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Management of boys with nonpalpable undescended testis

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SUMMARY

Cryptorchidism is one of the most common genitourinary disorders in young boys. Although the management of boys with palpable testis is standardized, there are no formal guidelines for the management of boys with nonpalpable testis. In this Review we look at the current trends in the diagnosis and treatment of this disorder, as well as the indications for therapy and surgical procedures. On the basis of current evidence, we find that there is no optimum orchidopexy technique for the treatment of intra-abdominal testis, although it is preferable to adopt techniques that preserve the spermatic vessels. We also briefly examine the follow-up of patients with this disorder and its common complications. As yet, there are no data that assess the potential of laparoscopic orchidopexy being a risk factor for impaired fertility later in life.

KEYWORDS laparoscopy, nonpalpable testes, orchidopexy, pediatrics

REVIEW CRITERIA

Information presented in this Review was found by searching MEDLINE for all articles pertaining to the management of boys with nonpalpable testes. Only published articles were selected for this Review. Keywords included in our search were "laparoscopy", "nonpalpable testis", "orchidopexy" and "pediatrics".

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Learning objectives

Upon completion of this activity, participants should be able to:

1 Describe the incidence of unilateral and bilateral undescended testis.
2 Describe the potential locations of undescended testis.
3 Identify the most reliable tests for the diagnosis of nonpalpable testis.
4 Describe the use of hormone therapy for undescended testis.
5 List techniques with highest success rates for treating nonpalpable undescended testis.

Competing interests

The authors, the locum journal editor N Siva and the CME questions author D Lie declared no competing interests.

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INTRODUCTION

Undescended testis (UDT) is one of the most common congenital abnormalities of the genitourinary system in young boys.[1–4] Approximately 1–2% of boys at the age of 1 year have a UDT, the disorder being unilateral in about 90% of cases and bilateral in about 10%, depending on the clinical series.[5–7] About 20% of UDTs are nonpalpable.[8] The testis can be located in the abdomen in some boys, but it might have been pushed into the upper inguinal canal: this disorder is termed 'peeping testis'.[9–11] In about half of the cases of nonpalpable testis (NPT), a testis is located in the abdominal cavity; the remainder are atrophic, either secondary to an antenatal torsion *in utero* or agenesis.[12–14]

Despite 15 years of international research on the topic, there are no guidelines on the management of boys with NPT. The management of boys with this disorder is still controversial, and in this Review we aim to summarize the current evidence that is available on the topic and provide an update on how best to manage NPT.

DIAGNOSTIC PROCEDURES

Several diagnostic modalities have been advocated for the assessment and diagnosis of NPT, such as CT or MRI, but only ultrasonography and laparoscopy have been adopted into routine practice.[15–17]

Although ultrasonography is simple, noninvasive and readily available in every district hospital, its use as a test to ascertain the presence or absence of an intra-abdominal testis (IAT) is extremely controversial because intestinal loops full of gas represent a barrier for ultrasound.[18]

Clinical examination

Assessing the presence of UDT requires careful physical examination. Occasionally, the testis is not palpable because it descends into an ectopic position; most commonly the testis lies superficial to the inguinal canal, but might be in front of the pubis, in the perineum or the upper thigh, and, therefore, it is important to extend the examination to include these locations.[11,19] Additionally, the child's anxiety about the examination might preclude the palpation of a testis distal to the internal inguinal ring (IIR).

If the testis remains clinically nonpalpable with the patient awake, a further examination of the patient under anesthesia allows palpation of a testis in about 20% of cases.[11] If the testis remains nonpalpable even after examination under general anesthesia, the surgeon may use laparoscopic exploration during the same procedure.[20]

Ultrasonography

In 1986, Weiss *et al.*[17] reported a series of 21 patients with NPT, in which the reliability of ultrasonography was as low as 12%. These authors stated that ultrasonography is not a satisfactory stand-alone screening modality for the management of NPT. About 20 years later, Stéfaniu *et al.*[21] reported that ultrasonography helped to identify only 45% of NPTs. There has been no improvement in ultrasonography for patients with NPT in the past few years; in fact, this examination is rarely used in such patients.[18] Considering that intestinal loops full of gas obstruct ultrasonography, this examination does not provide surgeons with additional information compared with palpation in a cooperative child.

