

Diagnostic Accuracy of Ultrasonography for Diagnosis of Undescended Testes in pediatric population using Magnetic Resonance Imaging as gold standard

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ABSTRACT

Background: Undescended testes or cryptorchidism is a developmental condition of abnormal location of testes and they are not normally located in the scrotal sac. It can be unilateral or bilateral. Accurate diagnosis is necessary for healthy fruitful life of male children in future. Ultrasound is being considered the useful imaging tool for the localization of palpable testes. But controversy was noted.

Aim: To ascertain the diagnostic accuracy of Ultrasonography for diagnosis of undescended testes in pediatric population using MRI as gold standard

Study Design: Cross sectional study.

Setting: Department of Diagnostic and Interventional Radiology, Sir Ganga Ram Hospital, Lahore.

Duration of Study: 6 months from 09-07-2017 to 10-01-2018

Methods: 130 cases fulfilled inclusion criteria were registered in the study. Patients underwent ultrasonography and later on MRI scan for confirmation of presence of undescended testes. The findings were collected on proforma. Data was entered and evaluated through Statistical Package for Social Sciences (SPSS). Sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasound was calculated taking MRI scan as gold standard.

Results: The mean age of children was 8.64±4.08years. The mean weight of children was 30.40±13.81kg. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasound were 90.2%, 94.9%, 92%, 93.8% and 93.1% respectively, taking MRI as gold standard.

Conclusion: Thus, ultrasound is accurate enough to detect undescended testes. So in future, we can replace MRI with ultrasound for detection of undescended testes and prevent children from hazardous rays of MRI.

Keywords: Undescended testes, cryptorchidism, ultrasound, magnetic resonance imaging, male children

INTRODUCTION

Cryptorchidism or undescended testes is an embryological anomaly resulting in the failure of testicular descent into the scrotal sac. It is the most commonly occurring anomaly of male genitourinary system. Prematurity is the significant risk factor for this anomaly as upto 30% pre term male babies are affected.²

This condition has got serious implications in the form of infertility (in case of bilateral disease) and malignancy as there is increased risk of testicular cancer in the undescended testis. Therefore early detection and treatment of cryptorchidism can prevent patients from the lifelong agony of infertility and also from the fatal complications of testicular malignancy¹.

The normal embryological route of testicular descent is the common location to look for undescended testis. However ectopic locations for undescended testis may also be looked for and includes superficial inguinal pouch, prepenile, femoral, perineal locations or the opposite hemiscrotum. Physical examination is the primary tool of the clinician to diagnose cryptorchidism. By the virtue of detailed and cautious palpation of the scrotum and inguinal region, the location of undescended testis can be usually ascertained².

It is really a challenging and complicated task for the clinician to diagnose the exact location of nonpalpable testes. The precise diagnosis and accordingly suitable management of undescended testes has an important effect on the restoration of testicular hormonal function in viewpoint of infertility. Moreover the initial detection of testicular malignancy can also be made by the exact diagnosis of undescended testes⁴.

MRI is used as gold standard method for diagnosis of undescended testes. In 1999, Yeung et al. reported the sensitivity and specificity of MRI for detecting undescended testes, 96% and 100% respectively³.

The palpable testes have variable detection rate on ultrasound and the reported sensitivity and specificity of ultrasound is 45% and 78% respectively³. It was concluded that ultrasound assessment is beneficial in pre-operative evaluation of children with undescended testes⁵. Another study showed that sensitivity, specificity and accuracy of ultrasound for diagnosing undescended were 82.6%, 100% and 84.6% respectively⁶.

Principle of this study is to ascertain the diagnostic accuracy of Ultrasonography for diagnosis of undescended testes in pediatric population using MRI as gold standard. Ultrasound is a cheap and easily accessible method for prediction of undescended testes. But controversy has been observed in literature. So to confirm the reliability of ultrasound in local setting, we conducted this study, as there are no local evidence available in this regard. Results of this study will help in future for non-invasive diagnosis of

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undescended testes instead of going for radiation or use of contrast medium in cases of MRI scan.

