

REVIEW

Laparoscopic management of non-palpable testis

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ABSTRACT

We present a new approach to high intraabdominal testis (IAT) for elongation of the testicular vessels without division. The technique entails fixation of the testis to a point one inch above and medial to the contralateral anterior superior iliac spine for 12 weeks. Subdartos orchiopexy is then done as the second stage. Both stages are laparoscopically assisted. The a new approach to high intraabdominal testis, two-stage laparoscopic traction-orchiopexy, is useful and resulted in significant elongation of the testicular vessels without atrophy. It is a safe and valid alternative to the two-stage laparoscopic Fowler–Stephens technique, which entails division of the main testicular vessels.

Keywords: Intrabdominal testis, elongation

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Introduction

Cryptorchidism or an undescended testis is one of the most common genital anomalies in boys. The incidence of cryptorchidism is approximately 2% in newborns, and 1% in 1-year-olds. 80% of the testes are clinically palpable and 20% of them are nonpalpable¹.

A testis may be non-palpable because of intra-uterine demise (vanishing testis), agenesis (true monorchia), intra-abdominal location, or inguinal location with a different grade of dysplasia or atrophy.

A non-palpable testis is defined as a testis not palpated by any examination technique, including pre-operatively, under anaesthesia². Non-palpable testes have an increased risk of malignant transformation, infertility and epididymal malformation.

In patients with bilatera non-palpable testis, the karyotype and hormones need to be checked to confirm the presence or absence of a testicular structure. If this study confirms the absence of testes, no laparoscopic or surgical exploration is needed. If the workup confirms the presence of testicular tissue, then laparoscopic surgery should be continued for further management. If no testicular structures are found by laparoscopy, the patient should be referred to a pediatric endocrinologist for hormone replacement therapy³.

Diagnosis

Clinical examination

A bimanual examination is performed with one hand which is placed near the anterior iliac spine and the other on the scrotum. The first hand is swept from the anterior iliac spine along the inguinal canal to gently express any retained testicular tissue into the scrotum. If the testis remains nonpalpable, a careful examination under anesthesia allows palpation of the testis in approximately 20% of cases (Figure 1).



Figure 1. Bimanual examination of the inguinal region.

Clinical examination

Ultrasound is a simple and noninvasive procedure. Intestinal gas represents a barrier for ultrasound (Fig 2,3,). Reported data with US showed sensitivity of 44% and specificity of 70%. Accurate diagnostic rates are 60% for intrascrotal testes, 20% for intra-abdominal testes (IAT), and 14% for absent testes⁴.

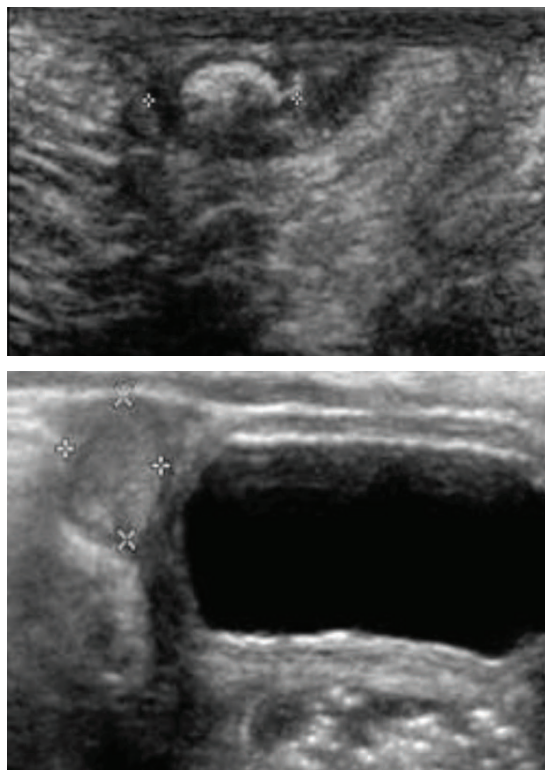


Figure 2, 3. An ultrasound examination showed an intra-abdominal testicle located next to the urinary bladder.

