Lapaoscopy, as a diagnostic and therapeutic tool in the management of patients with nonpalpable testes

دور المنظار كاداة تشخيصية و علاجية في علاج مرضى الخصى غير المحسوسة

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Abstract

Background: So far there is much debate as to the next move to be done when nonpalpable testes (NPT) are encountered. Some advocate imaging methods as ultrasonography (US), CT, or MRI. However, none of these has demonstrated to be 100% dependable in predicting the presence or absence of a testis. On the other hand, laparoscopy can be diagnostic and therapeutic as well. **Methods:** 28 patients with 39 NPT were enrolled. A preoperative US and MRI were performed for all patients followed by laparoscopic exploration. **Results:** Of the 39 NPT, 23 (59%) were intra-abdominal. Seventeen (44%) of these were viable intra-abdominal and underwent orchidopexy, 6 (15%) were atretic and eventually excised, while 8 (20.5%) were absent or vanishing. In contrast, 8 (20.5%) testes were found to be inguinal, three (7.7%) of them were viable, and 5 (12.8%) were atrophic, and ultimately excised. US localized 17 (43.6%) of these nonpalpable testes, while laparoscopy localized 31 (79.5%) testes, with a P-value of <0.01. In comparison to laparoscopy, MRI localized only 21(53.8%) of these testes with a P-value of < 0.05. Overall, the sensitivity, specificity, and accuracy of US and MRI were (54.8%, 12.5%, and 46.1%), and (67.7%, 50%, and 64.1%) respectively. Seven viable intra-abdominal testes (18%) were fixed with one-stage orchidopexy, and 10 (25.6%) testes were fixed with two-stage orchidopexy. Three viable inguinal testes (7.7%) underwent inguinal orchidopexy. Totally 11 (28.2%) testes were excised (6 intra-abdominal and 5 inguinal), while eight testes (20.5%) were vanishing. Additionally 4 hernias (10.3%) were simultaneously repaired inguinally. **Conclusion:** Neither US nor MRI correctly localize a true NPT. In contrast, laparoscopy is safe, precise, and aids in subsequent surgical planning.

Key words: nonpalpable testes, laparoscopy, ultrasound, MRI

الخلاصة

المقدمة: لحد الأن هنالك الكثير من الجدل حول الخطوة القادمة التي يجب اتخاذها عندما نواجه حالة الخصية الغير محسوسة.البعض ينصح باستعمال طرق التصوير مثل التصوير بالامواج فوق الصوتية و الرنين المغناطيسي والمفراس الحلزوني. على الرغم من ذلك،ولا واحدة من هذه الطرق تبينت انها معتمدة 100% في توقع وجود او عدم وجود الخصية، من ناحية اخرى من الممكن ان يكون الناظور تشخيصي وعلاجي بنفس الوقت.

الطرق:28 مريض كانت لديهم 39 خصية غير محسوسة سجلوا في هذه الدراسة.جميعهم اجري لهم التصوير بالموجات فوق الصوتية والرنين المغناطيسي، بعدها اجري لهم الناظور التشخيصي.

النتائج: من 39 خصية غير ملموسة، 23(59%) كانت داخل البطن، 17(44%) منها كانت حية وخضعت لعملية تنزيل خصية، 6(15%) كانت مضمحلة وتمت ازالتها، بينما 8(20.5%) كانت غير موجودة او متلاشية. من ناحية اخرى 8(20.5%) منها كانت مغبنية، 3(7.7%) كانت حية و 5(12.8%) كانت مضمحلة وبالتالي تمت ازالتها. التصوير بالموجات فوق الصوتية حدد موقع 17(43.6%) من الخصى، بينما الناظور استطاع تحديد موقع 31(79.5%) منها(P<0.05)

بالمقارنة بالناظور الرنين حدد موقع 21 (53.8%) من الخصى فقط (P<0.05)عموما ،الحساسية والخصوصية والدقة للسونار والرنين كانت (54.8% ،12,5% ، 46.1%) و(76,7%، 50 %، 64,1%) على التوالي. سبعة من الخصى الغير ملموسة (18%) تم تثبيتها بمرحلة واحدة، وعشرة (25,6%) ثبتت بمرحلتين لتنزيل الخصية ، ثلاثة(7.7%) من الخصى مغبنية حية اجري لها تنزيل خصية مغبني. بصورة اجمالية 11(28.2%) من الخصى تمت ازالتها (ستة منها داخل البطن و5 مغبنية)، بينما 8(20,5%) من الخصى كانت متلاشية. بالاضافة لهذا اربعة فتوق (10.3%) تم تصليحها بنفس الوقت في المنطقة المغبنية.

