The value of laparoscopic classifications in decision on definitive surgery in patients with nonpalpable testes: our experience and review of the literature

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Background/purpose **The aim of the study was to present our clinical experience with the laparoscopic approach in patients with nonpalpable testes (NPTs) and review the literature on laparoscopic classifications.**

Materials and methods **Between May 2010 and August 2012, 30 boys with NPT (mean age 3.9 years) underwent laparoscopy as a part of diagnosis and treatment in our clinic. The laparoscopic findings were classified into four types according to Castilho. The patients were managed according to the presence or position of the testes and testicular vessels.**

Results **Six patients were excluded from the study. Twenty-six testicular units (19 left, three right, and four bilateral units) in 24 patients were managed laparoscopically. Laparoscopy was terminated in eight patients in whom blind-ending cord structures were detected intra-abdominally. An inguinal canal exploration was performed in 10 cases in whom cord structures were seen entering the internal inguinal ring. No viable testis was found, and testicular remnants were excised for histopathologic examination. Four canalicular testes (peeping) were treated with open orchiopexy. Laparoscopy-assisted orchiopexy without vascular ligation was performed in two testes. Fowler-Stephens orchiopexy in single stage was performed in one testicular unit and in two stages in another unit. All patients were discharged on the same day. The testes were normal in size and found in the scrotum after a mean follow-up period of 14 months.**

Conclusion **The laparoscopic findings in NPT had an important influence on treatment decisions. To be able to interpret the definitive surgery relative to the laparoscopic classification, collaborative studies are required. *Ann Pediatr Surg* 9:74–78**

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Keywords: laparoscopy, nonpalpable testis, nubbin, orchiopexy, vas deferens

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Introduction

The incidence of an undescended testis is ~1% in boys, of which 20% are nonpalpable [1,2]. One of the following conditions are anticipated in patients with a nonpalpable testis (NPT): agenesis, atrophy, vanishing testis, or intra-abdominal testis. Early diagnosis and management of an intra-abdominal testis are required to preserve the patient's fertility and prevent the risk of testicular malignancy. The traditional approach to NPT was on the basis of an open groin exploration, followed by an abdominal exploration if necessary [2]. In recent times, laparoscopy has become the 'gold standard' for the diagnosis and treatment of NPT [3]. This endoscopic management helps to localize the testis and guide the definitive operation, and can be used safely in children. With the widespread use of laparoscopy in children with NPT, new classifications, success rates, and approaches have been described. In this study, we aim to present our experience with the laparoscopic approach for NPT and review the literature on laparoscopic classifications.

Patients and methods

Between May 2010 and August 2012, 30 boys (age range 1–14 years; mean age 3.9 years) were referred to our department for NPT. No preoperative radiological investigation was performed as a routine. Laparoscopy was performed in all patients if the testis was really nonpalpable after a careful physical examination under general anesthesia. Data were collected from the patient's charts and video records. Patients who had undergone a groin exploration previously and with intersex anomalies were excluded from the study.

The laparoscopic procedure started with the stomach decompressed and the patient lying in the supine position. A pressure of 10 mmHg pneumoperitoneum was created with carbon dioxide insufflation after puncturing the abdomen by means of a transverse subumblical incision using a Veress needle. A 5 mm 30° telescope was placed through the umbilical port. With the patient in the trendelenburg position, the area between the internal inguinal ring (IIR) and the kidney vessels was inspected to locate the testes and/or to visualize the testicular vessels and the vas deferens on both sides. One or two additional 3 mm working ports were placed into each iliac fossa under direct vision if required, and an atraumatic grasper was used.

The Castilho [4] classification was used to evaluate the operative findings. The choice of surgical procedure was made on the basis of the laparoscopic findings. In cases of blind-ending cord structures (Fig. 1a), the procedure was terminated. If testicular vessels were not seen, a detailed laparoscopic investigation from the pelvis to the renal area was conducted to rule out an ectopic gonad. When normal testicular vessels and a vas deferens were seen

