ORIGINAL RESEARCH

To assess the influence of intravascular contrast agent on apparent diffusion coefficient measures of ovarian neoplasms by the use of diffusion-weighted imaging

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ABSTRACT

Aim: To assess the influence of intravascular contrast agent on apparent diffusion coefficient measures of ovarian neoplasms by the use of diffusion-weighted imaging. **Materials and methods:** This Prospective Study was conducted in the Department of Radiodiagnosis. 50 patients selected based on universal sampling, with Study population being women with newly diagnosed ovarian tumors who underwent CEMRI study to evaluate the nature of tumor and extent. Women referred from gynaec OPD for evaluation of ovarian neoplasms and With normal RFT were included in this study. Patients with Failed to follow up in our institute with HPE reports and Pregnant women were excluded from the study. **Results:** In benign ovarian tumors, Pre contrast mean ADC was 1.48± 0.46 and Post contrast mean ADC value was 1.40±0.62 with statistically insignificant P value. So it can be concluded that the contrast agent did not make much difference for measurement of ADC values in benign tumors. In malignant ovarian tumors, Pre contrast mean ADC was 0.91±0.20 and post contrast mean ADC value was 0.94±0.23 with statistically insignificant P value. So, it can be concluded that the contrast agent did not make much difference for measurement of ADC values in malignant tumors. ADC values of solid and cystic components in both benign and malignant tumors before and after administration of contrast, did not make statistically significant difference. **Conclusion:** ADC measures using our approach were not significantly changed after contrast administration for ovarian tumors at 1.5T. Our findings support the possibility that DWI optimized may be obtained before or after DCE-MRI without compromising important clinical information.Benign ovarian tumors had higher ADC values compared to malignant tumors, consistent with some of the previous studies.

Keywords: Intravascular, Ovarian, Neoplasms, Diffusion-weighted imaging

INTRODUCTION

Diffusion-weighted imaging (DWI) has become a critical tool in the evaluation and characterization of ovarian neoplasms. DWI leverages the Brownian motion of water molecules within tissues, providing valuable information on tissue cellularity and the integrity of cell membranes, which are often altered in malignant tumors. This imaging technique is particularly useful in differentiating benign from malignant ovarian lesions, as malignant tumors typically exhibit restricted diffusion due to their higher cellular density and reduced extracellular space.[1,2]The apparent diffusion coefficient (ADC) is a quantitative measure derived from DWI that reflects the magnitude of water diffusion within tissue. Lower ADC values generally indicate restricted diffusion, commonly associated with malignancies. However, the accuracy of ADC measurements can be influenced by several factors, including the presence of intravascular contrast agents. Contrast agents can enhance the vascularity of tissues, potentially affecting the ADC values and complicating the interpretation of DWI .Recent advancements in MRI technology have facilitated the use of intravascular contrast agents to improve the delineation of ovarian neoplasms.[3,4] These agents enhance the visibility of blood vessels and improve the contrast between different tissue types, aiding in the accurate localization and characterization of tumors. However, their impact on ADC measurements remains an area of active investigation. Studies have suggested that contrast agents may either increase or decrease ADC values depending on the timing of image acquisition relative to contrast administration, as well as the type

of contrast agent used .The impact of contrast agents on ADC values also raises considerations for the clinical management of ovarian neoplasms. Accurate characterization of these tumors is crucial for determining the appropriate therapeutic approach, whether it involves surgical intervention or chemotherapeutic management. Understanding the nuances of how contrast agents affect DWI and ADC values will enhance the diagnostic precision and improve patient outcomes by enabling more tailored treatment strategies .[5-7]

MATERIALS AND METHODS

This Prospective Study was conducted in the Department of Radiodiagnosis.50 patients selected based on universal sampling, with Study population being women with newly diagnosed ovarian tumors who underwent CEMRI study to evaluate the nature of tumor and extent.Women referred from gynaec OPD for evaluation of ovarian neoplasms and With normal RFT were included in this study. Patients with Failed to follow up in our institute with HPE reports and Pregnant women were excluded from the study.

Methodology

MRI was performed with a Philips Achieve Tx 1.5 tesla (T) scanner using a dedicated abdomino-pelvic protocol. All pelvic MRIs included a T2-weighted fast spin echo sequence, T1-weighted non-fat-suppressed sequence, T1 weighted fat-suppressed DCE-MRI sequences, and DWI sequences before and after the DCE-MRI. Data collection performed according to the hospital regulations, after approval by the hospital authorities and consent by the patient.

Statistical analysis

The data will be entered in the Microsoft office excel 2007 and IBSS version 22 was used for analysis. The data will be presented in the form of tables, and percentages. Paired t test was used to assess the statistical significance. P value of < 0.05 will be considered significant.

RESULTS

In benign ovarian tumors, Pre contrast mean ADC was 1.48± 0.46 and Post contrast mean ADC value was 1.40±0.62 with statistically insignificant P value as shown in Table 4.So it can be concluded that the contrast agent did not make much difference for measurement of ADC values in benign tumors. In malignant ovarian tumors, Pre contrast mean ADC was 0.91±0.20 and post contrast mean ADC value was 0.94±0.23 with statistically insignificant P value as shown in Table5.So, it can be concluded that the contrast agent did not make much difference for measurement of ADC values in malignant tumors. ADC values of solid and cystic components in both benign and malignant tumors before and after administration of contrast, did not make statistically significant difference in Table 6 and 7.

