Original Article

Access this article online
Website: www.afrjpaedsurg.org
DOI: 10.4103/0189-6725.115037
Quick Response Code:

Diagnostic value of high resolution ultrasound in localisation of the undescended testis in children

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ABSTRACT

Background: The use of ultrasonography in the pre-operative localisation of undescended testes has become controversial due to fears about its accuracy. This study was designed to ascertain the accuracy, sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of ultrasonography in the localisation of the undescended testes in children. **Patients and Methods:** A prospective evaluation of all boys undergoing operation for undescended testes at the Lagos University Teaching Hospital, Idi-Araba, Lagos, over a 12 month period was performed. The pre-operative clinical and ultrasound findings were compared with the findings on surgical exploration. **Results:** Forty boys with 52 undescended testes were studied. The mean age of the boys at the time of surgery was 4.0 ± 0 years (range 1-11 years). Forty-six (88.5%) testes were localised pre-operatively by ultrasound- 20 of 22 (90.9%) palpable testes and 26 of 30 (86.7%) non-palpable testes. Intra-operatively, 49 (94.2%) of the undescended testes were found while 3 (5.8%) were absent/vanishing testes. Ultrasound evaluation had an accuracy of 86.5%, sensitivity of 89.8%, and specificity of 33.3%, PPV of 95.7% and a NPV of 16.7%. **Conclusion:** Ultrasound assessment is beneficial in pre-operative evaluation of children with undescended testes.

Key words: Children, pre-operative assessment, ultrasonography, undescended testes

INTRODUCTION

Undescended testis is a clinical condition characterised by the absence of the testis from the base of the ipsilateral hemiscrotum due to arrest along the path of embryologic descent during development.[1] It is a common congenital urologic anomaly found in boys, with an incidence of 4% at birth which decreases to about 1% of boys at age 1 year.

Pre-operative testicular localisation is beneficial in the management of undescended testes.[2] Confirmation of the existence of the testis is reassuring to the patient and his guardians. The extent of surgical exploration may also be determined by the site of the testicle. If the testis is not present in the inguinal-perineal region, the treatment options-laparoscopy or laparotomy can be rationally discussed with the parents pre-operatively.

Localisation of the testes may be achieved by various diagnostic techniques including physical examination, radiological investigations and laparoscopy.[3,4] Laparoscopy is highly sensitive in detecting non-palpable undescended testes.[5,6] However, it is not widely available in resource – limited settings such as ours. Physical examination may fail to localize the undescended testis in obese children and when the testis is intra-abdominal or intracanalicular.[2] Abdominal and inguinal sonography for evaluation of undescended testis is appealing because it is cheap, non-invasive, has no risk of ionizing radiation and does not require sedation or general anaesthesia. Its routine use however, remains controversial with some authors considering it inaccurate and hence unnecessary.[2,4,7-11]

There has been no prospective study in the West African sub-region to ascertain the usefulness of ultrasonography in the pre-operative localisation of undescended testes in children. In other to fill this gap in literature, we describe our experience with the use of ultrasonography in the pre-operative assessment of children with undescended testes.

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PATIENTS AND METHODS

We prospectively studied all boys between age 6 months and 15 years who presented at the paediatric surgical out-patient of our institution with undescended testes from July 2010 to June 2011. Boys who had had previous inguinal surgery or who had co-existing anterior abdominal or life threatening congenital anomalies were excluded. Clearance was obtained from the ethics committee of the Lagos University Teaching Hospital before commencement of the study and parents/guardians of all participating children gave consent before inclusion.

The boys were all examined at the clinic by the first author and subsequently had ultrasonographic assessment at the Radio diagnosis department of the Lagos University Teaching Hospital (LUTH). The sonographic assessment was performed by a Senior Radiologist before each patient was operated upon. The Radiologist was blinded to the clinical examination findings. Each patient was subjected to pre-operative ultrasound evaluation using a 7.5 mHz linear array transducer (Aloka 3500 Pro scan Japan, 2005 model). The inguinal canal, pelvis and abdomen were scanned. When the testis was not seen in these regions, the suprapubic, perineal and femoral regions were assessed to rule out ectopic sites. In unilateral cryptorchidism, sonography was performed initially over the normal testis and then over the course of undescended testis to give an idea of the echo-texture. Each child was then prepared for surgery under general anaesthesia. An inguinal approach was employed for the groin exploration but this was extended proximally for the high inguinal or intra-abdominal testes. Orchidopexy or orchidectomy was performed based on the findings at surgery.

Data recorded included patients age at surgery, physical examination, ultrasound and intra-operative location of the testes as well as treatment offered. Ultrasonographic findings were subsequently compared with intra-operative findings. Standard definitions of accuracy, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) were used to ascertain the diagnostic value of ultrasonography.[12] Other analyses were performed using the Statistical Package for Social Sciences (SPSS) version 16, (SPSS Inc., Chicago, IL). A *P*-value of ≤0.05 was considered significant.

