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Title page

Laparoscopic single-stage orchidopexy followed by groin exploration: the best two-stage orchidopexy?

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Extended summary/abstract:

Laparoscopic single-stage orchidopexy followed by groin exploration: the best two-stage orchidopexy?

Aim:

Various laparoscopic approaches have been described for managing intra-abdominal testicles.

We aimed to evaluate the outcomes of patients who had laparoscopic single stage vessel sparing (LSSVO) with regards to testicular atrophy, testicular ascent, and with special emphasis on surgical outcomes of a subsequent groin exploration for testicular ascent.

Methods:

Retrospective review of patients who had LSSVO at a UK tertiary paediatric surgery centre between 2006-2024. We included all patients under 16 years following LSSVO who had complete follow up. We analysed age at operation, laterality, pre-and post-operative description of testicular size, whether tension was present on fixing the testis, and testicular position at follow-up. In addition, we evaluated the outcomes of patients who had recurrent testicular ascent requiring groin-based redo surgery.

Results:

105 patients had LSSVO over the 18 year period. Mean age at operation was 2 years and mean follow up was 19 months. The testis size at time of surgery was subjectively described rather than objectively measured. The scrotal position after surgery and tension was recorded.

First post-op follow up was at 6 months. Twenty-six testicles (24%) had ascended requiring a groin approach for further mobilisation; all were scrotal at 6 months follow up with no testicular atrophy.

We found no association between tension at the time of LSSVO, age or associated anomalies with the risk of needing further surgery.

Discussion:

Laparoscopic Fowler-Stephen's orchidopexy remains the standard approach for the intra-abdominal testis although vessel division may decrease germ call count. We preferred sparing the testicular vessels, accepting that a second procedure involving inguinal incision may be required. We had no cases of testicular atrophy, in comparison to the up to 25% rate in the literature for vessel dividing orchidopexy.

24% of our cohort required a second groin-based operation to bring the testis to a more satisfactory scrotal position, compared to a recurrent ascent rate of 0-14% in the literature. We accepted this higher recurrence rate as the groin exploration has proven to be technically straightforward, and as there were no cases of subsequent testicular atrophy.

Conclusion:

LSSVO, paired with groin exploration for recurrent testicular ascent when needed, achieved a scrotal testis in all patients with no testicular atrophy, whilst preserving the testicular blood supply and avoiding any potential effects on its histology. It has the added benefit over other 2-stage techniques of avoiding both a 2nd stage in 76% of patients and the need for repeat laparoscopy.

Manuscript:

Laparoscopic single-stage orchidopexy followed by groin exploration: the best two-stage orchidopexy?

Introduction:

By 6 months of age, 1% of full term infants have an undescended testis, with approximately 20% being impalpable [1,2]. Various laparoscopic approaches have been described for managing intra-abdominal testicles including the Fowler-Stephens vessel-dividing orchidopexy (single- or two-stage); single stage vessel-sparing orchidopexy; gubernacular sparing orchidopexy; and the testicular traction technique (Shehata technique) [3,4,5]. The key question for the surgeon is how to decide which orchidopexy is best in which anatomical situation.

We evaluated the outcomes of our patients who had laparoscopic single-stage vessel-sparing orchidopexy (LSSVO) over the past 18 years with regards to testicular atrophy, testicular ascent, and with special emphasis on surgical outcomes of a subsequent groin exploration for testicular ascent. We also looked at potential correlations between degree of tension of the pexed testis and patient age at time of surgery and surgical outcomes.

Materials and methods:

This was a retrospective review of patients with intra-abdominal testicles who had LSSVO at a tertiary paediatric surgery and urology centre in the UK between 2006-2024. All data were collected using a prospectively maintained departmental surgical database and the trust electronic records.

