Research Article

Management of Non Palpable Undescended Testis: What after Initial Laparoscopy?

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Abstract
Objective: To evaluate the value and outcome of initially used laparoscopy for diagnosis and treatment of non-palpable undescended testis (UDT) in comparison with open procedure. **Patients and Methods:** Forty boys were initially evaluated by diagnostic laparoscopy for ٤٤ non-palpable UDT. Patients with viable abdominal testes were treated with either open orchidopexy (OO) or laparoscopic orchidopexy (LO). The success of procedure was defined as a testis in the scrotum with absence of atrophy. **Results:** The mean age of the studied patients was ٢.١±١.٦ years. Non-palpable testes (NPT) were absent in ٩.٠٩٪, atrophied in ١١.٣٦%,canalicular in ٤٠.٩٪, low intra-abdominal in ٣٦.٣٦٪, and high intra-abdominal in ١٣.٦٣٪. Orchidectomy of atrophic testes was done in five (١١.٣٦٪): Three by laparoscopy and two by open surgery. Procedures were divided into two groups based on position of the testis. The first group included LO which was done for ٢٠ viable NPT (٤٥.٤٥٪). Of these ٢٠ testes, the four high intra-abdominal ones were managed by two-stage LO. The second group included the testes managed by one-stage OO was done for ١٥ (٣٤.٠٩٪). The overall success rate of all procedures was ٩١.٤٣٪, being ٩٥٪ and ٨٦.٧٪ for LO and OO respectively. On multivariate logistic analysis, young age was a significant predictor of success after orchidopexy. **Conclusion:** The initial use of diagnostic laparoscopy is recommended determining the viability and intra-abdominal location of NPT. Laparoscopic orchidopexycan be done safely with a high rate of success.Young age at surgery is a significant predictor of successful result.

Keywords: Undescended testis, laparoscopy, orchidopexy

Introduction
Testicular development is determined by the influence of a gene on the Y chromosome of the fetus. This influences the germ cells to produce testosterone and Mülleri an inhibiting substance which control descent of the testis[١].The undescended testis (UDT) or cryptorchidism indicates a testis, which has failed to descend to the scrotum and is located at any point along the normal path of descent or at an ectopic site. It is present in about ٤.٥٪ of newborns with a higher incidence in preterm, which decreases to ١.٢٪ by the first year[٢].

In approximately ٢٠٪ of cases the testis is not palpable. When it is non-palpable, about ٥٠٪of cases are intra-abdominal and ٥٠٪ are absent or atrophic[٣].Surgical intervention, either open or laparoscopic, has been the only modality proven to accurately diagnose, localize, and treat the non-palpable testis. The ideal timing of surgery is between ٦ and ١٢ months of age, since spontaneous testicular descent has been noted as late as ٤ to ٦ months of age. The overall goals of orchidopexy are to preserve testicular function and fertility, to relocate the testis to the scrotum for easier neoplasm detection, and to prevent testicular torsion and trauma[٤].

Nowadays, there is nodoubt regarding the role of laparoscopy as being the best initial approach to non-palpable testis. Some surgeons,in the past, did not recommend laparoscopy as an initial exploratory procedure in cases with non-palpable UDT except when initial inguinal canal exploration proves negative[٥].However, others recommend laparoscopy as the only initial exploratory procedure that is accurate enough to enable the diagnosis of non-palpable UDT and also allow the surgical treatment[٦-٩].Therefore,

the aim of the present study was to evaluate the value and outcome after initial laparoscopy for diagnosis and treatment of non-palpable UDT in comparison with open procedure.

Patients and Methods

Study population:

This comparative emulti centerr and omized study was done in El-Minia University Hospital, Egypt, Prince Salman Bin Abdul-Aziz Hospital, Riyadh, KSA and Al Jafel Specialized Hospital, Riyadh, KSA between January ٢٠٠٩ and January ٢٠١٣, and included ٤٠ boys with non-palpable UDT who underwent diagnosis and orchidpexy for UDT. The diagnosis of non-palpable UDT was made by physical examination and imaging studies which included: ultrasound in all patients, computed tomography (CT) and magnetic resonance imaging (MRI) was used in some cases according to the availability of the study.CT was done in ١٥ patients (٣٧.٥٪) and MRI was done in ٥ patients (١٢.٥٪)

At operative room, careful physical examination was performed under general anesthesia. We excluded patients with palpable testis and patients with non-palpable bilateral testes required a preoperative pediatric endocrine work-up. All patients underwent initial diagnostic laparoscopy, and those with viable testes were treated with either open or laparoscopic orchidopexy procedures. All procedures were done during the study period and by the same surgeons.

