Laparoscopic management and its outcomes in cases with nonpalpable testis

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ABSTRACT

Objective: Diagnostic laparoscopy is the gold standard in the algorithm of nonpalpable testis. Testicular tissue is examined and treatment is planned accordingly. In this study we reviewed the place of diagnostic laparoscopy, and evaluated the results and effectiveness of laparoscopy in the diagnosis and management of nonpalpable testis.

Material and methods: Children who had diagnostic laparoscopy for nonpalpable testes were included in the study. Physical examination results, ultrasonography (USG) reports, age at surgery, laparoscopic and inguinal exploration findings, surgical procedures, orchiopexy results, early and late-term complications were evaluated. Follow-up visits were performed at 3-month intervals for the first, at 6-month intervals for the 2. year, then at yearly intervals. Testicular size and location was evaluated by during control examination.

Results: Overall 58 boys, and 68 testes (26 left: 44.8%; 22 right: 37.9%, and 10 bilateral: 17.2%) were included in the study. Mean age at surgery was 5.5 years (10 months-17 years). Diagnostic value of USG was 15.7%. Diagnostic laparoscopy findings were as follows: Group 1: blind-ended vessels, n=7 (10.2%); Group 2: intraabdominal testes, n=8 (11.7%); Group 3: vas and vessels entering internal ring, n=53 (77.9%). Overall 43 testes underwent orchiopexy, which were normal (n=8) or hypoplastic (n=35). Mean follow-up period was 19 months (1-12 years), and on an average 7 visits were performed (5-14). On follow-up, 5 testes were normal-sized and located in the scrotum, while 4 testes were atrophic and underwent orchiectomy. Two testes were found in the inguinal canal and redo orchiopexy was performed. Control USG revealed reduced testicular blood supply and volume.

Conclusion: Laparoscopic surgery is safe and effective in the management of nonpalpable testes. In the majority, routine use of diagnostic laparoscopy in the algorithm does not confer any additional contributions in many patients.

Keywords: Algorithm; diagnostic laparoscopy; orchiopexy; nonpalpable testis.

Introduction

During intrauterine period testicles together with peritoneum descend from abdominal cavity into scrotum through inguinal canal.^[1] The testicles stuck through this immigration path for any reason (hormonal, and mechanical reasons) are defined as undescended testis. Nonpalpable testis is a subgroup of undescended testis which can not be detected during physical examination. The incidence of undescended testis is 1-3 percent. Nonpalpable testes account for 20% of undescended testicles. Nonpalpable testes are localized in the intraabdominal cavity ($\approx$ 20-25%) and inguinal canal (65%). Some of these testes atrophy during intrauterine period.^[2]

Physical examination is a must in cases with nonpalpable testes. Diagnostic value of ultra-

sound (US), and magnetic resonance imaging (MRI) is acceptedly low.^[3] In classical urological education, in cases with nonpalpable testis, as is the case with undescended testis, inguinal exploration, and orchiopexy are aimed. If testis can not be found, then the procedure is proceeded with open abdominal exploration. Use of laparoscopy was firstly recommended by Cortesi et al. for this purpose^[4] in 1976, and laparoscopic orchiopexy was firstly performed by Jordan et al. in 1992. Nowadays, laparoscopic procedure is a gold standard in cases with nonpalpable testis, and it is used prevalently in many centers. Algorithm starts with diagnostic laparoscopy. Afterwards a) if blind-ended spermatic cord, and vessels are found, then the procedure is terminated; b) laparoscopic orchiopexy is performed if intraabdominal testis is detected.; c) if cord, and vessels

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extend from internal ring into inguinal canal, then inguinal exploration is carried out. In this study, in cases with nonpalpable testis, we reviewed the place of laparoscopy in algorithm, and evaluated our diagnostic, and therapeutic outcomes.

Material and methods

Cases with nonpalpable testis who underwent laparoscopic surgery in the Department of Pediatric Surgery of Mersin University Faculty of Medicine between the years 2005, and 2015 were analyzed. For the study, patients' informed consent, and approval of The Ethics Committee for Clinical Investigations of Mersin University (03.26.2015, and decision #: 2015/105) were obtained. Physical examination findings, patient's age at surgery, US reports, laparoscopic, and inguinal exploration findings, short-, and long-term complications, and outcomes of orchiopexy were evaluated. The children were laid supine, and in the frog-leg position. During physical examination, inguinal canal was caressed towards the scrotum, and testicles were evaluated. The patients did not undergo routine US, and MRI examinations, and only those performed at an external center were evaluated.