We included all patients under 16 years of age following LSSVO who had at least one postoperative follow up. The decision to proceed to a LSSVO was based on the surgeon's assessment of the intra-abdominal testis with regards to distance from internal ring and an evaluation of testicular vessel length based on the ability to bring the testicle to the contralateral ring with little or no tension after mobilization. Intra-abdominal testis were laparoscopically mobilised on a peritoneal pedicle of vas deferens and testicular vessels; re-routed medial to the inferior epigastric vessels; brought to a scrotal sub dartos pouch via a size 11 STEP port; and fixed to the median raphe by 3-0 vicryl. Parents/carers were informed of the possibility of needing a planned 2 stage laparoscopic Fowler Stephen's orchidopexy or Shehata technique based on surgeon's assessment (i.e., if testis was felt to be in a high intra-abdominal position or if degree of tension was felt to be too much to bring to the scrotum after testicular mobilization). Complications and outcomes of various procedures were clearly highlighted in clinic and at time of obtaining informed consent for surgery including the 24% risk of testicular ascent in LSSVO requiring further groin exploration.

We excluded patients who had any different surgical technique, patients with abnormal gonads or, disorders of sex development (DSD), and those with incomplete data or who were lost to follow up.

We collected and analysed demographic data, age at operation, laterality, pre- and post-operative description of testicular size, presence or absence of tension on pexing the testis into the scrotum, and testicular position at follow-up. In addition, we evaluated the outcomes of patients who had recurrent testicular ascent requiring groin-based redo surgery aimed at mobilising the testis to a more optimal scrotal position. This procedure involved a groin skin incision centred over the external ring. The testis was identified, freed from any scar tissue, and mobilised on the testicular vessels and vas deferens through the external ring and muscle to the peritoneum. The testis was secured to the median raphe as above.

Data were analysed using Microsoft Excel 2010 and GraphPad Prism 10.2.0. Categorical data are presented as percentages and continuous data (due to the non-normal distribution of some parameters) are presented as median value and 25th-75th percentiles. For statistical analysis the Chi-Square test was employed for categorical data and Mann-Whitney test for continuous data. P-value <0.05 was considered to be statistically significant.

Data were collected with institutional review board approval. Ref: PSURG/SE/2024-25/03.

Results:

105 patients had LSSVO with complete follow-up over the 18 year period (Figure 1). The median age at operation was 1.4 years (25th and 75th percentiles; 1.0 – 2.3 years). The median operative time for the procedure was 50 minutes (41 – 65 minutes), and the median follow-up was 10 months (6-22 months). 40 patients had bilateral intra-abdominal testis, 39 had right and 26 left intra-abdominal testis. (Table 1)

The testis size at time of surgery was not objectively measured and was described as small, normal, and/or equal to the other side, or uncommented on (Table 2). The scrotal position after surgery was recorded (Table 3), and tension, when documented, was described as 'some tension' in 35 and no tension in 17.

Most patients had their first post-op follow up at 6 months, then further follow up was planned depending on the testicular position at this review (Table 4). A 2^{nd} stage was recommended when the testis was not in a scrotal position on follow up 6 months or more after the initial surgery. Twenty-six testicles (24%) had ascended and required a groin approach for further mobilisation; all were scrotal at 6 month follow up. Further follow up was arranged if there was uncertainty about testicular scrotal position or size. The median operative time for the second surgery was 41 minutes (30-53 minutes). Only one patient had bilateral groin exploration. No intraoperative complications were encountered. None of the patients in this cohort had testicular atrophy at final follow up, including the 26 patients that required redo surgery.

We found no association between presence or absence of tension at the time of LSSVO, age or associated anomalies with the risk of needing further surgery (Table 5)

Discussion:

Laparoscopic staged Fowler-Stephen's orchidopexy remains the standard approach for the intra-abdominal testis in many paediatric surgical centres, although testicular vessel division may decrease germ call count [6-7]. In our centre, our preference has been to spare the testicular vessels where possible, accepting that a second procedure may be required, involving an inguinal incision through minimally scarred tissue.

