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The role of ultrasonography in the management of undescended testes. A 6 year review.

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Abstract

Background: Undescended Testis (UDT) is a common condition that has a potential to cause infertility and may become malignant if not treated surgically in time. Ultrasound is requested by different specialties for diagnosis of UDT before referring to a pediatric urology clinic.
Objectives: To evaluate the trends for Ultrasound Scan (USS) requests by particular specialties before referral to a surgical team and to assess the sensitivity and specificity of ultrasound in accurately localizing UDT compared to per operative findings and its impact on the management plan.
Methods: We reviewed all the patient between 1st of January 2014 to 1st of January 2019, who were referred to our paediatric urology department for UDT and had an USS testes before referral. Patients with ambiguous genital, hydrocele and redo orchidopexy were excluded. We recorded age at referral, referring specialty, their findings on clinical examination, the USS findings, and per operative findings. The results were expressed as mean/median, percentages, sensitivity, specificity and positive and negative predictive value.
Results: We received 670 referrals for UDT to our clinic during this period. Among these 207 patients (31.04%) had an USS done before referral to us. There were nearly equal number of referrals made by the main specialties, which included neonatology, general paediatrics and family medicine. All the decisions as regards to surgery were based on the clinical examination in outpatient and the surgical approach of either open or laparoscopy was based on examination under anaesthesia irrespective of USS findings. The sensitivity and specificity of ultrasonography for correctly diagnosing a testis in the groin was 87.79% and 72.13%, in the abdomen 70.73% and 96.08% and for vanished testes 87% and 94.8% respectively when compared to per operative findings. USS missed diagnosed 43 out of 101 normal testes as either in the groin n=41(16.87%) or abdomen n=2(2.81%). This practice cost our hospital US$ 10350 (US$ 50 per scan).
Conclusion: The use of ultrasound does not aid significantly in the accurate diagnosis or management of undescended testes and incur unnecessary additional cost to the health system. Physicians should refrain from requesting ultrasound for localization of testes before referral to surgical team.

Keywords: Undescended tests, Ultrasound, Pediatric urology, Referral.

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Introduction

Undescended Testes (UDT) is a failure of the normal descent of the testes from the intra-abdominal cavity to the scrotum. It is one of the commonest congenital anomalies. It is estimated that about 1%-4% of full-term new-borns are affected with this condition and the rate is even higher (30%-45%) among preterm babies [1,2]. Some of these testes descend spontaneously by 3 months of age, reducing the overall incidence of UDT to 1.2% [3].

Many different practitioners are involved in the initial diagnosis and investigation of undescended testes before seen by a paediatric surgeon/urologist. These include neonatologists, general practitioners, general paediatricians, endocrinologists etc.

In new-borns, the testis is much easier to palpate as they have less abdomino-pelvic fat and minimal cremasteric reflex till 3 months of age [4]. After this age, it may become difficult to palpate the testis, mainly due to strong cremasteric reflex, fat deposition in the area and above all difficult examination in an uncooperative child.

When unable to palpate the testes, many of these practitioners request an Ultrasound Scan (USS) to aid in localizing the

testicles before referral to a surgeon with a hope that it might help in diagnosis of management of the condition [5]. This practice has not been recommended in the majority of the guidelines available today since it does not change the management of the condition, cause unnecessary delay in referral and incur an additional cost [6,7].

We noticed in our clinic that many USS are being requested for these children by our colleagues before referral to us. We wanted to know the pattern of these referrals, to elucidate if USS can accurately identify or localize UDT and if helps in management plan of these children.

Materials and Methods

After ethical approval, we retrospectively reviewed charts of all the patients referred to us for UDT between January 01, 2014 till January 01, 2019 who had an USS done before referral to us. Patients with ambiguous genitalia, hydrocele, redo orchidopexy and multiple congenital anomalies were excluded from the study.

The data obtained included patient's age at referral, referring specialty, site and laterality of UDT, clinical findings by referring physician, and use of ultrasound for diagnosis of UDT before referral to us, findings of USS, clinical findings by our team, any change in management plan due to USS findings and operative findings.

The USS was done either by a consultant paediatric radiologist or if by a fellow, the images were reviewed and validated by a paediatric radiology consultant.

In our clinic all the patients were seen either by a senior doctor or if seen by a junior doctor, the findings were confirmed by a senior doctor before deciding about the surgery. Decision to operate was based solely on the clinical findings irrespective of the USS results. During surgery all the patients had an examination under anaesthesia and the approach to do either laparoscopy or groin exploration was based on this examination.