In his 2002 review, Elder[18] concluded that ultrasonography is unnecessary to assess boys with NPT, and most of the recent studies concur with this statement.

The only indication for ultrasonography in patients with NPT is probably in those who are obese, when body habitus prevents the surgeon from palpation of a testis located in the inguinal canal, and particularly in uncooperative children.[4]

MRI

Other diagnostic modalities, such as CT and MRI, are nonspecific and do not preclude operative intervention.[22] MRI is not routinely used to localize NPT because it is not sensitive for IAT, and requires anesthesia in young children.[18,23]

Yeung and colleagues,[23] however, showed that gadolinium-enhanced magnetic resonance angiography (Gd-MRA) has a diagnostic sensitivity of 96% and a specificity of 100% for localizing a nonpalpable UDT. In our practice, we believe that this technique can be useful in the rare case of a child who has undergone multiple abdominal surgeries, since intra-abdominal adhesions might make laparoscopic exploration difficult and risky. Gd-MRA can probably also be useful in prepubertal patients with NPT and massive obesity.[23] The need for sedation in children is the main limiting factor in the expansion of its routine use for NPT.[11]

Laparoscopy

The laparoscopic technique consists of CO_2 insufflation into the abdominal cavity, and the introduction of a microcamera linked to a videomonitor. This technique can be advantageous because of the ability to magnify the picture and the zoom potential of the camera, allowing the surgeon a magnified view of the entire abdominal cavity.

This type of examination, however, always requires general anesthesia. There are three main laparoscopic findings possible: an IAT (40% of cases), intra-abdominal blind-ending cord structures (15% of cases) or cord structures entering the IIR (45% of cases).[5,24]

In the case of normotrophic IAT, the surgeon has to choose the best method of doing an orchidopexy.[25–27] If the testis is hypotrophic or atrophic, a laparoscopic orchiectomy should be performed.[28] In patients with blind-ending

cord structures (also called vanishing testis), there is no need for an open inguinal exploration.[12] When cord structures enter the IIR, some investigators prefer not to explore the inguinal canal;[4,8] however, most surgeons in this case prefer to perform an inguinal exploration to look for an ectopic or an intracanalicular atrophic testis, which can be a risk factor for testicular cancer.[29,30]An inguinal exploration is recommended in patients who are obese, particularly if cord structures enter the IIR, because these patients might have a small, normal testis in the inguinal canal.[30,31] Laparoscopic inguinal exploration should always be performed if the IIR is open, as an IAT might have been pushed into the inguinal canal as a result of the abdominal insufflation. In patients with a closed IIR, exploration can be done via open surgery.

The incidence of complications associated with laparoscopy in boys with NPT are rare; a recent study reported only one complication out of 412 boys (0.2%) who had surgery for this pathology.[19] However, it is important to remember that in order to avoid major complications secondary to trocar insertion, the first access should routinely be done by the 'open laparoscopy' technique.[19]

TREATMENT

Hormone therapy

There are two current protocols for hormonal treatment of UDT: the first one is based on gonadotropin-releasing hormone 1 (GNRH1) and the other on human chorionic gonadotropin (hCG).[7] Some protocols that use a combination of GNRH1 and hCG have been introduced, but their results for testicular descent are highly controversial.[32] The success rate reported for the treatment of UDT with hCG or GNRH1 varies between 6% and 75%. Hormone therapy seems to be more effective in older children (aged >5 years), in boys with bilateral pathology, and in those with retractile testes.[7,11,32]

Assessing the effect of hormone therapy is quite difficult because cohort studies of UDT include acquired variants, such as ascending or retractile testis.[32] In 2003, our group performed a prospective study that compared five different medical protocols for the management of patients with UDT (hCG alone; GNRH1 alone; urofollitropin alone; hCG plus GNRH1; hCG plus urofollitropin). The best success rate was 30%, with no statistically significant difference between hCG and GNRH1, alone or in association.[32]

Hormone therapy has shown generally poor results for the treatment of NPT, although there might be an indication for this therapy in bilateral NPT.[7,32] Schwentner *et al.*[33] reported that after hormone therapy for bilateral NPT, one or both testes became palpable in about 15% of cases.