Surgical technique:

I-Open technique:

A transverse skinincision was performed in an ipsilateral inguinal skin crease along Langer's lines. Gentle pressure was exerted on the inguinal region to bring testes just inside the internal ring. If testis was found, it was assessed, and if it was normal, orchidopexy was performed. We followed the mainprinciplesof open orchidopexy which include: (١) adequate emobilization of the spermatic cord and testis, (٢) divisionof the gübernaculum, (٣) high ligation of the patent processus vaginalis, (٤) dissection of the internal spermatic fascial layers, and (٥) the testis was secured in a superficial sub-dartos pouch by non-absorbable sutures in the ipsilateralhemiscrotum.

If there was a patent process us vaginalis (hernia sac), it was transected and separated from the cord to allow testicular mobilization. If the sperm aticcordwas too short, Prentiss maneuverwas performed by taking down the floor of the inguinal canal, moving the spermatic cord to the medial aspect of the canal, and reclosing the floor of the inguinal canal. If the testis located in the abdomen, more mobilization and Prentiss maneuver were done with preservation of the testicular blood supply.

II-Laparoscopic technique:

A three ports technique was used, with a single ٥ mm umbilical port and ٢ additional ٣ or ٥ mm ports in the mid-clavicular line at the level of the anterior superior iliac spine. Diagnostic laparoscopy was performed to identify the position and morphology of the affected testis, vas, and vessels (Figure ١, A). In order to mobilize the testicle, the gubernaculums was transected (Figure ١, B). Then, the testis was gasped only by the remaining gübernacular attachments to avoid tissue trauma.

In case of dysplastic or malformed testes, orchidectomy and biopsy was performed.If the vas and vessels end blindly before the inguinal ring and no testes were identified despite a thorough search (intrauterine torsion, atrophy, or aplasia), the operation was terminated. If both the vas deferens and vessels enter the inguinal canal, laparoscopy is terminated and open standard technique was performed. Low abdominal testes (<٣ cm from the inguinal ring or below the iliac vessels) were treated by laparoscopicorchidopexy. High intra-abdominal testes might require a two-stage Fowler-Stephens procedure. The first stage comprised transection of the testicular vessels and placing the testicle near the internal inguinal ring. After a ٦-month interval, orchidopexy was performed. In the second stage, the testis was mobilized along with a generous flap of peritoneum, which assures adequate blood supply. A twelvemillimeter expandable portwasintroduced through the base of the scrotum to create a neo-ring medial to the epigastric vessels was created (Prentiss maneuver).Then, testis was grasped by a forceps introduced through the scrotal expandable port and pulled down into the scrotum (Figure ١, D). The port was removed,

and the testis was secured in the scrotum in the conventional way.

