Role of MRI in Differentiating benign Versus Malignant Ovarian Lesions

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ABSTRACT

Introduction: MRI offers supplemental diagnostic information in cases of a suboptimal or equivocal ultrasound examination or in patients in whom there is discrepancy between sonographic findings and physical examination . The study aims to determine the role of MRI in evaluating USG proven ovarian lesions with regards to characterization of lesions as benign or malignant.

Material and methods: Patients with suspected pelvis mass, referred to the Radiology Department, SN Medical college, Kochi, underwent UGG(GE Logic P5) and as further, MRI was done at Medical Trust Hospital, Kochi, during January 2015 to December 2016. Total 60 patients were included in the study.

Results: In our study out of 60 cases, by MRI 22 (36.7%) cases were diagnosed as malignant and 38(63.3%) cases benign. We had sensitivity of 100% in detecting malignant lesions and specificity was 95%, positive predictive value 90.9% and negative predictive value 100%. The study findings showed excellent correlation with the results obtained by others studies.

Conclusions: For ovarian lesions, in whom there is discrepancy between ultrasound findings and physical examination, MRI should be the choice. Usefulness of MRI in evaluating adnexal and uterine masses is due to its high sensitivity and specificity, accurate in finding the origin of mass, and to stage malignancies.

Keywords: Contrast Enhanced MRI, Ovarian Cyst, Benign, Malignant.

INTRODUCTION

Ovarian masses are considered one of the common disorders in gynaecology. Ovarian masses pose a special dilemma to the gynaecologist because the differential diagnosis is difficult and complex. Ovarian cancers are one of the most lethal of all gynaecological cancers, as they are characterized by late presentation and poor response to treatment. The primary goal of imaging in the evaluation of an ovarian mass is to differentiate malignant and benign lesions in order to direct patients to the appropriate treatment algorithm. Management options include radical surgery for suspected ovarian malignancy and less invasive surgery (i.e., laparoscopy) for potentially benign neoplasms. US is the first line imaging investigation for suspected ovarian lesion helping in detection of ovarian tumors.[1] An adnexal mass is defined as indeterminate on US when it cannot be confidently placed into either the benign or malignant category, even after thorough interrogation including Doppler assessment, or for which the site of origin, from the ovary, uterus or another pelvic structure, remains to be established.[2] When US findings are nondiagnostic or equivocal, MRI can be a valuableproblem solving tool, an adjunctive modality for evaluating adnexal lesions, useful to give also surgical planning information without radiation exposure. MRI is well known to provide accurate information about hemorrhage, fat, and collagen.[2] It is able to identify different types of tissue contained in pelvic masses, distinguishing benign from malignant ovarian tumors, with an overall accuracy of 88% to 93%.[3] MRI because of its superior soft tissue contrast and direct multiplanar capabilities can better delineate and characterize normal uterine anatomy and focal and diffuse uterine conditions. MRI is non-invasive, has no risk of radiation, requires no anesthesia and is less operator dependent. Features that are more suggestive of benign tumors include a diameter less than 4 cm, entirely cystic components, a wall thickness less than 3 mm, lack of internal structure, and the absence of ascites, peritoneal disease or adenopathy.[4] Most important morphological features of high risk ovarian masses include (a) solid/cystic or solid lesions with a maximum diameter greater than 4 cm; (b) the presence of irregular, nonfatty, solid vascularized areas greater than 28 mm in diameter (c) the presence of papillary projection (vegetation) and thick wall and septa greater than 3 mm in a cystic lesion.[5] Ancillary findings of pelvic organ invasion, implants (peritoneal, omental, mesenteric), ascites, and adenopathy increase diagnostic confidence for malignancy. Features such as wall thickening, septa, and multilocularity are less reliable indicators of malignancy because they are frequently seen in benign neoplasms, particularly cystadenoma- fibromas, mucinous cystadenomas, and endometriomas.[6] Unenhanced T1- and T2-weighted imaging is important for accurate tissue characterization. Lipid and blood are readily detected on T1-weighted imaging with and without fat suppression.[7] T2-weighted imaging helps to identify the relatively low signal intensity of endometriomas, reflecting blood degradation products from repeated cyclical bleeding or the very low signal intensity of fibrous tissue in a fibrous tumor of the

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ovary (i.e., Brenner tumor, ovarian fibroma, fibrothecoma).[8, 9] Gadolinium is usually reserved for improved delineation of papillary projections, nodules, and thick septations in ovarian cancers. Conventional and contrast material– enhanced MR imaging are used to evaluate morphologic features, including lesion complexity, signal intensity, and enhancement of solid areas. At dynamic contrast-enhanced MR imaging with semi quantitative analysis, early enhancement characteristics may help differentiate some complex benign and malignant lesions.[10] Diffusion-weighted imaging has a limited but useful role in evaluating adnexal masses. Those with a hypo intense solid area on both diffusion-weighted (b = 1000 sec/mm2) and T2-weighted images are likely benign, whereas those that are hyper intense on diffusion-weighted images (b = 1000 sec/mm2) with intermediate signal intensity on T2-weighted images are likely malignant.[10] Benign ovarian diseases can simulate malignancies. The knowledge of clinical syndromes and MRI features of these conditions is crucial in establishing an accurate diagnosis and determining appropriate treatment.The study by Adusumilliet al in 2006[11] which showed high sensitivity and specificity in detecting malignant lesions.