RESULTS

Forty boys with 52 undescended testes were studied (28 were unilateral while 12 were bilateral). The mean age of the boys at the time of surgery was 4.0 ± 0 years (range 1-11 years).

A total of 22 (42.3%) of the testes were palpable while 30 (57.7%) were non-palpable. Forty-six (88.5%) testes were localized pre-operatively by ultrasound- 20 of 22 (90.9%) palpable testes and 26 of 30 (86.7%) non-palpable testes. On pre-operative ultrasound the testes, 42 (80.8%) of the undescended testes were visualized within the inguinal canal, 4 (7.7%) were intra-abdominal while 6 (11.5%) were not seen [Tables 1 and 2].

On the total, 45 (86.5%) of the undescended testes were found within the inguinal canal, 4 (7.7%) were intra-abdominal while 3 (5.8%) were not seen [Table 2]. Forty-four (95.7%) of the testes localised pre-operatively by ultrasound were found at surgery while 2 (4.3%) were absent [Table 3].

Comparison of ultrasound and intraoperative location is as shown in Table 3. Forty-four testes were accurately localised pre-operatively by ultrasound-20 of 22 (90.9%) palpable testes and 24 of 30 (80%) non-palpable testes.

Table 1: Comparison of physical examination and ultrasound findings

Findings	Palpable testes	Non-palpable testes	Total
Ultrasound positive	20	26	46
Ultrasound negative	2	4	6
Total	22	30	52

Table 2: Comparison of ultrasound and intra-operative locations

Ultrasound locations	Surgical locations
6 not visualised	1 absent
	4 inguinal
	1 abdominal
42 inguinal	41 inguinal
	1 abdominal
4 abdominal	2 absent
	2 abdominal

Table 3: Comparison of ultrasound and surgical findings

Ultrasound finding	Surgical positive	Surgical negative	Total
Ultrasound positive	44	2	46
Ultrasound negative	5	1	6
Total	49	3	52

There were 2 false-positives, 5 false-negatives, 1 true negative and 44 true positive on ultrasound. Ultrasound accurately localised 41/45 (91.1%) inguinal testes and 3/4 (75%) abdominal testes and 1/3 (33.3%) vanishing testes. Ultrasound corresponded with intra-operative findings in 45 out of 52 (86.5%) cases.

Statistical values

Ultrasound evaluation had an accuracy of 86.5%, sensitivity of 89.8%, and specificity of 33.3%, PPV of 95.7% and a NPV of 16.7% in pre-operative localisation of undescended testes.

DISCUSSION

Opinion is divided on the value of ultrasonography in pre-operative localisation of the undescended testis. Some authors recommend it for its feasibility and potential to settle the subsequent operative procedure.[2,4,7,8] Others are sceptical because of poor outcome for non-palpable undescended testes, and because ultrasound does not exclude the necessity for laparoscopy or surgical exploration.[13-15]

Ultrasound location corresponded with intraoperative location in 45/52 (86.5%) of cases in this study. There was no significant statistical difference between accuracy of pre-operative localisation by ultrasound and intraoperative localisation ($P = 0.113$) whereas physical examination findings were significantly less accurate than intra-operative localisation ($P = 0.000$) [Tables 4 and 5].

The sensitivity and accuracy of ultrasound assessment in this study (89.8% and 86.5% respectively) were higher than values obtained in some other studies. Komine *et al*.[14] in Japan (1988) obtained sensitivity and accuracy of 82.6% and 84.6% respectively while Phewplung *et al*.[15] in Bangkok, Thailand (2010) reported a sensitivity of 82% and accuracy of 79% respectively. These high sensitivity and accuracy imply that ultrasound is reliable in pre-operative location of the undescended testes.

Table 4: Localisation: Pre-operative ultrasound versus intraoperative localisation

Finding	Ultrasound (%)	Surgery (%)
Localised	44 (84.6)	49 (94.2)
Not localised	8 (15.4)	3 (5.8)

$P = 0.113$

Table 5: Pre-operative ultrasound localisation compared with physical examination

Finding	Ultrasound (%)	Physical examination (%)
Localised	45 (86.5)	25 (48.1)
Not localised	7 (13.5)	27 (51.9)

$P = 0.000$

The two false positives seen on ultrasound in this study reduced its specificity and PPV. The specificity (33.3%) was worse than what was reported by Daghighi[4] in Iran (2006) and Komine (Japan)[14] who both observed specificity of 100%. False-positives on pre-operative ultrasound may occur if the sonographer is inexperienced or mistakes enlarged inguinal nodes for undescended testes. Although there was no case of lymphadenitis in this series, the sonographer was observed to improve in accuracy as the duration of the study progressed.

