ORIGINAL ARTICLE

Diagnostic Accuracy of Magnetic Resonance Imaging for Localizing Testes in Cases of Cryptorchidism

SMEERA AHMAD, NADIA SULTAN, ASHFA AMEER

ABSTRACT

Aim: To determine the diagnostic accuracy of MRI for localizing undescended testes in clinically detected cases of cryptorchidism taking surgical findings as gold standard.
Study design: Cross-sectional survey
Methods: It was a cross-sectional survey. Patients were recruited by non probability purposive sampling technique. One hundred and seventy clinically and ultrasonically (superficial linear 7.5 MHZ transducer with AU5 Harmonic EZAOTI) diagnosed cases of non palpable undescended testes having age ranged between 0-16 years were selected from the Department of Diagnostic Radiology, The Children's Hospital and Institute of Child Health, Lahore during the period of six months from 03-08-2007 to 02-08-2009. Children having ambiguous genitalia on clinical examination and Boys not fit for anesthesia or surgery were excluded from study. MRI of all cases using 1.5 Tesla MR System was performed.
Results: The age of the patients ranged between 0-16 years. Mean age of the patients was 5.1±2.3 years. According to the side affected, there were 49 cases (28.8%) on right side, 93 cases (54.7%) on left side and 28 cases (16.5%) bilateral. Comparison of the results of MRI with surgical findings showed that there were 127 true positive cases, 3 false positive cases, 27 false negative cases and 13 true negative cases. Statistical analysis of the study revealed sensitivity 82.4%, specificity 81.2%, diagnostic accuracy 82.3%, positive predictive value 97.6%, and negative predictive value 32.5% of MRI for localizing undescended testes in clinically detected cases of cryptorchidism taking surgical findings as gold standard.
Conclusion: It is concluded that magnetic resonance imaging (MRI) offered a new promising imaging modality for localization of the undescended testis because it has better resolution, multiplanar capability, different sequences and is also non-hazardous and safe.
Key words: MRI imaging, Localizing of testes, Diagnostic accuracy

INTRODUCTION

The most common problems associated with undescended testes are testicular neoplasm, subfertility, testicular torsion and inguinal hernia. Chung and Brock[1] reported common scenarios of referral of men with prior history of cryptorchidism and orchidopexy seeking advice for infertility, and examine the association between cryptorchidism and male infertility. Cryptorchidism or undescended testis is amongst the most commonly encountered congenital disorders in the pediatric population. The incidence of cryptorchidism in full-term infants is 1% and 3%, and premature boys it is reported to be as high as 30%[2].

Boys with cryptorchidism face greater risk for infertility as well as testicular cancer.[3] Preliminary diagnosis and referral of boys with undescended testes is made by primary care providers who detect cryptorchidism at the time of routine physical examination.

The precise developmental phenomena resulting in cryptorchidism are not well understood; nevertheless, abnormalities in functional, anatomic as well as hormonal aspects during embryogenesis and testicular descent are implicated[4].

Undescended testis can be categorized on the basis of physical and operative findings: (1) true undescended testicles (including intra-abdominal, peeping at the internal ring and canalicular testes), which exist along the normal path of descent and have a normally inserted gubernaculum; (2) ectopic testicles, which have an abnormal gubernacular insertion; and (3) retractile testicles, which are not truly undescended. The most important category to distinguish on physical examination is the retractile testis, because no hormone or surgical therapy is required for this condition.

Cryptorchidism is connected with quite considerable clinical implications, such as infertility and testicular malignancy. Un-descended testes which can be non-palpable and located high up usually tend to have associated epididymal anomalies producing obstruction to the sperm conducting pathway.[5] despite the fact that surgical intervention is eventually required; there are described roles of diagnostic imaging. Imaging assessment of the patient with a non-palpable testis has evolved over recent decades.[6] MRI is considered to be more accurate in determining an undescended testis[7].

Department of Diagnostic Radiology, The Children's Hospital and Institute of Child Health, Lahore
Correspondence to Dr. Sameera Ahmad

Being a non invasive modality with added advantage of no exposure to ionizing radiation[8,9]. It is now widely accepted that MRI should be performed before any invasive procedure. The purpose of this study is to evaluate the diagnostic role of MRI for localizing testes in cases of clinically non palpable undescended testes as pre- requisite for an early corrective surgery. It will go a long way in reducing complications.

