



CORRELATION BETWEEN SONOGRAPHY AND MRI IN EVALUATION OF HEMORRHAGIC AND ENDOMETRIOTIC CYSTS

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Abstract:

Background: In evaluation of adnexal masses ultrasound serves an important initial modality but MRI, due to its excellent soft tissue resolution, serves as a problem solving tool in assessing the organ of origin and characterization of tissue components.

Methods: This is a hospital based prospective comparative study conducted in postgraduate department of Hamdard Institute of Medical Sciences and Research, New Delhi where in patients with sonographically labelled Endometriotic and hemorrhagic cysts were subjected to MRI for further characterization.

Results: we conducted a study on 86 patients out of which 56 patients were labelled as Endometriomas and 30 patients were labelled as Hemorrhagic cysts. MRI characterized 52 patients with endometriomas corresponding 60 % and 25 patients as Hemorrhagic cysts corresponding to 29 % whereas 4 of sonographically labelled Endometriotic cysts turned out to dermoid on MRI and 5 patients labelled as Hemorrhagic cysts turned out to cyst adenomas On MRI and so on Histopathological correlation.

Conclusion: Sonography is initial modality of choice in evaluating the adnexal masses, but MRI is problem solving tool in characterizing the tissue content and organ of origin.

Keywords: Adnexa, Endometriotic cyst, Hemorrhagic cyst, Sonography, MRI.

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1. INTRODUCTION

Adnexal mass is a lesion occurring in the adnexa of uterus: organs closely related structurally and functionally to the uterus such as ovaries, fallopian tubes and surrounding connective tissues.

Imaging anatomy: On USG, myometrium shows three discernible layers as: a thin inner hypoechoic compact layer adjacent to myometrium, middle layer which is uniformly echogenic and outer thinner hypoechoic layer. Endometrial appearance varies with the menstrual cycle appearing as very thin echogenic line in early proliferative phase and shows progressive hypoechoic thickening in later part of proliferative phase. Secretory phase shows uniformly echogenic endometrium. Ovaries are seen lateral to uterus with central echogenic medulla with multiple cortical follicles of varying sizes. MRI displays three distinct zones as: High signal endometrium, Low signal junctional zone and outer intermediate signal myometrium. Pre-menopausal Ovaries display central stroma of low signal intensity with peripheral follicles of high signal intensity on T2W. Ovaries display same signal intensity as that of uterus on T1 weighted images and enhances to lesser extent than myometrium on post-contrast images. Immature follicles are less than 1 cm in size. Follicle which is greater than 3 cm is termed as cyst. Post-menopausal ovaries are now frequently visualized using high resolution cross-section imaging. Adnexal masses whether symptomatic or asymptomatic are one of the most frequent indications of gynaecological imaging¹. The imaging plays its role by differentiating the adnexal masses into benign and malignant and direct the patient to appropriate treatment algorithm¹. To evaluate the patients with adnexal masses, Sonography is initial imaging modality of choice owing to its widespread availability, relatively low cost and high sensitivity in detecting adnexal masses^{2,3}. Majority of patients need Ultrasonography only for characterization of the adnexal lesion as the lesion may have typical

benign features or overt malignant characteristics⁴. However when no typical signs of benignity or malignancy are present, second line imaging technique is used to characterize the mass^{5,6}. Use of ultrasound is limited by decreased specificity for benignity and results in 20% cases labelled as Indeterminate^{7,8}. Endometrioma and hemorrhagic cysts are frequently encountered lesions seen in adnexa in young females and ultrasound serves as initial tool to characterize the lesion but MRI serves as a problem solving tool in elucidating the organ of origin, characterization of adnexal masses⁹. MRI has become an important modality in evaluating the patients with adnexal masses owing to its multi-planar capabilities and excellent soft tissue resolution¹⁰. In case of T1 bright adnexal masses, fat suppression sequences are used. If signal is suppressed, it confirms fat containing lesion (dermoid). If high signal persists it is mucinous or haemorrhagic lesion. Apart from this, haemorrhagic lesions also show T2 shading, fluid-fluid level and T2 darkening in the walls of the lesion¹¹. This effect is because of the protein and iron accumulation due to repeated haemorrhages. The loss of T2 shading over serial examination points towards the development of malignancy within the lesion because of dilutional effect of secretions of malignant epithelium on blood products¹². If it has suspicious solid component, contrast-enhanced T1W images are used to look for enhancement pattern and categorize the lesion as malignant or benign accordingly. Organ of origin on MRI is ascertained by "Claw sign" where in the normal portion of organ drapes around the lesion like a claw¹³. In case of inhomogeneous T2 masses, further information is gathered by using Gadolinium enhanced contrast studies. Histopathology serves as gold standard in the diagnosis of Adnexal masses. On pathological examination, adnexal lesions are interpreted keeping in view the patient's age, clinico-radiological behavior and accordingly subdivided into non-neoplastic, benign, malignant and those of uncertain behavior.