The descriptive statistics are presented as frequencies and percentages, sensitivity, specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV), as the categorical variable are presented as mean/median and range.

Results

There were a total of 670 referrals during the study period. USS for testes for patients fulfilling our inclusion and exclusion criteria was done in 207 (30.89%) patients for a total number of 414 testes, before referral to us. The main referring clinicians were neonatologists, pediatricians, and family medicine doctor with nearly equal numbers referred by them (Table 1). The median age at referral was 10 months (range: 0 months to 12 years) which was also the same for patients who did not have an USS before referral. Actual clinical findings about the location of testes were only mentioned in 22/207 (10.46%) patients by the referring physician.

Specialities	USS values
Neonatology	37 (17.87%)
General pediatrics	38 (18.35%)
Family medicine	47 (22.7%)
Other specialties	23 (11.11%)
Unknown	62 (29.95%)

Table 1: Specialties breakdown according to USS done before referral.

Out of the total 207 patients, 205 USS were done in our hospital and only two USS were done in another hospital. Two patients also had an MRI done in other hospitals before referral to us. In 19 patients the USS was done despite testes being palpable by the referring team. Laparoscopy was done in 61 patients (29.46%) and the rest had groin exploration (Table 2).

USS showed all types of errors from reporting vanishing testes as normal to a normal testes being reported as intra-abdominal. It did not show a 100% sensitivity to detect even normally descended testes. The sensitivity, specificity, PPV and NPV of USS compared to per operative findings for testes in different locations has been summarized in Table 3. USS wrongly diagnosed 13 out of 71 testes (18.3%) as normal. USS misdiagnosed 22/29 (75.87%) cases as vanishing testes. If we include nubbins as vanishing testes even then USS misdiagnosed 17/29 (58.62%) cases as vanishing testes. If we had solely relied on USS, we would not have operated on these 17 cases assuming these have vanished testes, and the 13 cases wrongly reported as normal, which could have resulted in potentially serious complication of malignancy or infertility in bilateral cases.

Operative findings	USS Findings (Patient n=207, tests n=414)				
	Normal=71	Scrotal neck/ Inguinal=243	Abdominal n=71	Negative n=29	Total
Normal	58 (81.69%)	41 (16.87%)	2 (2.81%)	0	101
Inguinal/ scrotal neck	11 (15.71%)	187 (78%)	7 (9.85%)	8 (27.58%)	213
Intra-abdominal	1 (1.4%)	14 (5.76%)	58 (81.69%)	9 (31.03%)	82
Vanishing	0	0	1 (0.41%)	7 (24.13%)	8
Nubbin groin	1 (1.4%)	1 (0.41%)	3 (1.4%)	5 (17.24%)	10
Total wrong diagnosis n=101 (24.3%)	13 (18.30%)	53 (22%)	13 (40.84%)	22 (75.87%)	

Table 2: Comparison of USS findings *vs.* per operative findings.

Similarly 9 testes were reported wrongly as intra-abdominal by USS. On examination under anesthesia two of these were

found to be normal and 7 were felt in the groin. These children would have undergone un-necessary laparoscopy if we had acted on the findings of USS alone. USS also diagnosed 243 testes as in the groin. Among these 41 (16.87%) were found normal per operatively. USS diagnosed one vanishing testis as intra-abdominal. The total number of testes miss diagnosed by USS in all the locations was 104 (25.12%). Overall the sensitivity, specificity, PPV and NPV of USS was not high enough for any location of testes to rely on it confidently to decide either about the surgery or the type of surgery e.g. groin exploration *vs.* laparoscopy.

USS for testes costs about US $50 in our hospital. The cost for 207 patients for USS only was US $10350. To add to that the parents journey to hospital, day off work, arrangement of nanny for other children and parking charges etc. the actual cost would have been much higher.

Actual location of tests	Sensitivity %	Specificity %	Positive predictive value %	Negative predictive value %
Normal	57.42	95.84	76.95	87.46
Inguinal/ Scrotal neck	87.79	72.13	76.95	84.79
Intra-abdominal	70.73	96.08	81.69	77.05
Vanishing	87	94.58	24.13	99.74

Table 3: Sensitivity, specificity, PPV and NPV of USS for testes in various location when compared to per operative findings.

