

The use of ultrasonographic contralateral testicular volumetry as a guide for primary inguinal exploration for unilateral impalpable undescended testes

Original
Article

Ahmed Ab. Youssef^a, Mohamed S. Mostafa^a, Islam Allam^b and Mohamed H. Soliman^a

Department of ^aPediatric Surgery, ^bRadiology, Faculty of Medicine, Ain-Shams University Hospitals, Cairo, Egypt.

ABSTRACT

Introduction: Undescended testis (UDT) is a prevalent genital anomaly, with 12–24% of cases being impalpable. Since 1995, laparoscopy has been considered the gold standard for the treatment of impalpable UDT. However, a significant number of patients still require inguinal exploration after the visualization of testicular vessels and vas deferens when entering a closed ring.

Objective: In this paper, we describe the use of contralateral compensatory testicular hypertrophy as a guide for surgical approach. We hypothesize that inguinal exploration is adequate for most patients with contralateral compensatory hypertrophy. Therefore, unnecessary laparoscopy can be avoided.

Study design: The study was conducted at Ain-Shams University in the interval from March 2022 to January 2023. Inguinoscrotal ultrasonography was performed on all patients with unilateral impalpable UDT. Patients with contralateral testicular volume more than 0.54 ml were included in the study and underwent primary inguinal exploration.

Results: Among patients with unilateral impalpable UDT, 25 contralateral testes volumes matched our cutoff (0.54 ml), indicating the absence of the impalpable testis. These patients underwent primary inguinal exploration, revealing 21 (84%) testicular nubbins, and four inguinal explorations were inconclusive (16%). The four inconclusive patients underwent laparoscopy, which confirmed a vanishing testes.

Conclusion: Contralateral testicular compensatory hypertrophy serves as an indicator for primary inguinal exploration in unilateral impalpable UDT. We recommend conducting primary inguinal exploration in cases with a contralateral testicular volume more than 0.54 ml.

Key Words: Impalpable testis, intraabdominal testis, orchiopexy.

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Corresponding Author: Mohamed H. Soliman, MD, Department of Pediatric Surgery, Faculty of Medicine, Ain-Shams University Hospitals, Cairo, Egypt. **Tel.:** 24346774, **E-mail:** mohamed.hisham.soliman@gmail.com

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INTRODUCTION

Undescended testis (UDT) is a prevalent genital anomaly that affects ~3% of full-term males, although the occurrence rises significantly to as high as 30% in preterms. The treatment for palpable UDT (76–88%) is uncomplicated. Nevertheless, surgery for impalpable UDT (12–24%) can be challenging and may jeopardize the testicular blood supply^[1].

Since 1995, when Docimo first reported laparoscopic orchiopexy in cases of impalpable UDT, laparoscopy has been the gold standard diagnostic and therapeutic test for impalpable UDT for years^[2]. However, some authors restrict the use of laparoscopy to cases of failed inguinal or scrotal exploration^[3].

Contralateral testicular compensatory hypertrophy is currently considered a reliable indicator for the absence of contralateral impalpable UDT, with a positive predictive

value of 100%^[4]. Although contralateral hypertrophy plays a vital role in preoperative parental counseling, it has yet to be implemented in clinical practice^[5,6].

The analysis of a significant number of intraabdominal testes revealed that in the absence of a viable ipsilateral testis, it is more commonly observed that vas and vessels entering the deep inguinal ring rather than vas and vessels ending intraabdominal, with an incidence of 84 and 16%, respectively^[7,8]. This finding is also supported by data from the literature^[9].

Based on the previously mentioned findings, we have determined that cases of absent testes represent the group with the lowest rate of benefit from laparoscopy. Therefore, in this study, we prospectively examined the use of ultrasonographic contralateral testicular compensatory hypertrophy as an indication of primary inguinal exploration to avoid unnecessary laparoscopy in the majority of patients in this group.