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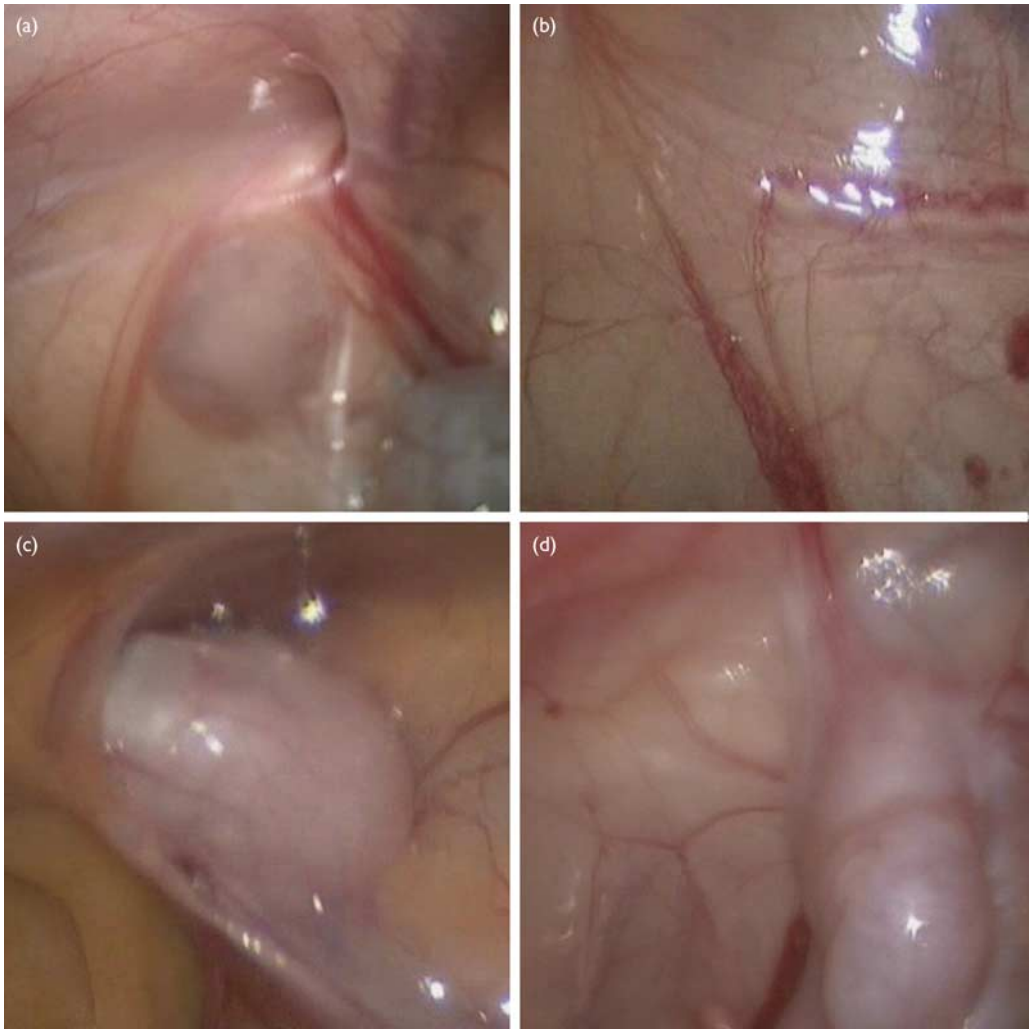
Fig. 1



