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# Role of Conventional and Diffusion-Weighted MRI in Diagnosis of Female Pelvic Masses

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## Abstract

**Background:** In routine clinical practice, female pelvic masses are often discovered. For the diagnosis of female pelvic masses, magnetic resonance imaging (MRI) methods often employ diffusion-weighted imaging (DWI).

**Aim:** To assess DWI's enhanced utility in describing female pelvic masses compared to traditional MRI.

**Patients and methods:** This research had 30 female patients with uterine and adnexal masses. All participants were subjected to history taking and clinical assessment. Initial pelvic ultrasound was done to display provisional identification of benign and malignant tumors and to exclude functional and pure simple cysts. Color Doppler was superimposed on masses to detect vascularity. Conventional MR Imaging with DWI for all cases.

**Results:** We found that there was no substantial variation between Conventional MRI, DWI and Pathology as regard to presence of malignant and benign masses ( $P$  value  $> 0.05$ ). The sensitivity value of Conventional MRI was 90.3%, the specificity value was 86.7%, PPV was 91.8% and NPV was 89.4%. The sensitivity value of DWI was 93.6%, the specificity value was 90.0%, PPV was 95.0% and NPV was 85.6%.

**Conclusion:** We can conclude that DWI may confirm or rule out probable malignancy in gynecological masses if conventional MRI data is included and combined quantitative and qualitative DWI criteria analysis is performed.

**Keywords:** Diffusion-weighted imaging, Magnetic resonance imaging, Pelvic masses

## 1. Introduction

Female pelvic tumors are a frequent discovery in routine clinical practice and may be unintentionally found or found in patients who are symptomatic. A diagnostic issue, the characterization of female pelvic tumors is crucial in the preoperative environment to plan appropriate treatment operations and may have an impact on the patient's therapy.<sup>1</sup>

Combining conventional MRI with DWI suggests employing a totally noninvasive method with no radiation exposure. It is inexpensive (the MRI examination does not incur any extra costs), simple to include into the Magnetic Resonance research procedures, and does not significantly increase the examination duration. It increases the MRI's specificity and the radiologist's confidence in image

interpretation, which will ultimately have an impact on the patient's prognosis and result.<sup>2</sup>

Malignancy is often accompanied by high signal intensity on DWI and concomitant low signal intensity on apparent diffusion coefficient maps.<sup>3</sup>

In order to characterize female pelvic masses that have previously been identified by conventional ultrasonography or computed tomography, we sought to assess the additional utility of diffusion-weighted MRI to conventional MRI.

## 2. Patients and methods

According to a pelvi-abdominal or *trans*-vaginal ultrasound scan, 30 female patients with uterine and adnexal masses were included in the prospective cohort research. Between May 2020 and July 2022, patients were referred from the gynecological

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department of Al Mataria Teaching Hospitals to the diagnostic radiology department. All patients provided written informed consent prior to study inclusion, and the Ethics Committee approved this research.

Pelvic conventional MRI with DWI was employed for all cases, with pathological correlation of all malignant lesions.

All participants were subjected to history taking and clinical assessment. Initial pelvic ultrasound was done to display provisional identification of benign and malignant tumors and to exclude functional and pure simple cysts. Color Doppler was superimposed on masses to detect vascularity. Conventional MR Imaging with DWI for all cases.

### 2.1. Magnetic resonance imaging

A 1.5-T MRI scanner was used for all of the experiments (Philips Ingenia). Prior to the assessment, patients were told to fast for 3 h and urinate twice. To lessen intestinal peristalsis, a 10 mg intravenous dose of the antispasmodic medication hyoscine butylbromide was administered 20–30 min before to MR imaging. A pelvic phased array coil was used to photograph every patient while they were all lying flat. After a conventional, regular pelvic MRI, a DWI sequence was run. Before applying any contrast material, DW Images were produced utilizing a single shot echo-planar imaging process in the axial and sagittal planes. Three alternative b values were used to evaluate the examined lesions: 0, 500, and 1000 s/mm<sup>2</sup>.

Utilizing the Statistical Package for Social Science, the data was examined (Version 21.0 of SPSS Statistics for Windows. Armonk: IBM Corp.). The parametric numerical data were described utilizing Mean and standard deviation. The non-numerical statistics were described utilizing frequency and percentage. The Student *T* test, Mann-Whitney *U* test, Chi-Square test, and McNemar's test were all used. *P* value < 0.05 was regarded as substantial.

