

# Laparoscopic Diagnosis and Treatment of Nonpalpable Testes in a Tertiary Care Center

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## ABSTRACT

**Background:** Cryptorchidism is the commonest genitourinary anomaly in boys. Laparoscopy has been the mainstay for the management of nonpalpable testes.

**Aim and objective:** This study has been done to assess the role of laparoscopy in diagnosing and treating nonpalpable testes.

**Materials and methods:** Medical records of 160 patients of laparoscopic testicular exploration, during a 10-year period, were retrospectively analyzed. All 160 boys with 320 testicular units were examined prior to surgery—118 of the 320 testicular units were normally descended (37%), 9 had palpable undescended testicular units (3%), and 193 testicular units (60%) were nonpalpable.

**Results:** After laparoscopy, 111 of the 193 nonpalpable testicular units were found to be intra-abdominal, 32 were atrophic testes, 22 were peeping testes, 19 were intracanalicular, and 9 were vanishing testes. Of the 111 intra-abdominal testicular units according to the location in relation to the deep inguinal ring, 51 of the testicular units were located within 2 cm from the deep inguinal ring. Among these, 49 cases underwent single-stage laparoscopic orchidopexy and 2 patients required laparoscopic mobilization followed by open orchidopexy due to long loop vas. Sixty testicular units were found greater than 2 cm from the deep inguinal ring and were managed by two-stage Fowler–Stephens laparoscopic orchidopexy.

**Conclusion and clinical significance:** Laparoscopy is safe and effective in managing nonpalpable testis. Single-stage orchidopexy is the treatment of choice for intra-abdominal testis located within 2 cm from the deep inguinal ring with pliable testicular vessels and two-stage surgery is required for intra-abdominal testis located more than 2 cm from the deep inguinal ring and with nonpliable testicular vessels.

**Keywords:** Laparoscopy, Nonpalpable testes, Testicular units, Undescended.

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## INTRODUCTION

Undescended testis is a common condition referred to pediatric surgeons, as cryptorchidism is the most common genitourinary anomaly in boys. It is found in 3% of full-term neonates, rising to 30% with prematurity. About 20% of maldescended testes are nonpalpable.<sup>1–3</sup> Management of nonpalpable testis provides many challenges from accurate localization to successful repositioning of the testicular units. Laparoscopy has been found to be a useful tool in both these aspects.<sup>4</sup> The aim of our study was to assess and discuss the role of laparoscopy in managing nonpalpable testis.

## MATERIALS AND METHODS

We retrospectively reviewed documents of all children below 12 years of age undergoing laparoscopy for nonpalpable testis over a study period of ten years after getting institutional ethical committee clearance. All boys with undescended testes presenting to the outpatient clinic were examined for palpability of testis. Children with palpable undescended testicular units were posted for open orchidopexy through an inguinal incision and not considered in this study. If the testis was not palpable, an ultrasound of the abdomen and inguinoscrotal region was performed and the child was posted for orchidopexy, once older than 6 months. Possibility of different findings and procedures was always discussed with parents prior to the surgery.

A careful physical examination under general anesthesia was always performed in the operating room prior to laparoscopy. If the testis was palpable, the child was operated on by open technique

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and was therefore excluded from the study sample. In case the testis was not palpable, we proceeded with laparoscopy.

A 5-mm port was inserted by open technique for the telescope via a subumbilical curved incision. We used a 5-mm 30° telescope for all cases. Pneumoperitoneum was created and diagnostic laparoscopy was conducted to locate the testis and to note its size, any abnormalities, distance from the deep inguinal ring and iliac vessels, pliability of testicular vessels, presence of an open deep inguinal ring, and the presence of a long loop of vas deferens entering the deep ring. Further procedure was decided accordingly.

If a closed deep ring with blind-ending vas and vessels was found, and no testicular tissue was seen on inguinal exploration, the testis was deemed to be vanishing and so no further procedure was done. In case hypoplastic testicular vessels with vas deferens enter a closed deep ring, then the testis was deemed atrophic and further surgery for the removal of nubbin and the placement of prosthesis was planned at puberty.