MRI

Kato et al. reported predictive accuracy of 98.4% by fat-suppressed, T2-weighted, and diffusion-weighted MRI, that visualizes changes in the translational motion of water molecules to provide tissue contrast⁵. The need for anesthesia is the main factor limiting the routine use of MRI for IAT (Figure 4).

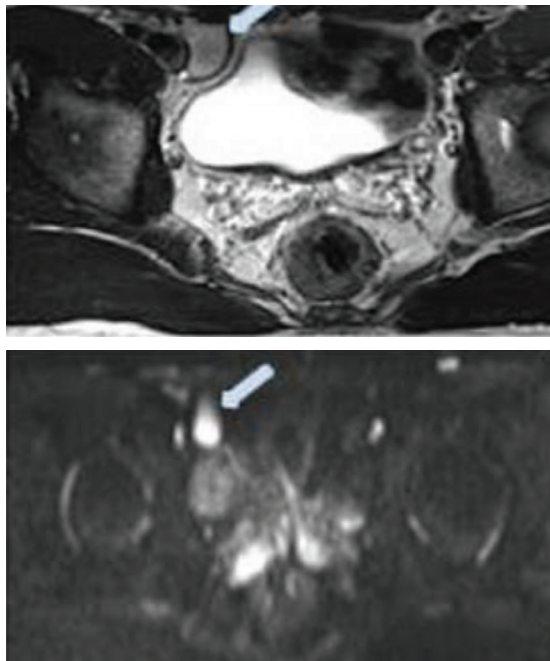


Figure 4. Intraabdominal MRI in a 3 year old boy with a nonpalpable right-side testis close to the inner ring.

Laparoscopy

Laparoscopy is a diagnostic and therapeutic procedure. It was initiated in Europe at the beginning of the 20th century, and there were further improvements after 1952 with the introduction of a rod lens system and advances in fiber optics. The first case of IATs identified by laparoscopy was published by Cortesi et al. in 1976. Castilho and Ferrari extended their experience to therapeutic interventions⁶. In 1959, Fowler and Stephens described dividing the testicular vessels high above the collaterals to the vasal vessels⁷. The initial results were disappointing with a rate of atrophy of around 50%. Staging the operation by leaving the testis in situ following vessel ligation and using laparoscopy

improved the results⁸. The accurate diagnostic rate is 97-100%. There are three main possible findings: an IAT (40%) (Fig 5), a cord structure with a blind ending (15%), (Figure 6), and a cord that enters the internal inguinal ring (45%) (Figure 7).

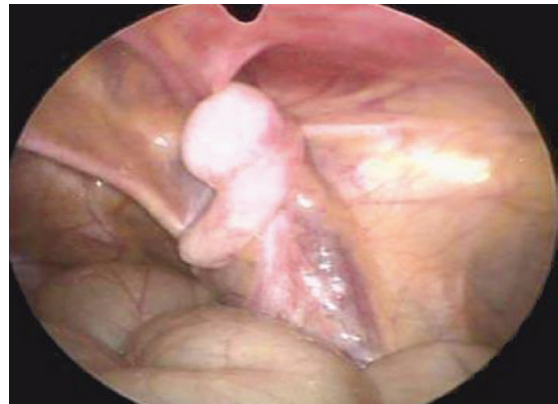


Figure 5. IAT (intraabdominal testis).

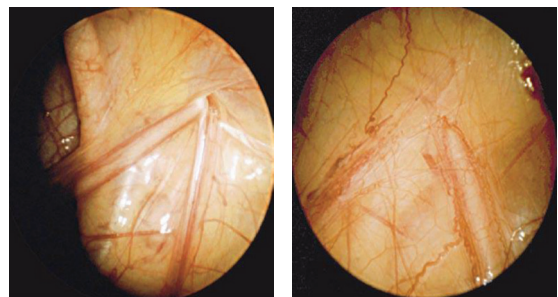


Figure 6. Vas and vessels passing through the internal inguinal ring; **Figure 7.** Blind ending vas and vessels.

