

Reliability of hypertrophy of the contralateral testis in prediction of the status of impalpable testis

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Background The hypertrophied testis can predict the status of the impalpable contralateral one. The aim of this study was to assess the accuracy of contralateral testicular hypertrophy for predicting the presence or absence of impalpable undescended testis (UDT) in Egyptian boys.

Patients and methods This study was carried out on 204 patients with unilateral impalpable UDT who presented to the Pediatric Surgery Department, Al-Azhar University Hospitals, from July 2014 to April 2016. Only 40 patients with unilateral impalpable UDT and hypertrophy of the contralateral testes were included in this study. They were subjected to routine laboratory investigations, ultrasonography measurement of the volume of the hypertrophied testis, and diagnostic laparoscopy for the impalpable intra-abdominal testis (IAT). Both ultrasonography and laparoscopic findings were reported.

Results Out of 204 patients with unilateral impalpable UDT, only 40 patients fulfilled the inclusion criteria. Their ages ranged from 1 to 5 years, with a mean of 2.3 ± 1.18 years. Testicular volume ranged from 0.94 to 6.33 cm³, with a mean

of 3.12 ± 1.41 cm³. Diagnostic laparoscopy indicated 30 patients with vanishing testis, four patients with low IAT, and three patients with high IAT and three patients with testicular vessels and vas passing internal inguinal ring, where inguinal exploration indicated atrophic testes.

Conclusion Hypertrophied testis can predict the absence of other contralateral impalpable testis when its volume is 1.85 cm³. *Ann Pediatr Surg* 13:150–154 © 2017 Annals of Pediatric Surgery.

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Introduction

Contralateral compensatory testicular hypertrophy has previously been shown to correlate with the laparoscopic finding of an absent testis (monorchia) in boys with unilateral nonpalpable undescended testis (UDT) [1]. Imaging studies are rarely useful in locating UDT. Clinical examination by an experienced surgeon has a higher sensitivity in locating the UDT more than ultrasonography (US), computed tomography, or MRI as documented by many reports [2]. Diagnostic laparoscopy is a useful modality for the assessment of nonpalpable testicles (NPT). On the basis of findings, the course of surgical intervention is determined [3]. In case of blind-ending vas and vessels, no further exploration is necessary. In case of testicular vessels and vas entering the internal inguinal ring (IIR), inguinal exploration is indicated for excision of testicular nubbin or orchiopexy. Peeping or intra-abdominal testes (IAT) will require orchiopexy [3]. Testicular volumes can be assessed using different types of orchidometers or calipers. Prader's orchidometer is the most widely used orchidometer; however, US measurements of testicular volume have a high degree of accuracy and reproducibility and are considered the standard for the quantification of testicular volume [4,5]. The aim of this study is to assess the accuracy of contralateral testicular hypertrophy for

predicting the presence or absence of impalpable UDT in Egyptian boys.

Patients and methods

After receiving the approval of the ethics committee at Faculty of Medicine, Alazher University, this prospective study was carried out at the Pediatric Surgery Department by examining children who attended the clinic for unilateral impalpable UDT from December 2014 to April 2016. Totally, 204 patients with unilateral impalpable UDT were examined. Totally, 40 patients fulfilled the inclusion criteria and were included in this study. A written informed parental consent was obtained. All parents were informed about the pathology and the suggested treatment according to the diagnosis of their children. Inclusion criteria were as follows: children between age 1 and 5 years of age with unilateral impalpable UDT and contralateral physiologically hypertrophied testes (no tumors, no history of hernia, or hydrocele). Children with other causes of unilateral testicular hypertrophy or receiving hormonal treatment for UDT were excluded from the study. On the basis of these exclusion criteria, 164 patients were excluded from the study as they did not fulfill the inclusion criteria.

All patients were subjected to routine laboratory investigations, US measurement of the volume of the hypertrophied testis, and diagnostic laparoscopy.