MATERIAL AND METHODS

Study group had 60 patients with suspected pelvis mass, referred to Radiology Department, SN Medical college, Kochi, where UGG (GE Logic P5) was done and as further investigation, undergone MRI at Medical Trust Hospital, Kochi, for the time duration of Jan 2015 to December 2016. Contrast enhanced MRI scan was performed using 1.5T MRI scanner (Siemens Espree).

Sample size: We have studied total of 60 patients. Based on the previous study by Adusumilli S et al[11], it was observed that the specificity of MRI for identifying benignity (n=90) was 94%, 6% precision and with 95% Confidence level .The Minimum required Sample Size was 60.

Inclusion Criteria:

1. All patients with clinically suspected uterine and adnexal masses.
2. Patients with incidentally detected uterine and adnexal masses on sonography.
3. Patients of all age groups.

Exclusion Criteria:

1. Patients with bladder carcinoma and rectal carcinoma.
2. Patients who have underwent treatment for pelvic mass .
3. Patients with metallic implants, cardiac pacemakers, cochlear implants.
4. Patients who are claustrophobic.
5. Patients who are unwilling for imaging.

Methodology: Concurrence was taken from the Principal, Medial super intendant, scientific committee and ethical committee for the study. Informed consent was taken from all patients undergoing MRI. A thorough clinical history was taken followed by physical examination.

All MRI images are interpreted on synapse PACS and MRI console monitor with adequate gray-scale center level and window width settings.

STATISTICAL ANALYSIS

Data from the proformas were entered into a Microsoft excel spreadsheet and exported into a statistical analysis suite. Outcomes were analysed using Pearson Chi square test. The software used for the analysis is IBM SPSS statistics 20. 'p' value less than 0.05 was considered significant and charts were made using Microsoft excel. Sensitivity, specificity, positive predictive value and negative predictive values were calculated using the software MedCalc.

RESULTS

In our study, maximum prevalence was seen in females less than 50 years. Of the total 60cases that we had, 44 (73.3%) were aged less than 50 years. Most of the benign lesions were seen in age less than 50 years and majority of the malignant lesions were seen in age more than 50 years. Of the 40 benign cases in our study 37 (92.5%) were less than 50 years of age and of the 20 malignant cases 13 (65%) were

Diagnostic Groups and Criteria	Unilocular Cystic Masses	Multilocular Cystic masses	Cystic and Solid Masses	Solid Masses
Pathologic Groups	Benign tumors	Benign and borderline malignant tumors	Benign, borderline malignant and malignant tumors	Benign, borderline malignant and malignant tumors
Common possibilities	Nonneoplastic masses, hydrosalpinx, neoplasms (serous cystadenoma)	Mucinous cystic tumor, hydrosalpinx	Primary malignancy, metastatic malignancy	Primary malignancy, metastatic malignancy (Krukenberg tumor)
High Signal intensity on T1-WI	Hemorrhagic functional cyst, endometriotic cyst, tubuo-ovarian cyst, hematosalipinx	Endometriotic cyst, tubo-ovarian abscess, hematosalpinx	Teratoma, endometriosis associated malignancy, malignant tumor with hemorrhage, granulosa cell tumor	Malignant tumor with hemorrhage, granulosa cell tumor
Low Signal intensity on T2-WI	-	-	-	Fibroma, Brenner tumor
Contrast enhancement	Peripheral (cyst wall)	Peripheral (cyst wall), septa	Solid components, vegetations, nodules	Solid components

Table-1: Strategy for Diagnosis of Ovarian Masses with MR Imaging

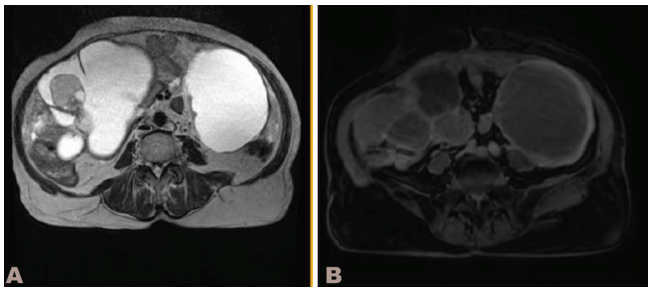

Figure-1: Mucinous cystadenocarcinoma: Axial T2WI (A) and contrast-enhanced fat-suppressed T1WI weighted (B) images show a cystic and abundantly solid mass showing irregular enhancement.