When normal testicular vessels and vas deferens were found entering an open deep ring, then the testis was deemed to be intracanalicular and an open orchidopexy was done in these patients.

When the testis was present just at the level of the deep ring and it pops back into inguinal canal on insufflation, then it was termed a peeping testis and an open orchidopexy was done in initial part of this series but later single-stage laparoscopic orchidopexy was done for these testes.

In laparoscopic orchidopexy, two 5- or 3-mm secondary ports/direct instruments were created on both sides in the midclavicular line at the level of the umbilicus under vision, depending on the age of the patient and surgeon preference. In the case of intra-abdominal testes, they were divided into two groups based on their location relative to the deep inguinal ring and pliability of testicular vessels.

In case testis located more than 2 cm proximal to the deep inguinal ring (high location) and testicular vessels were not pliable (Fig. 1), then two-stage Fowler–Stephens procedure was done laparoscopically with an interval of 6 months in between the two stages. Vessels were either clipped with 5-mm titanium clips or coagulated with bipolar cautery in the first stage.

When the testis was located less than 2 cm (low location) from the deep inguinal ring and testicular vessels were found to be pliable, then single-stage laparoscopic orchidopexy was done.

## RESULTS

One hundred and sixty patients were taken for our study after checking the inclusion and exclusion criteria from the records maintained. The age of surgery ranged from 9 months to 12 years.

One hundred and sixty boys with 320 testicular units were examined prior to surgery—118 of the 320 testicular units were normally descended (37%), 9 had palpable undescended testicular units (3%), and 193 testicular units (60%) were nonpalpable (Fig. 2).

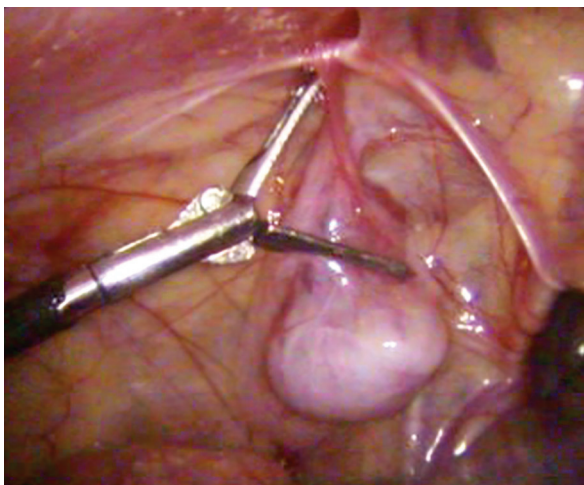


Fig. 1: Intraoperative photograph showing testis located more than 2 cm proximal to the internal inguinal ring (high location)

Out of the 193 nonpalpable testicular units, 49 were unilateral right nonpalpable testicular units, 78 left nonpalpable testicular units, and 66 were bilateral nonpalpable testicular units before anesthesia.

After laparoscopy, 111 of the 193 testicular units were found to be intra-abdominal, 32 were atrophic testes, 22 were peeping testes, 19 were intracanalicular, and 9 were vanishing testes (Table 1).

After the clinical examination, there were 78 patients with left nonpalpable testicular units, 49 patients with right nonpalpable testicular units, and there were 33 patients in whom testicular units could not be palpated bilaterally.

After laparoscopy of the 78 patients with left nonpalpable testis, 34 testicular units were intra-abdominal in location, 9 testicular units were vanishing testis, 7 were intracanalicular, 21 were atrophic, and 7 were peeping testicular units.

Among the 49 patients with right nonpalpable testicular units on examination after laparoscopy, 31 testicular units were intra-abdominal, 6 testicular units were intracanalicular, 2 were atrophic, and 10 were peeping testicular units.

On examination, 33 patients had bilaterally nonpalpable testicular units, i.e., 66 testicular units were nonpalpable. After laparoscopy, 46 testicular units were intra-abdominal, 6 were intracanalicular, 9 were atrophic, and 5 were peeping testis.

