ORIGINAL ARTICLE

LAPAROSCOPIC ORCHIOPEXY FOR MANAGEMENT OF BILATERAL NON-PALPABLE TESTES

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Background: Despite numerous clinical studies regarding the management of unilateral impalpable testes by laparoscopy, there is a paucity of such studies regarding the management of bilateral 'non-palpable' testes. We shared the outcome of the laparoscopic management of bilateral 'non-palpable' testes in terms of successful orchiopexy and complications in children. **Methods:** A total of 22 children underwent bilateral diagnostic laparoscopy for undescended testes who presented to our department from January 2010 till March 2018. We did chart review for variables such as the age of children, operative time, hospital stay, single-stage or 2 stage procedure, and operative complications. Preoperatively history and physical examination were done along with baseline investigations and Ultrasound abdomen and scrotum before surgery for general anaesthesia fitness. They were managed by single or two steps laparoscopic orchiopexy according to suitability for each case. **Results:** We performed bilateral laparoscopic orchidopexies in 22 children having a mean age of 4.1±1.98 years (49.2 months) Mean operative time for single setting bilateral single-stage orchiopexy was 136±32 minutes. Out of twenty-two children with bilateral impalpable testes, 12 boys (54.5%) were managed with a single-stage Bilateral Laparoscopic technique while the other 10 (45.45%) were managed in 2 staged laparoscopic intervention using Fowler-Stephens technique. Testicular atrophy was seen in 2/44 testes (4.54%). While 1 /44 (2.27%) testis had ascended to the inguinal region requiring redo surgery. **Conclusion:** Laparoscopic management of bilateral 'non-palpable' testes in a single or double setting is a safe and effective method of bringing testes down to the scrotum. It has no major morbidities.

Keywords: Children; Intra abdominal testis; Laparoscopic Orchidopexy

Citation: Iqbal N, Hasan A, Saghir S, Iqbal S, Saif U, Choudhry AM, *et al.* Laparoscopic orchiopexy for management of bilateral non-palpable testes. J Ayub Med Coll Abbottabad 2020;32(4):445–9.

INTRODUCTION

Undescended testis is considered as crucial and one of the most frequent disorders of childhood. It roughly affects about 0.8% of infants reaching one year of age, 3% among the full-term newborns, and 21% of premature babies. It is estimated to be on the unilateral side in approximately 90% of cases while bilateral in almost 10%.[1–3] Furthermore, It is postulated that twenty percent of the undescended testes are found to be non-palpable.[4] Undescended testes are mostly evaluated and subsequently managed by modalities of imaging and surgery, respectively.[5–8]

There are many approaches for the evaluation and management of the undescended testis, including imaging studies and various surgical procedures.[9–10] Laparoscopy was initially demonstrated by Cortesi *et al.* to find the location of an undescended testis. After the introduction of this technique, it has gained popularity over the passage years amongst urologists because of its minimal invasiveness and lesser morbidity. Furthermore, there is no fear of long time consumption during the performance of the procedure. Apart from locating testis, laparoscopy has also been used successfully for doing orchiopexy in cases of the intraabdominal testis.[11] As far as imaging studies are concerned, none of the available imaging techniques such as ultrasound, computed tomography [CT] scan, or magnetic resonance imaging [MRI] has shown 100% reliability in predicting the presence or absence of the testis. That is the reason laparoscopy has gained much acceptance to be used as a diagnostic procedure for identifying the exact anatomical location of the impalpable testis.[12]

Over the previous few years, there have been many clinical studies regarding the experience of managing unilateral impalpable testes but there is a paucity of studies pertaining specifically to laparoscopic management and outcomes of bilateral undescended testes. It is important to note that children having bilateral intra-abdominal testes forces the surgeon's mind to ponder over some pertinent surgical questions regarding the evaluation of the testicular size and the exact location inside the abdomen. In addition to this, a decision has to be formulated by the operating surgeon, as to whether the testes can be brought into the scrotum

in a single stage or would it be a better option to do orchiopexy in two stages.[13]

We here share our single-Centre experience with single or double stage laparoscopic management of bilateral impalpable testes in children in terms of successful surgical outcomes and complications. To the best of our knowledge, no such study has been reported in Asia. Furthermore, it has the longest follow-up duration reported in the literature regarding the subject matter.