Sahin *et al.*[34] hypothesize that hormone therapy improves fertility by enhancing germ-cell maturation and increasing germ-cell number. Hormone therapy might, therefore, be indicated preoperatively, but only in the case of bilateral NPT.

Surgical options

The surgical procedures for the treatment of IAT can be performed laparoscopically or via open surgery through an inguinal incision.[35,36] Both these options might be accomplished with or without spermatic vessel ligation.[4,37] Our current algorithm for the management of IAT is shown in Figure 1. To perform a laparoscopic orchidopexy, three ports are needed: a 3 or 5 mm umbilical trocar for the camera and two 3 mm ports for the operative instruments.[25,38] Only a surgeon who has mastered laparoscopic skills can freely choose whether to perform the orchidopexy by laparoscopy or by open surgery; however, for the past 10 years laparoscopy has been considered the gold-standard procedure for assessing a boy with NPT.[12]

Standard open orchidopexy

In patients with unilateral NPT, some surgeons prefer to do a standard inguinal incision, with lateral extension if necessary.[11] If the testis is not found within the inguinal canal, the IIR is immediately opened.[39] In most patients whose testis is in an abdominal location, it can be found near the IIR.[11] If the testis is in a high abdominal position or near the bladder, the inguinal approach is usually unsuccessful because it does not provide a sufficiently ample view of the abdominal cavity to correctly localize the testis.[16] Ideally, the testicular blood supply should be preserved whenever possible. If the testicular vessels are too short, a two-stage orchidopexy (also called staged orchidopexy), without sectioning the vessels, is recommended.[11] The standard staged orchidopexy involves mobilizing the abdominal testis and fixing it as low as possible (e.g. at the pubic tubercle or inguinal ligament), then performing the second stage procedure 6–12 months later.[4] The advantage of this procedure is that the testicular artery is preserved; the disadvantage is that, during the

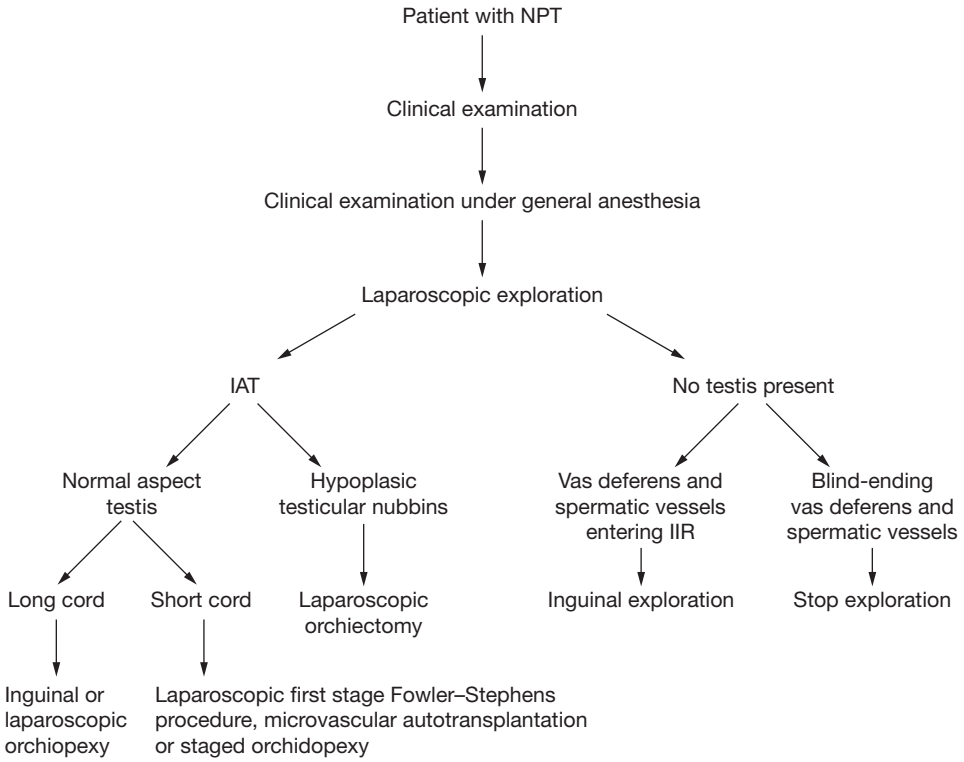

Figure 1 Algorithm for a suggested approach to patients with NPT. Abbreviations: IAT, intra-abdominal testis; IIR, internal inguinal ring; NPT, nonpalpable testis.