Of the 78 patients with left nonpalpable testicular units, 34 had intra-abdominal testes. Of these, 20 were amenable to single-stage laparoscopic orchidopexy and 14 patients required two-stage surgery. Nine patients with vanishing testis just required a diagnostic laparoscopy to confirm the diagnosis. Of seven patients

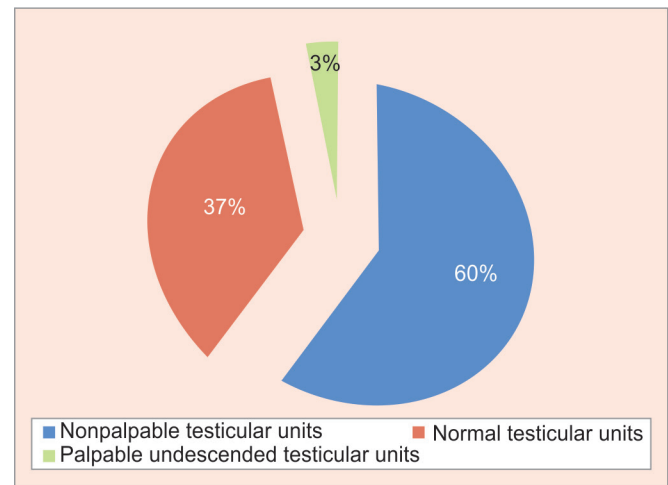


Fig. 2: Distribution of testicular units according to a location in the study group

Table 1: Final diagnosis depending on the location of the testes

Location after laparoscopy	Number of testes (n = 193)
Intra-abdominal	111
Vanishing	9
Intracanalicular	19
Atrophic	32
Peeping	22

**Table 2:** Distribution of surgery done in intra-abdominal testicular units

Procedure	Single-stage laparoscopic orchidopexy	Stephen Fowler stage 1 Stephen Fowler stage 2	Laparoscopic mobilization of vessels and open orchidopexy
	Total number of testicular units	49	60

with peeping testicular units, four required open orchidopexy, while in three patients, single-stage laparoscopic orchidopexy was done. In case hypoplastic spermatic vessels with vas deferens enter a closed deep inguinal ring, the testis was deemed atrophic and further surgery for the removal of nubbin and placement of prosthesis was planned at puberty.

Of the 49 patients with intra-abdominal right nonpalpable testicular units, 31 were intra-abdominal; of these, 12 were amenable to single-stage laparoscopic orchidopexy, 2 patients needed laparoscopic mobilization with inguinal exploration for long loop vas, and 19 needed two-stage procedure. Out of 10 patients with peeping testicular units, 9 required open orchidopexy, while in 1 patient, single-stage laparoscopic orchidopexy was done. Six intracanalicular testicular units underwent open orchidopexy.

Thirty-three patients had bilateral nonpalpable testicular units. Of these 66 units, 46 were intra-abdominal testes. Of these, 19 testicular units were possible to bring down by single-stage bilateral orchidopexy and 27 testicular units required two-stage surgery. Out of five peeping testicular units, four required open orchidopexy, while in one patient, single-stage laparoscopic orchidopexy was done. Six intracanalicular testicular units underwent open orchidopexy. Out of nine atrophic testicular units, five had diagnostic laparoscopy, one unit had laparoscopic nubbinectomy, and the rest three had open nubbinectomy.

When we studied the location of the intra-abdominal testis according to the location in relation to the deep inguinal ring, we found that 51 of the testicular units were located within 2 cm of the deep inguinal ring. Of these, 49 cases underwent single-stage laparoscopic orchidopexy and 2 patients required laparoscopic mobilization followed by open orchidopexy due to long loop vas. Sixty testicular units were found beyond 2 cm from the deep inguinal ring and all were managed by two-stage Fowler–Stephens laparoscopic orchidopexy (Table 2).

There were no complications after the surgical procedure. There were no inguinal or scrotal infections. Patients were discharged on the same evening or the next day, depending on parental comfort and distance from the hospitals. Boys with bilateral repairs were generally kept for one night.

Single-stage orchidopexy was tougher in older children. Testicular placement in older boys was frequently high scrotal, despite the near distance from the ring and pliable vessels.