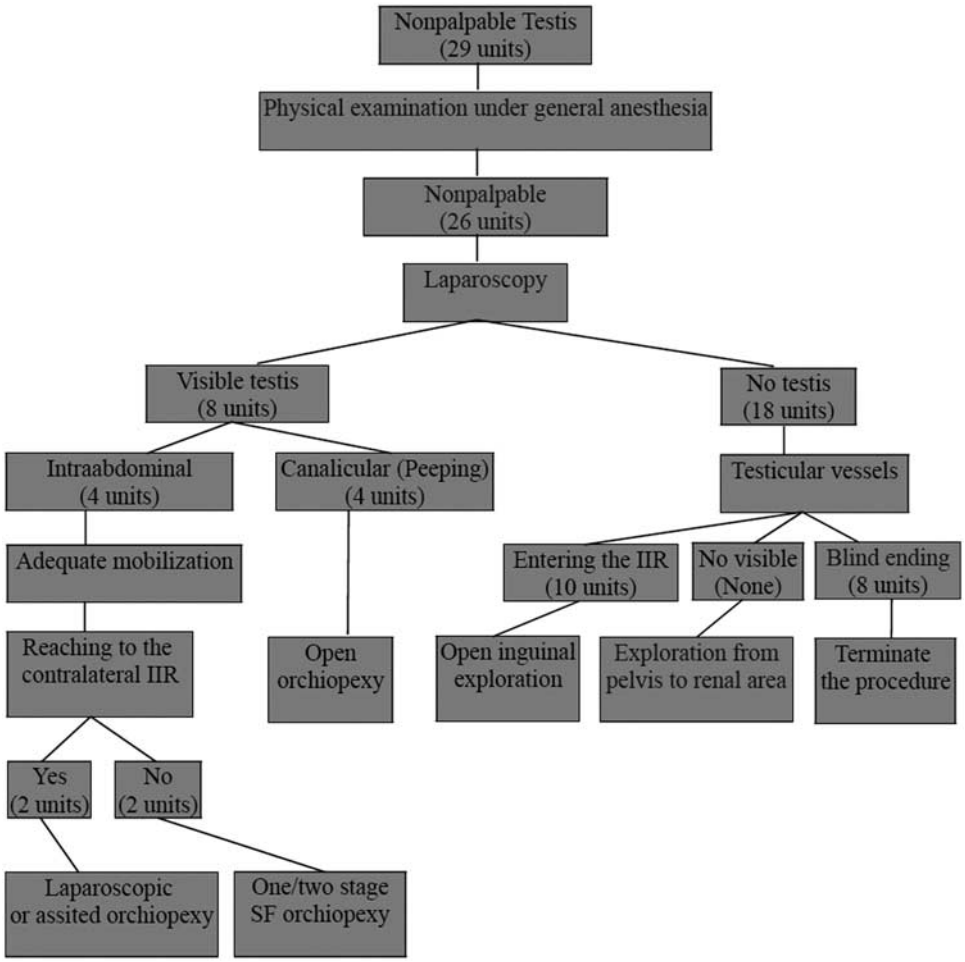
Findings during laparoscopy in patients with NPT; vas deferens and testicular vessels entering the IIR (a), blind-ending vas and spermatic vessels (b), the laparoscopic appearance of a peeping testis (c), and intra-abdominal testis (d). NPT, nonpalpable testis.

to be entering the IIR (Fig. 1b), an open inguinal exploration was carried out, and when a viable testis was identified orchiopexy was performed. If the testis was close to the IIR with an open inguinal canal (peeping testis) (Fig. 1c), inguinal orchiopexy was preferred. When intra-abdominal testes were found (Fig. 1d), they were pulled with graspers to the contralateral IIR [5]. If they reached the IIR, a laparoscope-assisted orchiopexy with mobilization of testicular vessels was performed. If the testes could not reach the contralateral IIR, the testicular vessels were clipped under laparoscopy for a single stage or for the first of two stages of Fowler-Stephens orchiopexy. All atrophic testicles or nubbins were excised for histopathologic examination.

Results

Three children with unilateral NPTs were excluded from the presentation because the testes became palpable under anesthesia. One boy with a unilateral NPT who had undergone a groin exploration previously and two boys with persistent Mullerian duct syndrome were also excluded from the study. In all, 26 testicular units (19 left, three right and four bilateral units) in 24 patients were managed laparoscopically. There was no complication from the laparoscopic procedure. The laparoscopic findings and our management procedure for the NPTs are summarized in Table 1. Laparoscopy was terminated in eight patients in whom were detected blind-ending cord structures above the IIR (30%). Ten patients were found to have cord structures entering the IIR. On open inguinal exploration, all of them were found to be atrophic testes or nubbins and were removed for histopathologic examination (38%). No intra-abdominal atrophic testis or nubbin was detected. Four testes were seen close to the open IIR (peeping) and were managed by standard inguinal orchiopexy (15%). Four testes were located in the abdominal cavity on laparoscopy. Laparoscope-assisted orchiopexy without vascular ligation was performed in two testes that reached the contralateral IIR (8%). One testis was managed by laparoscopic mobilization followed by laparoscopic vessel clipping and orchiopexy in a single stage. One patient, who had short testicular vessels and had undergone vascular

Fig. 2



Flow chart of patients.

Table 1 Castilho classification of testicular units and management of the patients

	Total	Left	Right	Bilateral	Management
Absent testis (blind-ending cord strictures)	8	6	2	–	No further exploration
Canalicular testis (cord strictures entering the IIR)	10	9	1	–	Inguinal exploration and excision of atrophic testis or nubbins
Peeping testis	4	–	–	4	Inguinal orchiopexy
Abdominal testis	4	4	–	–	Laparoscopic orchiopexy in two, laparoscopic Fowler-Stephens orchiopexy (single stage) in one, and laparoscopic Fowler-Stephens orchiopexy (two stage) in one
Total	26	19	3	4	

clipping, successfully underwent the second-stage operation of the two-stage Fowler-Stephens orchiopexy 6 months later. The mean period of clinical follow-up was 16 ± 50 months, ranging from 3 to 30 months. All viable testes were successfully descended to the scrotal position; six low scrotal and two high scrotal in position. No testicular atrophy was observed during the follow-up period. Histological examination of two atrophic testes revealed the structure of the seminiferous tubules and no testicular tissue in eight nubbins.

