# THE ROLE OF TWO DIMENSIONAL VERSUS THREE DIMENSIONAL ULTRASONOGRAPHY IN ASSESSING PELVIC MASSES IN PERIMENOPAUSAL WOMEN CORRELATED WITH PATHOLOGIC ANALYSIS

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# Abstract

Medical ultrasound has experienced enormous technological progress during the last decades. 3D-US represents a new technique of imaging owing to its ability to register all three imaging planes simultaneously to reconstruct new planes which are otherwise not visible as well as to visualize surfaces three-dimensionally. Characterization of surface features infiltration and precise depiction of volume are all possible. ***The aim of the present study*** was to evaluate the role of 3D in diagnosis of uterine and adnexal lesions and its superiority over 2D-US, correlated with pathological analysis as a gold standard for the final diagnosis. ***This study included*** a random sample of 50 patients with perimenopausal pelvic mass accidentally discovered during routine ultrasound examination or symptomatizing ,attending the outpatient gynecologic clinic, aging between 40 and 56 years old. In this study, 37 out of 38 patients with fibroids has been correctly diagnosed by 3D-US whereas 2D-US detected 35of them (sensitivity 97.3% vs. 92.1%, and specificity 97.5% vs. 99.9% respectively).3D-US was able to diagnose 5 out of 6 patients polyps, whereas 2D-US diagnosed 2 of them (sensitivity 83.3%, vs. 33.3%, respectively and the same specificity 99.9% for both).3D-US was able to diagnose 11 of 16 patients with adenomyosis whereas 2D-US diagnosed 5 of them (sensitivity 68.75%, vs. 31.2%, respectively and the same specificity 99.9% for both).3D-US was able to diagnose 13 of 16 patients with ovarian cysts), whereas 2D-US diagnosed 4 of 16 ovarian cysts (sensitivity 81.2% vs. 25% respectively and the same specificity 99.9% for both). ***In conclusion***, the present study confirms the superiority of 3D-US over 2D-US in diagnosing pelvic masses. 3D U/S can be used to supplement 2D assessment. Further large-scale studies are needed to refine and test the scores used to differentiate benign from malignant lesions.

**Keywords:**

Perimenopause, two-dimensional ultrasound, three-dimensional ultrasound, pelvic masses.

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| | |
|---|---|
| Ob/Gyn. | Obstetrics and Gynecology |
| 2D US | Two-dimensional Ultrasound |
| 3DHS | Three-dimensional hysterosonography |
| 3D-HyCoSy | Three-dimensional hysterosalpingo contrast sonography |
| 3DPD | Three-dimensional power doppler |
| 3D US | Three-dimensional Ultrasound |
| 4D US | Four-dimensional Ultrasound |
| ACR-BIRADS | American college of radiology-breast imaging reporting & data system |
| AFP | Alpha fetoprotein |
| ANOVA | Analysis of variance |
| B-mode | Brightness mode |
| BRCA-1 | Breast cancer gene-1 |
| BRCA-2 | Breast cancer gene-2 |
| CA | Cancer Antigen |
| CAD | Computer aided detection |
| CI | Confidence interval |
| CT | Computed tomography |
| D & C | Dilatation & curettage |
| DCIS | Ductal carcinoma in situ |
| DES | Diethylstilbestrol |
| DGC | Depth gain compensation |
| E2 | Estradiol |
| EOC | Epithelial ovarian cancer |
| EORTC | European organization for research and treatment of cancer |
| EP | Extrauterine pregnancy |
| ET | Endometrial thickness |
| FDG | Fluoro-Dioxyglucose |
| FI | Flow index |
| FMP | Final menstrual period |
| FSH | Follicular Stimulating hormone |
| GI | Gastro-intestinal |
| hCG | Human chorionic gonadotropins |
| HRT/HT | Hormonal replacement therapy |
| HSG | Hysterosalpingography |
| HSSG | Hystero-sono-salpingography |
| HPV | Human papilloma virus |
| IVD | Intra-Vascular Doppler |
| KHz | Kilo-hertz |
| LH | Luteinizing Hormone |
| MD | Medical doctor |
| MHz | Mega-hertz |
| MI | Myometrial invasion |
| MRI | Magnetic resonance imaging |