METHODOLOGY

It was a cross-sectional survey. Patients were selected by non-probability purposive sampling technique. One hundred and seventy clinically and ultrasonically (superficial linear 7.5 MHZ transducer with AU5 Harmonic EZAOTI) diagnosed cases of non palpable undescended testes aged between 0-16 years were recruited from the Department of Diagnostic Radiology, The Children's Hospital and Institute of Child Health, Lahore during the period of six months from 03-08-2007 to 02-08-2009. These children were followed up in surgery units of respective hospitals to record surgical outcome. Children having ambiguous genitalia on clinical examination and boys not fit for anesthesia/ surgery were excluded from study. After taking informed consent the basic demographic information (age) was recorded and hospital ethical committee would be appraised. MRI of all cases at 1.5 Tesla MR System (Philips Gyro Scan NT, Compact Plus, Holland) was performed. Standard MR imaging techniques included axial and coronal images on T-1, T-2 and Fat Suppression sequences. MRI findings were recorded as testes localized/ not localized, if localized whether in the sac, pre-scrotal area, inguinal canal, pelvis or abdomen, right, left or bilateral. MRI findings were compared with surgical findings as reference standard. The collected information was analyzed by SPSS version10. Mean and standard deviation were computed for quantitative variables like age and side affected. Qualitative variables from MRI findings included testes localized/ not localized, if localized whether in the sac, pre-scrotal area, inguinal canal, pelvis or abdomen were presented in the form of frequency and percentage. Sensitivity, specificity, negative predictive value, positive predictive value and diagnostic accuracy of MRI were calculated by constructing a 2 x 2 table taking surgical findings as gold standard.

RESULTS

The age of the patients ranged between 0-16 years. Mean age of the patients was 5.1±2.3 years (Table 1). According to the side affected, there were 49 cases (28.8%) on right side, 93 cases (54.7%) on left side and 28 cases (16.5%) bilateral (Table 2). The MRI examination localized 130(76.5%) undescended testes while 40(23.5%) undescended testes were not localized by MRI examination (Table 3). Among the 130 localized undescended testes, 70(53.9%) were in inguinal canal which appeared to be the commonest location for undescended testes. 37(28.4%) undescended testes were found in pre-scrotal area, 13(10%) in pelvis and 10(7.7%) in the abdomen (Table-4). Surgical findings revealed localization of 154 undescended tests whereas in 16 babies testes were found to be absent on surgery (Table 5). The distribution of the location of testes according to surgical findings also showed that inguinal canal was the commonest location for undescended testes as 73 testes (47.4%) were found here. 41(26.6%) testes were found in pre scrotal area, 23 testes (14%) in pelvis and 17 testes (11.1%) in abdomen (Table 6). Comparison between MRI and surgical findings showed that there were 127 true positive cases, 3 false positive cases, 27 false negative cases and 13 true negative cases (Table 7). Statistical analysis of the study revealed sensitivity 82.4%, specificity 81.2%, diagnostic accuracy 82.3%, positive predictive value 97.6%, and negative predictive value 32.5% of MRI for localizing undescended testes in clinically detected cases of cryptorchidism taking surgical findings as gold standard.

Table 1: Distribution of cases by age (n = 170)

Age (Year)	n	Percentage
< 5	77	45.3
5-10	83	48.8
11-15	10	05.9

Table 2: Distribution of clinically diagnosed undescended testes

Unilateral				Bilateral	
Right Side		Left Side			
No.	%	No.	%	No.	%
49	28.8	93	54.7	28	16.5

Table 3: MRI localization of undescended testes

Findings	No. of testes	Percentage
Localized	130	76.5
Not localized	40	23.5
Total	**170**	**100.0**

Table 4: Distribution of undescended testes by location on MRI (n=130)

Location	No. of testes	Percentage
Pre-scrotal area	37	28.4
Inguinal canal	70	53.9
Pelvis	13	10.0
Abdomen	10	07.7

Table 5: Surgical findings of localization of undescended testes

Findings	No. of testes	Percentage
Localized	154	90.6
Not localized	16	09.4

Table 6: Distribution of undescended testes by location on

surgery (n=154)

Location	Number of testes	Percentage
Pre-scrotal area	41	26.6
Inguinal canal	73	47.4
Pelvis	23	14.9
Abdomen	17	11.1

Table 7: Comparison MRI vs surgery

MRI	Surgery (Gold Standard)		Total
	Positive	Negative	
Positive	127	3	130
Negative	27	13	40
Total	**154**	**16**	**170**

Sensitivity= 82.4% Specificity = 81.2%
Accuracy = 82.3% PPV = 97.6% NPV = 32.5

DISCUSSION

The embryonic development of testis takes place in abdomen initially. It, then moves toward the scrotum during the last trimester and becomes palpable at birth. Undescended testis refers to the condition in which the movement of the testis has been arrested before reaching the scrotum. Undescended testis is one of the most frequent disorders of the genitourinary system in male infants[10]. The undescended testis presents a special diagnostic and therapeutic challenge because leaving a testis in an undescended position increases the riskoccult malignant degeneration in the future.

