3D Ultrasonography Compared With Magnetic Resonance Imaging for the Diagnosis of Adenomyosis

Thesis

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By

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List of Abbreviations

Abbr.	Full-term
ACOG	: American College of Obstetricians and Gynecologists
AUC	: Area under the curve
AUC	: Area under the ROC curve
CEA	: Cryo-endometrial ablation
CT	: Computed tomography
EMI	: Endometrial-myometrial interface
EMJ	: Endomyometerial junction
ESS	: Endometrial stromal sarcoma
ET	: Echo time
FI	: Flow index
FS	: Fat-Sat
FSH	: Follicle stimulating hormone
FSH	: Follicular stimulating hormone
GnRH	: Gonadotropin releasing hormone
IDMA	: Ill-defined, relatively homogeneous, low-signal-intensity myometrial area
IUCD	: Intrauterine contraceptive device
IUD	: Intrauterine device
IVF	: In-vitro fertilization
JZ	: Junctional zone
LAVH	: Laparoscopic assisted vaginal hysterectomy
MR	: Magnetic resonance
MRI	: Magnetic Resonance Imaging
NMR	: Nuclear Magnetic Resonance
NPV	: Negative predictive value

NSAIDs : Non-steroidal anit-inflammatory drugs
PI : Pulsitility index
PPV : Positive predictive value
RCOG : Royal College of Obstetricians and Gynecologists
RF : Radiofrequency
RI : Resistance index
ROC : Receiver-operating characteristic
RT : Repetition time
S/D : Systolic/diastolic ratio
SD : Standard deviation
SPSS : Statistical package for social science
SSRI : Selective serotonin reuptake inhibitors
TAH : Total abdominal hysterectomy
TAUS : Transabdominal ultrasound
TIAR : Tissue injury and repair
TVUS : Transvaginal ultrasonography
VCI : Volume contrast imaging
VFI : Vascularization flow index
VH : Vaginal hysterectomy
VI : Vascularization index
VOCAL : Virtual organ computer-aided analysis
2D : Two dimensional
3D : Three-dimensional

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Abstract

Background: Adenomyosis is a common benign gynecological affecting premenopausal woman, in which there is increased overgrowth of the endometrium with invasion of the underlying myometrium. The precise pathogenesis of adenomyosis remains unknown with many theories being proposed that consider it to be a pathology that initially affects the endomyometrial junctional zone (JZ). **Aim of the Work:** The study aims to compare 3D transvaginal ultrasound with MRI in diagnosing adenomyosis in comparison with the gold standard histopathology. **Patients and Methods:** This cross sectional study was carried out on 77 patients who were recruited from women presenting to the outpatient clinic at Ain Shams University Maternity Hospital planned to undergo hysterectomy (abdominal, vaginal or laparoscopic assisted hysterectomy) for adenomyosis according to the inclusion/ exclusion criteria. **Results:** Out of 77 patients included in the study, 67(87%) were +ve for adenomyosis by 3D TVUS, confirmed in 46(59.74%) by histopathology, while 52(67.53%) were +ve by MRI, confirmed in 39(50.64%) by histopathology.3D transvaginal US was able to diagnose adenomyosis in 67(87%) patients and fibroid in 23(29.9%) patients, while MRI was able to diagnose adenomyosis in 52(67.5%) and fibroid in 36 (46.8%). **Conclusion:** our study results indicated that, 3D transvaginal ultrasound is highly accurate as MRI in diagnosing adenomyosis and leiomyoma as a preoperative diagnostic tool. **Recommendations:** As the 3D ultrasonography is more available, cheaper, less time consuming and easier technique, it is recommended to be used in every day clinical practice, helping the clinicians to reach an accurate diagnosis, select an appropriate treatment, and individualize management for each patient to reach the best outcome therapeutic rates.

Key words: ultrasonography, magnetic resonance imaging, adeomyosis

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Introduction

Adenomyosis refers to a disorder in which endometrial glands and stroma are present within the uterine musculature (uterine adenomyomatosis) ***(McElin TW and Bird , 1974)***.

