

Our experiences of laparoscopy in the non-palpable testes

Ele gelmeyen testiste laparoskopi deneyimimiz

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ABSTRACT

Aim: To demonstrate the superiority of laparoscopic undescended testicular surgery for non-palpable testicles in children in diagnosis and treatment.

Methods: The files of patients between the age of 6 months and 18 years who underwent laparoscopic undescended testis investigation due to non-palpable testis in our clinic, between January 2010 and September 2021, were reviewed retrospectively. Patients with palpable testicles and patients with disorders of sex development in the examination performed under general anaesthesia were excluded from the study.

Results: Fifty-three patients were included in the study. The mean age of the patients is 3.2 years (min: 8 months-max 17 years). Laparoscopic intervention was performed for a total of 59 non-palpable testicles which were left-sided in 54.7% (n=29) of the patients, right-sided in 34% (n=18), and bilateral in 11.3% (n=6). Throughout these 59 testicles, cords and vessels of 31 testicles were visualized entering the inguinal canal, atrophic testes in the abdomen were detected in 7 patients, the cord and vessels had an intraabdominal blind ending (vanishing testis) in 7 patients, and 14 testicles were in the abdomen with normal aspect.

Conclusion: Simultaneous laparoscopic orchiectomy is performed in case of atrophic testis in laparoscopic exploration for non-palpable testicles. It allows the ligation of vessels of testes farther than 2 cm away from the inguinal canal, and for testes that are closer than 2 cm it grants the vessels to be released under a more precise vision thereby protecting from the complications of conventional surgery.

Keywords: Laparoscopic orchiopexy, non-palpable testis, children

ÖZ

Amaç: Çocuklarda ele gelmeyen testisler için yaptığımız laparoskopik inmemiş testis ameliyatlarının tanı ve tedavide üstünlüğünü ortaya koymak.

Yöntemler: Kliniğimizde Ocak 2010 ile Eylül 2021 tarihleri arasında ele gelmeyen testis nedeniyle laparoskopik inmemiş testis araştırması yapılan 6 ay-18 yaş altı hastaların dosyaları retrospektif olarak incelendi. Genel anestezi altında yapılan muayenede palpe edilen testisler ve cinsiyet gelişim bozukluğu bulunan hastalar çalışma dışında tutuldu.

Bulgular: Çalışmaya 53 hasta dahil edildi. Hastaların ortalama yaşı 3,2 yaştır (min:8 ay-max 17 yaş). Hastaların %54,7'sinde (n=29) sol, %34'ünde (n=18) sağ ve %11,3'ünde (n=6) bilateral olmak üzere toplam 59 ele gelmeyen testis için tanı ve tedavi amacıyla laparoskopik girişim yapılmıştır. 59 testis için yapılan laparoskopide 31 tane testisin kord ve damarlarının inguinal kanala girdiği, 7 hastada karnın içindeki testisin atrofik olduğu, 7 hastada kord ve damarların intraabdominal olarak kör sonlandığı (vanishing testis), 14 adet testisin karnın içinde normal boyutta olduğu saptandı.

Sonuç: Ele gelmeyen testisler için yapılan laparoskopik eksplorasyonda atrofik testis bulunması durumunda eş zamanlı laparoskopik orşiektomi yapılmakta, özellikle inguinal kanala 2 cm'den uzak testisler için damarların bağlanmasına olanak vermekte, 2 cm'den yakın olan testisler için ise daha iyi bir görüş altında damarlarının serbestlenmesine izin vererek açık cerrahi komplikasyonlarından korumaktadır.

Anahtar Kelimeler: Laparoskopik orşiopeksi, ele gelmeyen testis, çocuk

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INTRODUCTION

Undescended testis is the most common congenital malformation of the genital tract in boys. The testicles follow a path descending from the abdomen to the scrotum during the intrauterine period. It is seen in 3 to 5% of term newborn boys, while the incidence decreases to 1.5 to 3% at 6 months of age due to postnatal migration [1,2]. Undescended testicles can be classified according to their position as peeping (glides in and out of the inner inguinal ring), canalicular, extra canalicular (superficial inguinal pouch), suprapubic (high scrotal) or intraabdominal [3]. Some 20 to 25% of non-palpable testicles are in the intra-abdominal space and 65% are in the inguinal canal. A number of testicles TABend up in atrophy in the intrauterine period [4]. Undescended testes are recommended to be operated between 6 months and 1.5 years due to the potential for future infertility and malignancy.