We saw no testicular losses after Fowler–Stephens first-stage orchidopexy. Testicular placement was satisfactory after the second stage in all patients operated by staged the Fowler–Stephens technique.

## DISCUSSION

Cryptorchid or undescended testes are those which fail to migrate to the base of the scrotum and occupy a final position either in the groin or within the abdomen; the risk factors being,

excessive estrogen exposure during pregnancy, intrauterine growth retardation, and prematurity.<sup>1</sup> It has been stated that around 4–5% of males are born with undescended testes, which may be unilateral or bilateral. This incidence decreases to around 1–2% at the age of 3 months, due to the spontaneous descent in the first few months of life.<sup>2</sup> The risk of neoplastic changes in an intra-abdominal testis is about 5%. In about 9 out of 10 men with bilateral undescended testes and in about a third of men with a unilateral undescended testis, azoospermia may be present. Increased risk of infertility, malignant changes, trauma, and a realistic possibility of psychological stigma on patients with cryptorchid testis warrants its treatment.<sup>3</sup>

Descent of testes is a complex embryological process. Most literature reviews suggest that the complex remodeling and migration of the gubernaculum into the scrotum under the effects of androgens and calcitonin gene related peptide (CGRP) production by the genitofemoral nerve are the possible causes of cryptorchidism. Inadequacy of androgen production by the developing testis as a result of subnormal pituitary or placental stimulation is the cause of testicular maldescent. Androgens act through the genitofemoral nerves; hence, a minor deficiency of either of the two nerves may be the cause of unilateral undescended testis.<sup>3</sup>

Radiological imaging may be done by ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). Several data with ultrasonography (USG) have shown a sensitivity of 44% and a specificity of 70%.<sup>5</sup> Elder, in 2002, suggested USG to be unnecessary to assess boys with nonpalpable testes.<sup>6</sup>

The timing of the surgery is controversial. The principle of orchidopexy is based on the idea that temperature effect is reversible once the testis is placed in the scrotum and it aims to prevent abnormal gonocyte maturation. Currently, around 6–12 months of age is taken as the age for surgery in most pediatric centers. Therefore, it is recommended that undescended testes (UDT) surgery should be done in the first year of life (most probably within 3–6 months). The surgical principle for cryptorchidism is testicular mobilization that includes separation and ligation of the processus vaginalis and other investing structures of the testes and their attachments, before relocating them within the scrotum.<sup>3</sup>

Current studies in the literature suggest that nonpalpable testes should be managed laparoscopically. Radiological investigations may or may not be used as an adjunct.<sup>1</sup> Laparoscopic management of nonpalpable testis was first described by Jordan et al. in 1992. In 1976, Cortesi et al. introduced a diagnostic laparoscopy as a treatment modality for the nonpalpable testis.<sup>7</sup> Index study emphasizes the role of laparoscopy as an invaluable tool for the holistic management of nonpalpable testes as it has helped in the localization of all the 182 nonpalpable testicular units.

It has been reported that approximately one in five cryptorchid testes is not palpable.<sup>2</sup> It might be intra-abdominal, intracanalicular, atrophic, or even totally absent. Vanishing testis reportedly results from perinatal vascular accidents or intrauterine testicular torsions. Vanishing testis needs no further intervention after the diagnosis, and in these cases, laparoscopy is most advantageous as it avoids an inguinal exploration. In atrophic testis, the atrophic element needs to be removed and inguinal exploration is unnecessary without testicular implant placement in the same sitting.<sup>1</sup> Index study had 41 patients with atrophic and vanishing testis. The inguinal exploration was deferred in these cases. These boys will require testicular implant at puberty, when the excision can be done through the inguinal incision. Elder had observed that testicular vessels and vas entering a closed deep

inguinal ring suggest an atrophic testicular remnant, but if the deep ring is patent, a normal or hypoplastic testicle is likely to be found.<sup>8</sup> Following this principle, inguinal explorations were deferred in patients with atrophic testes.