Lesion	Histopathology
Endometriotic cyst	Lined by cuboidal or columnar epithelium and has varying amount of endometrial stroma with or without hemosiderin laden macrophages.
Hemorrhagic cyst	Unilocular with hemorrhagic fluid having inner granulosa cell and outer layer of luteinized theca cells

Aims and objectives:

- 1) To evaluate Hemorrhagic and Endometriotic with sonography and correlate with MRI.
- 2) Indeterminate masses on MRI to be subjected to surgery and correlate with Histopathology.

Study Design:

The study is hospital based prospective comparative study titled “correlation between sonography and MRI in evaluation of Hemorrhagic and Endometriotic cysts” was conducted in PG department of Radio-diagnosis and imaging, Hamdard Institute of Medical Sciences and Research, New Delhi over a period of 18 months after obtaining the ethical clearance from institutional ethics committee from July 2021 to Feb 2023. This study was prospective in nature where the patients with hemorrhagic and endometriotic cysts were subjected to Ultrasound scan and then MRI.

2. METHODOLOGY

Patients were referred from Department of Obstetrics and Gynaecology with clinical suspicion of adnexal mass lesion to Department of Radio-diagnosis. After fulfilling the selection criteria informed consent were taken for the study and were subjected to following investigations:

Ultrasound:

Ultrasound was performed with ultrasound scanner in the department of Radiodiagnosis HIMSR on Samsung HS70A using 5 to 10 MHz transducer. Ultrasound gel was applied to create a smooth acoustic interface. Patients were scanned trans-abdominally and wherever feasible TVS was done and lesion was classified using IOTA classification. A vascularity score was given to each lesion while assessing the lesion with Colour or Power Doppler with following settings:

PRF 0.3; Velocity scale 3 -6 cm/sec; Balance 220
Vascularity score is given as:
No flow=1;
Minimal flow=2;
Moderate flow=3;
Strong flow through-out= 4

MRI:

MRI was done using 1.5 Tesla Siemens MAGNETOM ESSENZA DOT MRI Scanner Before starting the examination, patients were advised for overnight fast and in addition study was done after emptying the bladder. A premedication with antispasmodic drug was given (buscopan 40

mg IV slow) in order to reduce the artefacts produced by intestinal peristalsis. The pelvis was studied using different pulse sequences in various orthogonal planes using T1W (FS and NON FS), T2W, Diffusion weighted and contrast enhanced T1 W sequences. Sagittal T2 of pelvis (4mm / 0.4mm) evaluated the uterus and determined the position of adnexal lesion. Axial T1 and T2 of pelvis according to adnexal axis which corresponded to coronal plane of uterine body. To characterize the lesion on MRI, signal intensities of both T1 and T2W sequences were assessed: high T1 signal that dropped on T1 FATSAT suggesting the fatty content of the lesion; High signal on T1w that did not drop on FATSAT suggests blood, Low signal on both T1 and T2 sequences suggested fibrous component in the lesion.

Histopathology:

After the surgery, the specimen was sent for Histopathological examination and was taken AS gold standard for diagnosis.