Eighteen percent of non-palpable testicles become palpable under general anaesthesia [5]. In such a case, the standard inguinal approach is preferred. Imaging methods such as ultrasonography (USG), magnetic resonance imaging (MRI), computed tomography (CT), venography and angiography have been used to determine the localization and size of previous non-palpable testicles, but none of them have a specificity and sensitivity over 90%. Routine use of imaging methods is not recommended in the European Urology Guidelines, except in specific cases such as suspicious genitalia [6].

In this study, we aimed to present our laparoscopic exploration experiences for non-palpable testicles in our clinic.

MATERIAL AND METHOD

After the approval from the clinical research ethics committee of our university, the files of patients between the age of 6 months and 18 years who underwent laparoscopic ectopic testicular investigation due to non-palpable testis in our clinic, between January 2010 and September 2021, were retrospectively analyzed according to preoperative imaging findings, testicular dimensions, findings during surgery, type of surgery performed and the outcome of the testis

after surgery. Patients with palpable testicles and disorders of sex development in the examination performed under general anaesthesia were excluded from the study.

After inserting a nasogastric and urinary catheter in all patients under general anaesthesia, a Veress needle was inserted from the umbilicus to create a pneumoperitoneum with CO₂ at a rate of 8-12 mmHg at 2-3 lit/min, depending on the age of the child, and a 5 mm trocar was advanced into the abdominal cavity. Abdominal exploration was performed with a 5 mm optic (Karl-Storz®, Germany) and it was checked whether the testis was in the abdomen. In the case of blind-ended spermatic cord and vein in the laparoscopic exploration, after the testicular descent path was explored and no other structures belonging to the testis were observed, the diagnosis of vanishing testis was established and the exploration was terminated. In the presence of testis in the abdomen, two more 5 mm trocars were inserted in the right and left lower quadrants. In patients with testis closer than 2 cm to the inguinal canal and in cases with peeping testis, the vessels of the testis and the spermatic cord were released laparoscopically, and the testis was advanced from the inguinal canal to the scrotum with a grasper. The two-stage Fowler-Stephens surgery was performed on testicles that were more than 2 cm away from the inguinal canal. In the first operation, testicular vessels were ligated with endoclips away from the testis and the testis was left over intraabdominal cavity. In the laparoscopy performed 6 months later, if the testicular dimensions were deemed as good, laparoscopy-assisted orchiopexy was performed. A new path was created aside medially from the inguinal canal in patients when the inguinal canal was closed. If the testis was atrophied, laparoscopic orchiectomy was performed. If the testis could not be brought up to the scrotum in patients who underwent laparoscopic orchiopexy, we fixed it in the superficial inguinal pouch or scrotum and brought it down to the scrotal position after 6 months of the previous operation. Laparoscopic orchiectomy was performed in the presence of intraabdominal hypoplastic or atrophic testis. Laparoscopy was terminated and inguinal exploration was performed in the same session in cases where the spermatic cord and vessels were observed to enter through

the inguinal canal. Postoperatively, the patients were discharged after being followed up in the hospital for 24 hours.

RESULTS

The mean age of fifty-three patients included in the study was 3.2 years (min: 8 months-max 17 years). Laparoscopic intervention was performed for a total of 59 non-palpable testicles which were left-sided in 54.7% (n=29) of the patients, right-sided in 34% (n=18), and bilateral in 11.3% (n=6). A total of 62.3% (n=33) of the patients were younger than 2 years old. The mean operative time was calculated as 26 min (15 min to 55 min). The mean post-operative hospital stay was 20.6 hours.

Routine abdominal USG was requested in all our patients, but testis could be detected in only 9 (15.2%) patients. In three of these nine patients, the testis was detected in the upper inguinal canal. MRI was requested priorly from twelve patients before the admission to our hospital by pediatricians and testis could only be detected in three patients (25%).

In the laparoscopy performed for fifty-nine testicles, cords and vessels of 31 testicles were visualized entering the inguinal canal (Figure 1), the testis was atrophic in 7 patients, the cords and vessels were intraabdominally blind-ended (vanishing testis) in 7 patients (Figure 2), and 14 testicles with no other obvious pathology were seen in the abdominal space. Gender development disorder was detected in one patient, and thus the procedure was terminated, and the patient was referred to pediatric endocrinology.

Seven atrophic testicular tissues in the abdomen were removed by laparoscopic orchiectomy. In cases with vanishing testis, both the spermatic cord and the spermatic vessels were found to end blindly close to the inguinal canal, and the operation was terminated.