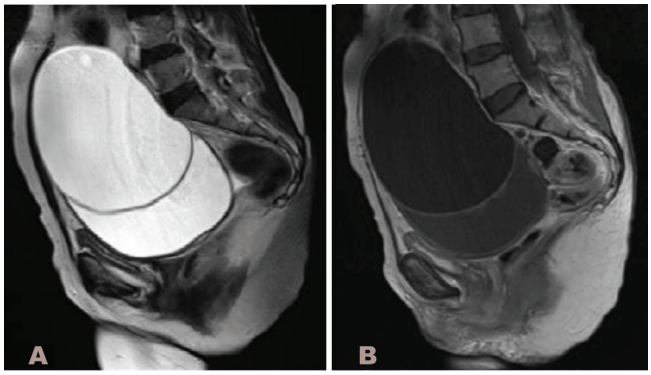

Figure-2: Serous cystadenonoma: Axial T2WI **(A)** and contrast-enhanced fat-suppressed T1WI, **(B)** images show a lesion with thick, mildly enhancing internal septation.

above 50 years. In our study out of 60 cases, by MRI 22 (36.7%) cases were diagnosed as malignant and 38(63.3%) cases were diagnosed as benign. MRI was able to classify ovarian lesions accurately as unilocular, multilocular cystic or solid according to the signal characteristic, morphology and contrast enhancement (Table 1). The sensitivity of MRI in detecting malignant lesions according to our study was 100%, specificity was 95%, positive predictive value 90.9% and negative predictive value 100%.In our study, internal characteristics of ovarian lesion in MRI which pointed to a malignant pathology were thick enhancing septations, heterogenous enhancement in the wall, mural nodules. Lymph nodal involvement was also seen more in malignant lesions. The most commonly involved nodal groups in our study were obturator nodes followed by paraaortic nodes. Out of the 16 benign cystic tumors of ovary MRI diagnosed 12 as benign and falsely reported 4 as malignant which showed internal characteristics of thick septation.

DISCUSSION

The present study was done on 60 females who had clinically suspected uterine or adnexal lesions who were initially investigated with USG then by MRI. The final diagnosis was confirmed by histopathological correlation.

In our study out of 60 cases, by MRI 22 (36.7%) cases were diagnosed as malignant and 38(63.3%) cases were diagnosed as benign.MRI was able to classify ovarian lesions accurately as unilocularcystic, multilocular cystic, solid cystic and solid lesions according the signal characteristic, morphology and contrast enhancement (Table 1). The sensitivity of MRI in detecting malignant lesions according to our study was 100%, specificity was 95%, positive predictive value 90.9% and negative predictive value 100%.The study findings correlated well with the results obtained by a study done by Adusumilliet al in 2006[11] which showed MRI sensitivity of 100% and specificity of 94%.

Our study showed most of the benign lesions are unilocular, the cyst wall appears smooth without vegetations, nodularity, or a solid component and lack of significant contrast enhancement. In our study, internal characteristics of ovarian lesion in MRI which pointed to a malignant pathology were thick enhancing septations, solid areas, heterogenous enhancement of the wall, mural nodules and masses (Fig 1). Sohaib SA et al in 2007[5] has described that MRI findings suggestive of malignancy include the demonstration of solid masses, solid/cystic masses and the presence of papillary projections (vegetations)and thick septa in a cystic lesion.

MRI was able to detect the presence of fat in all 4 cases of dermoid which showed hyper intense signal on T1 and T2 weighted images which were suppressed on STIR sequences. The T1 hyper intense signals seen in endometriomas were not suppressed on STIR sequences which suggested haemorrhage.

Out of the 16 benign cystic tumors of ovary MRI diagnosed 12 as benign and falsely reported 4 as malignant which showed internal characteristics of thick septation (Fig 2) and small papillary projections.

Lymph nodal involvement was also seen more in malignant lesions. The most commonly involved nodal groups in our study were obturator nodes followed by paraaortic nodes. Of the malignant lesions, in 14 cases (29.1%) there was involvement of obturator nodes, 12 cases (25%) showed paraaortic nodal involvement, 8 (16.5%) showed external iliac nodal involvement, 8 (16.5%) showed internal iliac nodal involvement and 6 (12.5%) showed inguinal lymphadenopathy.

MRI offers supplemental diagnostic information in cases of a suboptimal or equivocal ultrasound examination and inpatients in whom there is discrepancy between sonographic findings and physical examination.

CONCLUSION

Sonography is the initial choice for imaging study in the evaluation of women with suspected ovarian masses. However, sonography is limited by its decreased specificity for the diagnosis of benignity.The strengths of MRI in the evaluation of adnexal and uterine masses is its high sensitivity and specificity, its ability toaccurately determine the origin of a mass, to characterize its content and its role in staging gynaecological malignancies and also in patient selection for treatment, and detection of disease recurrence. Administration of gadolinium chelates allows better depiction of internal architecture and is useful in differentiating cystic from solid lesions and malignant from benign lesions.

We conclude that in any suspected uterine and adnexal lesions, the first line of investigation is sonography with colour Doppler studies as it is easily available, having low cost

and is free of radiation. However, in case of indeterminate or equivocal cases on sonography or in patients in whom there is discrepancy between sonographic findings and physical examination, MRI should be the investigation of choice.

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