Statistical Methods:

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Statistical software SPSS (version 20.0) and Microsoft Excel were used to carry out the statistical analysis of data. Continuous variables were expressed as Mean±SD and categorical variables were summarized as percentages. Graphically the data was presented by bar and pie diagrams. The MRI determination of the origin of mass and its tissue content were compared with the final diagnosis, and agreement between MRI and the final diagnosis was established using the Kappa statistic and 95% confidence interval [$\kappa = 1.0$, perfect agreement; $\kappa \geq 0.8$ but < 1.0 , excellent agreement; $\kappa \geq 0.6$ but < 0.8 ; good agreement; $\kappa \geq 0.4$ but < 0.6 , fair agreement; $\kappa > 0$ but < 0.4 , poor agreement; and $\kappa = 0$, agreement by chance alone]. Diagnostic accuracy (sensitivity, specificity, positive predicted value, negative predicted value and accuracy) of MRI was obtained for determination of benignity and malignancy of a mass, taking final diagnosis as gold standard.

3. RESULTS

We performed USG on 86 patients. Cysts with typical sonographic features of hemorrhagic cyst was 30 and that of typical endometriotic features was 56. The age range in our study was 20-55 years with mean age of 33.5 years.

Table 1: Age distribution of study patients		
Age (Years)	Number	Percentage
20-29	44	51.2
30-39	14	16.3
40-49	15	17.4
≥ 50	13	15.1
Total	86	100
Mean±SD (Range)=33.5±11.31 (20-55)		

Table 3: Showing MRI findings of study patients		
MRI Findings	Number	Percentage
Endometriotic cyst	52	60
Hemorrhagic cyst	25	29
Dermoid	4	0.04
S.Cystadenoma	5	0.05

On MR based characterization of lesions, Endometriotic cysts were the commonest among the adnexal masses seen each corresponding to 60% of the total lesions. 4 dermoid cysts were falsely labelled as endometriotic cysts and 5 cyst adenomas are falsely labelled as Hemorrhagic cysts on sonography which were clearly characterized by MRI and proven by histopathology.

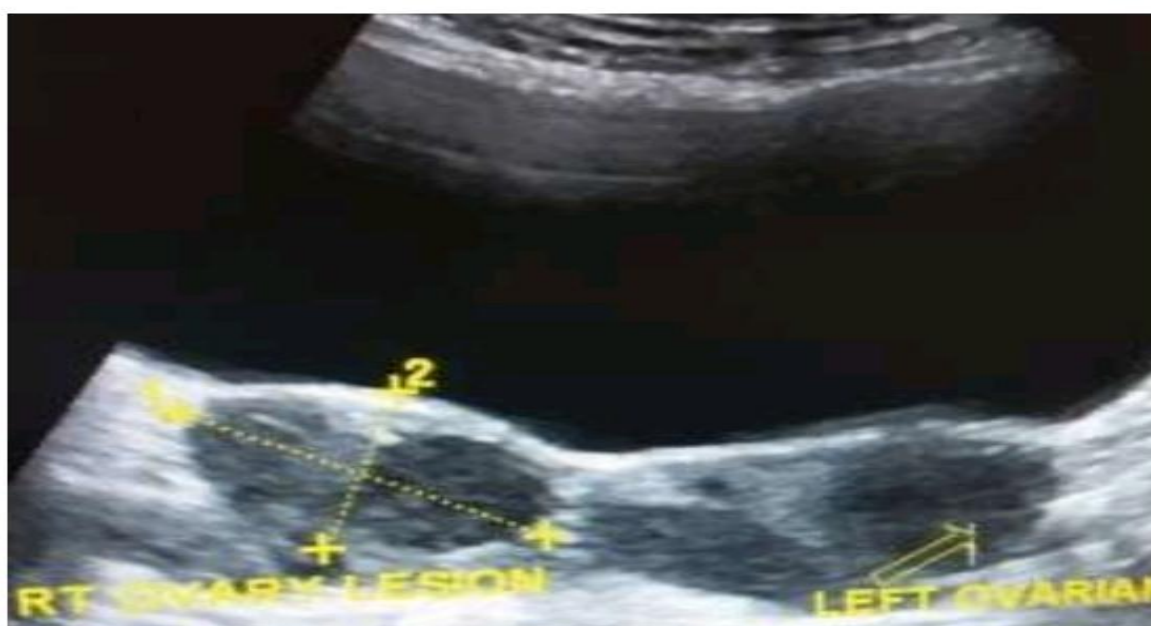


Fig 1: Ultrasound pelvis reveals bilateral complex cysts with ground glass echoes within it.

