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Original Research Article

DEGREE OF AGREEMENT BETWEEN ULTRASONOGRAPHY AND MAGNETIC RESONANCE IMAGING FOR DETECTION OF NON-PALPABLE TESTIS AMONG PATIENTS WITH CRYPTORCHIDISM

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Abstract: *The current study aimed to determine the degree of agreement between ultrasonography and magnetic resonance imaging to detect non-palpable testis among patients with cryptorchidism. This cross-sectional study was conducted at the Department of Radiology, Jinnah Hospital, Lahore, from 15th May 2014 to 14th November 2014. 120 patients under 12 years of age with cryptorchidism were included to detect the presence or absence of testis by magnetic resonance imaging and ultrasonography. 120 patients had a mean age of 5.10 ± 2.5 years ranging from 2 to 11. 90 patients (75%) showed undescended testes by ultrasonography while MRI detected the presence of undescended testes in 98 patients (81.7%). 84 patients were detected for the presence and 16 for the absence of undescended testes by MRI and ultrasound (kappa = 0.512). It is concluded that the agreement between ultrasonography and magnetic resonance imaging (51.2%) is although moderate yet acceptable for detection of non-palpable testis among patients of cryptorchidism.*

Keywords: Cryptorchidism, Undescended Testes, Magnetic Resonance Imaging, Ultrasonography

Introduction

Cryptorchidism (undescended testes) refers to the incomplete descent of one or both testicles in the scrotum and is the most common birth anomaly in boys, affecting 2-8% (Ladjouze and Donaldson, 2019). Approximately 20% of undescended testes are non-palpable as they are either located in the abdomen or the canaliculi or are completely absent (Fazal et al., 2022). The treatment of cryptorchidism should begin after six months and ideally be completed by the child's first birthday as it may lead to infertility or increased risk of testicular cancer otherwise (Adachi et al., 2019). Treatment comprises mainly surgical exploration and fixation of the testis in the scrotum. This can minimize the risk of infertility and cancer (scrotal positioning allows easier examination of the testicle, which favors early detection of malignancy) (Agrawal and Kataria, 2015). The diagnosis and treatment are straightforward if the testes are palpable. However, the diagnosis and management of non-palpable testis are challenging. Laparoscopy is considered the most reliable for establishing the diagnosis (considered the gold standard) (Van Oosterom et al., 2019). However, this is invasive and is not out of risk of complications like infection and visceral injuries. Currently, diffusion-weighted magnetic resonance imaging has been suggested with the sensitivity of 91% and diagnostic accuracy of 92% for the detection of undescended testis. However, diffusion-weighted MRI is expensive and is not readily available everywhere (Abd Alnabie, 2017).

A study, as concluded by Kanemoto K, on 59 patients with non-palpable testes. All the patients had ultrasonography followed by MRI for detection of testes. The sensitivity of USG was 79%, and the specificity was 100%. These observations were further confirmed by surgical exploration. 2 In A study conducted by Adele A Shehta & Osama M Zakeria on 30 patients, MRI, and ultrasound were done for the detection of undescended testis, the sensitivity of ultrasound was 89.3% & with the specificity of 100% and MRI 100% sensitivity & 100% specificity 90% of agreement between ultrasonography and MRI (Shehata and Zakeria, 2003). Usually, diffusion-weighted MRI is used, especially in developed countries, which is costly and non-affordable (Kantarci et al., 2010). The rationale of this study was that imaging studies for accurate

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preoperative localization of non-palpable testis are the general practice, and ultrasonography is cheap, easily available, and a very time-saving procedure. This study aimed to study the agreement between ultrasonography & MRI in diagnostic procedure to detect the location of the testis.

Methodology

The current Cross-Sectional survey was conducted at the Department of Radiology Jinnah Hospital, Lahore, from 15th May 2014 to 14th November 2014. Taking the Agreement between ultrasonography and MRI to detect non-palpable testis 90%, the required sample size was 120 with a 95% confidence interval. A purposive, non-probability sampling technique was used to collect the data. Children below 12 years with only male gender were included, whereas children with inguinal pathology like hernia or hydrocele detected on clinical examination were excluded from the study.