Table 1: Age

Age Group of females (in yrs)	Numbers	Percentage
20-40	5	10
40-60	15	30
>60	30	60

Table 2: Ovarian tumors

Ovarian Tumors	Numbers	Percentage
Benign	30	60
Malignant	20	40

Table 3: Size characteristics (Longest Dimensions)

Size (in mm)	Numbers	Percentage
<50	0	0
51-100	5	10
101-150	15	30
151`-200	20	40
201-250	7	14
>250	3	6

Table 4: Type of ovarian tumor

Type of ovarian tumor	No of lesions	Pre contrast ADC range	Pre contrast mean ADC	Post contrast ADC range	Post contrast ADC mean	ADC difference	P value
benign tumors	25	0.48,2.21	1.48±0.46	0.20,2.32	1.40±0.62	0.08 (3.4 %)	0.86
Serous cystadenoma	12	0.48, 2.21	1.52±0.19	0.52, 2.3	1.36±0.23		
Mucinous cyst adenoma	10	1.12, 1.79	1.48±0.20	1.22,1.88	1.51±0.18		
Fibro thecoma	1	1.2	1.2	1.22	1.22		

Cystadeno fibroma	1	0.89	0.89	0.9	0.9		
Brenner's Tumor	1	1.23	1.23	1.48	1.48		

Table 5 Type of ovarian tumor

Type of ovarian tumor	N	Precontrast ADC range	Pre contrast mean ADC	Post contrast ADC range	Post contrast ADC mean	P value
Malignant Tumors	25	0.5,1.45	0.91±0.20	0.54,1.50	0.94±0.23	0.3
Serous Cystadeno carcinoma	10	0.66,1.35	0.97±0.20	0.70,1.37	0.99±0.22	
Mucinous Cystadeno carcinoma	8	0.65,1.31	0.89±0.19	0.68,1.35	0.92±0.23	
Serous borderline tumor	4	0.78,1.45	1.05±0.19	0.80,1.49	1.09±0.24	
Mucinous borderline tumor	1	0.99	0.99	1.31	1.31	
Clear cell adenocarcinoma	1	0.82	0.82	1.12	1.12	
Endometriod adenocarcinoma	1	0.93	0.93	1.23	1.23	

Table 6: Differences between ADC values of SOLID component in benign and malignant tumors

Differences between ADC values of SOLID component in benign and malignant tumors			P Value	
	Minimum	Maximum	Mean	
ADC in Malignant	0.13	0.90	0.56±0.26	0.13
ADC in Malignant post contrast	0.15	0.95	0.61±0.23	
ADC in benign	1.1	1.55	1.18±0.24	0.21
ADC in benign post contrast	1.14	1.67	1.23±0.20	

Table 7: Differences between ADC values of Cystic component in benign and malignant tumors

Differences between ADC values of Cystic component in benign and malignant tumors			P Value	
	Minimum	Maximum	Mean	
ADC in Malignant	0.9	2.66	2.4±0.73	0.18
ADC in Malignant post contrast	0.94	2.57	2.35±0.23	
ADC in benign	1.8	2.9	2.54±0.35	0.45
ADC in benign post contrast	1.76	2.82	2.12±0.22	

DISCUSSION

DWI is increasingly being incorporated into MRI protocols due to its potential for improving characterization of ovarian lesions. However, controversy still exists regarding the effects of gadolinium-based contrast agents on DWI measures.In our study, ADC values were not significantly different after the DCE-MRI sequence in ovarian tumors, which is in agreement with the majority of the prior studies that found no statistically significant change in ADC values after contrast administration.Several factors of our study design may explain why ovarian tumor ADC values were not significantly affected by contrast. These include field strength (3T versus 1.5T), contrast agent type, and repetition time (TR).[2, 6]The late timing of the post-contrast DWI acquisition, approximately 9 minutes after injection, may also explain why our study did not identify significant alterations in lesion ADC. At this timing, much of the contrast has leaked from the microvasculature to the extracellular space (and perhaps even washed out of the tumor region).[7]Gadolinium is known to reduce signal-to-noise (SNR). As a result, the diffusion-weighted images may have a lower SNR, closer to the noise floor, and result in an artificially increased (or decreased, at higher b values) ADC calculation.[8-10]We investigated only a single delayed post-contrast DWI time point of 9 minutes after injection and one type of contrast agent (Gadopentetate Dimeglumine). Other agents may produce different findings. The number of b values was limited due to scan time restrictions (B0 and B800). Institutional based study with less number of sample size.

CONCLUSION

ADC measures using our approach were not significantly changed after contrast administration for ovarian tumors at 1.5T.Our findings support the possibility that DWI optimized may be obtained before or after DCE-MRI without compromising important clinical information.

Benign ovarian tumors had higher ADC values compared to malignant tumors, consistent with some of the previous studies.

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