Original Research Paper

Radiodiagnosis

PROSPECTIVE STUDY ON EVALUATION OF OVARIAN MASS LESIONS WITH DIFFUSION WEIGHTED MRI

Dr. Alka Agrawal	Professor & HOD, Department of Radiodiagnosis, M.G.M Medical College & M.Y Hospital, Indore.
Dr. P.S.Tripathi	Associate Professor, Department of Radiodiagnosis, M.G.M Medical College & M.Y Hospital, Indore.
Dr. Amit Shankhwar	Associate Professor, Department of Radiodiagnosis, M.G.M Medical College & M.Y Hospital, Indore.
Dr. Soorya K	Third year PG resident, Department of Radiodiagnosis, M.G.M Medical College & M.Y Hospital, Indore.
Dr. Pankaj Kujur	Third year PG resident, Department of Radiodiagnosis, M.G.M Medical College & M.Y Hospital, Indore.
Dr. Gaurav Bhandari*	Assistant Professor, M.G.M Medical College & M.Y Hospital, Indore. *Corresponding Author

ABSTRACT
Background: The high mortality associated with ovarian cancer is due to delayed detection. Novel agents are being developed for more targeted therapy. Hence, a more accurate interpretation of the lesion is required. DW-MRI forms a promising tool in the same.
Aims & Objectives: To assess the diagnostic potential of DW-MRI in the evaluation of ovarian mass lesions.
Methods: 103 women with ovarian lesions were evaluated with DW-MRI. The characteristics were recorded, analysed and compared with histopathology reports wherever possible.
Results: With a sensitivity of 93.94%, a specificity of 98.08% and accuracy of 96.47%, DW-MRI is a promising tool to be considered in the evaluation protocol of ovarian mass lesions, for a more accurate interpretation.
Conclusion: With advancements like diffusion-weighted, in conventional MRI, the diagnostic performance has been improved and needs to be utilised in the evaluation of ovarian mass lesions.

KEYWORDS : Ovarian, MRI [Magnetic Resonance Imaging], DW-MRI [Diffusion Weighted MRI]

INTRODUCTION

Ovarian cancer is the third most common gynaecological malignancy, after cervical and uterine cancer. Even in the era of advanced target therapy, the high mortality rate can be attributed to the late detection due to the late onset of symptoms[1]. The prognosis depends on early diagnosis as the survival rate drops drastically with stage advancement.

The diagnostic triad, till date, constitutes a bimanual pelvic examination, USG and CA-125. However, the present scenario states that the majority [59%] of the cases are diagnosed at the stage of distant metastasis, and only 15% are detected when confined to the primary site.[2]

MRI can better delineate the lesions. DWI is an evolving functional MR imaging. It gives quantitative information about the tissue cellularity. This can be utilised to detect tumors and to distinguish them from treatment-related changes. DW-MRI is a promising imaging tool in earlier detection and treatment evaluation.

MATERIALS & METHODS

103 patients with ovarian lesions were evaluated in the Department of Radiodiagnosis in MGM Medical College, Indore from March 2019 to September 2020 after ethical and scientific committee clearance. DW-MRI was used for the evaluation. The lesion characteristics were recorded and analysed with the histopathological report, wherever possible.

RESULT

The age group in the study ranged from 18 to 80 years with a mean of 41.57 years. 32% of the cases had bilateral involvement. Morphology was evaluated. 8% of the lesions showed fat saturation and were characterised as teratoma.

3.8% of the cases showed hyperintensity in T1WI and fat-supressed sequences, and signs like shading sign and T2 dark spot sign, and were characterised as endometrioma. Features like thick septations, papillary projections and solid components, that point towards a malignant lesion were looked for and were found respectively in 24%, 34% and 40% cases. Among solid components, 29.3% were hypointense and 63.4% showed intermediate signal intensity in T2WI. Ascites, omental deposits, lymphadenopathy, liver metastasis and pleural effusion were seen respectively in 21.3%, 6.7%, 9.7%, 2.9% and 4.8% cases.

Considering features like irregular thick septations, heterogenous solid components and presence of ancillary findings like peritoneal deposits as features pointing towards malignancy, 72% of the cases were interpreted as benign and 28% as malignant on evaluation with MRI.