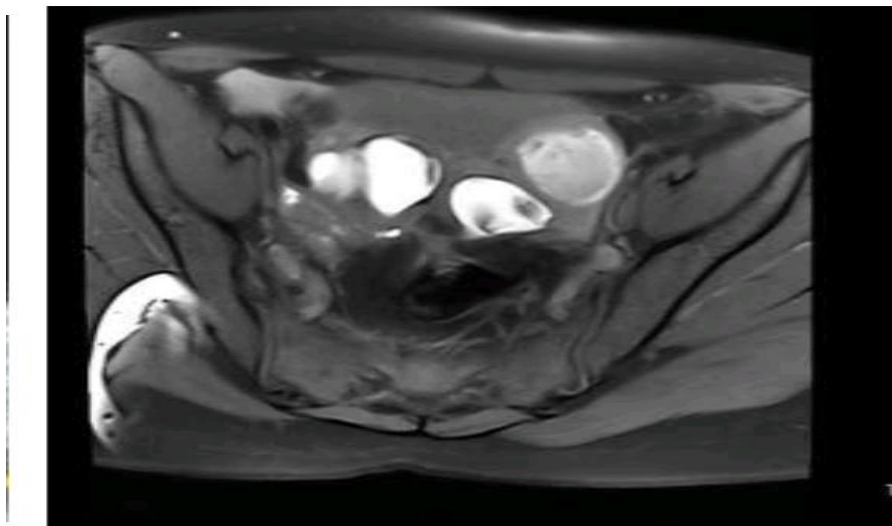


Fig 2: Axial T1W image of pelvis reveals bilateral ovarian cysts with hyperintense signal without suppression on fat sat images.