First session Fowler-Stephens surgery was performed by clipping the testicular vessels for eight testicles where the testis in the abdomen was farther than 2 cm away from the inguinal canal. When re-laparoscopy was performed 6 months later, atrophy was observed in two testicles

so laparoscopic orchiectomy was performed. Laparoscopy-assisted scrotal orchiopexy was performed for six testicles. Since the inguinal canal was completely closed in two patients, orchiopexy was performed by creating a new medially located tract. Since the spermatic cord of one testis was not long enough to bring down to the normal scrotal position, it was fixed in the scrotal inlet. Since there was no regression in the size of the testis 6 months later, it was placed in its normal location in the scrotum.

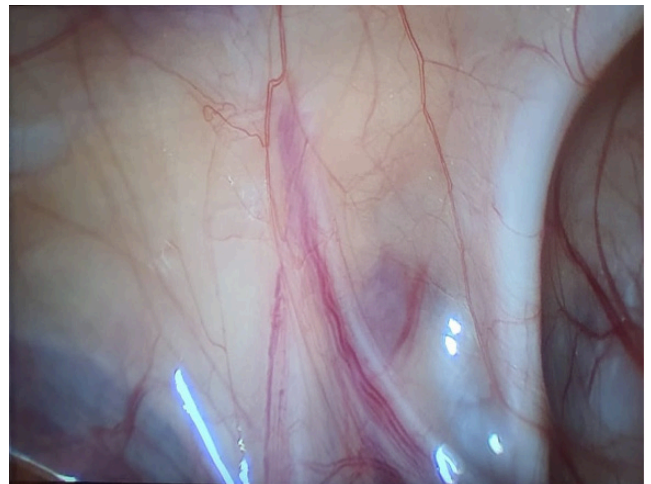


Figure 1: The spermatic cord and vessels entering the inguinal ring

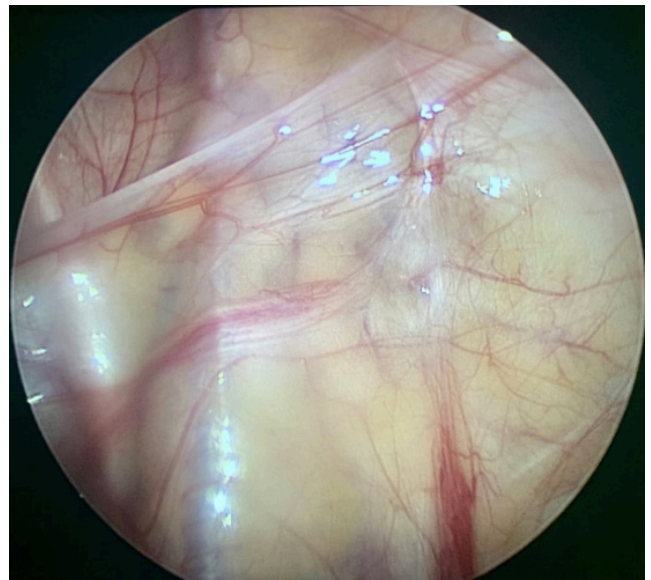


Figure 2: The spermatic cords and vessels were intraabdominally blind-ended (vanishing testis)

Laparoscopy-assisted scrotal orchiopexy was performed in four testicles that were closer than 2 cm to the inguinal canal and in two peeping testicles, after the spermatic cord and vessels

were released. In one patient, it was observed that the inguinal canal was completely closed, and a new canal was created medially and orchiopexy was completed. A superficial inguinal pouch was detected because the veins of one testis and spermatic cord were not long enough to “pex” them into the scrotum. Inguinal orchiopexy was performed 6 months later.

Inguinal exploration was performed in the presence of thirty-one cords and vessels entering the inguinal canal; Orchiectomy was performed in twenty-six patients with atrophic testis and cord structure, and standard inguinal orchiopexy was performed in five patients with testicular tissue in small sizes compared to the contralateral testis. The surgical algorithm we used for non-palpable testicles in our clinic is shown in Figure 3 and the operations performed are shown in Table 1.

Complications were detected in three patients, including port infection in one patient, scrotal hematoma in one patient, and preperitoneal emphysema in one patient. In the pathological examination of thirty-four testes that underwent orchiectomy, immature tubule structure was detected in seven testes in histology and no malignancy was detected.