After approval of this study, 120 patients were included according to the selection criterion from the Department of Radiology, Jinnah Hospital Lahore. Informed consent was taken from all participants' guardians after explaining the study's purpose.

Ultrasonography was done in all patients. Findings were noted in terms of the presence or absence of undescended testes. Similarly, all patients underwent magnetic resonance imaging for the presence of undescended testes.

Data collected were entered and analyzed in SPSS version 17. Mean with standard deviation was calculated for quantitative variables like age, while frequency and percentages in categorical variables like the presence of undescended testes. Data were stratified by age to determine the effect modification. A p-value <0.05 was considered significant.

Results

120 patients were included in the study population with a mean age of 5.10 ± 2.5 years ranging from 2 to 11 years. Sampled population (n=120) was distributed into different groups according to their ages. 77 patients (64.2%) were either 5 years or below 5 years of age. While resting, 43 patients (35.8%) were between 6 to 11 years of age (Figure 1).

Among 120 patients with cryptorchidism, 90 patients (75%) showed undescended testes on ultrasound, while the remaining 30 patients (25%) were not detected by ultrasound. MRI detected 98 patients (81.7%) with undescended testes while the rest 22 (18.3%) patients (figure 2).

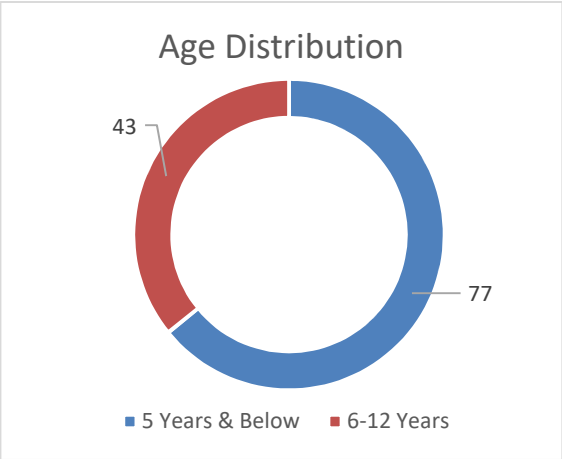

Figure 1 Distribution of age groups

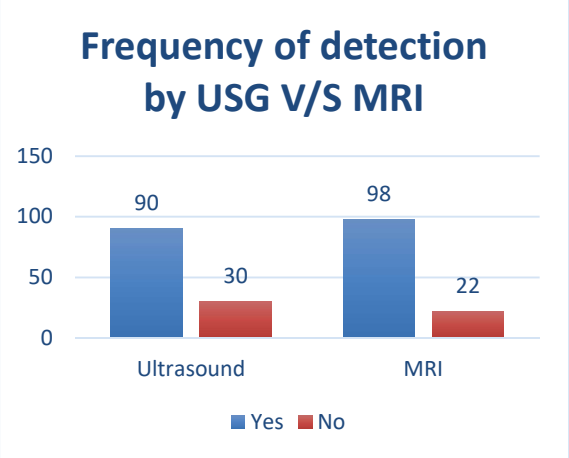

Figure 2: Frequency distribution of detection of cryptorchidism by USG versus MRI

When we tabulated the results of detection by ultrasound and detection by MRI, there was an agreement for 84 patients (90%) between MRI and ultrasound; 14 patients showed undescended testes only by MRI but not by ultrasound. (Table 1). To find out the distribution of detection by MRI in different age groups, we cross-tabulated age groups with detection by MRI. The results were significant (*p*=0.000). Out of 77 patients belonged to the age group 5 years and below. 55 patients (71.4%) showed undescended testes detected by MRI. While in age groups 6 to 12 years, all 43 patients were detected with Cryptorchidism by MRI. (Table 2) To evaluate the distribution of detection by ultrasound in different age groups, we cross-tabulated age groups with detection by ultrasound. The results were non-significant (p=0.742). Out of 77 patients in the age group 5 years and below, 57 patients (74%) showed undescended testes detected by ultrasound. While in age groups 6 to 12 years, all 33 patients (76.7%) were detected with cryptorchidism under ultrasound. (Table 3)