Measurement of testicular volume

The testis was scanned in both transverse and longitudinal planes using a 7.5 MHz linear, phased-array transducer while the patient was in the supine position, and analgesia was used when required in the form of a paracetamol suppository. The volume of the contralateral testis was calculated using the technique and formula published by Goede *et al.* [6]. The volume of the testis was measured and reported. The testis is considered hypertrophied if its volume is more than the reference values reported by Goede *et al.* [6].

Operative procedure

The procedure was performed under general endotracheal tube anesthesia. A prophylactic parental antibiotic was administered to patients just after induction of anesthesia in the form of third-generation cephalosporin at a dose of 50 mg/kg body weight. Then, the patient was examined again under general anesthesia to detect an inguinal or a canalicular testis.

The operative procedure was based on what was described by Shehata *et al.* [7]. The concept of surgery was laparoscopic complete visualization of the abdomen and pelvis. Looking for the IAT and visualization of both IIRs, the normal side was inspected first and this provided a comparative image for reference to the opposite side. If the testis is not observed intra-abdominally, the vas and testicular vessels are looked for at IIR. If there are signs of vanishing testis, such as end-blinded vessels, the procedure is terminated and if not, single-stage orchiopexy, testicular traction, and first-stage Fowler–Stephen orchiopexy are performed for IATs. The operative findings are recorded, reported, and collected, especially the presence or absence of the testis.

Statistical analysis

SPSS Version 18 was used to analyze the data (SPSS Inc., Chicago, Illinois, USA). Qualitative data will be presented as frequency and percentage. Quantitative data with a normal distribution will be presented as mean \pm SD. We used a receiver operating characteristic to predict the presence or absence of impalpable UDT from the size of contralateral testis. *P* value less than 0.05 was considered significant.

Results

Totally, 204 patients with unilateral impalpable UDT were examined during the period of the study from July 2014 to April 2016 at the Pediatric Surgery Department, Al-Azhar University Hospitals. Only 40 patients with unilateral impalpable UDT and hypertrophy of the contralateral testes were included in this study and the remaining 164 patients were excluded as they did not fulfill the inclusion criteria.

Diagnostic laparoscopy was performed for 40 patients during the period of the study. Their age ranged from 1 to

6 years, with a mean of 2.3 ± 1.18 years. Testicular volume ranged from 0.94 to 6.33, with a mean of 3.12 ± 1.41 cm³. The demographic data and laparoscopic findings of all patients are shown in Table 1. Diagnostic laparoscopy indicated 30 patients with vanishing testis (attenuated testicular vessels) (Fig. 1), four patients with low IAT and three patients with high IAT (Fig. 2), and three patients with testicular vessels and vas passing IIR, where inguinal exploration showed atrophic testes (Fig. 3). The sizes of IATs showed a mild degree of decreased size.

The success rate of laparoscopy for the diagnosis of NPT was 100%. All cases were laparoscopically without any complications or conversion. Laparoscopic findings and procedures for all cases are presented in Table 2.

The receiver operating characteristics curve was used to define the best cut-off value of volume (cm³), which was more than or equal to 1.85, with a sensitivity of 84.8%, specificity of 100%, positive predictive value of 100%, negative predictive value of 80.3%, and diagnostic accuracy of 93.9% (Fig. 4).

The contralateral testicular hypertrophy predicted the absence and the presence of the impalpable UDT with an accuracy of 93.9 and 6.1%, respectively, when the hypertrophy of the contralateral testis was more than or equal to 1.85 cm³ in boys 2–5 years of age.

Discussion

In the present study, we used US for the estimation of contralateral testicular volume in children with NPT. The age range of the children in our study was 1–6 years. The contralateral testicular volume ranged from 0.94 to 6.33, with a mean of 3.12 ± 1.41 cm³. This is larger than the volumes reported by Shibata *et al.* [8]; they reported that in Japanese boys with absent testis, the mean contralateral testicular volume was 2.20 ± 0.75 cm³.