الاستنتاج: لا التصوير بالامواج فوق الصوتية ولا الرنين المغناطيسي تمكن بصورة صحيحة من تحديد موقع الخصية الغير ملموسة، وبالمقابل، الناظور امين، دقيق، ويساعد في التخطيط الجراحي اللاحق

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Background

An undescended testis is one of the commonest occurring genital anomalies encountered in the field of pediatric surgery [1]. Undescended testis in adults is seldom seen in developed countries. In general, the majority of patients with undescended testes are recognized and treated in childhood. Nevertheless, we still see adults with undescended testicles especially in our circumstances due to the inaccessibility of healthcare and various other socioeconomic reasons [2 & 3]. In undescended testes, the testis fails to move into the processus vaginalis. In doing so, it consequently fails to reach the scrotum at 35 weeks of gestation. It is unilateral in roughly 70% of cases and bilateral in the other 30%. Approximately 1% of full-term and 20% of premature boys have failure in testicular descent [4]. Undescended testes are associated with progressive loss of germ and Leydig cells. There is a 2% risk of severe germ cell loss and 1% risk of Leydig cell depletion for each month a testis remains undescended [5]. Although cryptorchidism involves around 1% of male births, nonpalpable testes (NPT) on physical examination comprises only 20% of all cases of cryptorchidism. Many reasons account for this fact. The testis may be absent (anorchia), the testis may be located in the scrotum or inguinal canal, but is quite atrophic or the patient is obese, or the testis may be situated within an indirect hernial sac, consequently the testis is interchangeably inguinal or intraabdominal in position. Lastly, it is in a true intraabdominal position [6].

Natural descent after the first year of life is uncommon. Deferring management of cryptorchidism has detrimental impact on the testis over time, with increased risk of malignancy. Consequently, prompt treatment of NPT is vital to decrease the chance of subfertility and to permit reasonable follow-up for potential risk of testicular tumours [7].

Given that clinical examination by palpation is rather subjective; its accuracy is quite doubtful in localization of the testis. So far there is much debate as to the next move to be done when clinical examination fails to identify a testis. Some advocate noninvasive imaging methods such as ultrasonography (US), CT, or MRI [8]. However none of these has demonstrated to be 100% dependable in predicting the presence or absence of a testis [9]. Diagnostic laparoscopy has become the gold standard as a diagnostic procedure for identifying the exact anatomy of impalpable testes. Moreover it can be therapeutic at the same time [10]. Although the treatment of patients with palpable undescended testes is obvious and undemanding, there are generally no main principles and there is substantial controversy in the management of patients with impalpable testes [11 & 12].

Patients and methods

This prospective study was conducted at University of Kufa from February 1, 2009 to December 1, 2013 over a total period of 58 months Twenty-eight patients with 39 nonpalpable testes who were referred to Al-Sadar Teaching Hospital and Al-Ghadeer Private Hospital for surgery were enrolled. A proper physical examination is then carried out and those with impalpable testes were enrolled in this study.

Most patients were referred by general practitioner, a paediatrician, a urologist or, occasionally, by a paediatric surgeon, who performed the first examination. The patients were examined in the supine position, with exposure of both groins and upper thighs. Palpation of the inguinal canal down to the ipsilateral hemiscrotum is meticulously carried out. If no palpable testis is discovered, every effort is made to clear the inguinal canal by performing a gentle scrotal-directed movement with the fingertips of the examining surgeon. A palpable testis may be felt at the level of the external inguinal ring. If this went in vain, the thigh, perineal area, the base of the penis are next thoroughly checked to rule out an ectopic testis.

A preoperative ultrasound and MRI examinations were performed for all patients with a view to localize the testes, by three different radiologists. Subsequently all boys were clinically re-assessed by the laparoscopic surgeon preoperatively and on operative table to review the imaging results.