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Table 1 Cross-tabulation between Detection by Ultrasound & Detection by MRI

		Detection by MRI		Total
		Yes (n, %)	No (n, %)	
Detection by Ultrasound	Yes (n, %)	84 (93.3%)	6 (6.7%)	90 (100%)
	No (n, %)	14 (46.7%)	16 (53.3%)	30 (100%)
	Total	98 (81.7%)	22 (18.3%)	120 (100%)

Table 2 Crosstab between Age Groups & Detection by MRI

		Detection by MRI		Total
		Yes (n, %)	No (n, %)	
Age Groups	5 Years and Below (n, %)	55 (71.4%)	22 (28.6%)	77 (100%)
	6-12 Years (n, %)	43 (100%)	0 (0%)	43 (100%)
	Total	98 (81.7%)	22 (18.3%)	120 (100%)
Using Fischer exact test, p- value < 0.001 (Significant)				

Table 3 Crosstab between Age Groups & Detection by USG

		Detection by USG		Total
		Yes (n, %)	No (n, %)	
Age Groups	5 Years and Below (n, %)	57 (74.0%)	20 (26.0%)	77 (100%)
	6-12 Years (n, %)	33 (76.7%)	10 (23.3%)	43 (100%)
	Total	90 (75.0%)	30 (25.0%)	120 (100%)
Using the chi-square test, p value= 0.74 (non-significant)				

Discussion

Cryptorchidism (undescended testis) is the most common genitourinary anomaly in male infants with difficult diagnoses (Tasian et al., 2011). Early diagnosis helps better management and prognosis. Laparoscopy is the gold standard for the detection of the location of testes within its descending tract, but it is an invasive procedure. The other modalities are magnetic resonance imaging (MRI) and ultrasonography (Salonia et al., 2006). We conducted this study to determine whether ultrasonography can replace magnetic resonance imaging in resource-scarce settings like ours. 90 patients (75%) out of 120 had undescended testes by ultrasonography, while MRI detected 98 patients (81.7%) with undescended testes. 84 patients (90%) were detected for the presence of undescended testes between MRI as well as ultrasound showing kappa statistics of 0.52 (p value < 0.001). 14 patients were those who showed undescended testes only by MRI. This agreement is moderate yet acceptable.

Age was significantly associated with magnetic resonance imaging detection but not ultrasonography. MRI detected all patients with ages ranging from 6-12 Years. We may safely conclude that for patients of age more than 6 years, magnetic resonance imaging is a better modality.

In addition, the results show a significant difference in the distribution of detection by MRI in different age groups, with a higher percentage of patients in the age group 5 years and below showing undescended testes detected by MRI (71.4%). This may be because the testes are still descending in younger children and, therefore, may be more difficult to detect by ultrasound (Hosokawa et al., 2020).

Interestingly, there was no significant difference in the distribution of detection by ultrasound in different age groups. This suggests that ultrasound may be equally effective in detecting undescended testes in patients of different age groups.

The results suggest that MRI may be a more sensitive diagnostic tool for detecting undescended testes, particularly in younger children. However, ultrasound may still be useful for detecting undescended testes in patients of all age groups. Further research is needed to confirm these findings and determine the most appropriate diagnostic tool for detecting undescended testes in different patient populations. Limitations of the current study include a non-representative sample and a purposive sampling technique.

Conclusion

It is concluded that the agreement between ultrasonography and magnetic resonance imaging (51.2%) is moderate yet acceptable for detecting non-palpable testis among cryptorchidism patients. We may use ultrasonography in our general practice.

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Conflict of interest

The authors declared absence of conflict of interest.

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