MATERIAL AND METHODS

A total of twenty-two children underwent diagnostic laparoscopy for bilateral undescended testes who presented to our department from January 2010 till March 2018. All procedures were done by single paediatric urologist. Informed consent was taken from parents of the children and a detailed and comprehensive briefing was given to them about the possibility of success rates and the occurrence of intraoperative and postoperative complications. For this study, ethical committee and departmental approval were taken before starting the data collection. Inclusion criteria consisted of paediatric patients, bilateral undescended testes, no prior surgery for orchiopexy from another hospital. Furthermore, patients having a minimum follow up of one year were included in this study. While adult patients and children undergoing open orchidopexy or those who had prior failed orchidopexy were excluded from the study. We did a retrospective chart review of consecutive bilateral laparoscopic orchiopexy at our department.

Preoperatively these children underwent full evaluation by doing complete history and physical examination. Moreover, they had to undergo an assessment by ultrasound abdomen and scrotum. Complete blood picture, serum electrolytes, renal function tests, and PT/APTT were performed as baseline investigations before surgery for general anaesthesia fitness. We did karyotype in all bilateral cases and if no '46, XX' was found then we proceeded for laparoscopic orchidopexy.

A single paediatric urologist operated all the cases. After induction of general anaesthesia, we re-examined the scrotum and inguinal regions. After confirming the testis to be impalpable, finally, a decision was made to proceed with laparoscopy. Children were placed in a supine position. We used open technique for port insertion (Hasson technique), in which a 5- mm trocar (Covidien) was placed through the umbilicus to enter the peritoneal cavity. CO2 (carbon dioxide) was being insufflated into the peritoneal cavity at a flow rate of 3–4 litres /minute, keeping a pressure of 8–10 mm Hg to create pneumoperitoneum. Laparoscopy was performed utilizing two more trocars (5- mm trocar size) inserted at the umbilical level laterally to the rectus muscle. Then a 5mm telescope with a 30^{o} lens optical lens was introduced into the trocar and inspected intra-abdominally for the presence and location of the testis. If testis were deemed to be of appropriate size and looked suitable in appearance keeping in view the patient's age, it was labelled normal testis. Execution of mobilization of spermatic vessels was done in a way to take a wide strip (1 cm) of peritoneum flap alongside the vas deferens. Spermatic vessels were divided in cases where it was not possible to mobilize testicle enough to reach the opening of the contralateral inguinal ring. In cases where the spermatic vessels were needed to be ligated in the first stage surgery, the second stage was planned after 6 months of the initial procedure.

For bringing the testis down into the scrotum, Kelly's forceps was inserted through the scrotal wall. Then smoothly delivering the testis into the scrotal sac. While doing this, utmost care was taken to avoid twisting of the spermatic cord. A dartos pouch was made and testis was placed in this pouch without tension. Then we closed the scrotal dartos and spermatic fascia with intermittent sutures. We made it sure that haemostasis was secured.

All patients were day cases (discharged on the same day following surgery). All children included in the study were followed regularly after surgery at 2 weeks, 6^{th} week, 3^{rd} month, 6^{th} month, and then annually. We assessed testes by inspection and physical exam on every follow up. We defined the success of the procedure (Lap orchiopexy) in children where testis could be palpable inside the scrotum and was turgid (no soft or hypoplastic look on palpation of testes). Testicular volume was calculated for testes soon after the procedure using Hansen's formula: testicular volume = $0.52 \times \text{length} \times (\text{width})^2$, by using an ultrasound probe (14). Furthermore, the growth ratio of the testicle was calculated as the ratio of postoperative testicular volume to preoperative testicular volume. Testicular atrophy was labelled in case more than 50% loss was observed in testicular volume compared with the first recorded postoperative testicular volume. The testes were deemed to survive when testicular atrophy criteria wasn't met by the testes.