Thereafter, these patients underwent laparoscopic examination. Laparoscopy was done in Al-Sadar Teaching Hospital and Al-Ghadeer Private Hospital. All patients underwent general anesthesia.

Laparoscopy was performed in all instances with the closed technique to obtain pneumoperitoneum through supraumbilical stab wound utilizing a Veress needle for CO_2 insufflation

A 30° angled Karl Storz laparoscope (Occasionally a 0° angled laparoscope according to availability) was used with the patient in a 30° head down tilted position. A 3-port technique was used, a 10-mm supraumbilical port for the camera, (occasionally 7-mm for 7-mm camera), and a 5-mm port to the right or left of the umbilicus lateral to the semilunar line depending on the site of the involved testis, was used as the working port. This is changed to 10mm port for introduction of 10mm clipper, in case, orchiectomy is considered or clipping the vessels in the two stage Fowler-stephens procedure. Another variably-sited 5-mm port was inserted according to patient body habitus and surgeon preference for grasping the testis during orchiectomy or orchiopexy. Commonly the suprapubic region or the opposite iliac fossa were selected. However in cases of bilateral intraabdominal testes, both ports were placed at the level of the umbilicus. Both sides are thoroughly inspected by the laparoscope. Normally the testicular vessels entering the pelvis and the vas deferens coming out of the pelvis meet in an inverted V-shaped manner. This inverted V was best identified on the normal side in order to become familiar with the anatomy of the region. Attention was then focused on the affected side where the findings could be classified into the following four types on the basis of the location and viability of the testes: intraperitoneal viable testes, intraperitoneal nonviable testes (including vanishing testes), extraperitoneal viable testes, and extraperitoneal nonviable testes. With the exception of intraperitoneal nonviable testes and the two stage Fowler-Stephens procedure, an exploratory inguinal incision on that side was performed to deliver the testes to the corresponding hemiscrotum, or to excise an atophic inguinal testis. Different operative procedures were used. Intraperitoneal viable testes are treated by single or two-stage orchiopexy depending on its distance from the deep ring. Those with testis distance < 2.5 cm from the deep ring are treated by one-stage orchidopexy, while those with distance > 2.5 cm from the deep ring are treated by two-stage orchidopexy (Fowler-Stephens approach). Prentiss's maneuver is performed in all of those patients to get an extra length to reach the scrotum. This maneuver involves creation a nonanatomical course for the descent of the intra-abdominal testis into scrotum, through the medial fossa medial to the inferior epigastric vessels. Testicular absence (anorchia) manifested by blind-ending vessels and vas near the deep ring or atrophied vanishing testes were treated by orchidectomy, and specimen was sent for histopathological examination. If the vas deferens and testicular vessels are observed piercing the internal inguinal ring (canalicular testis), inguinal exploration is next performed, as in ordinary undescended testis, where viable inguinal testes are moved down, and fixed in the ipsilateral hemiscrotum. Nonviable or vanishing inguinal testes are excised and sent for histopathological examination. Hernia present in a subset of the patients was also visualized and treated simultaneously. A single perioperative dose of a third generation cephalosporin (ceftriaxone) is given to all patients with no allergy to cephalosporines at induction of anesthesia. Oral feeding is started, once ileus is resolved usually within 24-48 hours. Most patients are discharged in 24-48 hours, whereas those with inguinal orchidopexy are discharged on the same day.

Statistical analysis is done using SSPS 20 with p value <0.05 considered significant.

Results

During the study, 28 patients with 39 nonpalpable testes underwent laparoscopic examination. Age of patients ranged from 2-35 years. Nine patients had right NPT, 8 patients had left NPT, and eleven patients had bilateral NPT, with a total of 39 NPT (20 right NPT and 19 left NPT). Of the 39 NPT, 23 (59%) were intra-abdominal. Seventeen (44%) of these were viable intra-abdominal and underwent orchidopexy, 6 (15%) were atretic and eventually excised, while 8 (20.5%) were absent or vanishing. In contrast, 8 (20.5%) testes were found to be inguinal, three (7.7%) of them were viable, and 5 (12.8%) were atrophic, and ultimately excised.