### 3. Results

Thirty patients in all, with an average age of 43.81 + 12.64 years and ages ranging from 27 to 62, were included in this research. Regarding comorbidity, there were 8 (26.7%) patients with Hypertension, 5 (16.7%) with Diabetes Meletus and 3 (10%) patients with Liver disease (Table 1).

According to symptoms, there were 14 (46.7%) patients presented with Pelvic pain, 5 (16.7%) with Abdominal &/or pelvic swelling, 7 (23.3%) with infertility and 4 (13.3%) patients with vaginal bleeding (Table 2).

Table 1. Distribution of studied patients regarding age and comorbidity.

	Cases (n = 30)
Age (year)	
Mean ± SD	43.81 ± 12.64
Range	27–62
Comorbidity	
Hypertension	8 (26.7%)
Diabetes Meletus	5 (16.7%)
Liver disease	3 (10%)

There were 13 patients with uterine masses (7 with benign mass and 6 patients with malignant mass) and 17 patients with ovarian masses (12 with benign mass and 5 patients with malignant mass) (Table 3).

Receiver operating curve (ROC) was employed to determine the value of Conventional MRI in diagnosis of female pelvic masses. The sensitivity value of Conventional MRI was 90.3%, the specificity value was 86.7%, PPV was 91.8% and NPV was 89.4% (Table 4). Also, ROC was used to assess the value of DWI in diagnosis of female pelvic masses. The sensitivity value of DWI was 93.6%, the specificity value was 90.0%, PPV was 95.0% and NPV was 85.6% (Fig. 1).

### 4. Discussion

While other organs and tissues in the pelvis, such as the gastrointestinal or urinary systems, may also give birth to female pelvic masses, the reproductive tract is where they most often develop. Common conditions include ovarian cysts, dermoid tumors, and uterine leiomyomas, among other pelvic masses. But it's also important to take into account less typical tumors such uterine sarcomas, fallopian tube carcinomas, peritoneal cancers, gastrointestinal cancers, and metastatic illness.<sup>4</sup>

The least intrusive and most economical diagnostic tool is ultrasound. It has been shown that MRI is preferable to ultrasound for identifying uterine or adnexal masses because it exhibits great soft tissue contrast resolution, which leads to precise tissue characterization and enhanced anatomical delineation.<sup>5</sup>

The examination of the female pelvis now includes functional imaging using diffusion-weighted

Table 2. Distribution of studied patients regarding symptoms.

Symptoms	Cases (n = 30)
Pelvic pain	14 (46.7%)
Abdominal &/or pelvic swelling	5 (16.7%)
Infertility	7 (23.3%)
Vaginal bleeding	4 (13.3%)

Table 3. Distribution of studied patients regarding origin of masses.

	Cases (n = 30)	Number (%)
Uterine (n = 13)		
Benign	7	(23.3%)
Malignant	6	(20%)
Ovarian (n = 17)		
Benign	12	(40%)
Malignant	5	(16.7%)

magnetic resonance imaging (DW-MRI), which is a common imaging technique.<sup>6</sup>

In order to improve variations in molecular diffusion across tissues, a 180° refocusing RF pulse is added to both sides of a sequence of two motion-providing gradient (MPG) pulses. Signal loss is measured after each MPG pulse.<sup>7</sup>

In the current thesis, thirty patients in all were involved in this investigation, their median ages was 43.81 + 12.64 years, there were 8 (26.7%) patients with Hypertension, 5 (16.7%) with Diabetes Meletus and 3 (10%) patients with Liver disease. There were 14 (46.7%) patients presented with Pelvic pain, 5 (16.7%) with Abdominal &/or pelvic swelling and 4 (13.3%) patients with Postmenopausal bleeding.

According to a prior investigation by Szklaruk et al.<sup>8</sup> titled 'Common and Rare Large Pelvic Masses on MR Imaging' revealed that, the range of the patients' ages was 42–53. Patients often report discomfort and abnormal vaginal discharge. Typically soft, tan, and polypoid, endometrial stromal sarcomas may fill the uterine cavity.

