Role of MRI in Diagnosis of Endometrial Cancer

Thesis
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List of Abbreviations

Abb.	Full term
1.5 T	1.5 Tesla
3D	3Dimension
3T	3 Tesla
ADC	Apparent Diffusion Coefficient
CE	Contrast Enhanced
CS	Carcinosarcoma
CT	Computed Tomography
DCE-MRI	Dynamic contrast enhanced magnetic resonance imaging
DWI	Diffusion Weighted Image
DW-MRI	Diffusion weighted magnetic resonance imaging
EC	Endometrial Carcinoma
EEC	Endometrial Endometrioid Carcinoma
Fig.	Figure
FIGO	International Federation of Gynecology and Obstetrics
FSE	Fast Spin Echo
G	Grade
Gd	Gadolinium
GE Sequences	Gradient echo sequences
IM	intra muscular
IV	Intravenous
JZ	Junctional zone
LN	Lymph Node
MRI	magnetic resonance imaging
ROI	Region of Interest
SC	Serous carcinoma
SE	spin echo
SEE	Sub-endometrial enhancement
SI	Signal Intensity
T1WI	T1 weighted image
T2 WI	T2 weighted image
TSE	Turbo Spin Echo

INTRODUCTION

Endometrial carcinoma is the most common malignancy of the female genital tract ***(Agrawal et al., 2012).***

The disease occurs most frequently in women during the sixth and seventh decades of life ***(Manfredi et al., 2005).***

It typically presents with abnormal uterine bleeding in 75% to 90% of patients ***(Jemal et al., 2011).***

MRI has been shown to be the best imaging modality in disease staging and treatment planning compared to endo-vaginal ultrasound and computed tomography, because of its contrast resolution and multi-planar capability ***(Tamai et al., 2007).***

The role of MRI in endometrial cancer includes the evaluation of depth of myometrial invasion, cervical invasion, and nodal metastasis. This greatly optimize the surgical procedure and therapeutic strategy ***(Agrawal et al., 2012).***

Prognosis depends on patient's age, histological grade, depth of myometrial invasion, cervical invasion, and the presence of lymph node metastases ***(Tamai et al., 2007).***

Magnetic resonance imaging has proven to be an accurate tool for assessing the depth of myometrial invasion.

It differentiates the presence of deep myometrial invasion from more superficial involvement.

The depth of myometrial invasion could be identified on a T2-weighted image according to junctional zone invasion ***(Ryoo et al., 2007).***

In postmenopausal women, the junctional zone may be poorly visible and the myometrium may be thinned due to uterine involution, making the presence and depth of myometrial infiltration more difficult to assess ***(Mubarak et al., 2009).***

Endometrial cancer is usually demonstrated as thickened endometrium or mass displaying hypo-to-isointense on (T1WI) with an intermediate signal intensity on (T2WI) ***(Savelli et al., 2008).***

On MRI, lymph node metastases were diagnosed when the short-axis diameter of the LN was 10mm or above and describing the characteristics of malignancy ***(Ryoo et al., 2007).***

The histological grade of the tumor is well-known as one of the most important prognostic factors regarding the lymph nodes metastasis and overall survival of the patient ***(Creasman et al., 1987).***

Diffusion-weighted imaging (DWI) with the aid of quantitative apparent diffusion coefficient (ADC) measurement

is a unique, non-invasive modality that was shown to improve the radiological diagnosis of malignant tumors ***(Levy et al., 2011).***

Areas characterized by high signal intensity (restricted diffusion) at DWI or by low values of the ADC generally correspond with foci of hyper cellularity represents a malignant tissue ***(Motoshima et al., 2011).***

Overall, MRI helps in decreasing endometrial carcinoma mortality rate due to early diagnosis and preoperative staging.

Postoperative MRI of the pelvis helps in assessing tumor reduction and decrease recurrence rate by choosing proper postoperative management ***(Frei and Kinkel, 2001).***

AIM OF THE WORK

The aim of this study is showing MRI role in diagnosis of female patients with endometrial cancer for better evaluation, prognosis and treatment strategies according to preoperative MRI staging.

Chapter 1

ANATOMY OF THE UTERUS

The uterus is a fibro muscular organ that can be divided into the upper muscular uterine corpus, which contains the endometrial cavity and the lower fibrous cervix, which extends into the vagina. The upper part of the uterus above the insertion of the fallopian tubes is called the fundus. The narrow portion situated between corpus and cervix is known as the isthmus and lies approximately at the level of the course of the uterine artery and the internal os of the cervix ***(Sokol and Glob, 2011).***

The uterus consists of the following 3 tissue layers (fig. 1): ***(Millie, 2015).***

- The inner layer, called the endometrium, is the most active layer and responds to cyclic ovarian hormone changes.
- The middle layer, or myometrium, makes up most of the uterine volume and is the muscular layer, composed primarily of smooth muscle cells, the inner most layer of myometrium is known as the junctional zone
- The outer layer of the uterus, the serosa or parametrium, is a thin layer of tissue made of epithelial cells that envelop the uterus.