METHODOLOGY

This study was performed in the Department of Diagnostic and Interventional Radiology, Sir Ganga Ram Hospital, between 09-07-2017 to 10-01-2018. Patients of age 2-15 with history of small scrotal size as compared to normal sac size in normal kids of particular age group or having empty scrotal sac on clinical examination were included in the study. Patients with previous inguinal surgery or who had co-existing anterior abdominal or life threatening congenital anomalies (on clinical examination) were excluded from the study. 130 cases fulfilled inclusion criteria and referred to Department of Radiology, Sir Ganga Ram Hospital, Lahore were enrolled in the study. Informed consent was taken. Demographic data (including name, age, gender and contact) was also recorded. Then patients underwent ultrasonography by using a 7.5 MHz(megahertz) linear array probe (Toshiba, Model:Nemio 10). All patients were reexamined and scanned in the lying posture position both in axial and longitudinal planes. The abdomen and scrotum were examined. Undescended testes were diagnosed by looking for ovoid homogenously hypoechoic structure having vascular pedicle along the path of testicular descent (abdominal cavity, inguinal canal). Presence of undescended testes was detected on ultrasound on the basis of finding testes not in the scrotal sac, rather in the ectopic location i.e. in the abdominal cavity or inguinal canal. Patients were labeled as positive or negative. Then patients underwent MRI scan by using 1.5 T MRI machine (Toshiba Model No. MRT 1503). All patients were scanned in the supine position with examination of lower abdominal cavity including the scrotal sac using body coil. Sequences which were acquired included axial T1WI, sagittal T1WI, coronal T1WI, axial and sagittal T2WI Fat-Sat. These scans were reviewed on PACS workstation on the basis of signal characteristics of testes and their location. Signal characteristics of both normal and undescended testes included bright signals on T2 weighted Fat-Sat and low signals on T1 weighted images. Normally testes were located in the scrotal sac while undescended testes could be found along the path of testicular descent. MR diagnosis of undescended testes was based on the detection of empty scrotal sac and the presence of testes in the ectopic location. Reports were assessed and patients were labeled as positive or negative. All the information was collected on a specially designed proforma.

All the collected data was entered and analyzed through SPSS version 20. Quantitative data i.e. age and weight were mentioned as mean and standard deviation. Qualitative data i.e. undescended testes (assessed on ultrasound/MRI) were mentioned as frequency and percentage. 2x2 table was created to determine sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasound using MRI scan as gold standard.

RESULTS

The mean age of children was 8.64±4.08years. The mean weight of children was 30.40±13.81kg. On ultrasound, there

were 50 (38.5%) positive while 80 (61.5%) negative for undescended testes (Fig 1). On MRI, there were 51(39.2%) positive while 79 (60.8%) negative for undescended testes (Fig 2). The sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasound were 90.2%, 94.9%, 92.0%, 93.8% and 93.1% respectively, taking MRI as gold standard (Table 1).

Figure 1: axial and coronal T1W and T2W FAT SAT MRI images showing the left testis located in scrotal sac while right testis is located ectopically in right inguinal canal near deep inguinal ring. Both testes are hyperintense on T2W and hypointense on T1W.

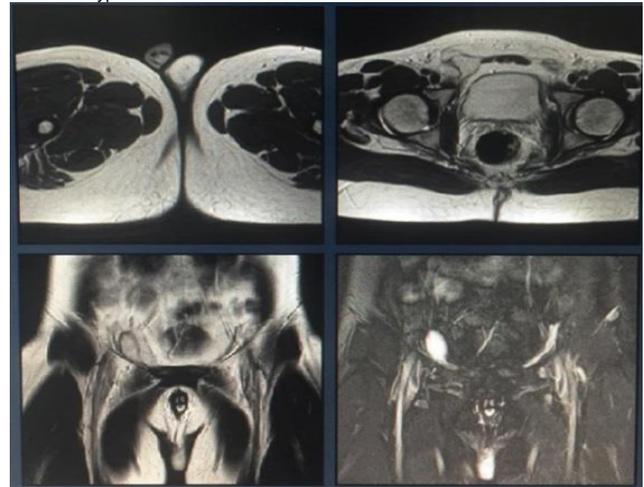
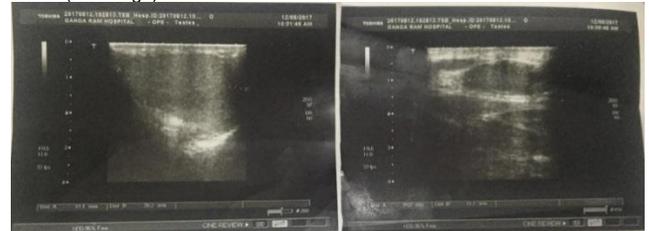
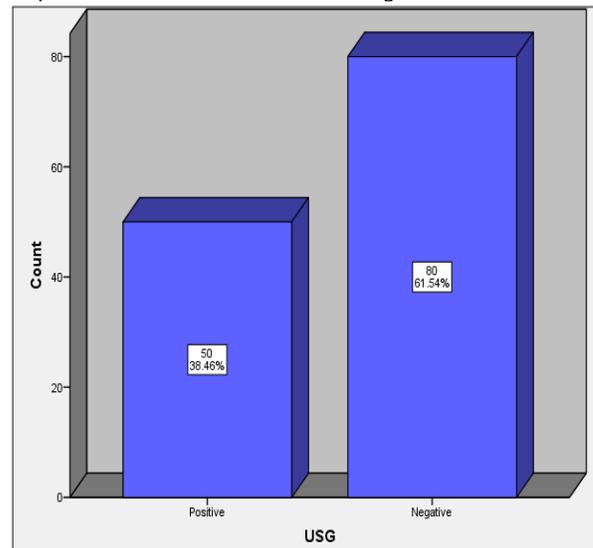