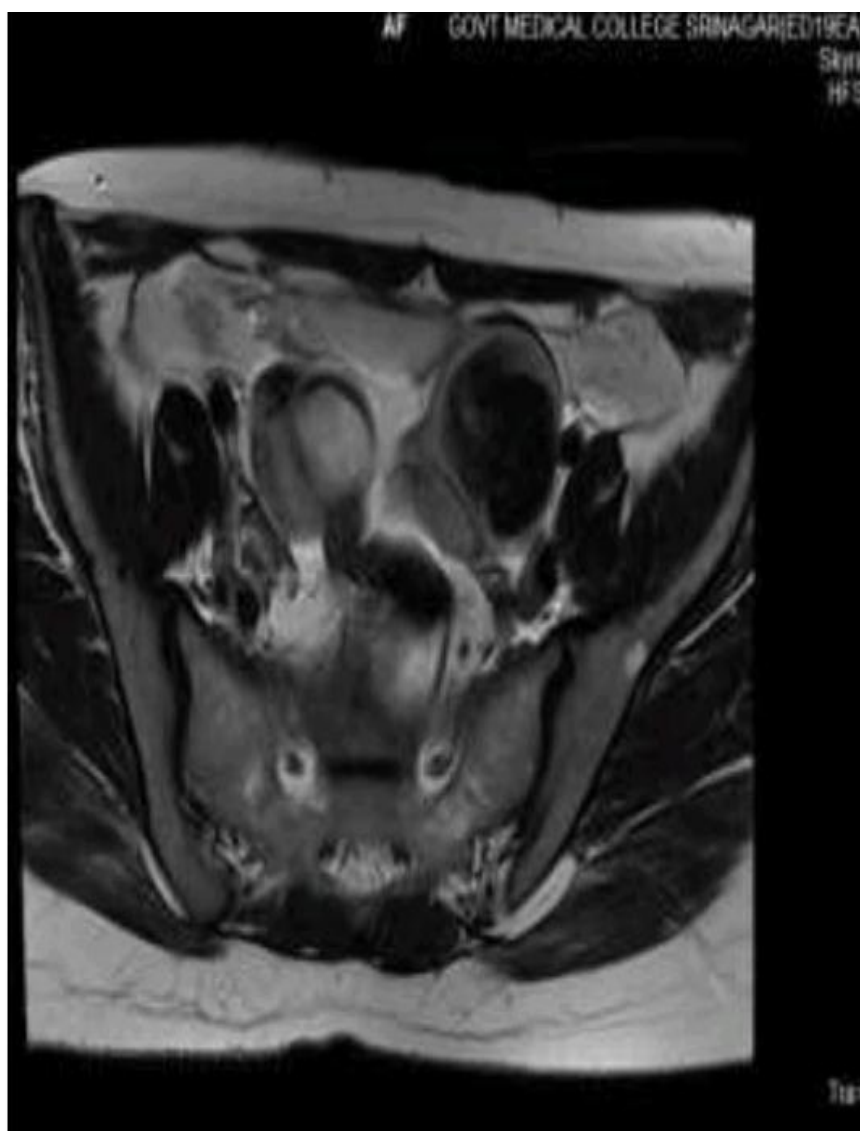


Fig 3: Axial T2W image of pelvis reveals typical T2 Shading artifact suggesting endometrioma which was eventually proven on HPE Correlation.

4. DISCUSSION

Sonography is the initial imaging study in the evaluation of women with suspected adnexal masses^{2,3}. However, Sonography is limited by its decreased specificity for the diagnosis of benignity, which can vary from 60-95% and approximately 20% are labelled as indeterminate^{7,8}. We evaluated the patients with endometriotic cysts and hemorrhagic cysts with sonography and subjected them to MRI. Our aim was not to compare the two imaging modalities but to find out what extra information could be acquired from MRI. Sonography is not able to determine the origin of mass in some cases, which is important aspect in characterizing the mass lesion; hence further evaluation by cross sectional imaging is mandatory. We found in our study that MRI has excellent agreement with final diagnosis in terms of organ of origin. Thus MRI is used as a second line imaging modality in examining the indeterminate masses. In a study conducted by Shanmugaet al¹⁵, mean age of presentation of patients was 35.9 years which supports our study. A study conducted by Shardha SO et al¹⁶ and Chinta vital et al¹⁷ found that the mean age of presentation of adnexal masses were in the age ranges of 35-41 and 36.88 years respectively. However studies by Mondalet al¹⁸ and wasim et al¹⁹ concluded that higher age of incidence of malignant masses were seen with mean age of 48 and 49.5 years respectively. But, there has been an increasing trend of ovarian neoplasms among younger age groups as concluded by some European studies. Among the lesions assessed on sonography, Endometriotic cysts were the commonest lesions in our study followed by hemorrhagic cysts and dermoid cysts Study conducted by Salam M et al²⁰ is in accordance to our study where they reported the incidence of Endometriotic cysts as the commonest lesions among the indeterminate adnexal masses followed by mature cystic teratoma. From our study, we conclude that the agreement of MRI with final diagnosis was excellent in determining the organ of origin, characterize the contents with both the variables having kappa value of >0.8. Endometriotic cysts were the most common lesions in our study. A study conducted by Salam M et al²⁰ found that the majority of the lesions among the indeterminate masses were benign and most common were the Endometriotic cysts accounting for approx. 22% of the total masses. Studies conducted by Alcazar JL²¹ and Guerriero S²² found the most common adnexal lesions being endometriomas in 29% and 19% cases respectively. In nutshell, our study showed the sensitivity and specificity of MRI in benign vs malignant lesions discrimination as 100% and 97% respectively. Our study is supported by the findings of Aruna k sumana¹⁰ where the MRI had sensitivity

of 100% and specificity of 97.7%. Our study had some limitations. We did not evaluate those patients who were subjected to surgery directly after the sonographic diagnosis. Also not all the patients underwent MRI after preliminary Ultrasonography. But our goal was not to compare the two imaging modalities but to characterize and get extra information of the sonographically indeterminate lesions.

5. CONCLUSION

We conclude from our study that endometriomas are commonest adnexal masses in females of child bearing age. Sonography is an excellent first line modality to assess the adnexal masses and reasonably characterizes the adnexal masses. However, MRI serves a problem solving tool to delineate the organ of origin, characterization of tissue components and extension of masses.

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