MRI is considered by many to be the single best imaging method for the evaluation of undescended testes[6]. The results of our study show that MRI is an important sensitive and specific diagnostic tool in detection of undescended testis, having a sensitivity of 82.4%, specificity of 81.2% and diagnostic accuracy of 82.3%. These results are in accordance with other studies such as: Kanemoto et al[8]. They demonstrated sensitivity of 86%, specificity of 79%, and diagnostic accuracy of 85%. Kamigaito et al[9] reported MRI sensitivity of 85.7% in preoperative localization of undescended testis[9].

The un-descended testes in our study were well imaged with MR in both the coronal and axial planes. This result agrees with Kier et al[11] as all the detected undescended testes were hypointense on T1W and slightly hyperintense on T2W images[11].

The result that cryptorchidism was unilateral in majority of the children i.e. in 142 (83.5%) and bilateral in 28 cases (16.5%) is comparable with study of Dogra et al[12]. According to Shehata and Zakaria[13] the most common location of undescended testis is with in inguinal canal 53.3%, followed by pre-scrotal area (26.7%) and abdomen (13.3%). Our findings are also close to theirs'. The commonest location for un-descended testis in our study was within inguinal canal (53.9%). The 2nd common location was pre-scrotal area (28.4%) followed by pelvis (10%) and abdomen (7.7%) on MRI.

Cryptorchidism develops in all boys with the Prune belly syndrome (lax abdominal wall musculature) in fact it is more prevalent in boys born with abdominal wall defects that cause a reduction in intra-abdominal pressure such as gastroschisis as well as omphalocele[13].

CONCLUSION

It is concluded that magnetic resonance imaging (MRI) offers a new promising imaging modality for localization of the undescended testis because it has better resolution, multiplanar capability, different sequences, non-hazardous and as well as safe. When an undescended testis is localized, orchidopexy can be planned on the basis of MRI findings.

REFERENCES

1. Chung E, Brock GB. Cryptorchidism and its impact on male fertility: a state of art review of current literature. Can Urol Assoc J 2011;5:210-4.
2. Kolon FT, Patel PR, Huff SD. Cryptorchidism: diagnosis, treatment and long-term prognosis. Urol Clin North Am 2004;31:469–80.
3. Pettersson A, Richiardi L, Nordenskjold A. Age at surgery for undescended testis and risk of testicular cancer. N Engl J Med 2007;356:1835–41.
4. Jared DC, Vikram SD. The Undescended Testis. Seminars in Ultrasound, CT & MRI 2007;28:307-16.
5. Athar MS, Mehmood MT, Ashraf S. Epididymal abnormalities associated with Undescended Testis. J Surg Pak 2004;9 :44-6.
6. Nguyen HT, Coakley F, Hricak H. Cryptorchidism: strategies in detection. Eur Radiol 1999;9:336-43.
7. Baloch TA, Iqbal P. Cryptorchidism in adults. Med Channel 2006;12:61-2.
8. Kanemoto K, Hayashi Y, Kojima Y, Maruyama T, Ito M, Kohri K. Accuracy of uitrasonography and magnetic resonance imaging in diagnosis of non-palpable testis. Int J Urol 2006; 12:668-72.
9. Kamigaito T, Nishizawa S, Nakayama T, Okaneya T, Suzuki K, Morita T, Preoperative magnetic resonance imaging in the management of the nonpalpable testis. Hinyokika Kiyo 2008; 54:107-9.
10. Elder JS. The undescended testis: hormonal and surgical management. Surg Clin North Am 1988; 68:983–1006.
11. Kier R, McCarthy S, Rosenfield AT, Rosenfield NS, Rapoport S, Weiss RM. Nonpalpable testes in young boys: evaluation with MR imaging. Radiology 1988;169:429-33.
12. Dogra VS, Mojibian H, Haddad JL. Cryptorchidism. eMedicine 2002;21:2-7.
13. Shehata AA, Zakaria OM. MRI versus ultrasound in localization of undescended testicles. Suez Canal Univ Med J 2003;6:291-300.