Physical examination was repeated under general anesthesia, and the diagnosis of nonpalpable testis was confirmed. Using open laparoscopic technique (Hasson), through the navel peritoneal cavity is entered, and 5- mm trochar (Storz®, Tuttlingen, Germany) was placed. CO₂ was insufflated into peritoneal cavity at a flow rate of 3 lt/min, under a pressure of 8 mmHg to create pneumoperitoneum. A 5mm- laparoscope with a 30° optical lens was inserted into trocar, and advanced further to evaluate presence of testis (if any), its location, and appearance, spermatic cord, and vessels, and patent processus vaginalis. Testis with appropriate size, and appearance in consideration of patient's age or contralateral testis (if any) was termed normal testis. The term hypoplastic testis was used for small testis with soft consistency. If intraabdominal testis was detected, then two 5-mm trocars were inserted into right, and left abdominal quadrants. Testes more than 3 cm away from the internal ring was accepted as remote testis. To mobilize testis, a sharp incision was made on the peritoneum 5 mm lateral to the spermatic vessels. The incision was extended down to the bladder so as to allow exploration of testis, and spermatic cord. Special care was exerted not to traumatize peritoneal triangle between spermatic cord, and vessels in order to protect the collateral circulation of the testis. A subdartos pouch was created, and testis was placed into scrotum. If testes which can not be translocated at the level of contralateral internal ring and/or can not be lowered into scrotum, then spermatic vessels were transected, and a single-session laparoscopic Stephen-Fowlers orchiopexy technique (FSO) was performed. The findings of diagnostic laparoscopy can be considered in three groups: Group 1. cases with blind-ended spermatic cord,

Figure 1. Testis in the vicinity of internal ring (white arrow); Spermatic cord, and vessels entering through internal ring (black arrow)

and vessels without any gonadal structure. Group 2: Intraabdominal testes. Group 3: cases where spermatic cord, and vessels enter through internal ring (Figure 1).

Patients were monitored at 3-, and 6- month intervals for the first, at 6- month intervals for the second year, and then every year. At control examinations, location, and size of the testes were evaluated. Orchiopexies were considered to be successful if testes remained in the same location without any decrease in their size after the procedure. Testicular blood flow, and volume were measured at > 12 months after the operation.

Statistical analysis

Statistical Package for the Social Sciences (SPSS Inc.; Chicago, IL, USA) 18.0.0 package program was used for analysis of data. Categorical variables were expressed as numbers, and percentages, while numerical variables as means, and standard deviations. Wilcoxon signed- rank two-sample test was used for the comparison of testicular volume variables of the affected, and the intact testes. For the comparison of the measurements of categorical variables Mann-Whitney U, and Kruskal- Wallis tests were used.

Results

A total of 68 testes in 58 patients diagnosed as nonpalpable testis were included in the study. Twenty-six (44.8%) cases with left, 22 (37.9%) cases with right testes were intervened. Also both testes of 5 patients (17.2%) were operated. Median age at surgery was 66 months (10 months-17 years). Twenty-six testes in 20 patients (34.4%) were evaluated based on US reports. The success rate of US in the identification of testes was estimated as 21.4% (3/14 testes) for inguinal, 0% for intraabdominal, and 15.7% (3/19 testes) for all testes.

Mean ages of the patients were 40 months (13 mos-8 yrs) in Group 1, 67 months (18 mos-12 yrs and 5 mos) in Group 2, and 63 months (10 mos, and 17 years) in Group 3. Based on the distance between the testis and the internal ring, 3 testes were near,

Figure 2. Diagnostic laparoscopy findings

and 5 testes were far away from the internal inguinal ring. Laparoscopic FSO was performed for 5 testes located far away from the internal inguinal ring. Laparoscopic FSO was performed for 3 testes which could not be lowered into scrotum. Inguinal orchiopexy was performed for 35 testes detected during inguinal exploration. Thirteen of them were localized at internal inguinal ring (peeping testes), while 22 of them were situated inside inguinal canal (Figure 2). In cases where standard orchiopexy could not brought the testes into scrotal cavity La Roque (n=5), and Prentiss (n=2) manoeuvres were employed. Diagnostic laparoscopic data, and relevant applications are shown in Tables 1, and 2. Patent processus vaginalis was detected during diagnostic laparoscopy of 43 testes, and hernia repair was performed during orchiopexy (Group 3, n= 15; and Group 2, n=1). During insertion of trocar vena caava of one patient was injured, and open surgical repair of the vessel was accomplished.

All of 43 orchiopexized testes were followed up. Average follow-up period was 19 months (1 month-12 years), on an average a total of 7 (5-14) follow-up visits were performed. Location, and appearance of testes on control examination are shown in Tables 3, and 4. During inguinal orchiopexy, and also laparoscopic FSO one testis was detected within the inguinal canal which required redo inguinal orchiopexy. A total 4 orchidectomized testes (inguinal orchiopexy; n=2, and laparoscopic FSO: n=2) were considered as atrophic testes, and orchidectomy was performed.