In our cohort, we had no cases of testicular atrophy, in comparison to up to 5% in published series, accepting that this is a retrospective review with no formal measurement of testicular size [8-16]. Not surprisingly, the reported atrophy rate is higher following surgery involving vessel division (whether single- or two-stage), ranging from 0-25% [17-18].

There is no standardised definition of testicular atrophy, though Bidault-Jourdainne et al describe small as a length under 10 mm, and atrophic as under 5 mm or absent [19]. We found comparing the operated testes to the contralateral one to be a useful guide, however, this becomes less reliable in bilateral cases. 38% of our patients fell into the later category and their results need to be interpreted with caution due to the aforementioned. Shehata et al similarly relied on comparing the operated testis to the contralateral size and considered a size less than 75% of the contralateral normal testis as a failure. Similarly 23% of their patients had Bilateral undescended testis.[20]

We found no association between presence or absence of tension at the time of LSSVO with the risk of needing further surgery. Bagga et al reported testicular atrophy in the absence of tension on the spermatic cord and have attributed it to a vascular event affecting testicular blood flow such as compression in the artificially created neo hiatus or subclinical torsion in the dartos pouch. They reported that tension during LSSVO affected their testicular viability outcomes [21]. This was not seen in our cohort where all testicles requiring an additional groin approach appeared viable regardless of the recorded tension at time of the initial operation.

Similarly, no association was found between age of patient at time of LSSVO and the risk of needing further surgery, where as other studies reported that older age was a predictive factor for testicular assent after LSSVO in their cohort. [21].

24% of our cohort required a second operation through a groin incision to bring the testis to a more satisfactory scrotal position, whereas previous studies have demonstrated a recurrent ascent rate of 0-14% [8-16]. We accept the need for a 2^{nd} procedure in this proportion of patients as the end result in our series was a scrotal testis with no cases of complete atrophy. The second procedure has proven to be technically straightforward as we encountered minimal groin scarring, however as one would expect scarring is encountered around the testis due to the previous pexy . Although it's self-evident from the nature of the surgery, it's worth emphasising that 76% of our patients had a single procedure which is a better proportion than the 0% of patients who had planned 2-stage procedures.

Follow up is limited in this study and due to the potential risk of recurrent ascent with pubertal growth spurt, all carers and patients are advised on discharge to perform regular scrotal examination.

We suggest that LSSVO may be the best approach for intra-abdominal testicles that can be brought to, or close to, the scrotum as a 2^{nd} stage groin procedure, if needed, can then achieve tension-free orchidopexy with vessel preservation, no testicular loss, and no need for further laparoscopy. This study was limited by its retrospective nature; the lack of objective assessment of testicular size; and the subjective assessment as to which testicles are suitable for LSSVO. Clearly there will be higher intra-abdominal testicles that would benefit from Shehata or Fowler-Stephen's orchidopexy, and there remains a need for more objective criteria to guide surgeons between these options.

Conclusion:

Laparoscopic single-stage vessel-sparing orchidopexy, paired with groin exploration for recurrent testicular ascent when needed, achieves a scrotal testis in all patients with no testicular atrophy , whilst preserving the testicular blood supply and avoiding any potential effects on its histology. It has the added benefit over other 2-stage techniques of avoiding a 2nd stage in 76% of patients and avoiding the need for repeat laparoscopy. Studies with longer follow up would be useful to confirm our outcomes.