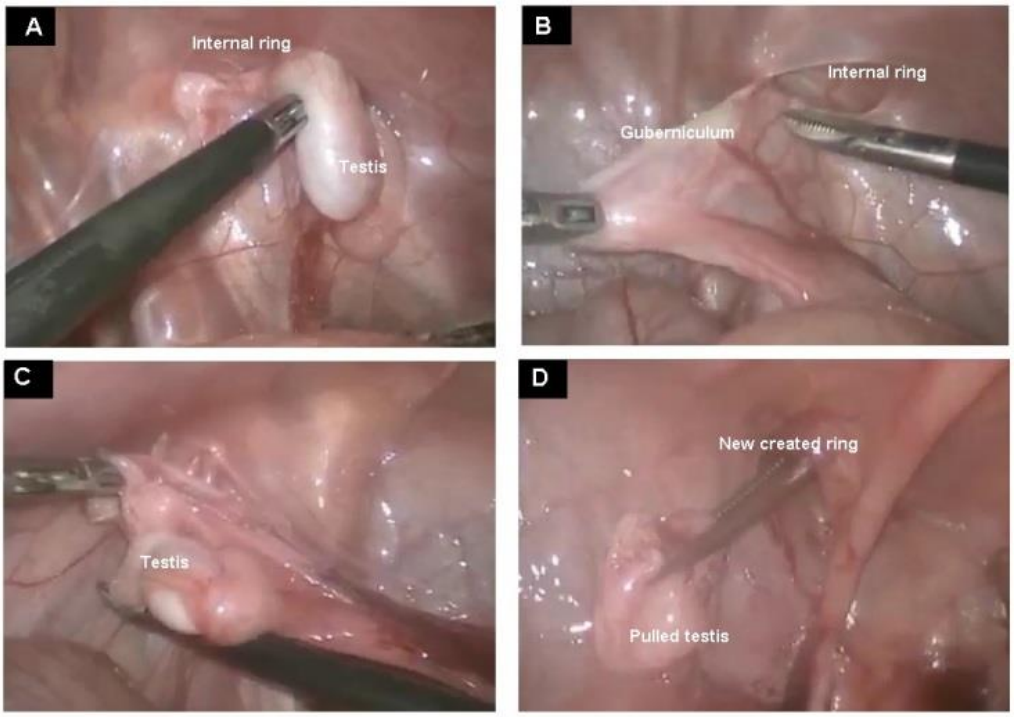

Figure (١): Laparoscopic orchidopexy of a right undescended testis. (A): Testis located near the internal ring. (B): Division of güberniculum. (C): Checking adequate mobilization of testis to the opposite side. (D): Pulling the testis into the scrotum through new created ring.

Postoperative care and follow-up:
Follow-up examination was conducted at one week, one month, six months and one year after surgery. Follow up included evaluation of testicular site and presence of atrophy. A successful orchidopexy was defined as a testis residing in a scrotal position with lack of testicular atrophy.

Statistical analysis

Statistical analysis was performed using the SPSS statistical software (version ١٦). The continuous variables were compared using Student's t-test and the categorical variables were compared using Chi-square test or Fisher exact test. The continuous variables were presented as mean±standard deviation (SD) and the categorical variables were presented as number and percent. Binary logistic regression test was used to determine the significant predictive factors for postoperative outcome. P value<٠.٠٥ was considered statistically significant.

Results

The age of the studied ٤٠ boys ranged from١ year to ٩ years old with mean age of ٢.١±١.٦years. Twenty one patients (٥٢.٥٪) aged less than ٢ years old. Diagnostic laparoscopy was performed for ٤٤ non-palpable testes in ٤٠ boys (Table ١). Four patients (١٠٪) presented with bilateral non-palpable testes (NPT). All patients with bilateral NPT had negative work-up for disorders of sexual differentiation. The left testis was undescended in ٢٠ boys, the right one in ١٦ boys,and both testes were undescended in ٤ boys. Diagnostic laparoscopy was carried out for all the ٤٤ NPT.

Testes were absent in ٤ cases (٩.٠٩٪) and atrophied in ٥ cases (١١.٣٦٪). The location of ٤٤ NPT was canalicular in ١٨ (٤٠.٩٪), low intra-abdominal in ١٦ (٣٦.٣٦٪), and high intra-abdominal in ٦ (١٣.٦٣٪). Orchidectomy of atrophic testes was doneinfive NPT (١١.٣٦٪), three (٦.٨١٪) by laparoscopy and two (٤.٥٤٪) by open excision. Laparoscopic orchidopexy was done in ٢٠ cases (٤٥.٤٥٪), and open orchidpexy was done in ١٥ cases (٣٤.٠٩٪).

Two-stages Fowler-Stephens laparoscopic orchidopexy was performed for cases with high intra-abdominal NPT (٤ cases; ٩.٠٩%). The mean operative time was ٤٢.٧±١١.٥ minutes for LO and ٤٩.٦±١٣.٢ minutes for OO, with statistically insignificant difference (P-value = ٠.١٠). An associated inguinal hernia was present in ٣ patients (٧.٥٪) and it was repaired at the same setting.