second stage, the reproductive tract (including the vas deferens and epididymis), as well as the testicular blood supply, might be injured.[4] A Fowler–Stephens procedure can also be performed as open surgery;[40] however, most authors believe that inguinal exploration is an unreliable method in boys with NPT because of the limited view of the abdominal cavity. For this reason, most would recommend that laparoscopy be performed as the initial diagnostic maneuver of choice in patients with NPT.[16] On the other hand, some researchers advocate inguinal exploration first, proceeding to laparoscopic exploration only in cases of absent inguinal structure.[14]

One-step Fowler–Stephens procedure

Fowler–Stephens orchidopexy is used in boys with IAT in whom the testicular artery and veins are too short to allow the testis to reach the scrotum with a standard orchidopexy.[13] If the testis is located more than 3 cm from the ipsilateral IIR, a Fowler–Stephens procedure is typically indicated.[8,41]

The Fowler–Stephens technique involves clipping and transecting the testicular vessels. Ideally, there is sufficient collateral arterial flow through the deferential (vasal) artery to allow the testis to survive.[13] This procedure can be done in one or two stages.[27] In addition, the Fowler–Stephens procedure can be permormed in open or laparoscopic surgery.[30] When this technique is performed as a single-stage procedure, the spermatic vessels are isolated, ligated (or clipped) and sectioned at least 3–4 cm away from the testis, allowing the testis to be placed in the scrotum without tension.[40] The testis remains viable owing to the vascularization derived from the deferential vessels.[41] The main disadvantage of this single-stage procedure is that the deferential artery might be so small that, if it goes into vasospasm, testis atrophy is very probable.[12,25,30]

Two-step Fowler–Stephens procedure

Most pediatric surgeons choose to perform the Fowler–Stephens procedure in two steps to reduce the risk of vasospasm of the spermatic vessels.[32] During the first step, the spermatic vessels are clipped 3–4 cm proximally to the testis.[42] The second step of the Fowler–Stephens procedure

is done 3–6 months later.[32] This interval is necessary for the improvement of the collateral circulation derived from deferential vessels. Both steps can be done as a laparoscopic procedure.[10] During the second step, spermatic vessels are divided between the clips and the testis is brought down into the scrotum.[1,10]

Laparoscopic-assisted orchidopexy

Laparoscopic-assisted orchidopexy preserves the spermatic vessels. The technique consists of dividing the gubernacular attachment and mobilizing the testicular vessels and the vas deferens from the posterior peritoneum by 8–10 cm.[25] At the end of the dissection, the testis is free from attachments to the posterior abdominal wall while the tissue between the spermatic vessels and the vas deferens remains intact.[43] At this point, the testis is brought down into the scrotum. If the IIR is closed, a neoinguinal ring is created medially to the inferior epigastric vessels and the obliterated umbilical artery.[25] This maneuver is also used in the case of a short cord and open inguinal ring in order to shorten the pathway for externalization of the testis (Prentiss maneuver).

Microvascular orchidopexy

Since Silber and Kelly's first description in 1976, microsurgical testicular autotransplantation has not been adopted by many surgeons for several reasons, including the long duration of the operation and the need for microsurgical skill and special instrumentation.[30,44] In general, this procedure is indicated when testicular vessels are too short for laparoscopy.[44,45] As to the technical details, this technique involves division of the testicular vessels and microscopic vascular anastomosis of the testicular artery and vein to the inferior epigastric vessels.[12,35] The use of microvascular orchidopexy has been reported from only a few centers, because the other procedures described previously seem easier and more efficacious.[30] In experienced hands, microvascular orchiopexy has a success rate of about 80%.[12,30]

Laparoscopic orchiectomy

If the surgeon finds a hypotrophic or atrophic IAT during laparoscopic exploration, the best therapeutic choice is to perform a laparoscopic orchiectomy.[4] Orchiectomy must be done in the postpubertal boy with an IAT and a contralateral descended testis.