PATIENTS AND METHODS:

In Ain-Shams University Hospitals, after obtaining the Department of Surgery ethical committee IRB approval, all patients with unilateral impalpable UDT in the period from March 2021 to January 2023 were sent for inguinoscrotal ultrasonography (USS). All USS examinations were performed by the same radiologist. They were performed using a sonographic machine equipped with linear transducers, either (Samsung HS40 probe LA3-16AD) or (Logic P9 probe 9L-RS). The examination done without sedation where the patients lied in supine position where the testis is evaluated in both short and long axes on greyscale images. The length and height were then calculated in longitudinal axis image, while the width was calculated in the short axis image. Automated volume calculation were then performed using the formula for an ellipsoid ($\text{length} \times \text{width} \times \text{height} \times \pi/6$)^[10]. Patients whose contralateral testicular volume was more than 0.54 ml were included in the study and underwent primary inguinal exploration. The ipsilateral inguinoscrotal area was also scanned for the presence of a nubbin or testicular structure to help aid in decision-making. Care was taken not to open the peritoneum during inguinal exploration in order to allow laparoscopy if needed. Laparoscopy was reserved for patients in whom inguinal exploration was inconclusive, that is, it failed to confirm neither the presence nor absence of a viable testis. Conversely, patients whose contralateral test volume did not reach the cutoff volume and underwent primary laparoscopy were excluded from the study. Patients with bilateral UDT were also excluded from the study.

RESULTS:

During the study period, 64 patients aged 13 ± 4 months were diagnosed with unilateral impalpable UDT, 35 left and 29 right. Twenty-five (39%) patients contralateral testes volumes reached our predefined cutoff (0.54 ml), predicting the absence of the impalpable testis. Nubbin was confirmed preoperatively in 18 patients when USS detected a small mass without apparent testicular parenchyma. These 25 patients underwent primary inguinal exploration, which revealed 21 (84%) testicular nubbins, which were excised and sent for histopathological examination. While four inguinal explorations were inconclusive, that is, they failed to confirm the presence nor absence of testis (16%). The latter four patients underwent laparoscopy, which all confirmed intraabdominal vanishing testes. Secondary laparoscopy was always feasible and was never compromised by inguinal exploration. All patients were followed up in our outpatient clinic for 6 months. They were doing fine with no complications.

DISCUSSION

The first step in treating impalpable UDT has always been a subject of controversy. Due to the higher prevalence of extra-abdominal testes compared

to intraabdominal ones, numerous authors have recommended inguinal exploration as the first course of action^[9]. This is further supported by the severe, rare complications associated with laparoscopy as well as its financial cost. Due to the wider and more straight nature of the inguinal canal in children, it is possible to access intraabdominal testes near the deep ring (peeping testes). However, several authors illustrated that a significant number of patients would still need laparoscopy^[11,12].

Laron and Zilka^[13] were the first to observe the phenomenon of contralateral hypertrophy in cases of monarchism. After 25 years, Koff^[14] conducted the first study to determine a cutoff value for hypertrophy. Several researchers conducted studies until Moriya and colleagues were able to establish a cutoff volume of 0.54 ml. This threshold demonstrated a sensitivity, specificity, positive predictive value, and a negative predictive value of 75, 100, 100, and 60%, respectively. Moriya *et al.*^[4] utilized this cutoff of 0.54 ml to predict the presence of nonviable testis (nubbin or vanishing testis) on the affected side. It is worth noting that this cutoff volume is hardly affected by age as long as prepubertal because the testicular volume remains relatively stationary until the age of 9 years^[15].

Testicular volume can be assessed either by Prader orchimeter or by USS. It is well known that USS is more reliable and precise^[16,17]. USS volumetry can be performed using one of the two most common formulas for volume calculation, either the formula for ellipsoid ($\text{length} \times \text{width} \times \text{height} \times \pi/6$) or Lambert's formula ($\text{length} \times \text{width} \times \text{height} \times 0.71$). We herein used the formula for ellipsoid used by Moriya as it underestimates the testicular volume, therefore reaching a sensitivity and a positive predictive value of 100%^[18,19].

Although the American Urology Association does not recommend USS, it rarely provides any guidance that aids in decision-making^[20]. In the current study, we utilized USS for objective volumetry of contralateral scrotal testes rather than localization of the UDT.