| | |
|---|---|
| MWMHP | Melbourne Women's Midlife Health Project |
| NPV | Negative predictive value |
| P | probability |
| PDU | Power doppler ultrasound |
| PET | Positron emission tomography |
| PI | Pulsatility index |
| PID | Pelvic inflammatory disease |
| PPV | Positive predictive value |
| r | Pearson correlation |
| RI | Resistive index |
| ROC | Receiver operating curve |
| RRs | Relative risks |
| RT-PCR | Reverse transcriptase-polymerase chain reaction |
| RVF | Retro-verted flexed |
| SCSH | Saline contrast sonohysterography |
| SIS | Saline-infusion sonography |
| SLN | Sentinel lymph node |
| SMWHS | Seattle Midlife Women's Health Study |
| SONAR | Sound navigation and ranging |
| STRAW | Stages of Reproductive Aging Workshop |
| TAS | Transabdominal sonography |
| TGC | Time gain compensation |
| TOA | Tubo-ovarian abscess |
| TVCDS | Transvaginal color doppler sonography |
| TVU, TVUS | Transvaginal ultrasound |
| TVS | Transvaginal sonography |
| US | Ultrasound |
| USG | Ultrasonography |
| VAIN | Vaginal intraepithelial neoplasia |
| VFI | Vascularization flow index |
| VI | Vascularity index |
| VOCAL | Virtual organ computer-aided analysis |
| VS | Versus |
| WHO | World Health Organization |

# *Introduction*
# *And*
# *Aim of the work*

# Introduction

Pelvic masses develop commonly in women of all ages and states of health and may involve the reproductive organs or non gynecologic structures. They may be identified in asymptomatic women during routine pelvic examination or may cause symptoms. Typical complaints include pain, pressure sensations, dysmenorrhea, or abnormal uterine bleeding. ***(Barney et al, 2008).***

Combining a patient's history and examination with ultrasound allows better diagnosis and thus any need for surgical intervention. ***(Shwayder, 2008)***

Ultrasound is the imaging modality of choice for the female pelvis. It is widely available, has broad acceptance by patients as a "familiar test," and is relatively inexpensive. High-resolution imaging of transvaginal ultrasound provides high diagnostic accuracy for pelvic pathology. When evaluating an adnexal mass on ultrasound, the diagnostic challenges that may arise include accurately localizing the mass, determining its origin, and, when complex, whether it is definitively benign or malignant. ***(Hubert and Bergin, 2008).***

Morphology is the foundation for assessment of adnexal masses. New developments with 3-D ultrasound, Doppler, vascular quantification, and use of contrast agents may further enhance the discrimination of malignant and benign tumors, which is critical in operative management. ***(Shwayder, 2008)***

A number of genital tract disorders cause pelvic masses in adult women. Uterine enlargement due to pregnancy, functional ovarian cysts, and leiomyomas are among the most common. Endometrioma, mature cystic teratoma, acute or chronic tubo-ovarian abscess, and ectopic pregnancies are other frequent causes.

With the cessation of ovulation and reproductive function, the causes of pelvic mass also change. Simple ovarian cysts and leiomyomas are still a common source. Although atrophy of leiomyomas typically follows menopause, uterine enlargement can still be noted in many women. Importantly, malignancy is a more frequent cause of pelvic masses in this demographic group. Uterine tumors, including adenocarcinoma and sarcoma, have associated uterine enlargement. In addition, ovarian cancer accounts for nearly 4 percent of cancers among all women. ***(Barnholtz-Sloan et al, 2003)***.