Figure 2: USG images showing normal homogenously hypo echoic left testis in the scrotal sac (right image) and undescended right testis in the inguinal canal. (left image)



Graph 1: Distribution of ultrasound findings



Graph 2: Distribution of MRI findings

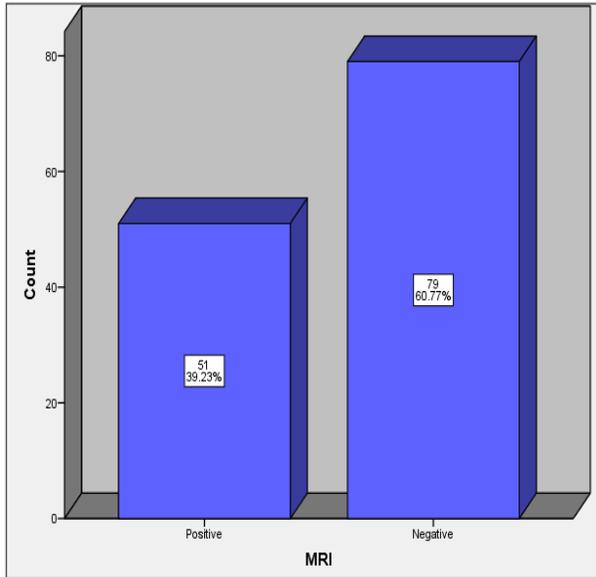


Table 1: Accuracy of ultrasound against MRI for undescended testes

		MRI		Total
		Positive	Negative	
Ultrasound	Positive	45	4	49
	Negative	5	75	80
Total		51	79	130

Sensitivity = 90.2%,
 PPV = 92.0%,
 Diagnostic accuracy = 93.1%

Specificity = 94.9%
 NPV = 93.8%

DISCUSSION

Cryptorchidism is one of the most commonly reported male genitourinary system anomalies in which there is lack of testicular descent into the scrotal sac^{7,8}.

In (our) this study, there were 50(38.5%) positive (patients) while 80(61.5%) negative for undescended testes on ultrasound while there were 51(39.2%) positive while 79(60.8%) negative for undescended testes on MRI. Thus the sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasound were 90.2%, 94.9%, 92%, 93.8% and 93.1% respectively, taking MRI as gold standard.

The palpable undescended testes have been identified variably by ultrasound with the reported sensitivity and specificity of 45% and 78%.³ While Phewplung et al., in Bangkok, Thailand reported a sensitivity of 82% and accuracy of 79% respectively. These sensitivity and accuracy imply that ultrasound is reliable in pre-operative location of the undescended testes⁹.

Komine et al., found that sensitivity, specificity and accuracy of ultrasound for the localization of undescended testes were 82.6%, 100% and 84.6%. Therefore based on mentioned statistics, ultrasound came out to be useful and

readily available diagnostic imaging modality for the detection of undescended testes in inguinal region⁶.

The empirical results reported in this study should be considered in the light of some limitations. The proper technique of ultrasound should be followed. The proper positioning of the patient was extremely important in the localization of undescended testes. Ultrasound was also highly operator dependent technique. At times excessive bowel gases obscured the abdominal cavity, making it difficult to detect the undescended testes in the abdominal cavity. All these limitations strongly influenced the interpretation of ultrasound findings. These results point out towards a sensible use of the modality in undescended patients.

CONCLUSION

Thus, ultrasound is accurate enough to detect undescended testes. So in future, we can use ultrasound for readily detection of undescended testes with confidence and thus can avoid the delay in the diagnosis especially in those areas where MRI facility is not available. Hence, by timely diagnosing the undescended testes on ultrasound, we can avoid the harmful complications.

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