The 5 testes missed on ultrasound reduced the sensitivity to 89.8% and the NPV to 16.7%. These may have led to needless laparotomy or laparoscopy as 4 of the testes were located inguinally (at the deep ring) and only 1 was abdominal in location. They were however, all treated without recourse to laparotomy. There is need for caution when ultrasound is negative as previously observed by Phewplung *et al*.[15] However, Nijs *et al.* (Netherlands 2007)[8] did not record any false negatives despite the large sample studied in their series (135 patients) probably because of the experience of the sonographer. It is worthy of note that the testes were palpable in 2 of these 5 cases. Combining clinical examination findings with ultrasound may thus, reduce the errors from this modality.

The high sensitivity and PPV and the low NPV and specificity in this study show that whereas ultrasound may reliably predict the presence of undescended testes, it is less reliable in predicting its absence. This implies that a negative ultrasound result in a child with undescended testes does not preclude further evaluation by laparoscopy or surgical exploration. However, the fairly high accuracy of ultrasound in this study suggests that such cases may be few and manageable.

Ultrasound evaluation in this study doubled pre-operative localisation of undescended testes from 42.3% by physical examination to 86.5%. The improvement is even more evident in non-palpable testes where USS correctly localized 26/30 (86.7%) of the non-palpable testes. This allayed the anxiety of parents of these children and additionally aided the surgeon in properly planning the surgery without recourse to laparascopy or other expensive and sophisticated diagnostic techniques.

In conclusion, abdominoscrotal ultrasonography is a beneficial pre-operative investigation in children with undescended testes especially, in resource poor settings where laparoscopy is not readily available.

REFERENCES

1. Hutson, JM. Undescended testis, torsion, and varicocele. In: O'Neill JA, Jr, Fonkalsrud EW, Coran AG, Grosfeld JL, editors. Pediatric Surgery. 6th ed. Philadelphia: Mosby Elsevier; 2006; p. 1193-205.
2. Rubin SZ, Mueller DL, Amundson GM, Wesenberg RL. Ultrasonography and the impalpable testis. Aust N Z J Surg 1986;56:609-11.
3. Perez-Brayfield M, Kirsch AJ. Cryptorchidism. 2010. Available from: http://www.emedicine.medscape.com/article/1017420-overview. [Last accessed on 2010 Jan 2].
4. Daghighi MH, Fathi HA, Pourfathi H. Assessment of diagnostic value of sonography for cryptorchidism. J Diagn Med Sonog 2006;22:42-7.
5. Diamond DA, Caldamone AA. The value of laparoscopy for 106 impalpable testes relative to clinical presentation. J Urol 1992;148:632-4.
6. Vijjan VK, Malik VK, Agarwal PN. The role of laparoscopy in the localization and management of adult impalpable testes. JSLS 2004;8:43-6.
7. Kullendorff CM, Hederström E, Forsberg L. Preoperative ultrasonography of the undescended testis. Scand J Urol Nephrol 1985;19:13-5.
8. Nijs SM, Eijsbouts SW, Madern GC, Leyman PM, Lequin MH, Hazebroek FW. Nonpalpable testes: Is there a relationship between ultrasonographic and operative findings? Pediatr Radiol 2007;37:374-9.
9. Elder JS. Ultrasonography is unnecessary in evaluating boys with a nonpalpable testis. Pediatrics 2002;110:748-51.
10. Hrebinko RL, Bellinger MF. The limited role of imaging techniques in managing children with undescended testes. J Urol 1993;150: 458-60.
11. Weiss RM, Carter AR, Rosenfield AT. High resolution real-time ultrasonography in the localization of the undescended testis. J Urol 1986;135:936-8.
12. Udeozo IO. Handling clinical laboratory data in research. In: Bankole MA, editor. Handbook of Research Methods in Medicine. Lagos. National Educational Research and Development Council (NERDC); 1991. p. 95.
13. Al-ahnoumi A,Yafai A, Al-Arigi A, Absi M, Al Wadan A, Senebani J. Comparison of ultrasonographic and operative findings in undescended testes. Urotoday International Journal. Available from: http//www.urotoday.com. [Last accessed on 2010 Jan 2].
14. Komine S, Murayama M, Kinoshita N, Iguchi A, Nakamuta S, Masaki Z, *et al*. High resolution ultrasound examination in the diagnosis of the undescended testis in the inguinal region. Hinyokika Kiyo 1988;34:305-8.
15. Phewplung T, Mahayosnond A, Trinavarat P. Accuracy of ultrasound in paediatric undescended testes. Asian Biomed 2010;4:983-6.

Cite this article as: Adesanya OA, Ademuyiwa AO, Bode CO, Adeyomoye AA. Diagnostic value of high resolution ultrasound in localisation of the undescended testis in children. Afr J Paediatr Surg 2013;10:127-30.

Source of Support: Nil. **Conflict of Interest:** None declared.