Further, diffusion weighted imaging sequence was used. 42.7% of the lesions showed restricted diffusion. Using maximum Youden index, optimal cut-off ADC value is taken as 1.077×10^{-3} mm^2 /s in our study and this showed sensitivity, specificity and accuracy of 90.9%, 92.3% and 88.24% respectively. 40% of the cases had ADC value below this cut-off. 5 of the ovarian lesions morphologically interpreted as benign, showed diffusion restriction and low ADC value and were characterised as malignant. Hence, with DW-MRI, 69% lesions were characterised as benign and 31% as malignant.

85 out of 103 lesions were histopathologically assessed, 8 resolved eventually and 10 were lost during follow-up. Among the histologically evaluated lesions, 61% were benign and 39% were malignant.

Conventional MRI showed sensitivity, specificity, PPV, NPV

and accuracy of 81.82%, 84.62%, 77.14%, 88% and 83.53% respectively. DW-MRI showed sensitivity, specificity, PPV, NPV and accuracy of 93.94%, 98.08%, 96.88%, 96.23% and 96.47% respectively. The diagnostic accuracy of conventional MRI improved when diffusion weighted imaging sequence was also studied. DW-MRI had 96.47% agreement with the histopathological examination, with cohen's kappa 0.925 [almost perfect agreement].

DISCUSSION

The age group in the study ranged from 18 to 80 years, with a mean of 41.57 years. 32% were bilateral. Similarly, Toussaint et al[3] in 2011 observed that 33% of the cases in their study had bilateral involvement.

8% of the cases in our study showed fat saturation and were characterised as teratoma. Similar was the observation made by Adel et al[4] in 2019.

Thick septations, papillary projections and solid components were seen in 24%, 34% and 40% cases respectively. Among solid components, 29.3% were hypointense and 63.4% showed intermediate signal intensity in T2WI. This was in concordance with the study by Li et al[5] in 2011, where 37% of the cases had solid component. Also, Thomassin et al[6] in 2009 observed low and intermediate signal intensity respectively in 25.4% and 68%. Hypointensity in T2WI is a feature more in favour of a benign lesion.

Ascites, omental deposits, lymphadenopathy, liver metastasis and pleural effusion were seen respectively in 21.3%, 6.7%, 9.7%, 2.9% and 4.8%. Similarly, Guerra et al[7] in 2008 and Li et al[5] in 2011 observed peritoneal deposits in 8.9% and 9.1% of their cases respectively.

Restricted diffusion and low ADC value point towards a malignant or hypercellular tissue. In our study, 42.7% of the lesions showed restricted diffusion. Using maximum Youden index, optimal cut-off ADC value is taken as 1.077×10^{-3} mm^2/s in our study and this showed sensitivity, specificity and accuracy of 90.9%, 92.3% and 88.24% respectively. 40% of the cases had ADC value below this cut-off. Khaled et al[8] in 2014 observed restricted diffusion in 40% of their cases.

Lesions with irregular thick septations, irregular heterogeneous solid components that showed diffusion restriction, low ADC value and associated ancillary findings are features suggesting the malignant nature of the lesion. Considering these features, on evaluation with DW-MRI, 69% of lesions were characterised as benign and 31% as malignant in our study. Comparable with our study, Nasr et al[9] in 2014 and Adel et al[4] in 2019 characterised 33% of cases in their respective studies as malignant based on MRI evaluation.

85 out of 103 lesions were histopathologically evaluated, 8 resolved eventually and 10 were lost during follow-up. Among the histologically evaluated lesions, 61% were benign and 39% were malignant. Goyal et al[10] in 2016 observed a similar result of 60% benign and 40% malignant ovarian lesions.

All teratomas, endometriomas, serous cystadenomas and serous cystadenocarcinomas were accurately characterised in DW-MRI. Also, the mucinous lesions were characterised as malignant with 94% accuracy. Guerra et al[7] in 2008 also observed accurate characterisation of teratoma with detection of fat content.