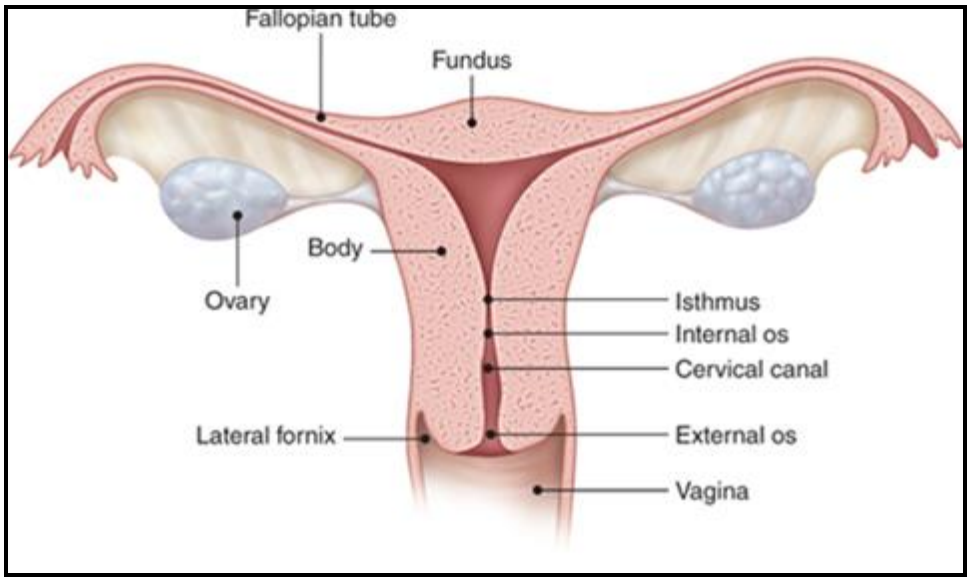

Figure (1): (anatomy of the uterus) quoted from ***(Posner et al., 2013)***.

Normal uterine anatomy on MRI imaging: *(Kaori et al., 2001)*

On T1WI images the entire uterus is isointense to muscle and different anatomic zones cannot be identified. The premenopausal uterine corpus on T2WI images show 3 distinct zones**:** (Fig. 2)

- The central high-signal intensity endometrium and secretions measure 3 to 6mm in the proliferative phase and 5 to 13mm in the secretory phase**.**
- The middle low-signal intensity junctional zone or inner myometrium measures 2 to 8mm
- The outer myometrium of relatively high signal intensity.

Cervix on T2WI shows the following distinct zones**:** (Fig. 2)

- Central hyperintense mucous
- High-signal intensity endocervical mucosa and glands. Combined thickness of zones 1 and 2 is 2 to 3mm
- Hypointense fibrous stroma is 3 to 8 mm thick
- Outer intermediate signal intensity loose stroma

The postmenopausal uterus has an indistinct zonal anatomy, and the junctional zone is not consistently visualized.

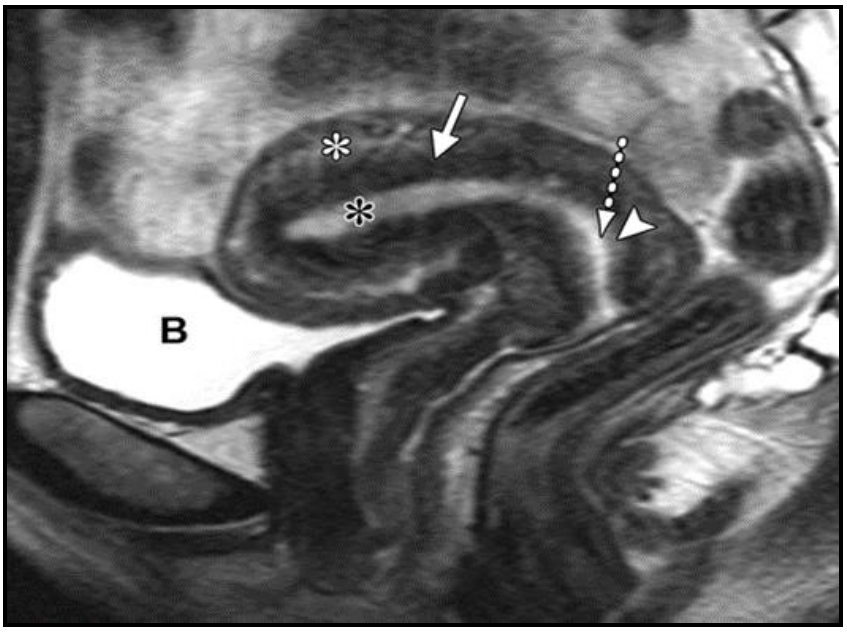

Figure (2): Midline sagittal T2-weighted MR image depicts the zonal anatomy of the uterus: endometrium (black*), junctional zone (solid arrow), and outer myometrium (white*). The striking difference in signal intensity between the junctional zone and the outer myometrium may reflect the higher density of smooth muscle cells in the junctional zone. In the cervix, a central cervical mucus (dotted arrow); endocervix (arrowhead); inner fibromuscular stromal layer, which is in contiguity with the junctional zone of the uterus and outer fibromuscular stromal layer, which is continuous with the outer myometrium. B = bladder Quoted from ***(Yitta et al., 2011).***