Postorchiopexy control US was applied for 23 out of 43 testes. Ten bilateral, and 16 unilateral orchiopexies were performed. Among them 16 testes were smaller, and had lower perfusion rates when compared with contralateral testes (Table 5).

Discussion

This study demonstrates that in the management of nonpalpable testis laparoscopic orchiopexy is a safe, and effective method. However routine use of diagnostic laparoscopy in the algorithm does not provide any additional contribution in many patients.

Table 1. Distribution of procedures applied in cases of nonpalpable testis

	Intraabdominal; laparoscopic surgery	Inguinal exploration; open surgery	Total
Orchiopexy	n=8	n=35	n=43 (63.2%)
Excision of the nubbin	n=1	n=12	n=13 (19.1%)
The procedure was terminated prematurely (vanishing testis)	n=6	n=6	n=12 (17.6%)

Table 2. Intraoperative appearance of testes in cases of nonpalpable testis

Testis is found: n=43; 63.2%						Testis is absent; n=25; 36.7%					
Normal	Hypoplastic	Nubbin	Vanishing	Agenesis	Total	Normal	Hypoplastic	Nubbin	Vanishing	Agenesis	Total
n=8 (11.7%)	n=35 (51.4%)	n=13 (19.1%)	n=10 (14.7%)	n=2 (3%)	n=68 (100%)						

Table 3. Post-orchiopexy testicular locations in cases of nonpalpable testis

Testicular locations on control examinations					
	Scro- tum	Upper part of the scrotum	Inguinal canal	Atrophic testis	Total
Laparoscopic orchiopexy	n=4	n=1	n=1	n=2	n=8
Inguinal orchiopexy	n=27	n=5	n=1	n=2	n=35

Table 4. Post-orchiopey testicular findings in cases of nonpalpable testis

Testicular appearance (before orchiopey)	Laparoscopic orchiopey (control examination)		Inguinal orchiopey (control examination)		Total
	Intact	Regressed (small, firm)	Intact	Regressed (small, firm)	
Hypoplastic testis	n=5	n=2	n=25	n=3	n=35
Normal testis	-	n=1	n=5	n=2	n=8

Table 5. Testicular perfusion, and volume as seen on post-orchiopey ultrasonograms

Number of cases; n=16	Testicular perfusion	Testicular volume
Orchiopey	Decreased: n=8	736.6 mm ³ (19.2-7750)
Contralateral testis	Normal: n=16	2168.4 mm ³ (205.9-10192)

In our clinic in cases with nonpalpable testes, US, and MRI are not routinely performed. This preference of ours priorly is based on the probability of overlooking existing testis. Also absence of testis should be definitely confirmed, and testicular nubbin should be removed. When we compared US reports of a total of 26 (26/68 testes, 38.2%) orchiectomies performed at an external center with our surgical findings, US was found to have relatively lower diagnostic value (3/19 testes, 15.7%). Inguinal nonpalpable testes were partially better visualized when compared with intraabdominal testes (3/14 vs 0/5 testes). Combined use of US and/or MRI in cases with nonpalpable testes is still debatable. In some centers the authors reported that US, and MRI did not make any additional contribution to physical examination, and they did not use them routinely.^[3,5] Cain et al.^[6] reported diagnostic sensitivities of US for inguinal, and intraabdominal nonpalpable testes as 33%, and 9%, respectively. Güvenç et al.^[7] reported that when they used US, and laparoscopy in combination, they could evaluate testicular location, and morphology much better, and they also indicated they could plan their treatment more accurately. Kantarcı et al.^[8] indicated that interpretation of conventional MRI, and diffusion-weighted MRI in combination increased both diagnostic specificity, and reliability. Problems of cooperation, and intraabdominal gases decrease diagnostic accuracy of US. Lower number of US applied in our clinic, and application of US at different centers in addition to generally detected hypoplastic testes, and testicular nubbin restrict our interpretation of diagnostic value of US.