We used the algorithm for non-palpable testis by X.Sepulveda⁹ (Figure 8). Every patient with a non-palpable testicle is examined on an outpatient basis. If the testicle cannot be palpated, echo is performed. If echo cannot detect the testicle, we do not perform MRI because it is an expensive diagnostic method and the patient must be under general anesthesia. If the magnet shows the presence of testicular tissue in the abdomen, we have to perform a laparoscopy. If the MRI does not detect an intra-abdominal testicle, we must again perform laparoscopy to confirm or deny this finding. Therefore, after a negative

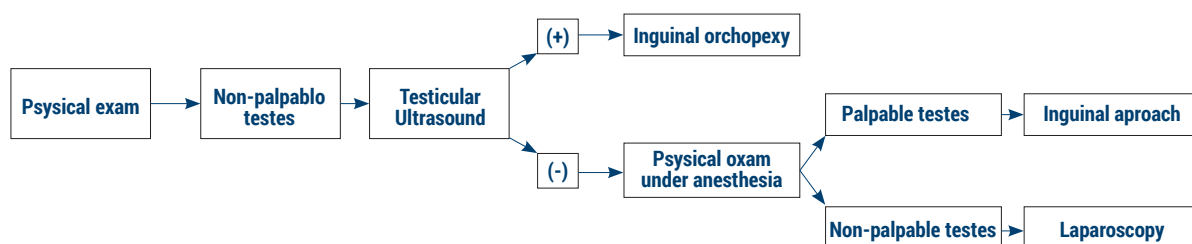


Figure 8. Algorithm for non-palpable testis that is applied at the Clinic for Pediatric Surgery in Sarajevo.

echo examination, the next diagnostic procedure is bimanual palpation under general anesthesia before the surgical procedure. If we palpate the testicle in the inguinum, we operate with an open approach, but if we do not palpate the testicle preoperatively under general anesthesia, then we perform a laparoscopy procedure.

Management

The management of non-palpable testes is surgical. Orchidopexy is indicated if the testis is not located in the scrotum after 6 months, as it improves fertility rates and allows close monitoring for the development of possible testicular masses.

The algorithm we use for management was published by Hsu et al.⁹ Management during the operation for a non-palpable testicle depends on its position. If we find that the vas testicularis and ductus deferens pass through the inner ring, then we explore the inguinal canal by open surgery to find, most likely, atrophic testicular tissue. If we find a testicle inside the abdomen and it is atrophic, then we perform an orchidectomy. If the testicle is of a satisfactory size, the further procedure depends on its position. If the testicle is next to the internal inguinal ring, then we proceed with orchidopexy or open surgery, or with Vessel Intact Laparoscopic Assisted Orchiopexy (VILO) technique. If the testicle is located 2 or more centimeters away from the inner ring, then we apply the two stage procedure because due to the short vas testicularis, we cannot place the testicle in the scrotum.

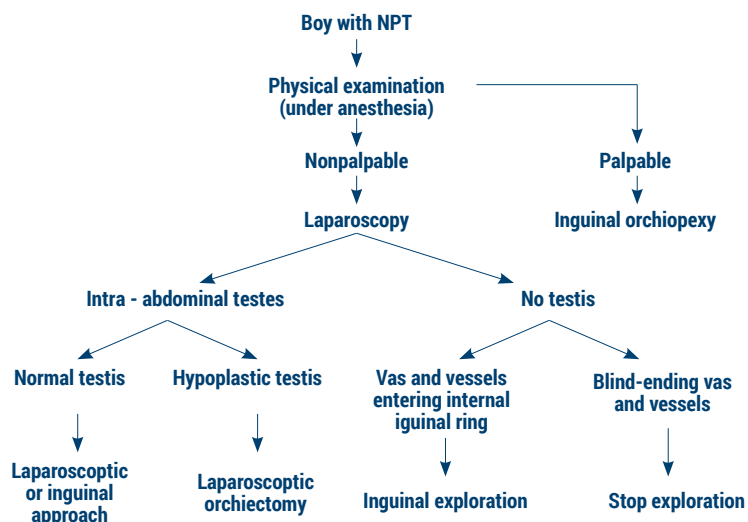


Figure 9. Management of boys with nonpalpable undescended testes, the algorithm used at the Clinic for Pediatric Surgery in Sarajevo.

