at the lowest achievable point, either within the scrotum or at the neck of the scrotum. Both inguinal and scrotal incisions were then closed.



Dissecting the preserved gubernaculum during the 2nd stage



Successful fixation to the scrotum during the 2nd stage

3. Results:

40 pediatric patients with 44 UDT (4 patients with bilateral UDT) were initially examined for analysis. Majority of patients had left-sided UDT (65%), with an average age of 3.3 years. inguinal extraction was done successfully in all 44 cases.

37 cases were average size and vascularity and had shown normal echogenicity (84%) with Successful scrotal or neck of scrotum descent.

In 33 cases descent was achieved after two stages and three stages in 4 cases.

Seven cases remained inguinal due to small size and heterogeneous echogenicity. No

cases with testicular ascent observed six months postoperatively.

No reported testicular atrophy or mortality. No major intraoperative complications occurred. Early/late postoperative complications included: Wound infection (2 cases, 4.5%), Inguino-scrotal hematoma (8 cases, 18%), Stitch sinus (2 case, 4.5%).

Additional Findings: 3 cases with high infrarenal testes were managed differently: One successfully descended to neck of scrotum after third stage. Two remained inguinal due to heterogeneous echogenicity. Dartos pouch creation for testicular fixation was successful in most cases (90%). Three-point fixation used in cases with rudimentary scrotum (10%). Overall, the results suggest that staged laparoscopic traction orchiopexy with vascular preservation is a safe and effective technique for the treatment of intra-abdominal UDT in pediatric patients, achieving high success rates with minimal complications.



Neck of scrotum position after the 2nd stage



Successful scrotal descent

4. Discussion:

Short spermatic vessels in intra-abdominal UDT limit direct scrotal placement, necessitating various laparoscopic

techniques like Fowler-Stephens orchiopexy or staged traction methods.^[9] For low intra-abdominal and intracanalicular testes, primary laparoscopic orchiopexy seems promising, with studies showing its feasibility.^[10] Laparoscopy has been established as the most reliable management (diagnostic and therapeutic) for impalpable undescended testis. The anatomy can be demonstrated clearly, and visual information can be provided by laparoscopy so definite decision can be made.^[11] The main limiting factor is the shortness/brevity of testicular vessels that is hindering adequate and tension-free placement of the testis into the scrotum.^[12] Moreover, too much stretching on the testicular vessels may cause circulatory affection, sometimes atrophy of the testis.^[13]

This research presents the findings of a single-arm clinical trial evaluating a novel technique for treating undescended testis (UDT): staged laparoscopic traction orchiopexy. The study achieved a 84% success rate in bringing the undescended testes to a proper scrotal position, comparable to other reported series using the Shehata technique.

No cases of testicular atrophy were observed, supporting the hypothesis that gradual

lengthening of intact vessels may lead to better preservation.

The staged approach allows for gradual traction, potentially minimizing the risk of complications like testicular ascent.

Limitations: The lack of a control group prevents direct comparison with other treatment methods. The study did not measure sex hormone levels or assess long-term complications. The relatively small sample size necessitates further research with larger cohorts.

Strengths: The study adopts a novel and potentially beneficial technique for UDT treatment. It provides valuable insights into the management of intra-abdominal UDT. The discussion clearly outlines the limitations and strengths of the study, paving the way for further investigation.

5. Conclusion:

We concluded that the studied technique in the present study is comparable in safety with previous techniques with good post-operative testicular position and the ability of following up the cases clinically and radiologically without jeopardizing the vasculature of the testis and without adding extra need for reexploration of the abdomen and is suitable for the treatment of NPT with appropriate scrotal location and excellent testicular atrophy rate.

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