The spermatic vessels are separated from the posterior peritoneum, and are then cauterized, ligated, or clipped and divided. The testis is removed through one of the port sites.

Surgical management of bilateral IAT

In patients with bilateral NPT, karyotyping and hormonal work-up is necessary to confirm the presence or absence of testicular tissue. If this work-up confirms the absence of testis, no laparoscopic or surgical exploration is needed.[46] If the hormonal work-up confirms the presence of testicular tissue, then laparoscopy is well suited for management.[1] If laparoscopy detects only one viable testis, the disorder is managed as a unilateral testis, with the aim being preservation of the main vascularity of the gonad.[27]

In the case of bilateral viable testis located in the abdominal cavity, the most popular approach is a unilateral orchidopexy during the first operation, with the contralateral orchidopexy performed 6–12 months later.[2] This solution allows the possibility to check the outcome of the first side before proceeding on the other side.[4,47] As for the surgical technique to adopt, bilateral UDT can be treated with any one of the previously described techniques. When no testicular structures are evident on laparoscopy, the patient should be referred to a pediatric endocrinologist for hormone replacement therapy.

Clinical evidence

Outcomes of orchidopexy are mainly assessed by testicular position and size.[12] Other factors that should be assessed later in life include fertility and risk of testicular cancer.[48,49]

Testicular atrophy or hypotrophy are the most important complications of orchidopexy, and occur when testicular vascularity is unable to maintain the testis viability.[30,50] Ischemic injury that leads to testicular atrophy can be secondary to one or more of the following factors: aggressive skeletonization of testicular vessels, postoperative edema, inflammation, and undue tension on the spermatic vessels.[2,48,50]

It seems that the more proximal the anatomical position of the testis, the lower the success rate in achieving a viable scrotal testis.[12] The clinician should understand, however, that not all abdominal testes can be managed with the same technique.[25] The results of studies that used the different orchidopexy techniques for NPT are shown in detail in Tables 1–5.

In 1995, Docimo[12] reported an 81.3% success rate for open orchidopexy in patients with

Table 1 Success rates of standard open orchidopexy for intra-abdominal testis.

Study	Number of testes	Success rate (%)
Docimo (1995)[12,a]	80	81.3
Kirsch *et al.* (1998)[4]	33	97
Dhanani *et al.* (2001)[28]	28	100

[a]Results are based on a literature review.

Table 2 Success rates of one-step Fowler–Stephens orchidopexy for intra-abdominal testis.

Study	Technique	Number of testes	Success rate (%)
Docimo (1995)[12,a]	Open	321	66.7
King (1998)[40]	Open	22	95.4
Kirsch *et al.* (1998)[4]	Open	33	74
Chang *et al.* (2001)[2]	Laparoscopic	20	85
Baker *et al.* (2001)[50]	Laparoscopic	20	74.1
O'Brien *et al.* (2004)[41]	Open	22	82

[a]Results are based on a literature review.

Table 3 Success rates of two-step Fowler–Stephens orchidopexy for intra-abdominal testis.

Study	Technique	Number of testes	Success rate (%)
Elder (1992)[10]	1st step laparoscopic, 2nd step open	12	92
Docimo (1995)[12,a]	1st step laparoscopic, 2nd step open	56	76.8
Law *et al.* (1997)[42]	1st step laparoscopic, 2nd step open	20	95
Esposito and Garipoli (1997)[8]	Both steps laparoscopic	33	100
Baker *et al.* (2001)[50]	Both steps laparoscopic	50	87.9
Dhanani *et al.* (2001)[28]	1st step laparoscopic, 2nd step open	55	98
Radmayr *et al.* (2003)[47]	Both steps laparoscopy	29	93
El-Gohary (2003)[37]	Both steps laparoscopy	31	77.4
Stéfaniu *et al.* (2004)[21]	1st step laparoscopic, 2nd step open	56	78.5

[a]Results are based on a literature review.