It can be suggested that the management of nonpalpable testes depends strongly on the initial laparoscopic findings. Visualization of the vas and vessels seen to be entering the inguinal canal via the deep ring purports a groin exploration. If only a remnant testicular nubbin is discovered, then excision should be undertaken. Alternatively, if on laparoscopy, either the vas or the vessels stop in the abdomen or are absent or there is a blind-ending vas without vessels, no further operative procedure is necessary. If, following laparoscopy for bilateral nonpalpable testes, no functioning testicular tissue is discoverable, appropriate counseling and endocrinological opinion need to be taken. These children will be infertile and will even require medical induction of puberty. Testicular prostheses may be inserted at a postpubertal age. Sufficient length of the testicular vessels and cord should be ensured before attempting this single-stage procedure. In patients with insufficient cord length and nonpliable testicular vessels, laparoscopic Fowler–Stephens orchidopexy is the procedure of choice.<sup>1</sup>

In some intra-abdominal testes, after distal gubernacular division and dissection of peritoneum, it is perfectly possible to do a single-stage laparoscopic orchidopexy. In an index study after laparoscopy, 111 of the 193 nonpalpable testicular units were found to be intra-abdominal. Of these, 50 of the intra-abdominal testes underwent a single-stage laparoscopic orchidopexy, all of these testes were located within 2 cm from the deep inguinal ring with pliable testicular vessels. This group of patients was the most benefited by laparoscopy as accurate diagnosis as well as surgical correction was achieved in the same single sitting. Ismail et al. in their study did single-stage laparoscopic orchidopexy successfully in 26 testes of the 75 nonpalpable testes.<sup>4</sup>

Sixty-one of the intra-abdominal testes in our study were not amenable to single-stage orchidopexy as the testes were located beyond 2 cm from the deep ring with no pliable testicular vessels. For these patients, laparoscopic staged Fowler–Stephens procedure was done. Ferdous et al. in their series could manage 19 cases of the 69 cases with intra-abdominal testes laparoscopically without inguinal exploration by Fowler–Stephens technique.<sup>9</sup>

Fowler–Stephens in 1959 described the division of testicular vessels in the first stage, to aid mobilization, thereby leaving the testes to rely on collateral blood supply along the vas deferens. Testicular atrophy was seen in 50% of cases who underwent this procedure.<sup>10</sup> Ransley proposed a two-stage procedure in 1984, with an interval between vessel division and testicular mobilization. He showed promising results.<sup>11</sup> For the two-stage Fowler–Stephens technique, success rates as high as 88% have been reported by Denes et al.<sup>12,13</sup> However, they reported only 33% rate success using single-stage Fowler–Stephens surgery.<sup>14</sup> Elyas et al. in 2010 reported a higher success rate with two-stage Fowler–Stephens orchidopexy than the single-stage approach (85 vs 80%).<sup>15</sup> Chang et al. in 2001 reported an 85% success rate of laparoscopy for single-stage or two-stage management of nonpalpable testis which is similar to the rate in the index study.<sup>16</sup>

A newer technique of two-stage laparoscopic traction orchidopexy (SLTO) for the high intra-abdominal testis leading to elongation of the spermatic vessels was described by Shehata

in 2008. This technique allows the retention of the native blood supply in instances where there are doubts of vascularity with the Fowler–Stephens technique. Shehata proposes that the weight of the intestines over the pedicle leads to a gradual increase in length without spasm, intimal tear, or occlusion of spermatic vessels.<sup>17</sup> We are at present studying the efficacy of this new technique; however, these patients are outside the purview of the current series.

## CLINICAL SIGNIFICANCE AND CONCLUSION

We conclude that for the management of nonpalpable testes, laparoscopy is the gold standard. It is more cost-effective than radiological tests for the localization of intracanalicular and peeping testes that are not localized even on examination under anesthesia.

Single-stage orchidopexy is the treatment of choice for intra-abdominal testis lying within 2 cm from the deep inguinal ring with pliable testicular vessels, and two-stage surgery is required for intra-abdominal testis located beyond 2 cm from the deep inguinal ring or with nonpliable testicular vessels. However, testicular placement can be suboptimal with single-stage orchidopexy in older boys. Staged Fowler–Stephens orchidopexy has good results with minimal testicular loss.

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