The postoperative hospital stay ranged from ١ to ٣ days in both groups. After a mean follow-up period of ٦ months, within ٣٥ viable testes on initial diagnostic laparoscopy, there were ٢ testes (٥.٧١٪) displaced to neck of the scrotum and one atrophied testis (٢.٨٦٪). Thus the overall failure rate was ٨.٥٧٪ and the overall success rate was ٩١.٤٣٪. Testicular atrophy occurred in no cases after LO (٠٪) and in ١ case after OO (٦.٦٦٪). Testicular displacement occurred in one case after LO (٥٪) and in another one after OO (٦.٦٦٪).Thus, the success rate was ٩٥٪ for LO and ٨٦.٧٪ for OO, with statistically insignificant difference between both groups (Table ٢).The success rate was ٧٥٪ (٣ out of ٤) for two-stages LO, and ٩٣.٥٪ (٢٩ out of ٣١) for one-stage LO.

Multivariate logistic analysis (Table ٣) revealed that young age at surgery was a statistically significant predictor of success after orchidopexy regardless of the used surgical technique. The evidence of bilateral UDT, abdominal location of UDT, and staged procedure were not significantly associated with failure of orchidopexy.

Table (١): Management of ٤٤ non-palpable testes in ٤٠ boyswith undescended testis underwent diagnostic laparoscopy

Location of testes	All testes (N=٤٤)	OO (N=١٥)	LO (N=٢٠)	Open orchidectomy (N=٢)	Laparoscopic Orchidectomy (N=٣)
Canalicular	١٨ (٤٠.٩٪)	١٥ (١٠٠٪)	١ (٥٪)	٢ (١٠٠٪)	-
Low intra-abdominal	١٦ (٣٦.٣٦٪)	-	١٥ (٧٥٪)	-	١ (٣٣.٣٪)
High intra-abdominal	٦ (١٣.٦٣٪)	-	٤* (٢٠٪)	-	٢ (٦٦.٧٪)
Absent	٤ (٩.٠٩٪)	-	-	-	-

OO: Open ochidopexy - LO: Laparoscopic ochidopexy - *: Two-stages procedure

Table (٢): Outcome of open and laparoscopic orchiopexy for viable ٣٥non-palpable testes underwentorchidopexy

Variables	Total (n=٣٥)	OO (n=١٥)	LO (n=٢٠)	P-value
Success rate	٣٢ (٩١.٤٣٪)	١٣ (٨٦.٧٪)	١٩ (٩٥٪)	٠.٣٨
Testicular displacement	٢ (٥.٧١٪)	١ (٦.٦٦٪)	١ (٥٪)	٠.٨٣
Testicular atrophy	١ (٢.٨٦٪)	١ (٦.٦٦٪)	٠ (٠٪)	٠.٢٤

OO: Open ochidopexy. LO: Laparoscopic ochidopexy.

Table (٣): Analysis of independent factors predicting post operative outcome after orchidopexy of ٣٥viable non-palpable testes

Factors	Outcome		Univariate Analysis (P-value)	Multivariate Logistic Analysis	
	Failure (n=٣)	Success (n=٣٢)		Beta	P-value
Age (years)	٥.٦±٣.٥	١.٧٦±٠.٨٨	٠.٠٠٠١*	-٠.٧٠	٠.٠٠٠١*
Bilateral UDT	٠(٠٪)	٨(٢٥٪)	٠.٣٢	-٠.٠٦	٠.٦٨
Abdominal UDT	١(٣٣.٣٪)	١٨(٥٦.٢٪)	٠.٤٤	-٠.١١	٠.٢١
Staged procedure	٠(٠٪)	٤(١٢.٥٪)	٠.٥١	-٠.١٨	٠.١٦

UDT: Undescended testis. * Significant test

Discussion

Surgery is the cornerstone of treatment of UDT. Inguinal or high scrotal approaches have been largely used for palpable or even NPT[١٠]. Laparoscopy has become a standard alternative-technique in the diagnosis and treatment of NPT[١١,١٢].Testes that are undescended at birth may descend spontaneously during early life, and the risk of infertility increases with age. Therefore, the procedure is recommended for patients younger than ٢ years old and even as young as ٦ months old[١٣]. Thus, in the present study, most of the studied patients (٥٢.٥٪) had an age less than ٢ years old at surgery.