All patients were followed up with physical examination and abdominal USG at the end of the 1st month, 6th month, 1st year and 2nd year. Atrophy was detected in two patients who underwent single-session laparoscopy-assisted scrotal orchiopexy, and an orchiectomy was performed. All patients who underwent an orchiectomy and those who were found to have vanishing testicles were informed that testicular prosthesis could be placed in a further session during puberty.

Table 1: Operation type performed and surgical findings

	n (%)	Testis morphology	Operation	Complication
Vanishing testis	7 (%11,9)	Testis not detected	Terminated	1 preperitoneal emphysema
Distance to inguinal canal <2 cm	6 (%10,2)	4 normal	Laparoscopic orchiopexy	1 atrophy
	3 (%5,1)	3 atrophied	Laparoscopic orchiectomy	1 wound site infection
Distance to inguinal canal >2cm	8 (%13,6)	8 normal	Fowlers-Stephens	3 atrophies
	4 (%6,8)	4 atrophied	Laparoscopic orchiectomy	None
Peeping testis	2 (%3,2)	2 normal	Laparoscopic orchiopexy	1 scrotal hematoma
Cord and vessels entering the inguinal canal	4 (%6,8)	5 normal	Inguinal orchiopexy	None
	27 (%45,8)	26 atrophied	Inguinal orchiectomy	None

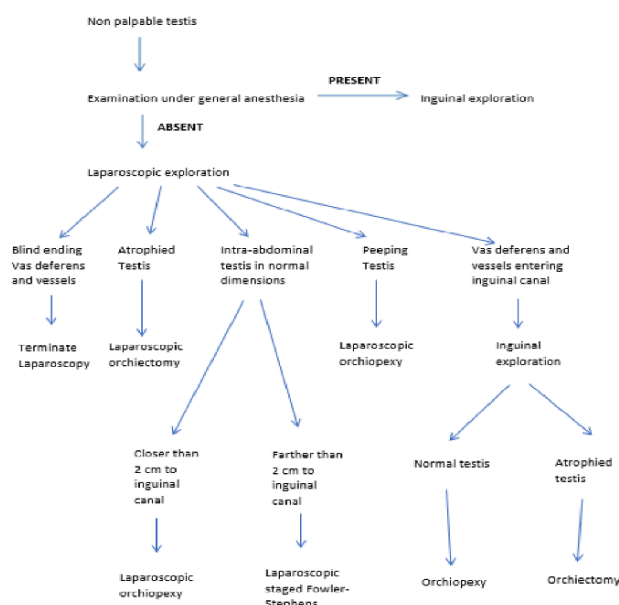


Figure 3: Treatment algorithm in non-palpable testes

DISCUSSION

The testicles normally follow a descending path from the abdomen to the scrotum during the intrauterine period. Sometimes along this path, an arrest during migration occurs in this route and they cannot reach the final position in the scrotum, resulting in an undescended testis. Undescended testis is a complex and not fully elucidated process in which hormonal, genetic, anatomical and environmental factors play a role [7]. Non-palpable testis is the inability of the testes to be identified in the inguinal canal and scrotum on physical examination and constitutes approximately 20 to 25% of all undescended testicles.

None of the current imaging techniques such as USG, CT or MRI performed to detect the presence or absence of non-palpable testicles have shown 100% reliability [8]. In the study of Erdoğan C et al., they were able to detect the location of only three testicles (15.7%) in USG performed for nineteen testicles [9]. For this reason, some authors have recommended the use of laparoscopy, which can provide diagnosis and treatment, when necessary, as the first choice without resorting to another imaging method [10,11]. In our study, we were able to detect the location of non-palpable testes in 15.2% of patients with USG and 25% with MRI. In laparoscopic exploration, however, we were able to detect the location and size of 100% of the non-palpable testicles, and we operated on all these cases with the exception of the vanishing testicles. In some cases, although the blind-ending spermatic cord is seen, the spermatic vascular structures may not be observed. In such cases, the colon should be lifted and laparoscopic exploration should be continued caudally, so that gonads could be observed at the tip of the vessels [12]. In all cases participating in the study, spermatic vessels and spermatic cord were identified separately

In non-palpable testicles during laparoscopy, incidence rate has been reported with spermatic vessels entering the inguinal canal as 40%, those in the abdomen as 40%, peeping testes as 10%, and blind-ended spermatic vessels as 10% [5]. In our series, 52.4% of the testicles were in the inguinal canal, 32.5% were intra-abdominal (15.3% were high intra-abdominal, 17.2% were

close to the inguinal canal), 11.9% were vanishing testicles and 1% were in the inguinal canal. It was determined that 3.2% of them had peeping testicles.