Discussion

The American Urology Association (AUA) latest guidelines in published in 2014 recommended against doing an ultrasound in children diagnosed with UDT. Instead, it is recommended to refer the child to a specialist when the clinician is unable to palpate the testicles by 6 months of age [6]. Similarly, The Canadian Urological Association guidelines published in 2017 also recommend against conducting any such studies [7]. The use of USS for detection of gonads is generally limited to certain conditions for example, intersex conditions to delineate anatomical structures to aid in gender differentiation [8]. Despite that, some referring physicians tend to use USS assuming it might aid in localizing the testes and help in its management before referring the patient to a surgeon.

There are two main aspects that need to be considered as the role of USS in the management of UDT. Firstly to locate testes with high sensitivity and specificity so that surgical approach can be based on it like the need for groin explorations *vs.* laparoscopy. Secondly to identify accurately an atrophic or vanishing testes so that surgery can be avoided altogether. The other aspects to consider would be delay in referral due to USS and the cost of the investigations.

Different sensitivity and specificity of USS has been reported to detect UDT which is intra –abdominal or impalpable and in the groin. Tasian et al. published a systematic review in 2011, which showed a low sensitivity and specificity of 45% and 78 to identify and localize a non-palpable testes [9]. They concluded that the USS was unreliable to rule out intra-abdominal testes and suggested that elimination of its use would not change the management of UDT. The reliability of ultrasound for impalpable testes was compared with operative findings in another study by Phewplung et al. which included 20 patients and 29 testes [10]. They also found a very high number of false positive and false negative reports by the USS. They calculated a sensitivity of 82%, a specificity of 0%, NPV of 0%, PPV of 95.8% and an accuracy of only 79.3%. The USS was not even able to detect two testes which were present in the groin. So they concluded that USS is unreliable to detect the presence or location of UDT irrespective of location. We had very similar experience. We also observed that USS had false positive reporting for vanishing testes. It can lead to a difficult situation to convince the parents post operatively that the testis has been absent. This can have potential medico-legal implications. Tasian et al. concluded from their systematic review that with the current sensitivity and specificity, if a surgeon decides not to operate as the testis appear to be absent on USS, there is still a 36% chance of missing an intra-abdominal testis which is a very high risk situation that cannot be justified [11]. In our study we found at least 58.62% patient were mislabelled as vanishing testes which is very concerning.

The correct diagnosis by USS for normal testes or testes in the groin has not been reliable either. In a study by Jamalalail et al. USS was not able to identify 50% of the intra-abdominal testes and 35% of the intra canalicular testes. Though they concluded that the USS sensitivity is high for testes in the groin but still 35% of the groin testes were not detected accurately by USS which is a significant number. Irrespective of USS findings, laparoscopic exploration was done in all non- palpable testicles and the use of ultrasound did not spare the patients the need for laparoscopy in such cases [12]. Haid et al. found that USS was not able to detect any of the 23 impalpable testes, five of which were palpable in the groin when examined under anaesthesia and the rest of the 18 were found intra-abdominally during surgery, 15 of which were recorded as good size [13]. In another study conducted in Canada, 51% of normal or retractile testes were misdiagnosed as UDT [14]. All these studies including our study suggest that if decision is based on USS findings alone, many unnecessary surgical exploration will be performed when not needed, surgery not performed when needed and wrong surgical approach would be adopted.

Very few studies have looked in to the cost of the investigation and the delay it can cause in referral to a surgeon. In the study by Kanaroglou et al. which included 894 patients who had and USS for testes before referral, cost the hospital 20547 Canadian dollars (71 dollars/scan) [14]. In another comparative study including UDT and hydrocele of patients who had an USS before referral with patients who had no USS before referral, it was found that USS had no impact on the need and type of surgery in either group, rather USS delayed referral of the patients to a surgeon and incurred an additional unnecessary cost [15]. This delay in referring to surgeons by up to 3 months has also been reported by Kanaroglou et al.

[14]. This delay was not seen in our study as patient who had and USS before referral and the rest who did not have an USS, presented to the clinic at similar mean age. The logical explanation to this is that our waiting time for USS appointment is very short for children.

There are many limitations to this study. Apart from retrospective nature of the study, many of the USS were done by trainees. Although the reports were verified by the consultants but we do not know how many of the representative pictures they were able to look at. Also the peeping testes may have altered the USS findings as it may have been intra-abdominally or in the groin during USS but may have been at the other location during surgery.

Conclusion

The use of ultrasound does not aid in the diagnosis or management of UDT, incurs an unnecessary cost and can be even potentially dangerous in certain situations if management is planned solely on its findings. Primary care physicians and paediatricians should refrain from requesting ultrasound before referral to a surgical facility.

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