Based on our previous analysis of an extensive series of impalpable UDT, we observed that vas and vessels entering the deep inguinal ring with testicular nubbins found on inguinal exploration were more common than vanishing testes with vas and vessels ending blindly intraabdominal, with an incidence of 84 and 16%, respectively^[1,21]. In their series, Callewaert *et al.*^[9] reported that 58% of the cases were either atrophic inguinal testis or scrotal nubbin. Igarashi and colleagues reported that in the majority of his unilateral impalpable cases, 62% were either absent or vanishing testes.

In this paper, we report the first practical implementation of contralateral compensatory testicular hypertrophy in preoperative parental counseling and as a guide for the operative approach.

During our study, we had 64 patients with unilateral impalpable testis by examination. A total of 35 patients presented with left-side impalpable UDT compared to 29 patients with right-sided impalpable UDT. The initial screening and examination included patients aged between 9 and 17 months. All 64 patients underwent preoperative scrotal USS for both sides. Findings such as the presence of nubbin, viable testis, and contralateral testicular volume according to Moriya's formula were documented^[4].

Our study included 25 patients who were selected based on the results of the USS findings. All patients had a testicular volume cutoff of 0.54 ml. Preoperative USS detected a nubbin in 18 patients when a small mass and no parenchyma detected. Based on our findings, 21 patients underwent inguinal excision of nubbins. USS failed to detect scrotal nubbins in 3 patients, which is consistent with Moriya *et al.*'s^[4] findings, where USS detected 19 nubbins out of 23.

Furthermore, four patients had no visible testicular structure, and no spermatic cord structures (vas/vessels) were found, which required laparoscopic exploration. The vas and vessels of those four patients abruptly terminated prior to the deep inguinal canal and were labeled as vanishing testis. Although an inguinal exploration was initially performed on the four patients, laparoscopy was still possible after closing the incision, and no issues were encountered regarding vision or air leakage.

By adhering to our previously mentioned protocol, we managed to spare 21 patients an unnecessary laparoscopy. Laparoscopy was still done safely and effectively in the four patients in whom it was indicated. Among our patients, if we had initially performed laparoscopy, we would have conducted 21 unnecessary laparoscopies, as these patients would still have required an inguinal incision to remove the nubbin, as per our standard excision method. Despite recommendations from other centers, we did not utilize laparoscopy to remove the nubbin at our facility.

By adhering to our algorithm, we were able to substantially decrease the expenses associated with patient treatment, including the costs of disposable items utilized in laparoscopy. Furthermore, it reduced the demand for booking laparoscopy-equipped operation rooms sparing these slots for other laparoscopic operations. While USS incurs a financial burden, it is significantly lower than the expense of

laparoscopy. Unlike laparoscopy, which requires endotracheal anesthesia, inguinal exploration can be performed under laryngeal mask anesthesia without muscle paralysis.

The primary limitations of our study include the relatively small group of patients and the absence of a control group. However, our study's findings will serve as a base for future research.

CONCLUSION

Contralateral testicular compensatory hypertrophy can serve as an indicator for primary inguinal exploration in unilateral impalpable UDT. In addition, we recommend utilizing inguinal exploration as an initial step in cases with contralateral compensatory testicular hypertrophy, with a cutoff value of 0.54 ml.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Elzeneini WM, Mostafa MS, Dahab MM, Youssef AA, AbouZeid AA. How far can one-stage laparoscopic Fowler-Stephens orchiopexy be implemented in intra-abdominal testes with short spermatic vessels? *J Pediatr Urol.* 2020 Apr;16(2):197.e1-197.e7.
2. Docimo SG, Moore RG, Adams J, Kavoussi LR. Laparoscopic orchiopexy for high palpable undescended testis: preliminary experience. *J Urol [Internet].* 1995; 154:1513–1515.
3. Cortes D, Thorup JM, Lenz K, Beck BL, Nielsen OH. Laparoscopy in 100 consecutive patients with 128 impalpable testes. *Br J Urol [Internet].* 1995; 75:281–287.
4. Moriya K, Nakamura M, Nishimura Y, Nishida M, Kudo Y, Kanno Y, *et al.* Impact of preoperative ultrasonographic evaluation for detection of a viable testis in patients with a unilateral nonpalpable testis. *J Ultras Med* 2018;37:1665–1670.
5. L.H. Braga, S. Kim, F. Farrokhyar, A.J. Lorenzo, Is there an optimal contralateral testicular cut-off size that predicts monorchism in boys with nonpalpable testicles?, *Journal of Pediatric Urology*, Volume 10, Issue 4, 2014, Pages 693-698, ISSN 1477-5131, <https://doi.org/10.1016/j.jpuro.2014.05.011>.