Surgical treatment

There are two surgical approaches for IATs: laparoscopy and an inguinal incision. For the past 10 years, laparoscopy has been considered the gold standard procedure for assessing boys with IAT.

Standard open orchiopexy

The key procedures include: 1) complete mobilization of the testis and spermatic cord; 2) repair of the patent process vaginalis by high ligation of the patent process vaginalis; 3) skeletonization of the spermatic cord without injuring vascularity to achieve tension-free placement of the testis in a dependent position to the scrotum; and 4) creation of a superficial dartos pouch of the hemiscrotum.

Laparoscopic treatment

The laparoscopic procedure is performed by creating a pneumoperitoneum by making an umbilical Hudson incision and placing a 5 mm trocar. After that, two more pararectal trocars of 3 or 5 mm are placed under optical control (Figure 10)



Figure 10. Positions of 3 trocars, one umbilical, 5mm, and two pararectal, 3 and 5mm.

Vessel Intact Laparoscopic Assisted Orchiopexy (VILO)

This technique is suitable for a low-lying abdominal testis near the internal inguinal ring, but they are attended by a high-riding testis in about 9% of cases (Figures 11-15).

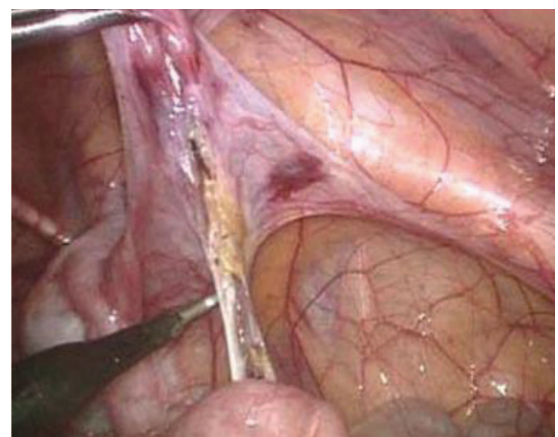
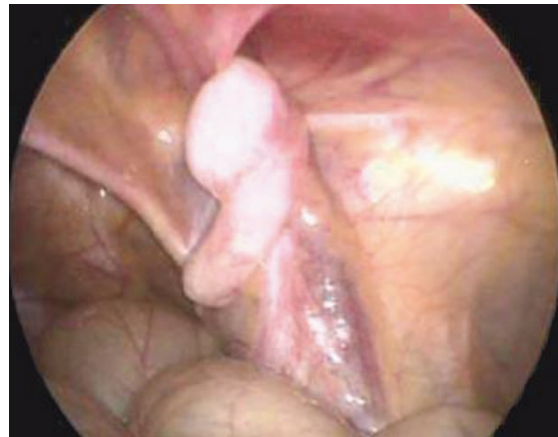


Figure 11,12,13. The testis is close to the inner ring, and mobilization of the peritoneum and testicle.