Charts were reviewed for variables such as age, duration of the procedure in minutes, presence of pre operative and postoperative complications such as pain, bleeding, fever, vomiting, need for two stage procedures, and redo surgery. Entries about these variables were put in the SPSS version 16 and eventually, data analysis was done. The categorical variables included success and failure of the procedure and complications were depicted in form of percentage/frequency, while the continuous variables such as operative time, hospital stay, and age of children were presented as mean ± standard deviation (SD).

RESULTS

We performed bilateral laparoscopic orchidopexies in 44 testis in 22 out of 293 children that presented to our department for the treatment of undescended testis. (See table 1). The mean age of children in this series was 4.11±1.98 years (49.2 months mean age) and the median age of 48 months (range 12 to 108 months). Other congenital anomalies included 1 (4.5%) patients with prune belly syndrome. All cases that were performed in our unit were discharged on the same day (day case basis). The mean operative time for single setting bilateral single stage orchiopexy was 136±32 minutes. Out of twenty-two children with bilateral impalpable testes, 12 boys (54.5%) were managed with a single-stage Bilateral Laparoscopic technique while the other 10 (45.45%) were managed in 2 staged laparoscopic intervention using Fowler-Stephens technique. Of the ten children in whom we couldn't do surgery in a single setting, bilateral testes needed 2 stage FS procedure in 3 boys while the rest of the seven boys needed 2 stage procedure for the contralateral testes that couldn't be brought down in the first setting. In a nutshell, 12 (54.5%) boys needed single surgery at one year follow up for achievement of viable testes in scrotal position.

One child (4.54%) in this series suffered from post-operative fever (Table-2). We didn't note Port site hernia in any of our patients. Furthermore, we didn't see any hospital readmission after surgery in any of the children within the first month of the follow up. Apart from this, no complication such as testes or vascular damage was seen in our children while doing the procedure. There was no significant blood loss in our series and no need for transfusion was required. Testicular atrophy was seen in 2/44 testes (4.54%). The two atrophic testes belonged to those children who underwent single-stage orchidopexy. Moreover, we had only 1 /44 (2.27%) testis that had ascended to the inguinal region and required open redo surgery for testis fixation. In the rest of the patients, the testicular position was mostly in mid scrotum or base of the scrotum was deemed successful. (Table-2). Apart from this, no inguinal hernia was seen in our series.

Table 1: Patient Characteristics

Characteristics	Number of children
Number of patients	22 children
Number of testes	44
Mean Age	49.2 months
B/L* Single setting Mean operation time	136±32 minutes
Hospital stay	All children Day cases
B/L* UDT≠ orchiopexy done in single setting	12 boys (54.5%)
Both testes done in 2 stage	3 boys
Ipsilateral testis in one stage and Contralateral testis done in 2 stage	7 boys

*Bilateral, ≠Undescended testes

Table-2: Complications of the procedure

Name of complication	Number of patients
Intra operative bleeding (requiring transfusion)	None (0 %)
Vascular damage	None (0 %)
Post-operative fever	1 (4.54%)
Per op injury to testis	None (0%)
Testicular atrophy	2/44 (4.54%) testes
Post op Abnormally high position of (ascended testis)	1 /44 (2.27%) testis
On table, Conversion to open surgery	None (0 %)

DISCUSSION

Cryptorchidism is present approximately in 3.7% of the newborn boys but only in 1% of male children when they reach the age of 1 year. It tends to be noticed more often in pre-term, small for gestational age, those with low birth weight, and twins.[13,14] Out of the cryptorchid testes, 80% are found to be palpable on physical examination (as they are located farther to the site of the internal inguinal ring) and as such amenable to open orchiopexy successfully. While the rest of the nonpalpable testes (20%) are found intra-abdominally. Unilateral non palpable testes have been frequently discussed in literature over the past few years but bilateral nonpalpable intra-abdominal testes represent a very minute fraction of undescended testes. Furthermore, they represent a challenging management scenario keeping in view the paucity of the studies presents in literature in this specific regard.[8,14] The vitality of managing such cases is because the risk of infertility in the adult age is markedly higher in males having bilateral UDT.[15,16]