Discussion

Laparoscopic NPT investigation was first reported by Cortesi *et al.* [6] in 1976. Diagnostic laparoscopy in patients with NPT has gradually gained greater acceptance among physicians. The advantages of laparoscopy are its excellent visualization of the anatomy to enable differentiation between viable and absent testes and the fact that open exploration can be completely avoided in some patients [7]. The main laparoscopic findings in patients with NPT included: the presence, atrophy, or absence of testes, the spermatic vessels and vas deferens entering the IIR or terminating blindly (vanishing), and intersex anomalies.

In the light of laparoscopic findings, many classifications have been proposed to establish the best-practice guidelines for the management of NPT, although none of them has been widely used in routine clinical practice. The first classification in 1984 was described by Malone and

Guiney, [8] and, similarly, a widely used classification was published by Castilho [4] in 1990 (Table 1). According to the intraoperative findings in our study, testicular units were also divided into four groups similar to those described by Castilho.

In 1992, Jordan *et al.* [9] introduced the therapeutic application of laparoscopy in patients with nonpalpable testes and, since then, in addition to being a diagnostic method, laparoscopy has been an option for treating this condition. Thus, laparoscopy in patients with NPT has changed to include procedures that are performed in a manner not significantly different from standard open techniques but without inguinal exploration. Further, previous laparoscopic evaluations are not designed to provide practical guidance to the surgeon who is planning a definitive surgery in children with NPT. Preliminary classifications were inadequate for the goals of therapeutic laparoscopy as they related to the undescended intra-abdominal testicle. For example, the initial measured distance of the testicle from the IIR will determine which laparoscopic approach should be utilized and is therefore a predictor of success rates. If an intra-abdominal testicle is found at a significant distance from the IIR it is thought to favor a staged Fowler-Stephens orchiopexy.

The advances in laparoscopic orchiopexy have led to the need to establish newer classifications. In the last decade, many new classifications have been described. Some of them have been summarized in Table 2. The categories and approaches are summarized below on the basis of the authors' classifications. Hay *et al.* [10] presented a classification of the laparoscopic findings in their series. Authors have put forward that this classification, although giving good anatomic results, must still be proved to have functional benefits. Recently, this classification was revised by AbouZeid *et al.* [11]. They stressed the patency of IIR and identified the subtypes of the Hay classification. Patil *et al.* [12] have proposed a basic management protocol for NPT according to which the four most important structures to be identified at laparoscopy are the testis, the testicular vessels, the vas deferens, and the patency of the processus vaginalis. Authors have categorized the pattern of these structures in boys with NPT into six clinical scenarios, from the most common to the least common. Papparella *et al.* [2] have described an algorithm for the management of NPT. Although it is not a classification, we adapted it to our table. In contrast, the laparoscopic aspect of the hypoplastic vessels with a closed internal IIR has been considered the anatomical expression of intracanalicular vanishing testes. El-Anany *et al.* [13] have classified patients into six types according to the presence or absence of the testis, the position of the testis, the looping of the vas deferens toward the IIR, and the presence of abnormal findings in order to facilitate decision making during the procedure. Gatti and Ostlie [3] have pointed out that laparoscopic findings will be broken down into four clinical scenarios. They have stated that the diagnosis of testicular agenesis is one that is made only after extensive laparoscopic exploration of the retroperitoneum from the inferior pole of the