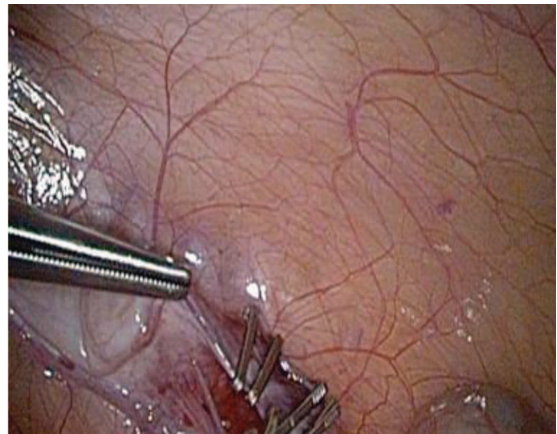
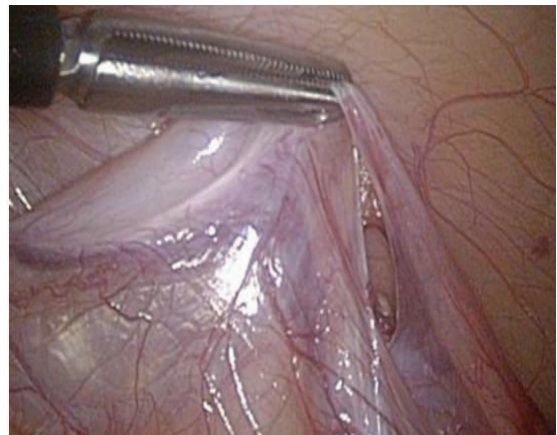
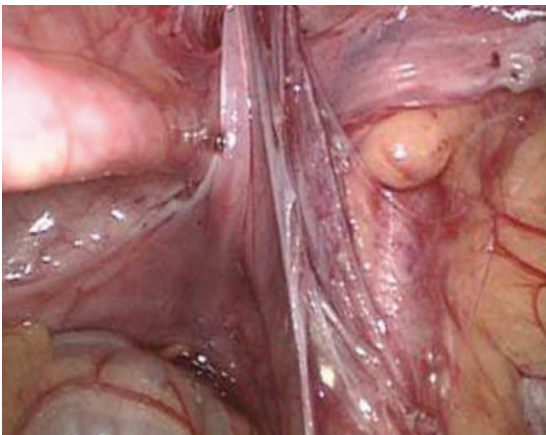
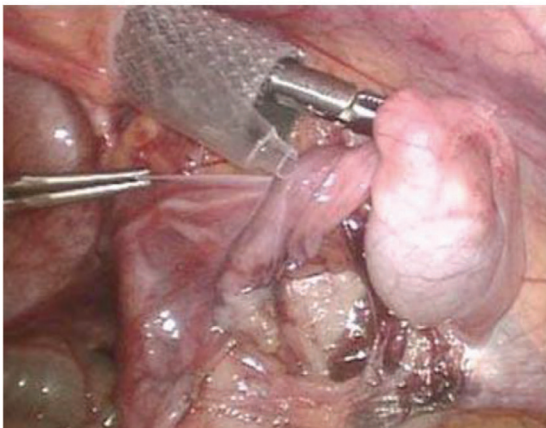


Figure 14,15. The testicle is placed in the scrotum by the shortest route, in one stage.

The One-step Fowlere-Stephens procedure

The indication for a Fowlere-Stephens procedure is a testis located >2 cm away from the ipsilateral internal inguinal ring. The procedure involves clipping and transecting the testicular vessels. There is sufficient collateral arterial flow through the deferential artery to allow the testis to survive. The procedure can be done in one or two stages⁶.

A Two-step Fowlere-Stephens procedure

Most pediatric surgeons choose to perform the Fowlere Stephens procedure in two steps to reduce the risk of vasospasm of the spermatic vessels. During the first step, the spermatic vessels are clipped 3-4 cm proximal to the testis (Figures 16-18).

Figure 16,17,18. The spermatic vessels are clipped 3-4 cm proximal to the testis.

The second step of the Fowlere Stephens procedure is performed 3-6 months later. During the second step, the spermatic vessels are divided between the clips, the peritoneum lateral to the testicular vessels is incised and the testis mobilized by sharp dissection

of the peritoneal covering, and the testis is brought down into the scrotum^{6,7} (Figure 19, 20).