Our results showed that, there were 13 patients with uterine masses (7 with benign mass and 6 patients with malignant mass) and 17 patients with ovarian masses (12 with benign mass and 5 patients with malignant mass), there was no substantial variation between Conventional MRI, DWI and Pathology regarding presence of malignant and benign masses ( $P$  value > 0.05).

Along with our study Gangadhar et al.<sup>9</sup> found that, Final histological study revealed 48 (76.19%) instances to be benign, of which 46 (73%) had been properly identified by MRI, and 15 (23.8%) cases to be malignant, of which 14 (22.2%) had been identified by MRI. Five (35.7%) of the 14 malignant masses were solid malignant ovarian tumors, eight (57.14%)

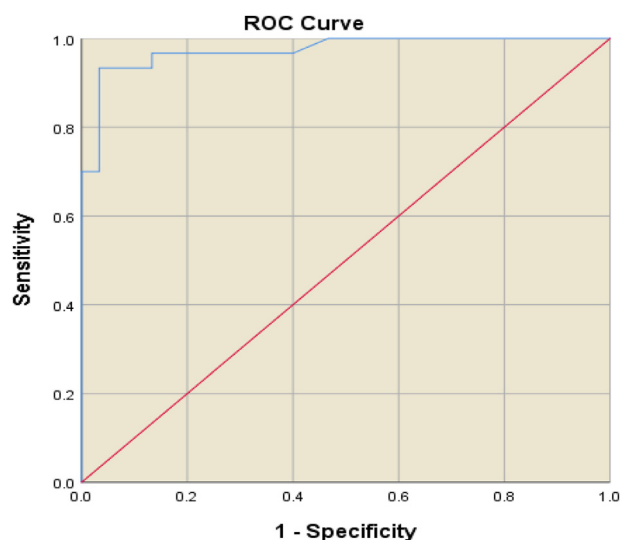


Fig. 1. ROC curve of DWI.

were solid-cumulus masses, and four (50%) of them displayed papillary projections.

In a study by Singla et al.<sup>10</sup> 2/33 tumors were borderline, 20/33 were benign, and 11/33 were malignant. 13/20 benign tumors and all malignant masses exhibited diffusion limitation. With 81.8% sensitivity and 63.6% specificity, the median apparent diffusion coefficient values demonstrated a substantial distinction between malignant and benign tissue.

Receiver operating curve (ROC) was used to determine the value of Conventional MRI and DWI in diagnosis of female pelvic masses. The sensitivity value of Conventional MRI was 90.3%, the specificity value was 86.7%, PPV was 91.8% and NPV was 89.4%. While, the sensitivity value of DWI was 93.6%, the specificity value was 90.0%, PPV was 95.0% and NPV was 85.6%.

A previous study done by Gangadhar et al.<sup>9</sup> included 48 benign masses with histological confirmation, of which MRI detected 46 with accuracy. The imaging procedure's sensitivity and specificity were 95.8% and 93.3% for the evaluation of benign lesions and 93.3% and 95.8% for malignant lesions, respectively. The results for the diagnosis of uterine mass were 100% and 97.5%, ovarian mass was 97.3% and 96%, and extra uterine/extra ovarian tumor was 66.6% and 100%. PPV was 95.6% and NPV was 100%.

Table 4. Receiver operating characteristics of conventional MRI in diagnosis of female pelvic masses.

	AUC	95% C. I.		Sensitivity	Specificity	PPV	NPV
Conventional MRI	0.916	0.907	1.00	90.3%	86.7%	91.8%	89.4%

AUC, Area Under a Curve; CI, Confidence Intervals; NPV, Negative predictive value;  $P$  value, Probability value; PPV, Positive predictive value.

\*Statistically significant at  $P \leq 0.05$ .

In another study, Anwar et al.<sup>11</sup> showed that the imaging procedure's sensitivity and specificity were 95.8% and 93.3% for the evaluation of benign lesions and 93.3% and 95.8% for malignant lesions, respectively. The results for uterine mass diagnosis were 100% and 97.5%, ovarian mass diagnosis was 97.3% and 96%, and extra uterine/extra ovarian tumor diagnosis was 66.6% and 100%.

#### 4.1. Conclusion

DWI can confirm benign and malignant gynecological masses, provided inclusion of the conventional MRI data, combined analysis of DWI quantitative and qualitative criteria and awareness of the possible sequence pitfalls.

#### Conflicts of interest

Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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