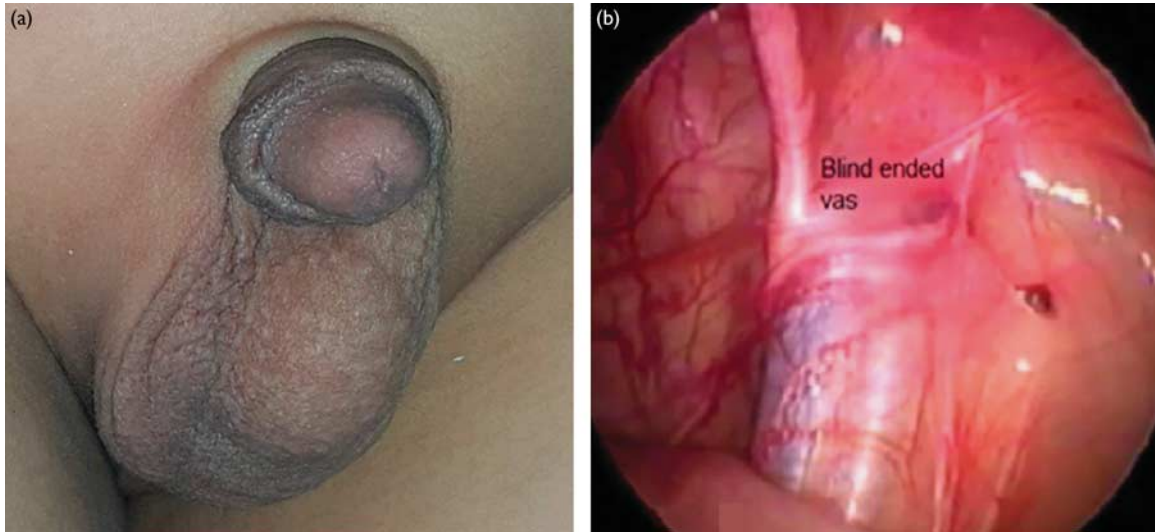
The testicular volume, which is estimated using different methods such as rulers, tapes, vernier callipers, orchidometer, graphic models, and US scan, is very important in the assessment of the status of impalpable testis [5,9].

US measurements of testicular volume have a high degree of accuracy and reproducibility and are the standard for the quantification of testicular volume. The volumes obtained with the clinical methods correlate with those obtained by US and are useful clinically, but overestimate US values by two to three folds mainly because of the inclusion of the scrotal skin and epididymis [5].

Table 1 Demographic data of all patients

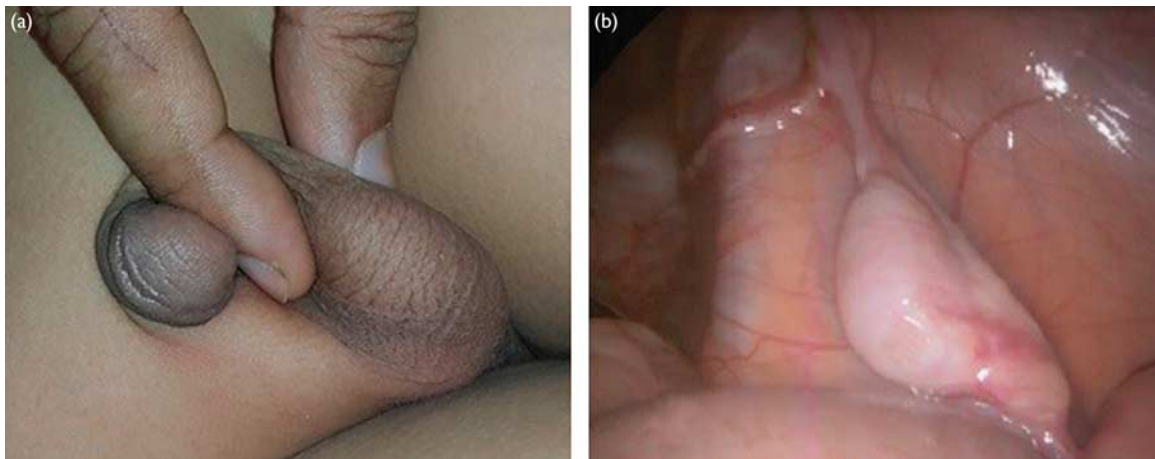
	<i>n</i> (%)
Age (years)	
2 to 3	13 (32.5)
3 to 4	11 (27.5)
4 to 5	16 (40)
Affected side	
Right	16 (40)
Left	24 (60)