In the present study, on initial diagnostic laparoscopy, NPT was mostly located intra-abdominal, in ٥٠٪ of patients (low in ٣٦.٣٦٪ and high in ١٣.٦٣٪). There is great variability on published literature on UDT regarding the incidence of intra-abdominal testes in NPT, with a wide range from ٢٠ to ٥٥%[٩,١٤,١٥].Our high incidence of intra-abdominal UDT supports the use of initial diagnostic laparoscopy to avoid-initial scrotal or inguinal explorations which may associate with missed diagnosis of intra-abdominal NPT. Moreover, there is evidence in literature that laparoscopy is not only regarded as the gold standard for their localization of NPT, it also confirms its absence[١٦].

The testis was absent in ٩.٠٩٪ of NPT on diagnostic laparoscopy, which could be suggested by the absence of testicular vessels. This finding is helpful to avoid further abdominal, inguinal, and scrotal explorations in those patients.Therefore, the sum of laparoscopic diagnosis of intra-abdominal (٥٠٪) and absent testes (about ١٠٪), increases the benefit of initial laparoscopy up to ٦٠٪ in diagnosis of NPT and hence avoiding un-necessary approaches, as it provided relevant anatomic information that directed further surgical intervention. Similar findings were demonstrated in other studies where diagnostic laparoscopy was beneficial to up to ٦٢٪ of patients in a recent study by Castillo-Ortiz et al.,[٩], and up to ٧٣٪ of patients in a study by Papparella et al.,[١٧], emphasizing the decision to use laparoscopy as the initial surgical intervention in the NPT. However, the earlier study by Sharifiaghd as and Beigi[٥], recommended laparoscopy for those patients with NPT in whom an initial inguinal canal exploration proves negative, as laparoscopy changed the management protocol of NPT in only ٢١٪ of cases.

In the present study, the overall success rate was ٩١.٤٣٪, and it was ٩٥٪ for LO and ٨٦.٧٪ for OO.In literature, there is similar evidence of high early success rate after LO for NPT in children. In the study by Lindgren et al.,[١٨] at ٦ months follow up, the low incidence of complications and ٩٣٪ success rate underscore the feasibility of this procedure. Thus, those authors considered LO as a logical extension of diagnostic laparoscopy for the evaluation and treatment of NPT.In the study by Chang et al.,[١٩] the overall success rate, including only those with follow-up, was ٩٦٪ (٩٠ of ٩٤) after LO. Patients who had undergone previous surgery had a higher risk of developing testicular atrophy. The additional dissection around the vas almost inevitably leads to testicular atrophy. In the study by Mcheik and Levard[٢٠], at follow-up of ٦, ١٢ and ٢٤ months, the success rate was ٨٩٪ after LO, as ٢٦ of ٢٩

testes are without atrophy, and in acceptable scrotal position.In a study by Ang and Forrest[٢١], at non-pediatric specialist centre, the success rate was ٧٦.٥٪ following diagnostic laparoscopy and standard OO for testes in the region of the internal ring, compared to a ٤٠٪ success rate following one-stage LO for 'low' intra-abdominal testes. This success rate is lower than in most reports from pediatric specialist centers, which suggests the importance of centralization of such complicated, less frequently performed surgical procedures to a specialist center.In the study by Kim et al.,[٢٢] the success rate of the laparoscopic orchidopexy for a non-palpable intra-abdominal testis was ٧٦.٢٪ after ٣ months of follow-up.