In cases with nonpalpable testis, testicular tissue was detected in one-third of the patients who had undergone diagnostic laparoscopy, and/or inguinal exploration, and only 1/5 of them had normal testicular appearance which were situated within intraab-

dominal cavity (n=1), and inguinal canal (n=7). This finding of ours support the viewpoint which asserts that intraabdominal testes are more severely affected.^[9] In our clinic age of the patients at the time of operation ranges between 9-12 months, however in our study it varied between 10 months, and 17 years (median, 66 months). This means that patients present to the health centers at an advanced age. Delay in referrals to the health centers is known to effect testes adversely.^[10]

At control examinations, testicular locations were evaluated, one testis in the laparoscopic FSO group, and one in the inguinal orchiopey group were detected within the inguinal canal (1/8 vs 1/35), and redo orchiopey was performed. Testicular dimensions were evaluated, and 8 (8/43, 18.6%) testes were found to be relatively small, and firm. These testes were hypoplastic (n=5), and normal in appearance (n=3). In a total of 4 patients who underwent laparoscopic FSO (n=2) or inguinal orchiopey (n=2) testicular atrophy developed, and orchidectomy was performed. The remaining 5 testes with normal appearance retained their dimensions, while 30 hypoplastic testes could not reach the size of the contralateral testes. Therefore in only 5 (11.6%) of a total of 43 cases who had undergone orchiopey, testes were of normal size, and located in their normal intrascrotal position. Control US demonstrated that orchiopey decreased the testicular perfusion, and reduced the size of the intervened testis when compared with the contralateral testis. Lenz et al.^[11] detected that testes exposed to orchiopey procedure were relatively smaller even during adulthood. In our clinic we are applying single-session laparoscopic FSO technique for the management of intraabdominal testes. The advantage of single-session surgery is that it does not necessitate anesthesia, and dissection for the second time. We found testicular survival rate as 75% in our 8 cases of laparoscopic FSO. Success rate of FSO might be effected by the testicular size, and distance of the testis to the internal inguinal ring. Indeed 7 of 8 testes were hypoplastic, and one testis was located far away from the internal inguinal ring. In the literature testicular survival rates following single-session laparoscopic FSO ranges between 43, and 93 percent.^[12,13]

In times when the use of diagnostic laparoscopy was not so widespread, in cases of nonpalpable testis, priorly inguinal ex-

ploration was performed, and if testis could not be found, the surgeons proceeded with abdominal exploration. However nowadays, diagnostic laparoscopy is considered to be a gold standard procedure. Being a minimally invasive method with better cosmetic results, and advantages of shorter hospital stay, and relatively less pain are favourable aspects of laparoscopic surgery. On the other hand laparoscopic surgery can lead to the development of serious complications as major vessel, and organ injuries, subcutaneous emphysema, hypercarbia, gas embolism, cardiac arrhythmia, and arrest.^[14,15] Laparoscopic surgery has been reported to be a safe, and successful procedure, and even its superiority over inguinal orchiopexy has been indicated.^[16] In our series, 8 intraabdominal testis were managed with laparoscopic FSO. However 13 intraabdominal testes near the internal ring were managed with inguinal orchiopexy. Snodgrass et al.^[17] demonstrated that inguinal orchiopexy is suffice for testes in the vicinity of internal ring. Daher et al. reported^[18] that inguinal orchiopexy adequately managed intraabdominal testes localized far away from internal inguinal ring, and shortened operative time. In our series we performed diagnostic laparoscopy for 68 patients, and major vessel injury was seen in only one patient. While laparoscopic orchiopexies for 8, redo inguinal orchiopexy for 1, and inguinal orchiopexy for 2 testes were performed. Complications of laparoscopic surgery were found in 5.8% (4/68) of the cases. One remarkable point is that 68 cases underwent diagnostic laparoscopy, and in 53 cases we switched to inguinal exploration when we had seen entry of spermatic cord, and vessel into the internal inguinal ring. In other words, additional diagnostic laparoscopies were performed in 4 of 5 cases where inguinal exploration itself would have been suffice for diagnostic purposes. Similarly, as literature reviews suggest, it has been reported that diagnostic laparoscopy does not offer advantages in many cases, and inguinal orchiopexy *per se* is a successful treatment for nonpalpable testes.^[19,20] The most predominant, and important outcomes of this study are as follows. 1) routine use of diagnostic laparoscopy does not provide additional contributions in many patients. Therefore in this algorithm, rather than starting from diagnostic laparoscopy, inguinal exploration should be the first step, and in cases where testis can not be found, then laparoscopic exploration should be preferred. Many studies cited in the literature support our viewpoint.^[19,21] 2) When obtaining patient's consent for their children, make sure that the family understood the contribution, and limitations of the laparoscopy. The family may not evaluate profit, and loss just like we present laparoscopy to family members. In a study, while obtaining the consent of the family, it was asserted that laparoscopy provided better cosmetic results, increased postoperative comfort of the patient, decreased hospital stay, and incidence of intraoperative bile duct injuries (0.2% vs 0.3-0.5%, for laparoscopic, and open surgery, respectively). As a consequence, 23 families preferred laparoscopic, and 12 families open cholecystectomy.^[22]

In conclusion, in cases with nonpalpable testis, laparoscopic surgery is a reliable, and useful method, but its priority in the algorithm should be evaluated anew.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Mersin University School of Medicine.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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