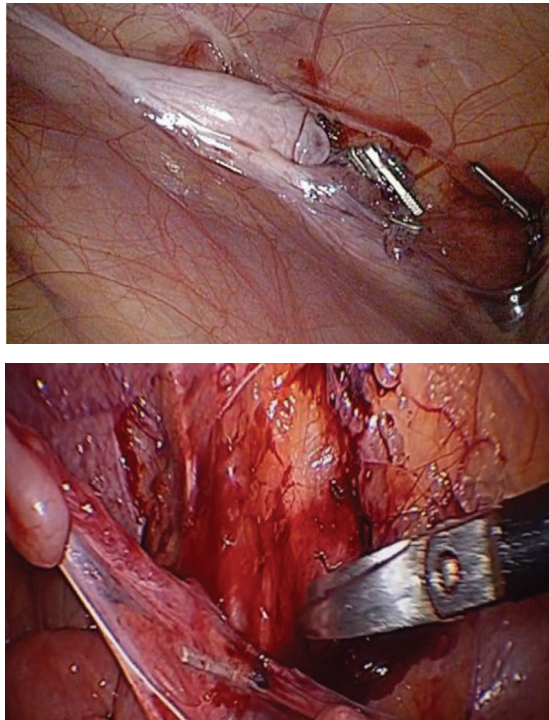


Figure 19, 20. The spermatic vessels are divided between the clips, and the testis is brought into the scrotum.

The two-stage laparoscopic Fowler-Stephens approach is currently the most popular technique for an intra abdominal testis, with a success rate of about 80–85%^{11,12}. Esposito et al. studied the 10 year follow-up of the FS technique, and reported an 83% success rate in terms of position, but stated that the operated testis was usually significantly smaller than the normal side¹³. There have been concerns about the possibility of histological damage despite maintenance of a good position. Rosito et al. showed a significant reduction in the number of spermatogonia and seminiferous tubules 6 months after ligation and division of the testicular vessels (TV), although testicular volume was not affected¹⁴.

Microvascular orchiopexy

Since Silber and Kelly's first description in 1976, microvascular autotransplantation has not been adopted by many surgeons for several reasons, including the

long duration of the operation, and the need for microsurgical skill and special instruments¹⁶⁻¹⁸.

Staged laparoscopic traction-orchiopexy (description of new technique)

First stage: The bowel is prepared by 5 mg Bisacodyl[™] suppository, 12 and 6 hours before surgery, and the bladder is evacuated by micturition or supra pubic pressure before surgery. The patient is supine in the Trendelenburg position with the ipsilateral side up, in order to move the bowel out of the way. A 5-mm port is inserted into the umbilicus by the open Hasson technique. Pneumoperitoneum is created up to 10–12mmHg. Two 5-mm accessory trocars are inserted under direct vision on the lateral edge of both recti muscles at the level of the umbilicus. The findings are classified as: (a) blind ending vas and vessels, (b) vas and vessels passing through IIR or (c) IAT (intra abdominal testes) found. The indication for Staged Laparoscopic Traction-Orchiopexy is if a testis is located >2 cm away from the ipsilateral internal inguinal ring. Mild traction on the mobile testis inferiorly is applied to detect the shortest distance. The gubernaculum is divided under direct vision with a monopolar blended low-current hook, cutting the diathermy away from the testis to avoid a 'long-looping vas'. The peritoneum lateral to the testicular vessels is incised, and the testis mobilized by sharp dissection of the peritoneal covering. The testis is fixed with a single stitch of Ethibond[™] 2/0 on a round needle to the fixation point two cm above and medial to the contralateral anterior superior iliac spine (Figures 21,22). The suture is passed from a small nick in the skin at the predefined point, received inside the abdomen, and passed, taking a broad bite in the lower pole of the testis, then returned outside the abdominal wall, where the two ends of the suture are tied extracorporeally and buried under the skin. In the case of bilateral intraabdominal testes, the procedure is applied bilaterally in the same setting. After the pneumoperitoneum is released, the ports are removed. The umbilical wound is closed with absorbable sutures. All boys are followed up in the outpatient clinic after 7 days, 2 weeks and 3 months¹⁹.