Fig. 1



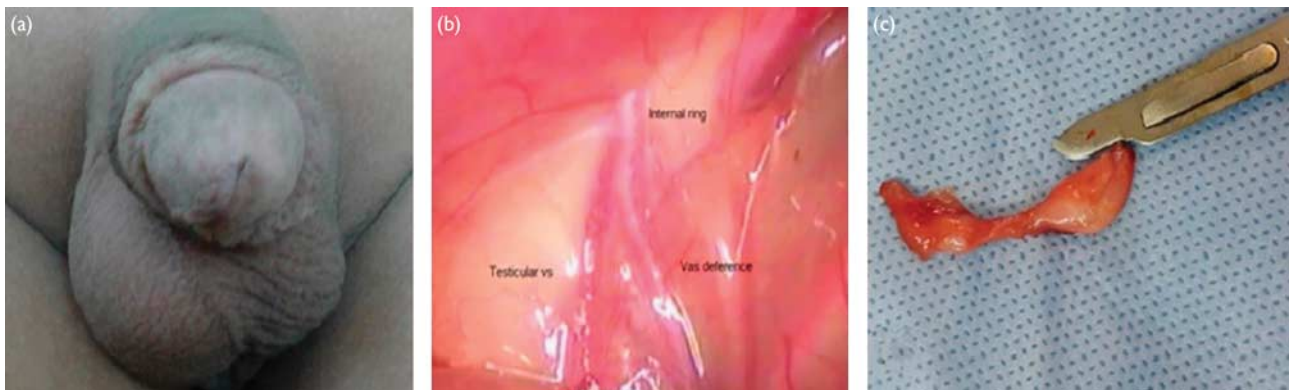
(a) A male patient, 2 years old, presented with right impalpable undescended testis and hypertrophy of the contralateral [volume was 2.99 cm^3 (normal: $0.35\text{--}0.55\text{ cm}^3$)]. (b) Laparoscopic finding of the same patient shows a blind-ended vas and testicular vessels (vanishing testis).

Fig. 2



(a) A male patient, 3 years old, presented with right impalpable undescended testis and hypertrophy of the contralateral. (b) Laparoscopic finding of the same patient shows a high intra-abdominal testis.

Fig. 3

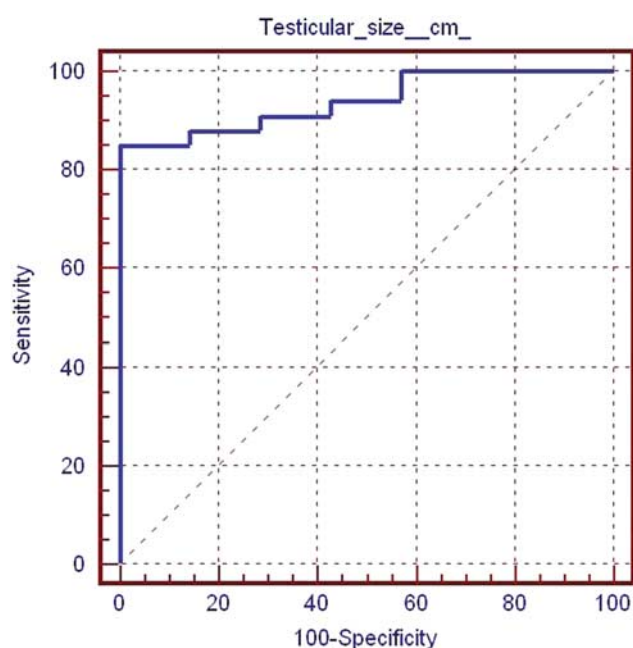


(a) A male child, 3 years old, presented with left impalpable undescended testis and hypertrophy of the contralateral. (b) Laparoscopic finding of the same patient shows vas and vessels are passing internal inguinal ring. (c) Inguinal exploration indicated a testicular nubbin.