Some authors have suggested that testicles that are 2 cm closer to the internal inguinal ring or that can be stretched out to the contralateral inguinal ring may have sufficient vascular length to be fixed into the scrotum [13,14]. We also performed single-session laparoscopic orchiopexy in four patients who were closer than 2 cm to the inguinal canal and in two patients with peeping testicles, and we found our success rate of single-session laparoscopic orchiopexy to be 83.4%. We detected atrophy in only one patient (16.6%).

If the intraabdominal testis was more than 2 cm away from the inguinal canal, we performed a phased Fowlers-Stephens surgery. The basic principle of this surgery is based on the ligation of the main vascular structures of the testis and the survival of the testis by being fed by collaterals, deferential artery of ductus deferens and cremasteric vessels. Orchiopexy can be performed in a two-session Fowlers-Stephens surgery if testicular atrophy has not developed 6 months post operatively after the first operation [15]. An estimated success rate of for single-session Fowlers-Stephens surgery is reported as 80% and 85% for two-session Fowlers-Stephens surgery [16,17]. We detected atrophy in three of eight patients (37.5%) and performed laparoscopic orchiectomy in the second session, we did not detect atrophy in the controls after staged Fowlers-Stephens in the other five patients. We found the success rate of staged Fowlers-Stephens surgery to be 62.5%. We think that the distance of the non-palpable intra-abdominal testicles to the inguinal canal and/or the excision of the vessels to fix them into the scrotum, are effective on the development of atrophy.

Dar SA et al. found that the internal inguinal ring was closed at a rate of 28% during laparoscopic orchiopexy [18]. We found that the internal inguinal canal was completely closed in 3 (25%) of 12 (8 of them >2cm, 4 of them <2cm) intra-abdominal testes cases and we completed the orchiopexy by creating a new canal from the medial of the inguinal canal with a grasper.

In the study conducted by Demir et al., they found that the testicular vessels and spermatic cord entered the inguinal canal in 50% of their patients in the laparoscopy and they found atrophy in 79.1% of the twenty-four testes they explored [19]. In our series where an orchiectomy was performed, the rate of cord and vessels entering the inguinal canal was 52.6% and atrophy was detected in 83.9% of these testes.

Since the histopathological examination of atrophic testes in non-palpable testes shows the presence of seminiferous tubules and viable germ cells in up to 0 to 16%, some authors suggest routine removal of atrophic testicular tissue in order to prevent malignant transformation, on the other hand some authors find orchiectomy unnecessary because no viable testicular tissue is detected so far [16]. In our study, immature tubule structures were found in seven (20.5%) of thirty-four atrophic testis in histopathological examination.

Surgical complications during a diagnostic laparoscopy for nonpalpable testis such as preperitoneal insufflation due to Veress needle insertion, or vascular or intestinal injuries due to trocar insertion, hypercarbia, gas embolism, arrhythmia and cardiac arrest, are rare and seen and at a rate of 5.4% [18]. In our study, our pre- and postoperative complication rate was 5.1%, which is consistent with the literature.

The recommended age for orchiopexy for an undescended testis has declined further over the years. In the 2000s, surgery was recommended between the ages of 1 and 2 years, while today it is currently recommended between 6 and 18 months [3]. In the guideline published by the European Association of Urology in 2019, it is recommended that any treatment for undescended testicles should be completed up to twelve months or by eighteen months at the latest [6]. Although undescended testis surgery is recommended between 6 and 18 months, we had older patients that admitted to us or to a doctor in this area of expertise due to low socio-cultural status and the majority of our patients in this category were living in rural areas.

CONCLUSION

Compared to conventional imaging methods for non-palpable testicles, laparoscopic exploration provides 100% diagnosis and can also be used for treatment. Synchronous laparoscopic orchiectomy is performed in cases of atrophic testes in laparoscopy performed for non-palpable testicles; it allows the vessels to be ligated, especially for testes that lie farther than 2 cm away from the inguinal canal, and for testes that are closer than 2 cm, it allows the vessels to be released under a better vision thereby protecting against surgical complications of conventional orchiopexy.

Limitations

This study was conducted retrospectively and the follow-up period was 2 years. Conducting a prospective study including after puberty may provide more useful information in terms of sperm morphology and fertility.

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