US localized 17 (43.6%) of these nonpalpable testes, while laparoscopy localized 31 (79.5%) testes, with a P-value of <0.01. In comparison to laparoscopy, MRI localized only 21(53.8%) of

these testes with a P-value of < 0.05. The remaining 8 (20.5%) testes were considered as vanishing testis (anorchia) by laparoscopy.

Of those truly localized by US, 13 (33.3%) were intraabdominal, and 4 (10.3%) were inguinal. It truly diagnosed one testis (2.5%) as vanished. It failed to localize 14 (35.9%) testes. Additionally, it falsely localized 7 (18%) testes as 6 (15.5%) intraabdominal testes and one (2.5%) inguinal testis.

Comparing the US results with the surgical findings, there was a 68.4% positive predictive value (PPV) for the intra-abdominal testes seen on US, as only 13 were true intraabdominal and 6 were either lymph nodes or other masses. Nevertheless, 10 viable intraabdominally located testes were missed by US, and further localized by laparoscopy (Table 1).

Additionally US has PPV of 80% for inguinal testes, as only 4 testes were truly inguinal and one was intraabdominal (falsely localized as inguinal). US missed 4 testes in the inguinal canal, which were later diagnosed by laparoscopy when both vas and gonadal vessels were seen entering the deep ring. Overall, the sensitivity and specificity of US were 54.8%, and 12.5% respectively with a diagnostic accuracy of 46.1% (Table 1).

Table 1: Testicular localization by US versus laparoscopy

Testicular localization	US	Laparoscopy	P-value
Truly Localized	17 (43.6%)	31 (79.5%)	<0.01
-Intra-abdominal	13 (33.3%)	23 (59%)	
-Inguinal	4 (10.3%)	8 (20.5%)	
-Falsely localized	7 (18%)	0	
Not localized	15 (38.4%)	8 (20.5%)	<0.01
- Truly vanished	1 (2.5%)		
-Falsely not localized	14 (35.9%)		
Total	39	39	

Of those truly localized by MRI (21 testes), 15 (38.4%) were intraabdominal, and six testes (15.4%) were inguinal. It failed to localize 10 (25.6%) testes. Additionally it falsely localized four testes (10.3%) as intraabdominal found to be enlarged iliac lymph nodes (truly vanishing on laparoscopy) (Table 2).

Comparing the MRI results with the surgical findings, MRI had a PPV of 84% and a NPP of 28.6%. Overall, MRI has a sensitivity, specificity and accuracy of 67.7%, 50%, and 64.1% respectively (Table2).

Table 2: Testicular localization by MRI versus laparoscopy.

Testicular localization	MRI	Laparoscopy	P-value

Truly Localized
  -Intra-abdominal
  -Inguinal
	21 (53.8%)
	15 (38.4%)
	6 (15.4%)
		31 (79.5 %)
		23 (59%)
		8 (20.5%)
			0.01

Falsely localized	4 (10.3%)	0	

Not localized
  - Truly vanished
  - Falsely not localized
	14 (35.9%)
	4 (10.3%)
	10 (25.6%)
		8 (20.5%)
		8 (20.5%)
		0
			0.01

Total	39	39	

In regard to the operative procedure, seven viable intra-abdominal testes (18%) were fixed with one-stage orchidopexy, and 10 (25.6%) testes were fixed with two-stage orchidopexy. Six atrophic testes (15.4%) were excised. Three viable inguinal testes (7.7%) underwent inguinal orchidopexy, and the remaining 5 atrophic inguinal testes (12.8%) were excised. Totally 11 (28.2%) testes were excised (6 intra-abdominal and 5 inguinal), while eight testes (20.5%) were vanishing, and nothing more was done. Additionally 4 hernias (10.3%) were noticed, and were simultaneously repaired inguinally (Table 3).

The duration of the procedure was 30 to 90 minutes. Mean in-hospital stay was 1.2 days. No major visceral or vascular complications were observed. Urine retention occurred in one patient with bilateral laparoscopic orchidopexy, and was treated with short term catheterization. Inguinal wound hematoma occurred in one patient and scrotal hematoma in two patients, and both were treated conservatively. One patient developed paralytic ileus, which resolved spontaneously on conservative measures.