Table 2 Different classifications listed in the table in chronological order

Malone and Guiney	Castilho	Hay *et al.*	Patil *et al.*	Papparella *et al.*	El-Anany *et al.*	Gatti and Ostle	Hassan and Mustafawi	Abbas *et al.*
Absent or atrophic	Absent testis	Type I: no testis seen	3: The appearance of fading vessels and a normal vas deferens 4: Normal vas deferens but no vessels or no obvious testis near the vas deferens. 6: No vas nor vessels identified	Hypoplastic vessels entering IIR Intra-abdominal blind-ending cord structures Absent cord structures (agenesia)	Type 0: no testis or vanished testis; vas and vessels ending blindly before the IIR	Blind-ending vas deferens and vessels	Group 1: vanishing syndrome; intra-abdominal vanished testis (1B)	Type 4: vanished testes (absent or rudimentary)
Canalicular testis	Canalicular testis	Type II: vas and vessels enter the IIR and loop back to a testis sited at the IIR	1: Normal testicular vessels and a vas deferens entering the IIR, with the presence of a patent PV	Vas/vessels entering internal ring	Type 1: atrophic intracanalicular testis with vas and vessels entering a closed IIR	Normal vas deferens/ vessels entering the IIR	Group 1: vanishing syndrome; intracanalicular vanished testis (1A)	Type 1: vas and vessels entering the ring
Just canalicular testis	Peeping testis	Type III: vessels do not enter ring, but enter a testis lying at IIR	5: Normal vessels pass through a patent PV but an absent vas deferens.	Intra-abdominal testis (low position)	Type 2: testis lying at the IIR with looping of the vas	–	Group 2: peeping testes; peeping testes without looping vas (2A) peeping testes with looping vas (2B)	–
Abdominal testis	Abdominal testis	Type IV: testis is intra-abdominal, not related to IIR	2: The identifiable testis	Intra-abdominal testis (high position)	Type 3: testis lying at the IIR without looping of the vas Type 4: high abdominal testes (more than 2.5 cm cephalic to the IIR)	Low-lying testicle High-lying testicle	Group 3: intra-abdominal testes; low intra-abdominal testes between the level of iliac vessels and internal ring (3A) higher than the iliac vessels (3B)	Type 2: low (below external iliac vessels) Type 3:high (above external iliac vessels)
–	–	–	–	–	Type 5: persistence of mullerian duct structures or other abnormalities	–	Group 4: disorders of sex development; persisten Mullerian duct syndrome (PMDS) (4A) subgroup (4B)	Type 5: disorders of sex development

Similar categories are presented on the same line. Categories were determined according to the oldest classifications.
PV, proceccus vaginalis.

kidney to the pelvis along the course of testicular descend. They decided on a primary orchiopexy according to the position of the testes, either high (lying above the level of the iliac vessels) or low (lying below the level of the iliac vessels). Hassan and Mustafawi [14] created another laparoscopic classification including subtypes for NPT in a manner that simplifies the findings. Abbas *et al.* [5] have classified NPT into five types according to the laparoscopic findings and these were used to determine subsequent management. Authors routinely test the length of the spermatic cord to determine the potential for successful setting of the testes in their hemiscrotal home. This test consists of pulling the testis toward the contralateral IIR; if it reaches there comfortably, there is a high possibility of easy fixation. In type 3, when the testes do not reach the contralateral IIR, laparoscopically staged Fowler-Stephens orchiopexy is the procedure of choice.

Although therapeutic approaches that are similar to one another in terms of certain important characteristics have been described, a standard classification for NPT has not been established. Current classifications for NPT do not help eliminate some of the controversy surrounding the management of NPT, such as the treatment method for peeping testes, the indications for primary laparoscopic orchiopexy, etc. This study shows the benefits accruing from the different laparoscopic classifications for the management of NPT. In order to be able to establish a common classification relative to different interpretations, it is necessary to standardize the categories of laparoscopic findings in patients with NPT.

Although our series is not enough to make a new classification, we applied a decisional flow chart based on laparoscopic findings in order to manage NPT (Fig. 2). We believe that the following issues should be taken into consideration in the classification. When there are no obvious testes or testicular vessels (even if a normal vas appeared) further exploration from the pelvis to the renal area is required to rule out an ectopic testis, which may be anywhere in the abdominal cavity. Therefore, the classification should be indicated separately for testicular vessels and vas. The length of testicular vessels and vas in the patients with NPT should be evaluated for primary or staged orchiopexy [15]. The length of the vessels can be determined by means of the contralateral reaching test after adequately mobilizing the testes regardless of its position and the presence of the looping of the vas. In contrast to previous interpretations, a peeping testis is actually a canalicular testis and it may be treated with standard orchiopexy. Finally, because disorders in sexual development are very important clinical issues with its different aspects relating to diagnosis, treatment, and sex of the child, it should not be classified as another type of NPT.

Conclusion

Laparoscopy helps to guide the management of patients with NPT and has become the gold standard for these patients. The laparoscopic findings in NPT have an influence on treatment decisions. Many different classifications described according to the laparoscopic findings help to manage NPT. To determine the effect of laparoscopic findings on the clinical outcomes, multicentric and collaborative work is needed.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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