A morphologic scoring schema has been described for evaluating adnexal masses. Masses with a morphologic score ≥ 9 were more associated with malignant adnexal masses with 100% sensitivity but 83% specificity. Scores < 9 were associated with benign lesions, with no false-negative results ***(Shwayder; 2008).*** Other authors, using morphology alone, found the negative predictive value of ultrasound to be more than 90% ***(Outwater et al, 2001)***

Leiomyomas, benign uterine neoplasms, are the most common tumor of the female genital tract. Their classification is based on their location within the uterine corpus as either intramural, submucosal, or subserosal. Most women are asymptomatic; however, the most common symptom is bleeding. Transvaginal ultrasound has been shown to be as efficient as MRI in the detection of the presence of myomas ***(Erik et al, 2002)***

Adenomyosis is characterized by the endometrial invasion of the myometrium. In addition, there is a generalized hypertrophy and hyperplasia of the surrounding muscular elements of the myometrium.

Transvaginal ultrasound has been reported to diagnosis adenomyosis with a sensitivity, specificity, positive and negative predictive value of 87%, 98%, 74.1% and 98.6%, respectively ***(Bazot et al, 2001)***

Endometrial polyps typically present with postmenopausal bleeding, particularly in patients on tamoxifen therapy. Transvaginal ultrasound has high sensitivity and specificity for endometrial polyps. ***(Grasel et al; 2000)***

Endometrial carcinoma, the fourth most common cancer in women and the most common gynecological malignancy, using endovaginal ultrasound, the sensitivity of detecting myometrial invasion of > 50% was 79%. However, the positive predictive value was 100%, in all cases when ultrasound suggested myometrial invasion of > 50%. ***(Karlsson et al 1992)***

Regarding the diagnosis of ovarian malignancies, researchers conclude that preoperative ultrasound examinations had a sensitivity of 40% and a specificity of 100% when carried out by routine operators, but had a sensitivity of 88% and a specificity of 96% when carried out by expert operators ***(Yazbek, 2008)*** .

Transvaginal ultrasound often is helpful in diagnosing tubo-ovarian abscess, which may complicate PID. The addition of color Doppler flow to the standard black-and-white transvaginal ultrasound has been used to assess vascularity and pulsatility indices. In one study, the power Doppler identified all laparoscopically confirmed cases of acute PID in the study group, and thus was found to be 100 % sensitive for this diagnosis ***(Molander et al;2001)*** .

Ovarian volume determined by 3-D ultrasound is more reliable than that obtained by 2-D ultrasound. Reconstruction and rendering can elucidate inner wall structure, presence or absence of complete septa, and can differentiate a fallopian tube from the ovary ***(Alcazar et al; 2003a).***

Three-dimensional ultrasound (3D US) is a new imaging modality, which is being introduced into clinical practice. Although this technique is unlikely to replace two-dimensional ultrasound, it is being increasingly used. It has been reported that 3D US is a high reproducible technique which has many applications in the field of Gynecology, as supported by a steady increase in the number of papers published in this area in the last few years. These applications include: imaging of the uterus, uterine cavity, adnexa and pelvic floor, as well as very interesting applications using three dimensional power-Doppler ultrasound. ***(Alcazar, 2005).***

Studies comparing 3-D with 2-D ultrasound in assessing ovarian masses are controversial. Initial studies found 3-D ultrasound more sensitive than 2-D ultrasound. (***Kurjak et al; 2001).*** Others found no statistical difference between 3-D and 2-D ultrasound. ***(Alcazar et al; 2003a).***

## Aim of the work

The aim of this study is to explore the diagnostic value of 3D ultrasonographic examination in perimenopausal patients; in terms of accurate detection of uterine and adnexal lesions compared to conventional ultrasonographic methods.

The final histopathological diagnosis based on surgically removed or biopsy specimens will be taken as the gold standard for comparison of the yield and accuracy of 3D ultrasonography to the conventional 2D ultrasonography.

# *Review of Literature*