Second stage: A second stage laparoscopic-assisted orchiopexy is planned after 12 weeks. The preoperative preparation, positioning and trocar positions are the same as the first stage. The abdominal cavity is inspected for any adhesive bands, and slippage of the suture and retraction of the testis,

internal herniation, and position of the intestine in relation to the TV are noted and recorded. The fixation stitch is divided and the testis is delivered through small inguinal incision before directing it to the scrotum to be fixed in the subdartos pouch (Figures 23-28).

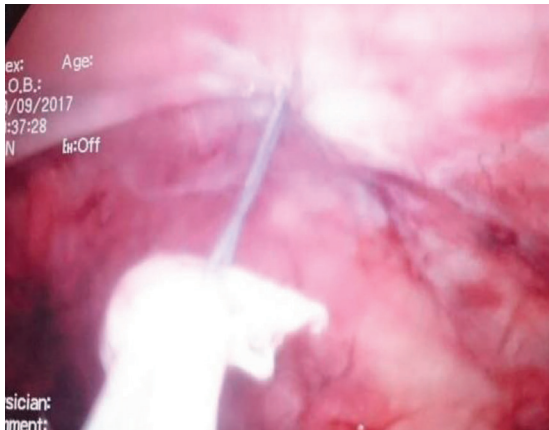


Figure 21, 22. Traction stitch applied to the testis and passed to the outside 2 cm above and medial to the contralateral ASIS.

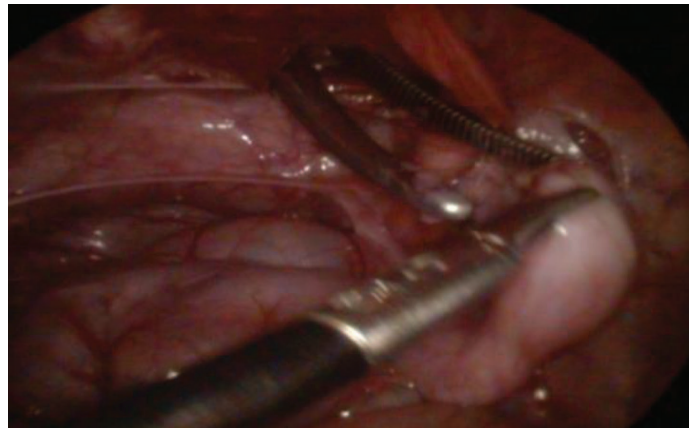
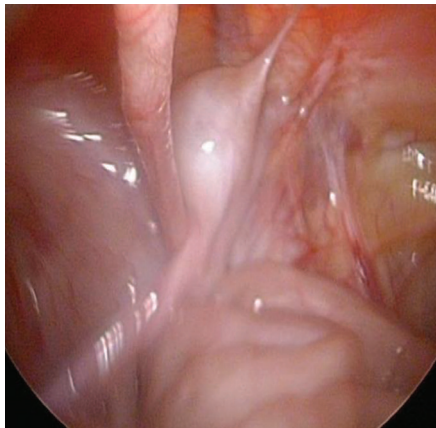


Figure 23, 24. Traction stitch applied to the testis and passed to the outside 2 cm above and medial to the contralateral ASIS.

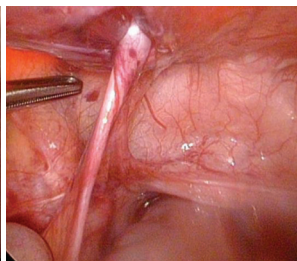
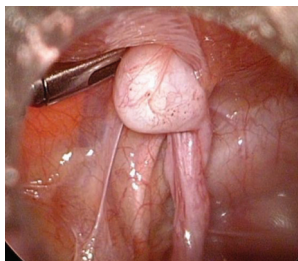
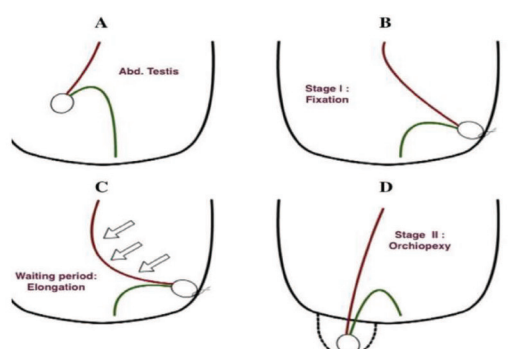