IAT. Using an inguinal incision and extensive retroperitoneal vascular mobilization, more recent series have demonstrated an even higher success rate. On the other hand, open-staged orchidopexy has a success rate of 64–71%.[12,30]

The success rate of the one-step Fowler–Stephens procedure is between 67% and 100%, but most studies report good results in less than 85% of patients.[2,30,50] This variation might depend on whether the ligation of the spermatic vessels was done as a planned procedure early in the operation or as a salvage procedure once extensive dissection had been done.

Theoretically, the two-stage Fowler–Stephens procedure should have a higher success rate compared with the one-stage Fowler–Stephens procedure.[1] In the review by Docimo,[12] the success rate of the two-step Fowler–Stephens procedure was 77%; however, more recent studies show success rates of 95% or more.[30] Laparoscopic-assisted orchidopexy has become the procedure of choice for many practitioners because it reproduces the same technique as in open surgery while preserving the original vascularity of the testis.[30]

In a series of patients from 10 different centers, Baker *et al.*[50] reported a 97% success rate with a

Table 4 Success rates of laparoscopic-assisted orchidopexy for intra-abdominal testis.

Study	Number of testes	Success rate (%)
Poppas and Lemack (1996)[20]	10	100
Lindgren *et al.* (1998)[43]	31	93
Esposito *et al.* (2000)[25]	20	95
Baker *et al.* (2001)[50]	140	97
Chang *et al.* (2001)[2]	72	92
Radmayr *et al.* (2003)[47]	28	100
El-Anany *et al.* (2007)[24]	44	91.3

Table 5 Success rates of microvascular autotransplantation orchidopexy for intra-abdominal testis.

Study	Number of testes	Success rate (%)
Docimo (1995)[12,a]	86	83.7
Bukowski *et al.* (1995)[35]	27	96
Tackett *et al.* (2002)[31]	17	88.2

[a]Results are based on a literature review.

single-stage laparoscopic orchidopexy, without division of the testicular vessels. Other studies that report the use of this procedure also show a success rate consistently above 92%, although most report a success rate of 95–100%.[2,28,46] Only a few studies have focused on microvascular orchidopexy, with success rates reported in the range 83–96%.[12,30,47]

The main criticism of these studies is that most authors checked the position of the testis with only a clinical examination, and only a few centers adopted ultrasonography or color Doppler ultrasonography to determine the structure and vascularity of the testis postoperatively.[25]

There are few data in the studies regarding the fertility rate and the possibility of developing testicular cancer in patients with NPT. These children should be followed up in the first month after surgery to check postoperative outcome, and then receive yearly assessments until puberty to check testicular size.

DISCUSSION

When reviewing the results of the different techniques adopted to manage boys with NPT, we must keep in mind the wide variability of studies and criteria chosen by each author to judge the results achieved. The meta-analyses published by Docimo[12] and then by Taran and Elder[30] perfectly indicate the lack of uniformity in defining success rates according to the type of operation. To date, there is no sound evidence on this topic from studies of pediatric surgery, as there are no randomized or prospective studies focused on the management of boys with NPT.

Despite the difficulty in finding evidence-based data on this topic, some clear points do exist. First of all, most authors consider laparoscopy as the best method of exploring NPT because it enables the surgeon to better plan the orchidopexy procedure.[2,50] Another point of evidence is that, in the case of intra-abdominal atrophic or hypotrophic testis, laparoscopic orchiectomy is considered the procedure of choice.[12]

By contrast, in cases of normotrophic IAT, it is difficult to find evidence that supports a single, optimum operative technique; however, laparoscopic-assisted orchidopexy seems to be better than other procedures for correctly placing the abdominal testis in the scrotum.[47,50] In general, it is preferable to choose procedures that spare the spermatic vessels, which should reduce the risk of damaging germ-cell lines as a result of temporal reduction in testicular vascularity.[12,30]

The importance of correct follow-up to verify the status and position of the testis and to identify hypotrophy or atrophy related to the procedure cannot be overstated.[47,48] For scientific accuracy, proper follow-up, including color Doppler ultrasonography, is preferable.