In one series of nearly 2000 cases of cryptorchidism over some time of 8-year it was found that (24%) of testes were nonpalpable. In their series bilateral nonpalpable testes (intra-abdominal) comprised only 15.3% of all the cases with intra-abdominal testes. Hence, it underscores the fact that how rarely bilateral UDT cases are found in any series even over a longer time of study duration.[17] Over the years, diagnostic laparoscopy has emerged as a popular approach for diagnosing as well as managing impalpable testes.[18,19] Multiple series have reported successful outcomes regarding the laparoscopic orchiopexy over the last few years. Most of these series have reported safety of unilateral laparoscopic orchiopexy.[14,18,20]

It's vital to note here that there has been little work done since Cortesi *et al*[11] and then Ansari *et al*[11,21] reporting the safe feasibility of doing bilateral single setting laparoscopic orchiopexy. Bilateral UDT cases are most challenging to rectify. The reason for this is that the testes are located higher and mostly have shorter vessels.[14,22] As mentioned earlier that only two series have tried to touch this aspect till now. These two series tried to look for the safety and feasibility of performing 1-stage laparoscopic orchiopexy in the management of

bilateral UDT.[22,23] Bilateral Laparoscopic Orchiopexy has an additional benefit that it can be accomplished by using the same 3 sites for trocar as utilized for the unilateral laparoscopic orchiopexy. It's in contrast to a bilateral open procedure for UDT, where an additional skin incision has to be made as compared to the unilateral open procedure. Taran *et al*[22] reviewed the success rates of various techniques used for the impalpable testes. They thought that all of the techniques used for managing UDT provided almost equal success rates, however, the literature regarding laparoscopic experience showed consistently more success rates as compared to the open techniques. Kaye JD *et al*[24] mentioned their experience regarding feasibility of doing Single-stage bilateral laparoscopic orchiopexy. They attempted this procedure in 21 children (42 testes). Their median age was 9 months (range 7–52 months). While we had 22 children with mean age of 4.1±1.98 years (49.2 months) and median age of 48 months (range 12–108 months). In their series, Single-stage bilateral laparoscopic orchiopexy was completed in 18/21 boys (36 testes). They had performed all of their procedures on an outpatient basis. In yet another series by Safwat *et al.*[23] Bilateral laparoscopic fowler Stephen orchiopexy was tried in a total of 48 testes (24 children) having a median age of 31.6 months (range 12–150). Of those 24 children, they could succeed only in six (25% boys) cases, to be managed with a single setting BLFSO (bilateral laparoscopic fowler Stephen orchiopexy). Similar to the Kaye JD *et al*, they too had performed surgeries on day case basis. While in our series, 12 /22 boys (54.5%) were managed with a single stage Bilateral Laparoscopic technique, and the other 10 /22 (45.45%) were managed in 2 staged laparoscopic intervention using Fowler-Stephens technique. We too had all cases done on a day case basis. It is pertinent to note here that the median age of Kaye JD *et al*[24] series was 9 months and that was much lower as compared to that of Safwat *et al*[23] and our series. It is conspicuous after making these comparisons that the lesser the age of children presenting with bilateral UDT (intraabdominal) the more are the chances of completing single setting bilateral orchiopexy. However, it's interesting that the age of Safwat *et al* was almost similar to that of our children but we had more boys (54.5%) successfully managed with single stage bilateral orchiopexy as compared to their results of 25% boys. This may be ascribed to the surgeon's expertise level that may vary among different centers.