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Ethical approval

Ethical approval wasn't required. Data were collected with institutional review board approval. Ref: PSURG/SE/2024-25/03

Conflict of Interest

The authors declare no conflict of interest

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Tables

Table 1: Patient Demographics

Intra-abdominal testis laterality	
Bilateral	40 (38%)
Right	39 (37%)
Left	26 (25%)
Median age in years at time of initial surgery (25th - 75th percentile)	1.4 (1.0 – 2.3)
Median age at time of 2nd surgery (25th - 75th percentile)	2.8 (2.9 – 4.2)

Table 2: Testicular size at time of LSSVO

Testicular size at time of surgery	Number of testes
Equal to other side	1 (1%)
Good/Reasonable/Normal	19 (18%)
Small	16 (15%)
Smaller than other side	4 (4%)
No comment	65 (62%)

Table 3: Testicular position after LSSVO

Testicular position after surgery	Number of testes
Scrotal neck	1 (1%)
High scrotal	6 (6%)
Mid scrotal	1 (1%)
Low scrotal	12 (11%)
Scrotal (Not specified)	85 (81%)

Table 4: Testicular position at clinic review post LSSVO

Testicular position at clinic review	Number of testes
Upper/high scrotal	16 (15%)
Mid scrotal	2 (2%)
Low scrotal	3 (3%)
Scrotal (Not specified)	29 (27.5%)
Good	29 (27.5%)
Inguinal	26 (25%)

Table 5: Relation between presence or absence of tension at the time of LSSVO, age or associated anomalies with the risk of needing further surgery

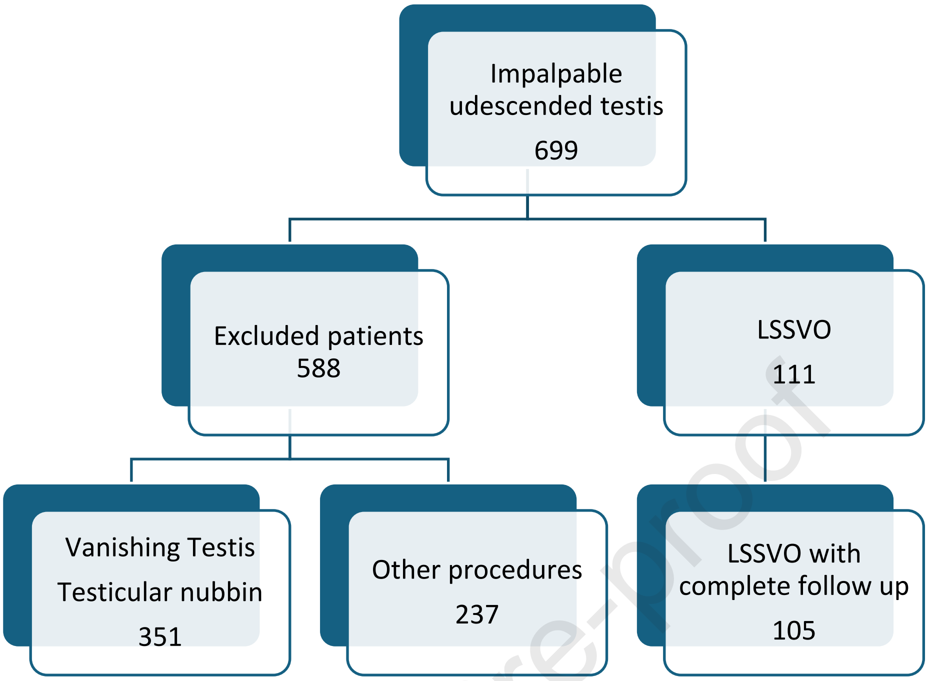
	Successful	Need for additional groin surgery	P-value
Tension at time of LSSVO	20	15	0.17
No tension at time of LSSVO	13	4	
Associated abnormalities (syndrome/genetic/hypospadias)	9	5	0.31
Isolated UDT	70	21	
Mean age in years	1.99	1.71	0.54

P-Value<0.05 was considered to be significant.

Figures

Figure 1

Figure number 1: Flow chart of All patients with impalpable undescended testis during study period



Impalpable udescended testis
699
Excluded patients
588
LSSVO
111
Vanishing Testis
Testicular nubbin
351
Other procedures
237
LSSVO with complete follow up
105