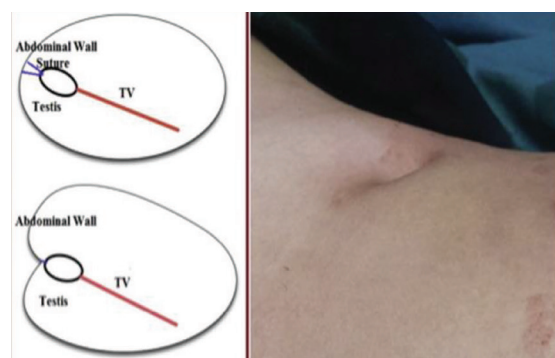
Figure 25, 26, 27, 28. The left testis is passed through the new opening and descends into the scrotal sac.

The first schematic diagram shows the steps of Staged Laparoscopic Traction-Orchiopexy A= abdominal testis, B= fixation in stage one on the contralateral side, C= progressive gradual elongation by movement of the bowel during the waiting period, D=scrotal position in stage II.



Schematic diagram 1. Staged laparoscopic traction-orchiopey

The second shematic diagram shows another mechanisam of elongation of testicular vessels. The fixation point to the abdominal wall is mobile and can indent inwards instead of causing excessive stretch of the testicular vessels, in contrast to fixation to an immobile point on the femoral region. Regular and repeated movement of the abdominal muscles during respiration stretches the testicular vessels.



Schematic diagram 2. Another mechanisam of elongation of the testicular vesels.

Follow up is at one week, 3 months, 6 months, and one year postoperatively, to check testicular

position, testicular size compared to the other side by ultrasonography, and color Doppler examination to check testicular size and vascularity after 6 months from the second stage. Success is defined as a scrotal testis (mid or low scrotal), with normal size (within 75–100% of the other side by U/S examination or normal controls), with good vascularity by Doppler.

The use of traction for elongation of the testicular vessels is not new. Franz Torek published in 1909 an article on the elongation of the TV using traction by fixation to the thigh²⁰. These techniques fell into disfavor, possibly because of excessive traction, which led to a high and unacceptable rate of testicular atrophy²¹. The two-stage laparoscopic Fowler-Stephens approach is currently the most popular technique for intraabdominal testes, with success rate of about 80–85%. Esposito et al. studied the 10 year follow-up of the Fowler-Stephens technique, and reported an 83% success rate in terms of position but stated that the operated testis was usually significantly smaller than the normal side²². There have been concerns about the possibility of histological damage despite maintenance of a good position. Rosito et al. showed significant reduction in the number of spermatogonia and seminiferous tubules 6 months after ligation and division of the TV, although testicular volume was not affected. Further studies are necessary to evaluate the repercussions of these changes in future fertility²³.

The mechanism of elongation in the new technique is by the weight of the intestines, very gently and gradually stretching the TV over the course of 12 weeks. This is in contrast to the excessive abrupt tension used in previous techniques that may have led to higher atrophy rates. In all cases, during the 2nd stage the intestine was found lying in front of the testicular vessels. The other important point is that the fixation point to the abdominal wall is mobile and can indent inwards, instead of causing excessive stretch of the TV as in fixation to an immobile point on the thigh or to a bony point. The other possible mechanism is the regular

and repeated movement of the abdominal muscles during respiration stretching the testicular vessels²⁴.

Conclusions

The technique of staged laparoscopic traction-orchiopey is safe and successful for managing most cases of intraabdominal testes.

It is indicated for cases of abdominal testis not amenable to laparoscopically assisted orchiopey.

Future directions include the histological confirmation of the microscopic structures of the testis after traction, and comparison with cases of Fowler Stephens approach.

Conflict of interests

The author has no relevant financial or non-financial interests to disclose.

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