THE ROLE OF DIFFUSION WEIGHTED IMAGING IN DIFFERENTIATION BETWEEN BENIGN AND MALIGNANT OVARIAN LESIONS

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Introduction

- Ovarian carcinomas represent 6th most common cancer, the second most common gynecologic cancer and 4th leading cause of cancer death in women. With no viable screening estimates accessible, 70% of ovarian malignancies are diagnosed at a late stage. Separation of benign lesions from the malignant ones is of foremost significance to direct the correct clinical management. Imaging modalities, particularly ultrasonography (US), computed tomography (CT), and magnetic resonance (MR) imaging have become the first line for ovarian lesions diagnosis.

- US remains the study of choice in the initial evaluation of suspected adnexal masses because it is relatively inexpensive, noninvasive, and widely available. Transabdominal US, endovaginal US, or both should be performed for the evaluation of adnexal masses.

- MR imaging is a useful modality for differentiating benign and malignant ovarian tumors, and a specific diagnosis can be made for certain pathologic entities. Morphologic appearance, signal intensity characteristics, DWI and adequate use of intravenous contrast material provide information for arriving at the correct diagnosis.

Aim of the work

- The aim of this study is to identify the role of diffusion weighted imaging in differentiation between benign and malignant ovarian lesions.

Patients & Methods

- This study included 20 patients presenting to the Radiology Department with proved adnexal lesion on US. All the studied patients were subjected to full history taking and MRI of the pelvis. The medical ethics were considered and the final diagnosis was reached either by surgical findings and histopathological examination or a consensus of the characteristic MRI findings and therapeutic response.

MRI Pelvis Protocol

- MRI sequences were acquired on 1.5T MRI machine using phased-array pelvic coils.

- Sagittal T2-weighted fast spin-echo sequence from one femoral head to the other, axial T2-weighted fast spin-echo sequence from the renal hilum to the symphysis pubis, axial T1-weighted spin-echo sequence, Coronal T2 weighted fast spin-echo sequence and Susceptibility- weighted sequence were systematically added.

- DW MR images were obtained in the axial plane by using a single-shot echo-planar sequence with the sensitivity encoding technique (sensitivity encoding factor, 2). The b values corresponding to the diffusion-sensitizing gradient were 0, 500, and 1000 sec/mm2. All images were acquired with a section thickness of 3.5 mm and no gaps. Motion-probing gradient pulses were placed in the three orthogonal planes. Isotropic DW images were generated by using the three orthogonal axis images.

Data Analysis

- Images were transferred to a post-processing workstation. DWI signal intensity was evaluated in the areas corresponding to the solid component, walls or septa and the cystic portion was avoided selected on the high b value DWI. T2- weighted images were used for lesion localization by cross-referencing to DWI and ADC maps and assessment for complexity. The lesion was classified as having restricted diffusion if it was hyperintense on DWI and hypointense on ADC maps. To measure the ADC we examined the high b-value image and ADC map and drew a region of interest (ROI) for each lesion.

Results

- The present work included 20 female patients with indeterminate adnexal lesions on ultrasound examination. They were classified according to the final pathological diagnosis or the characteristic MRI findings and therapeutic response into two groups fourteen of them had benign ovarian lesions and six had malignant ovarian lesions. Their ages ranged between 20 and 66 years. Fourteen patients were diagnosed as benign ovarian pathologies (1 cystadenofibroma, 1 serous cystadenoma, 4 endometriomas, 1 ovarian abscess, 2mucinous cystadenoma, 5 teratomas). Six patients were diagnosed as malignant ovarian neoplasms (1 patient with borderline serous cystadenocarcinoma, 2 serous cystadenocarcinoma, 1 papillary serous cystadenocarcinoma, 1 undifferentiated carcinoma, mucinous cystadenocarcinoma).

- Sixteen patients showed free diffusion on DWI (80.0 %), fourteen of them were benign (100.0 %) and 2 were malignant (33.3 %). Four patients showed restricted diffusion on DWI (20.0 %), all of them were malignant (66.7 %). (Table I)

Table (I): Comparison between the two studied groups according to DWI

DWI Soft tissue component, wall or septae	Total		Type				Sensitivity	Sensitivity	PPV	NPV	Accuracy
			Benign (n=14)		Malignant (n=6)						
	NO.	%	No.	%.	2No.	%.					
Free diffusion	16	80.0	14	100.0	4	33.3	66.7	100.0	100.0	87.50	90.0
Restriction	4	20.0	0	0.0		66.7					

- The ADC value of the soft tissue component, septations or walls ranged from 0.70 -3.10 (x10-3 mm2 /s) .Fourteen patient with benign lesions showed ADC value ranging from 1.2-3.1 (x10-3 mm2 /s) while six patients with malignant lesions showed ADC value ranging from 0.7 -2.3 (x10-3 mm2 /s). (Table II)

Table (II): Comparison between the two studied groups according to ADC

ADC (x10³mm²/s) Soft tissue component, wall or septae	Total (n=20)	Type		P
		Benign (n=14)	Malignant (n=6)	
Min. - Max.	0.70-3.10	1.20-3.10	0.70-2.30	0.017*
Mean± SD.	1.81±0.71	2.04±0.59	1.25±0.67	

- The ADC value for the six patients with malignant ovarian lesions has sensitivity (66.67%) and specificity (100%) with positive predictive value (100%) and negative predictive value (87.5%). The cut of value for ADC was ≤0.9. (Table III)

Table (III): Agreement (sensitivity, specificity) for ADC to diagnose patients with malignant (n = 6 vs. 14)

	ACU	P	95%	Cut off#	Sensitivity	Specificity	PPV	NPV
ADC (x10 -3 mm2 /s)	0.798	0.039*	0.549 – 1.046	≤0.9#	66.67	100.0	100.0	87.5
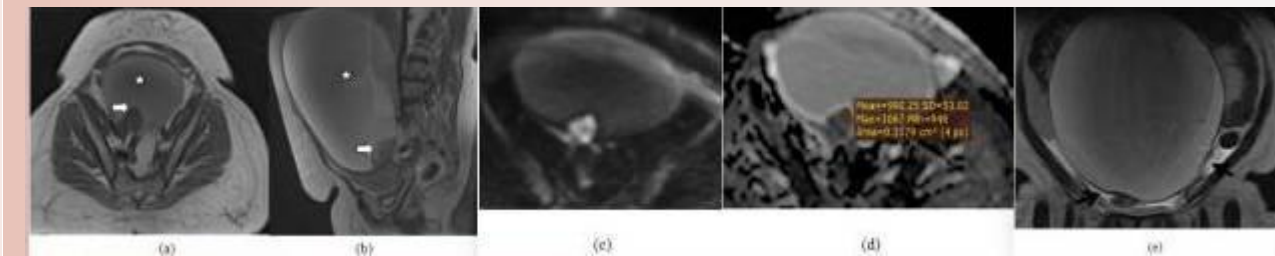
62 years old female patient with papillary serous carcinoma of left ovary (a) Axial T1 and (b) Sagittal T2 show hyperintense cystic lesion (   ) with isointense marginal nodules (   )(c) DWI and (d) ADC showing restricted diffusion of the nodules (e) Coronal T2 shows mild free pelvic ascitic fluid (   )

Conclusion

- MRI is useful in characterization of the ovarian lesions.

- DWI sequence with the ADC value is effective in differentiating between benign and malignant lesions with sensitivity 66.7%, specificity 100%.

- Ovarian lesions which show restricted diffusion of its soft tissue component with ADC value ≤ 0.9 should be considered malignant.