From a technical point of view, one of the most debated issues is the difficulty of assessing the length and mobility of the spermatic cord in cases of IAT. In fact, the cord is usually considered sufficiently long to perform the orchidopexy without dividing the vessel, only to find, at the end of dissection, that the cord is relatively short and vessel division would have been a good option.[8,25]

In the exceptional cases of unilateral, viable IAT with a short cord and uncertain deferential vascularization, we would recommend fixing the testis somewhere outside the abdomen where the spermatic vessels are not under tension, for example in the inguinal or iliac regions. This approach avoids the risk of atrophy and allows easy follow-up with ultrasonography.

As for the long-term follow-up of patients with a history of IAT, two important aspects should be analyzed; fertility outcome and the risk of testicular cancer. Despite there being few studies on these topics, certain comments can be made. Regarding fertility, men with a history of cryptorchidism have an increased risk of infertility.[48] Variables that are associated with infertility include age at orchidopexy, original position of the UDT and the technique of orchidopexy adopted. Infertility in men who were formerly cryptorchid might be caused by impaired germ-cell maturation; however, in rare cases, infertility might also be iatrogenic, potentially from injury during orchidopexy or from an associated congenital abnormality of the ductal system, which is present in up to one-third of UDTs.[12,47]

Orchidopexy at an early age is assumed to improve the likelihood of fertility.[50] Performing the orchidopexy at age 2–5 years, as happened in a few studies, is probably too late; doing the procedure before the age of 1 year might increase the chances of fertility.[30] As for the current management of NPT, the miniaturisation of laparoscopic instruments, which have a diameter as small as 3 mm, enable laparoscopic exploration and orchidopexy to be safely performed by an experienced laparoscopic surgeon in patients aged 1 year or younger.[25]

Another interesting point to consider in boys with a history of surgery for NPT is the risk of developing cancer. UDT is a well-established risk factor for testicular cancer, with the reported relative risk ranging from 3.7 to 7.5.[49] Although there is considerable variation in the literature, in general, 10% of the gonadal remnant located in the inguinal canal contains viable testicular tissue; this finding justifies the exploration of the inguinal canal in case the cord structure enters it.[48] Furthermore, an intratubular germ-cell neoplasm has been reported in the testicular remnant of a 9-year-old boy.[48] For this reason, we think that in the 45% of boys with NPT who present with the cord entering the IIR, it is wise to explore the inguinal canal by open surgery or by laparoscopy to remove any testicular nubbin, which might have the potential for malignant degeneration.[29]

CONCLUSIONS

On the basis of an extensive literature review, diagnostic laparoscopy seems to be the gold-standard technique for the management of boys with NPT on physical examination. When spermatic cord structures enter the IIR, and if the IIR is closed, it might be best to explore the inguinal canal with open surgery to find and remove any gonadal remnant; if the inguinal ring is open, the canal can be explored by laparoscopy. As for the operative management of IAT, the inner spermatic vessels should be preserved whenever possible to guarantee vascularization of the testis and ensure a high level of surgical success. In the absence of long-term results on the fertility of patients who have undergone the Fowler–Stephens procedure, preservation of the main vessels should be attempted whenever possible. In the rare cases of very high IAT, with a distance between the testis and the IIR greater than 3 cm, a laparoscopic Fowler–Stephens procedure should be performed. Long-term follow-up of such patients with ultrasonography is strongly advised to check the viability of the testis after orchidopexy.

KEY POINTS

- Undescended testis is one of the most common congenital abnormalities of the genitourinary system; about 20% are nonpalpable
- Ultrasonography is unnecessary in most cases of unilateral nonpalpable testis
- Diagnostic laparoscopy seems to be the gold standard for the exploration for nonpalpable undescended testicles
- On the basis of current evidence, there is no optimum orchidopexy technique for the treatment of intra-abdominal normotrophic testis, although empirically it is preferable to adopt techniques that spare the spermatic vessels
- There is a need for long-term follow-up and multicentric prospective studies that evaluate the various laparoscopic approaches

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