Table 1 : Comparison Of Ovarian Lesion Interpretation – Mri, Dw-mri And Histopathological Examination

Ovarian Lesion	Conventional MRI	DW-MRI	HPE
Haemorrhagic Cyst	4	4	4
Endometrioma	2	2	2
Teratoma	4	4	4
Mucinous Cystadenoma	29	27	26
Serous Cystadenoma	17	16	16
Mucinous Cystadenocarcinoma	20	22	23
Serous Cystadenocarcinoma	9	10	10
Total	85	85	85

Figure 1: Right ovarian cystic lesion with few thick septations on T2WI (A), showing diffusion restriction in DWI (B) & ADC map (C), interpreted as malignant ovarian lesion. Histopathological diagnosis – mucinous cystadenocarcinoma
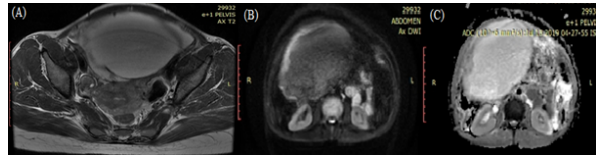

Table 2: Comparison of diagnostic performance of DW-MRI in our study with few other studies

	Our study	Li et al[5] in 2011	Nasr et al[9] in 2014
Sensitivity [%]	93.94	96.5	100
Specificity [%]	98.08	89.1	75
PPV [%]	96.88	94.3	78.57
NPV [%]	96.23	93.2	100
Accuracy [%]	96.47	93.1	86.9

Diagnostic performance of DW-MRI is observed to be highly efficient and had 96.47% agreement with histopathological examination, with cohen's kappa 0.925 [almost perfect agreement]. Similarly, Guerra et al[7] in 2008 observed cohen's kappa of 0.906, stating an almost perfect agreement. DW-MRI thus forms a promising imaging tool to be considered in the evaluation protocol.

CONCLUSION

The major determinant of prognosis of ovarian lesion is its stage. This depends on early and accurate detection. With a sensitivity of 93.94%, a specificity of 98.08% and an accuracy of 96.47% DW-MRI makes early and accurate detection possible. False positives lead to unnecessary interventions and false negatives lead to neglecting a serious disease. 1.92% false positive and 6% false negatives point towards the efficiency of DW-MRI. Hence, in the era of advanced therapies, advancement in the imaging modality is warranted and DW-MRI forms a promising tool in the same.

REFERENCES
1. Momenimovahed Z, Tiznobaik A, Taheri S, Salehiniya H. (2019) Ovarian cancer in the world: epidemiology and risk factors. Int J Womens Health. 2019;11:287-299. doi:10.2147/IJWH.S197604
2. Surveillance, Epidemiology, and End Results Program. Cancer Stat Facts: Ovarian Cancer. National Cancer Institute. https://seer. cancer.gov/ statfacts/ html/ovary.html
3. Toussaint I, Thomassin-Naggara I, Perrot N, et al. (2011) Characterization of complex adnexal masses: value of adding perfusionand diffusion-weighted MR imaging to conventional MR imaging. Radiology 258:793–803
4. Adel M El-Wekil1, Mohammad S Abdullah1, Sara S El-Kholy2: (2019) The role of MRI in the differentiation between benign and malignant ovarian lesions
5. Li W, Chu C, Cui Y, Zhang P, Zhu M. (2012) Diffusion-weighted MRI: a useful technique to discriminate benign versus malignant ovarian surface epithelial tumors with solid and cystic components. Abdom Imaging. 2012 Oct;37(5):897-903. doi: 10.1007/s00261-011-9814-x. PMID: 22038329
6. Thomassin-Naggara I, Darai E, Cuenod CA, et al. (2009) Contribution of diffusion-weighted MR imaging for predicting benignity of complex adnexal masses. Eur Radiol 19:1544–1552
7. Guerra A, Cunha TM, Félix A. (2008) Magnetic resonance evaluation of adnexal masses. Acta Radiol. 2008 Jul;49(6):700-9. doi: 10.1080/ 028 41 85 08 02064995. PMID: 18568564
8. Khaled A, Abdrabou A. (2014) The significance of added ADC value to conventional MR imaging in differentiation between benign and malignant ovarian neoplasms. Egypt J Radiol Nuclear Med 2014; 45:997–1002
9. Nasr E, Hamed I, Abbas I, Nagat M. (2014) Dynamic contrast enhanced MRI in correlation with diffusion weighted (DWI) MR for characterization of ovarian masses. Egypt J Radiol Nuclear Med 2014; 45:975–985
10. Goyal M, Agarwal VK. (2016) Diagnostic Accuracy of B-mode USG and Doppler Scan for Ovarian Lesions. J Clin Diagn Res. 2016;10(9):TC01-TC04. doi:10.7860/JCDR/2016/20619.8446