It is a condition that causes heavy menstrual bleedings, painful menstruation (dysmenorrhea), chronic pelvic pain, subfertility and infertility, in which the uterus gets larger than normal too ***(Struble et al., 2016), Bromley et al., 2000).***

Its incidence is estimated to be 25% to 35% in women undergoing hysterectomy because of benign gynecologic conditions, although in some studies, it has been reported to be as high as 70% ***(Farquhar and Brosens, 2006)***.. Approximately 50 percent of affected women have co-existent fibroids ***(Azziz, 1989)***.

The diagnosis of adenomyosis is still a challenging problem, until recently, the criterion standard for a definitive diagnosis of adenomyosis was histopathologic analysis of hysterectomy specimens ***(Vercellini et al., 2006)***. The only proven treatment for adenomyosis is surgery to remove the uterus, called a hysterectomy ***(Grimbizis et al., 2008)***. However, a recent meta-analysis has demonstrated that both US and MRI may enable accurate non-invasive diagnosis ***(Champaneria et al., 2010)***.

Magnetic resonance imaging (MRI) seems to be a highly accurate tool in the preoperative diagnosis of adenomyosis; however, the combination of transvaginal ultrasound and MRI (especially T2-weighted images) offers the highest sensitivity for preoperative diagnosis of adenomyosis ***(Kunz et al., 2005)***. In a review of 23 articles, the sensitivity and specificity of MRI for diagnosing adenomyosis was 77% and 89%, as compared with 72% and 81% for ultrasound ***(Champaneria et al., 2010)***. For 2D-TVS and 3D-TVS, respectively, the overall accuracy for diagnosis of adenomyosis was 83% and 89%, the sensitivity was 75% and 91%, the specificity was 90% and 88%, the positive predictive value was 86% and 85% and the negative predictive value was 82% and 92% ***(Exacoustos et al., 2011)***. Although it is more expensive than ultrasonography, MRI can be employed in cases with indeterminate

sonographic results for adenomyosis. Thin-section, high-resolution MRI scans obtained with a pelvic multicoil array are optimal for diagnosing adenomyosis. The uterine zonal anatomy is best seen on T2-weighted images ***(Karen, 2013)***.

On sonograms, the most common appearance of adenomyosis is areas of decreased echogenicity or heterogeneity in the myometrium, including irregular, myometrial, cystic spaces predominantly involving the posterior uterine wall; an enlarged uterus with a widened posterior wall; an eccentric endometrial cavity; and decreased uterine echogenicity without lobulations, contour abnormality, or mass effects (which is more commonly seen with leiomyomas) ***(Sakhel and Abuhamad, 2012)***.

Visual evidence for adenomyosis with both modalities includes (1) asymmetric thickening of the myometrium (with the posterior myometrial typically thicker), (2) myometrial cysts, (3) linear striations radiating out from the endometrium, (4) loss of a clear endomyometrial border, and (5) increased myometrial heterogeneity. With MRI, some quantitation of the thickening of the junctional zone is possible with >12 mm generally considered diagnostic of the disease and <8 mm excluding adenomyosis ***(Reinhold et al., 1999)***. The presence of myometrial cysts was the most specific 2D-TVS feature (specificity, 98%; accuracy, 78%) and heterogeneous myometrium was the most sensitive (sensitivity, 88%; accuracy, 75%). The 3D-TVS markers JZ dif ≥4 mm and JZ infiltration and distortion had high sensitivity (88%) and the best accuracy (85% and 82%, respectively) ***(Exacoustos et al., 2011)***.

The normal appearance of the JZ has been described on TVS or MRI as a regular inner layer of the myometrium, measuring 5mm or less in thickness ***(Hauth et al., 2007)***. Some two dimensional (2D) sonographic studies report only the subjective impression of a poorly defined JZ as a diagnostic criterion for adenomyosis, but with low sensitivity ***(Hulka et al., 2002)***. However, it has recently been observed that on the coronal section of the uterus, obtained with three-dimensional (3D) TVS, it is possible to visualize the JZ more clearly with certain postprocessing arrangements ***(Naftalin and Jurkovic, 2009)***.