The Diagnostic Value of Combined Conventional MRI and Diffusion Weighted MRI in Diagnosis of Non-Palpable Undescended Testes

Essay

Submitted for Partial Fulfillment of Master Degree in Radiodiagnosis

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2017

Abstract

Introduction: Undescended testis or cryptorchidism, a condition in which one or both testicles are not appropriately positioned in the scrotum at birth. It is the most common congenital genitourinary anomaly in boys and has an incidence of 1–3% in term and 15–30% in premature male infants. approximately 20% of undescended testes are nonpalpable and either located in the abdomen or the canaliculi, or atrophic or are completely absent. Cryptorchidism is associated with impaired fertility, inguinal hernia, and increased risk of testis cancer.

Aim of the work: The aim of the work is to assess the value of adding diffusion-weighted sequences (DWI) to routine magnetic resonance imaging (MRI) in identifying and locating nonpalpable undescended testes.

Summary and conclusion: Cryptorchidism is the absence of one or both testes in the scrotum The term ‘non-palpable testes’ implies that the testes cannot be detected on physical examination; they are intra-abdominal, absent, vanishing or atrophic. Additional MRI assessments, as fat-suppressed T2WI and DWI are useful methods to improve the accuracy and sensitivity of diagnosis of non-palpable testes.

Keywords: Conventional MRI, Diffusion Weighted MRI, Non-Palpable Undescended Testes

سورة البقرة الآية: ٣٢

ACKNOWLEDGEMENT

First of all, thanks to Allah whose magnificent help was the main factor in completing this work.

No words can express my deep sincere feelings Towards Prof. Dr. Sherif Hamed Abougamra, Professor of Radiodiagnosis, Faculty of Medicine–Ain Shams University for his continuous encouragement, guidance and support he gave me throughout the whole work. It has been a great honor for me to work under his generous supervision.

I would like to express my deepest appreciation, respect and thanks to Dr. Khaled Ahmed Mohamad Ali, Lecturer of Radiodiagnosis, Faculty of Medicine–Ain Shams University, for his continuous guide in all aspects of life beside his great science, knowledge and information.

Last but not least, sincere gratitude to *My Family* for their continuous encouragement and spiritual support.

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List of Abbreviations

ADC map	Apparent diffusion coefficient map
AMH	Anti-müllerian hormone
CT	Computed tomography
DEHP	Di-ethylhexyl phthalate
DWI	Diffusion weighted imaging
EPI	Echo planar imaging
Fat supp. T2WI	T2-weighted imaging with fat suppression sequence in magnetic resonance imaging
FSH	Follicle stimulating hormone
GnRH	Gonadotropin releasing hormone
hCG	Human chorionic gonadotropin
HFS	Head first supine (MRI position)
IV	Intravenous
LH	Luteinizing hormone
MIS	Müllerian inhibiting substance
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
MRV	Magnetic resonance venography
S3	Sacral nerve root 3 (posterior femoral cutaneous nerve)
SE	Spin echo

SRY	Sex-determining region of the Y chromosome
TDF	Testes determining factor
TE	Echo time
TR	Repitition time
T1WI	T1 weighted imaging (MRI sequence)
T2WI	T2 weighted imaging (MRI sequence)
UDT	Undescended testes
US	Ultrasound
USG	Ultrasonography
XY	Male chromosomal karyotype

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INTRODUCTION

Undescended testis or cryptorchidism, a condition in which one or both testicles are not appropriately positioned in the scrotum at birth. It is the most common congenital genitourinary anomaly in boys and has an incidence of 1–3% in term and 15–30% in premature male infants. approximately 20% of undescended testes are nonpalpable and either located in the abdomen or the canaliculi, or atrophic or are completely absent. Cryptorchidism is associated with impaired fertility, inguinal hernia, and increased risk of testis cancer. ***(Ehab et al., 2014)***

The Preoperative identification and location of testicles can help to determine the optimal type of procedure and allow for appropriate advance planning. On the basis of the imaging findings, the surgeon can appropriately counsel the patient and alter the operative approaches needed. The imaging findings could obviate the need for surgical exploration.in the case of absent or vanishing testicles. ***(Shah et al., 2006)***

The Various imaging techniques have been suggested for use in identifying and locating non-palpable testicles preoperatively with varying limitations including expense, invasiveness technical difficulty, radiation risk, need for contrast medium, and need for sedation. Imaging approaches include ultrasonography, computed tomography (CT), routine MRI, magnetic resonance angiography (MRA), and magnetic resonance venography (MRV), some of which require sedation or anesthesia and are without risks. ***(Miller et al., 2009)***

The least expensive and frequently used technique of all imaging tools is ultrasound. However it had been shown to have low sensitivity in identifying non-palpable testicles preoperatively in a recent meta-analysis. ***(Tasian and Copp, 2011)***

Conventional MRI is moderately specific in identifying absent testicles but poorly sensitive in identifying the presence of non-palpable testicles. Conventional MRI appears to be less efficient in locating intra-abdominal functioning testicles and shows limited sensitivity in locating inguinoscrotal testicles, but it fails to

locate most of the atrophied testicles, which makes conventional MRI a less reliable technique in providing guidance to differentiate those children needing surgery from those who do not. ***(Krishnaswami et al., 2013)***

Additional MRI assessments, fat-suppressed T2WI and DWI are useful methods to improve the accuracy of diagnosis of non-palpable testes. It could prevent needless surgery and be worth the additional imaging tests. ***(Kato et al., 2011)***

Diffusion weighted imaging (DWI) is an evolving technology with the potential to improve tissue characterization when findings are interpreted in conjunction with findings obtained with other conventional MRI sequences. It provides functional and structural information about biologic tissues; it is best used to solve specific problems. ***(Qayyum, 2009)***

Use of DWI therefore facilitates characterization of tissue at the microscopic level in a mechanism different from T1 and T2 relaxation. The degree of restriction of water diffusion in biologic tissue is inversely related to tissue cellularity and the integrity of cell membranes (e.g.

tumor tissue). Concordantly, intra-abdominal testes are considerably more cellular than the adjacent organs and tissues and can be detected easily on DW images owing to their increased signal intensity. Therefore added DWI to routine MRI to identify non-palpable undescended testes. ***(Kantarci et al., 2011)***