Despite the higher success rate in LO group, comparison of this rate between LO and OO groups revealed statistically insignificant differrence. The report by Chandrasekharam et al.,[٢٣] failed to demonstrate any specific advantage of initial laparoscopy in the majority of children with unilateral NPT. The success of orchid-pexy at ٤-٦ weeks post-operatively was ٨٥٪ in group of initial laparoscopy and ٨٦٪ in group of open inguinal exploration. In the study by Litula et al.,[٢٤] the overall success rate (acceptable scrotal position of the testis without testicular atrophy) in ١٦ children with ١٩ non-palpable intra-abdominal testes was ٨٨٪ in the LO group and ٨٢٪ in the OO group, with insignificant difference. In the study by Park et al.,[٢٥] although diagnostic laparoscopy was a very helpful technique in the diagnosis of NPT especially when preoperative ultrasonography is not sufficiently informative, after a mean follow-up period of ٣٠ months the success rate was ٨٥.٧٪ after OO and ٦٠٪ after ١-stage Fowler-Stephens LO, with statistically insignificant difference. The systemic review by Guo et al.,[٢٦] analyzed ٧ studies comprising ١٧٦ cases of LO and ٢٦٣ cases of OO and reported insignificant difference in viable testis rate success rate, and testicular atrophy between both techniques.

Our success rate was ٩٣.٥٪ for one stage LO done for viable canalicular and low intra-abdominal testes and ٧٥٪ for staged (two-stages) LO done for viable high intra-abdominal testes. There is a controversy regarding success rates of one-stage and two-stages LO in literature. Our findings were in accordance with the study by Bittencourt et al.,[٢٧] which showed that LO in one stage, without vascular ligation, for low intra-abdominal NPT had success rate of ٨٩٪, while this rate dropped to٧٧٪ for LO in ٢ stages, with ligation of the spermatic vessels, performed high located intra-abdominal testes. In the study by Abolyosr[٢٨], the success rate was ١٠٠٪ for primary (one-stage) LO and ٩٠.٥٪ for open and laparoscopic staged Fowler–Stephens LO. In the series by Moursy et al.,[٢٩], the overall success rate was ١٠٠٪ and ٨٨.٨٪ for one-stage LO and two-stages LO technique, respectively. However, other studies reported higher success rates with ٢ stages LO. In the study by Denes et al.,[٣٠],the success rate of one stage Fowler-Stephens surgery with primary vascular ligature reduced to ٣٣٪ and it was ٨٨٪ with the ٢ stages Fowler-Stephens approach and only. In a study by Burjonrappa et al.,[٣١], with a minimum of ١-year follow-up, the success rate is ٩٣.٣٪ (١٤/١٥) after ٢-stage LO. Because of these variable results, comparative studies are still needed between one- and two- stagesLO, to standardize the best management for high intra-abdominal testes. Younger age at surgery was a significant predictor associated with success (no atrophy and satisfactory position) after orchidopexyre gardless the used technique. This finding is supported by the recent study by Carson et al.,[٣٢]which aimed to determine if age at orchidopexy affected postoperative particularly testicular atrophy, and reported that unfavorable results (testicular atrophy) was highest for orchidopexy at ages ١٣–٢٤ months versus those less than ١٣ months, and those greater than ٢٤ months. Moreover, the current highest quality evidence recommends orchidopexy between ٦ and ١٢ months of age, because surgery during this timeframe may reduce postoperative failure as it may optimize fertility potential and protect against testicular malignancy in children with UDT[٣٣]. Morphometric and volumetric data in the study by Kollin et al.,[٣٤] showed that orchidopexy at ٩ months is more beneficial for testicular development than an operation at ٣ years of age. The most interesting finding in this concern was reported by Bagga et al.,[٣٥], who concluded that age or height of the patient at surgery is an independent factor predicting the success of vessel-intact laparoscopic orchidopexy for intra-abdominal testis. The internal ring-to-mid-

scrotum distance increases with age/height, resulting in increased testis-to-mid-scrotum distance and higher failure rate in older children.

In conclusion, there is a helpful role of diagnostic laparoscopy in determination of the viability and location of NPT. Laparoscopy guides the immediate decision taken by the surgeon in such cases and decreasing the use of unnecessary interventions. Moreover, laparoscopy proved to be a safe and effectiveapproach with a high success rate after laparoscopic orchidopexy. When the operation is carried-out at an earlier age, successful results can be expected.

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