Table 2 Laparoscopic findings and procedures of all cases

Number of cases	Laparoscopic finding	Procedure
30	Blind-ended vas and vessels (vanishing testis)	No further intervention (ended procedure)
3	Vas and vessels passing IIR	Inguinal exploration reveals atrophic testis
4	Low intra-abdominal testis	One-stage orchiopexy
2	High intra-abdominal testis	Laparoscopic traction orchiopexy
1	High intra-abdominal testis	Fowler–Stephens orchiopexy

IIR, internal inguinal ring.

Fig. 4

Sensitivity and specificity of the volume (cm) in differentiation of the findings.

Our study predicted the absence of unilateral impalpable UDT with a cut-off volume of contralateral descended testis more than or equal to 1.85 cm^3 , a sensitivity of 84.8%, a specificity of 100%, a positive predictive value of 100%, a negative predictive value of 80.3%, and an accuracy of 93.9%. Shibata *et al.* [8] reported a smaller cut-off volume (1.6 cm^3) with a sensitivity of 84.8%, a specificity of 86.4%, a positive predictive value of 90.3%, a negative predictive value of 80.3%, and an accuracy of 79.1%.

Other studies used the longitudinal axis of the testis to evaluate contralateral testicular hypertrophy. They reported a cut-off testicular length of 18–21 mm to predict monorchism [1,8,10].

Huff *et al.* [11] measured the contralateral hypertrophied testis volume using a caliper in children younger than 2 years old. They reported the association of contralateral

testis hypertrophy with absent testis. They observed that the mean volume of the contralateral hypertrophied testis in boys with an absent testis was greater than that in boys with an IAT at all ages. Of 10 patients 2 years old or younger with hypertrophy of the contralateral testis greater than 2 cm^3 , nine (90%) had monorchia [11].

Mesrobian *et al.* [12] used a ruler for measurement of contralateral testicular length and defined the hypertrophy to be more than 2 SD above the normal mean length in patients 6–223 months of age. Seventy percent of the patients with monorchia had contralateral testicular hypertrophy. Of the 10 patients aged 36 months or less, nine had contralateral testicular hypertrophy [12].

Snodgrass *et al.* [13] reported that a contralateral testicular length more than 1.8 cm can predict monorchism in 90% of cases. However, 25% of the patients with IAT had a contralateral testicular length more than 1.8 cm in patients with a median age of 23 months (range: 6–154) with unilateral NPT [13]. Hurwitz *et al.* [10] used a Takihara orchidometer and/or a ruler to measure the volume and/or the length for contralateral testis in patients 7 months to 11 years old. Contralateral testicular hypertrophy to 1.8 cm^3 or more predicts monorchia with an accuracy of about 90% [10].

Hodhod *et al.* [14] measured the volume of the contralateral hypertrophied testis using a Takihara orchidometer and they reported that contralateral testicular volume more than 2 cm^3 was significantly predictive for monorchism with 71.7% sensitivity and 100% specificity in prepubertal patients.

Finally, we can depend on the hypertrophy of the contralateral testis in the prediction of absence of unilateral impalpable UDT, but we cannot exclude the confirmatory role of laparoscopy as this predictive result is not conclusive. Our results provide a good idea of the status of the impalpable testis, which can provide reassurance for the family of the patient.

Conclusion

Diagnostic laparoscopy is the most useful modality for assessing NPT. In a child with unilateral impalpable UDT, significant hypertrophy of the other testis can predict the status of the impalpable testis with an accuracy of 93.9% when the hypertrophy of the contralateral testis is more than or equal to 1.85 cm^3 in boys with a mean age of 2.3 ± 1.18 years.

Conflicts of interest

There are no conflicts of interest.

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