6. Shibata Y, Kojima Y, Mizuno K, Nakane A, Kato T, Kamisawa H, *et al.* Optimal cutoff value of contralateral testicular size for prediction of absent testis in Japanese boys with nonpalpable testis. *Urology* [Internet] 2010; 76:78–81.
7. Abouzeid AA, Safoury HS, Hay SA. Laparoscopic classification of the impalpable testis: an update. *Ann Pediatr Surg* 2012;8:116–122.
8. Hay SA, Soliman HA, Abdel Rahman AH, Bassiouny IE. Laparoscopic classification and treatment of the impalpable testis. *Pediatr Surg Int.* 1999;15(8):570-2. doi: 10.1007/s003830050674. PMID: 10631737.
9. Callewaert PRH, Rahnama'i MS, Biallostowski BT, Van Kerrebroeck PEV. Scrotal approach to both palpable and impalpable undescended testes: should it become our first choice?. *Urology* 2010; 76:73–76.
10. Kolade-Yunusa HO, Itanyi UD, Achonwa CJ, Kolade-Yunusa O. Determination of a normogram for testicular volume measured by ultrasonography in a normal population boys in Abuja. *Orient J Med* [Internet] 2017; 29:56–62.
11. Igarashi A, Kikuchi K, Ogushi K, Hasegawa M, Hatanaka M, Fujino J, *et al.* Surgical exploration for impalpable testis: which should be first, inguinal exploration or laparoscopic abdominal exploration? *J Pediatr Surg* 2018;53:1766–1769.
12. Aljunaibi A, Alsaid A, Hobeldin M, Safoury HS, Abdelsalam S, Youssef AA. Modified traction technique for intraabdominal testes with short vessels. *Urology* 2022; 165:351–355.
13. Laron Z, Zilka E. Compensatory hypertrophy of testicle in unilateral cryptorchidism. *J Clin Endocrinol Metab* [Internet] 1969; 29:1409–1413.
14. Koff SA. Does compensatory testicular enlargement predict monorchism? *J Urol* 1991; 146:632–633.
15. Jaiswal VK, Khadilkar V, Khadilkar A, Lohiya N. Stretched penile length and testicular size from birth to 18 years in boys from Western Maharashtra. *Indian J Endocrinol Metab* [Internet] 2019; 23:3.
16. Diamond DA, Paltiel HJ, Dicanzio J, Zurakowski D, Bauer SB, Atala A, *et al.* Comparative assessment of pediatric testicular volume: orchidometer versus ultrasound. *J Urol* [Internet] 2000; 164(3 Pt 2):1111–1114.
17. Sakamoto H, Saito K, Oohta M, Inoue K, Ogawa Y, Yoshida H. Testicular volume measurement: comparison of ultrasonography, orchidometry, and water displacement. *Urology* 2007; 69:152–157.
18. Anyanwu LJC, Sowande OA, Asaley CM, Saleh MK, Mohammad AM, Onuwaje M, *et al.* Testicular volume: correlation of ultrasonography, orchidometer and caliper measurements in children. *Afr J Urol* [Internet] 2020; 26:1–6.
19. Liu C, Liu X, Zhang X, Yang B, Huang L, Wang H, *et al.* Referential values of testicular volume measured by ultrasonography in normal children and adolescents: Z-score establishment. *Front Pediatr* [Internet] 2021; 9:648711.
20. Evaluation and Treatment of Cryptorchidism (2018) - American Urological Association [Internet]. [cited 2024 May 25]. Available at: <https://www.auanet.org/guidelines-and-quality/guidelines/cryptorchidism-guideline>
21. Abouzeid AA, Safoury HS, Hay SA. Laparoscopic classification of the impalpable testis: an update. *Ann Pediatr Surg* 2012; 8:116–122.