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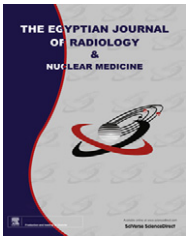

ORIGINAL ARTICLE

# Can diffusion weighted imaging distinguish between benign and malignant solid or predominantly solid gynecological adnexal masses?

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**KEYWORDS**

DWI;
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**Abstract** *Objective:* To determine the benefit of DWI in diagnosis of benign and malignant solid or predominantly solid gynecological adnexal or ovarian masses.
*Material and Methods:* This study is carried out on 23 patients with histologically proven solid or predominantly solid adnexal or ovarian masses out of which 5 cases (21.8%) have benign and 18 cases (78.2%) have malignant neoplasms. Among these 19 cases (82.6%) have unilateral disease and 4 cases (17.4%) have bilateral disease which was metastatic ovarian carcinoma.
*Result:* On DWI, high signal intensity is noted in malignant lesion more frequently than in benign lesion. ($P < 0.001$) in adnexal lesions, while in ovarian lesions ($P = 0.001$).
The differentiation between benign and malignant adnexal lesions revealed no significant difference in the apparent diffusion coefficient (ADC) value ($P = 0.22$).
*Conclusion:* DWI is a helpful tool in differentiation between predominantly solid and solid benign and malignant adnexal lesions because there is an increased frequency of higher signal intensity (diffusion restriction) in malignant lesions.


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## 1. Introduction

MRI plays an increasingly important role in the evaluation of the patients with adnexal disease. Accurate tissue characterization often allows definitive diagnosis not possible with other imaging modalities (1). Studies have looked at the utility of MRI in the differential diagnosis of benign and malignant lesions using some morphological and signal intensity features of the lesions (2–5). The use of DWI and ADC mapping in

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the radiologic differential diagnosis of neoplasms was first suggested for the central nervous system (CNS) and the head and neck regions (6). But over time DWI became recognized and accepted in body imaging for detection and characterization of focal lesion (7–11). Our goal in this study was to evaluate the role of DWI and ADC in discrimination between benign and malignant solid or predominantly solid adnexal or ovarian masses.

## 2. Materials and methods

The study is carried out on 23 patients, collected from gynecological department in the Zagazig University Hospitals during the period from February 2010 to February 2011. These patients are classified into two groups.

First group consists of 5 patients with pathologically proved benign adnexal lesions. Their age ranged from 20 to 60 years.
Second group consists of 18 patients with pathologically proved malignant adnexal lesions. Their age ranged from 30 to 70 years.

Among these 23 patients, 19 patients have unilateral lesions and 4 cases have bilateral lesions which were metastatic ovarian carcinomas. All these cases were diagnosed by transabdominal (TA) and transvaginal (TV) ultrasound as adnexal masses having solid or predominantly solid lesions.

### 2.1. MRI Protocol

MRI machine, 1.5 Tesla with phased-array body coil.
Imaging sequences and parameters are:

Sagittal T1 – HASTE-T2 – T2-FSAT WIs.
Axial T1 – HASTE-T2 – T2-FSAT WIs.
Coronal HASTE-T2.

Axial Diffusion WI (DWI): single shot echo planar during normal respiration. TR/TE = 7006/86; section thickness 6 mm; intersection gap 1 mm; matrix size $128 \times 128$; FOV $360 \times 360$ mm; partial Fourier factor 6/8; band width 1158, five excitations, b0, b400, b800 with fat saturation.
Apparent Diffusion Coefficient (ADC) axial image.
Sagittal – axial–coronal VIBE pre and post contrast.

### 2.2. Image analysis

The acquired images are transferred to a work station, on which all ADC maps are performed. The mean ADC volume is determined and the signal intensity of the lesions is measured.

#### 2.2.1. Qualitative analysis

The lesions are evaluated for signal intensity on DWI at maximum $b$ value ($b = 800$ s/mm$^2$), T2WI and post contrast images.

At least 3 areas of solid tissue signal changes are used in complex masses choosing the highest signal regions to evaluate restriction on DWI (800 s/mm$^2$).

On DWI, the signal intensity of each lesion is evaluated as hyper, hypo or iso-intense relative to the myometrium. None of our cases had hysterectomy; however, in case of hysterectomy or abnormal myometrial signal we can use the pelvic muscles as a reference but this needs further study.

On T2 WI, the signal intensity of each lesion is evaluated by comparison with signal intensity of the outer myometrium.

On T1, post contrast image, the enhancement pattern is divided into:

First group: Marked enhancement; for the lesions whose signal intensity was equal to or higher than the myometrium.
Second group: Mild enhancement; for the lesions with lower signal intensity than the myometrium.

#### 2.2.2. Quantitative analysis

The (ROI) region of interest is placed within the lesions in the area with the Lowest ADC volume on ADC map and highest intensity on DWI (800 s/mm$^2$) and mean value is calculated.

For adnexal lesions, we compared benign with malignant lesion.

For ovarian lesions we compared benign with malignant lesions and malignant lesions of ovarian origin with those of metastatic origin.

#### 2.2.3. Statistical analysis

Final diagnosis is performed by biopsy and histopathology (Table 1).

## 3. Result

### 3.1. Adnexal lesions

#### 3.1.1. Qualitative analysis

Fifteen cases of the total 23 cases (15 of 18 malignant lesions) have higher signal intensity on DWI. This means that the higher signal intensity is noted more frequently in malignant than in benign adnexal lesions ($P < 0.001$). Two cases of malignant lesions have iso-intense signal on DWI and 1 benign lesion has iso-intense signal on DWI ($P$ 0.53).

Four cases of the benign lesions have hypointense signal on DWI and 1 malignant lesion was hypointense ($P$ 0.002). (Table 2).

Leiomyoma had low signal intensity on DWI.

Leiomyosarcoma appears heterogenous with the main component appearing mildly hyperintense on DWI. Eleven cases of 23 patients (11 of 18 malignant lesions) have hyperintense signal on T2 WI of its solid component (Table 3), while solid components of benign lesions in this study show hyperintensity on the T2 WI in only one case (excluding fat containing lesions or cystic components). So that, hyperintense signal on T2 WI is noted more in solid parts of the malignant lesions ($P < 0.0001$). On the other hand, low signal intensity is noted more in the solid parts of benign lesions than in malignant lesions ($P = 0.000$). On post contrast T1 WI (Table 4), 16 of the total 23 cases (14 from 18 malignant lesions and 2 from 5 benign lesions) show marked post contrast enhancement. This means, there is a significant difference between benign and malignant adnexal lesions on T1 post contrast images ($P = 0.14$).