Diagnostic laparoscopy affords the surgeon not only the ability to localize the testis with visual certainty, but also the advantage of planning a highly successful treatment program.

Table 3: Operative results

Operative procedure	No. of testes (%)

Laparoscopic orchidopexy
  -One stage
  -Two stage
	17 (43.6%)
	7 (18%)
	10 (25.6%)

Inguinal orchidopexy	3 (7.7%)

Orchidectomy
  -Laparoscopic
  -Inguinal
	11 (28.2%)
	6 (15.4%)
	5 (12.8%)

Nil (Anorchia)	8 (20.5%)
Hernia repair	4 (10.3%)

DISCUSSION

Reproduction has always been of vital significance, yet undescended testis had plagued many poor patients with low education and poor understanding of the risk of infertility.US, CT scan, and MRI imaging fluctuate in the diagnostic results for nonpalpable testes from 32.1% to 67.0% [13]. Since Cortesi et al first described laparoscopy as a diagnostic tool for impalpable testes, laparoscopic orchiopexy and orchiectomy have gained considerable support and are used frequently [14-17].

The main benefit of laparoscopy lies in the fact that it can be used as a diagnostic tool that can be converted immediately into a therapeutic tool when needed. It is inacceptable to leave the intraabdominal testis untreated, unless it is a vanishing testis. Another benefit of laparoscopic surgery is that surgery can be done minimally invasively with few holes and a small inguinal incision. Traditional orchiopexy cannot produce optimal results in the case of intraabdominal testis, as the testicular vessels are short and satisfactory lengthening is not feasible. One- and two-stage laparoscopic Fowler-Stephens orchiopexy have been used successfully in pediatric patients [18].

Although US remains the commonest investigation sent by surgeons and pediatricians in a child with NPT, it has a modest efficiency in localizing NPT and is operator-dependent. This study confirmed the low sensitivity, specificity, and accuracy of US in localizing NPT (54.8%, 12.5%, and 46.1% respectively). These findings were comparable to the results of Pekkafali et al. [19], and Elder [20] et al who have established the restricted role of US in the management of NPT. Similar observations were declared by Shah and Shah [21] who showed that the whole diagnostic impact of US is only marginally beneficial in managing patients with NPT, and Tasian and Copp [22] who verified a poor value of US in children with NPT. Nonetheless, this is different from earlier results by Kanemoto et al. [23], and Wolverson et al. [24], who reported an US accuracy of almost 84-91%.

This study showed modest efficacy of MRI in the diagnosis of NPT with a sensitivity, specificity, and accuracy of 67.7%, 50%, and 64.1% respectively. This is similar to the results of Shah and Shah who reported showed the overall diagnostic agreement of MRI with laparoscopy in 52% of cases. Others declared higher efficiency of conventional MRI in localizing NPT like Kanemoto et al [23] (sensitivity and specificity of 86% and 79%) and Sarihan et al. [25] (sensitivity and specificity of 78.6% and 100%). Kantarci *et al.* indicated that the practice of diffusion - weighted imaging (DWI) improves the sensitivity and specificity of imaging with sensitivity of 88-91% [26]. Williams et al emphasized that the requirement for any preoperative diagnostic tool is debatable, and majority of laparoscopists defer further diagnostic workup for NPT [27]. Tekgul S. et al. stressed that all other diagnostic tools used for localization do not provide any further information over physical examination, and laparoscopy remains the only reliable gear to localize NPT [28]. Lakhoo et al. demonstrated in his study that laparoscopy localized more than 50% of NPT in boys whom earlier inguinal exploration was negative [29]. Likewise Perovic and Janic revealed that laparoscopy can detect NPT in those with former negative groin exploration [30]. Groin exploration alone is considered by Godbole *et al.*, to be unfair to patients and undependable in localizing NPT [31].

Conclusions

Although it is a common training, routine preoperative imaging for NPT is neither crucial nor useful. Neither US nor MRI correctly localize a true NPT, consequently does not change surgical management. In contrast, laparoscopy is safe, precise, and aids in subsequent surgical planning. Limiting the expense of non-beneficial investigations will reduce cost to the patient.

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