In our experience post-operative fever was seen in 1 (4.54%) patient. Hospital readmission within the first month of follow up was seen in none for post-operative complications. Apart from this, no complication such as testes or vascular damage was seen in our children while doing the procedure. There was only minimal blood loss seen in our cases and no need for transfusion was required. Kaye JD *et al.*[24] and Safwat *et al.*[23] had witnessed similar safety of this procedure as no child had experienced any complications or need for hospital admissions.

Testicular position in series by Kaye JD *et al.*[24] was found to be in the mid lower scrotum in 38 testes. While 3 were in the upper scrotum and 1 at the inferior pubic/superior scrotal position. In series by Safwat *et al* (boys managed with laparoscopy for Bilateral UDT), the position of testes was noted in the mid lower scrotum in 43/48 testes, the other five testes had retracted upward: inguinal canal (three children required redo fixation) and ascended to the scrotal neck (two children). In our series 23 testes were in lower scrotal position, 19 in mid scrotal, and 2 in upper scrotal position. Moreover, we had only 1 /44 (2.27%) testis that had ascended to the inguinal region and required open redo surgery for testis fixation. In rest of the patients the testicular position was mostly in mid scrotum or base of the scrotum was deemed successful.

Kaye JD *et al.*[24] mentioned that atrophy was seen in 2 /42 testes (19 of 21 boys) at 6-month follow up, that included 1 boy (underwent a 1-stage F-S procedure) and 1 (non F-S orchiopexy). According to Safwat *et al.*[23] testicular atrophy was noted on follow up in two (4.16%) testes. In our series Testicular atrophy was seen in 2/44 testes (4.54%). Patient selection and comfort level of the operating surgeon are the 2 main driving factors to do bilateral undescended testes in single or 2 stage setting (14,23). Abbas TO *et al* in a study of 100 undescended testes didn't comment in detail about dealing with the bilateral cases (only 9children). Regarding the feasibility of single stage procedure, they concluded that mobility of the testis towards the internal ring (inguinal) on the contralateral side was an excellent indicator to guide for doing single or double stage orchiopexy.[25] Wang CY *et al.*[26] recently mentioned their results on unilateral UDT in terms of safety of single or two staged procedure and they stated that single-stage Fowler Stephen (F-S) procedure should not be done forcibly as it might result in achieving poor surgical outcomes in some of the cases as a consequence of poor collateral circulation. On the other hand, care should also be taken to avoid casually applying two-stage Fowler Stephen (F-S) surgery for testes that could easily be dealt with in single stage procedure.[26] Our series was the largest reported in Asia and second in the world so far regarding the bilateral laparoscopic UDT management. We had longest followed up till now of up to 12–96 months. Another important aspect of this study was the fact that we used the concept of testicular atrophy based on ultrasound aided volume computation of testes. No study has touched this aspect in cases of bilateral orchiopexy cases. However, we had a limitation that is a

very low incidence of the B/L UDT we had a retrospective nature study and all cases were done by a single surgeon. Moreover, it was a single center study. As our center is a tertiary referral center for half of our country so increasing chances of the overall complexity level of the referred cases. No prospective study on B/L UDT in the world has ever been done till date. So, we need multi center prospective studies and also need to follow these children into puberty to look for normal hormonal production, normal spermatogenesis and the fertility potential (an important parameter to gauge the success of management of the bilateral non palpable testes).

CONCLUSION

Laparoscopic management of bilateral 'non-palpable' testes is a safe and effective method of bringing testes down to the scrotum on an outpatient basis. It has no major morbidities even if done in single setting bilaterally in judiciously selected patients.

AUTHORS' CONTRIBUTION

NA, AH, SS: Literature search, data, writing. SI: Data, design, literature search. US: Data, literature search, write-up. AMC: Write-up, literature search, data. BSG: Data, write-up, review. IH, DI, FK, SA: Literature search, write-up, critical review.

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Submitted: December 10, 2019	*Revised: February 23, 2020*	*Accepted: March 18, 2020*

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