

ORIGINAL ARTICLE

The Diagnostic Accuracy of Dynamic MRI in diagnosis of complex adnexal masses

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ABSTRACT

Background: When ultrasonographic data are restricted, magnetic resonance imaging (MRI) scans can assist identify adnexal mass features. Two European centers have done pioneering work on Dynamic MRI with varied accuracy in diagnosis of complex adnexal lesions.

Aim: To evaluate diagnostic accuracy of Dynamic MRI in diagnosing complex adnexal masses,

Methods: The Department of Radiology conducted a cross-sectional study. Sheikh Zayed hospital, Lahore for 6 months (September 2017-March 2018). Procedure was done for MRI and histopathology for detecting the adnexal masses. Results of MRI were compared with histopathology results, which are taken as gold standard. Reporting was done by researcher herself under supervision of consultant radiologist. SPSS version 20 was used to enter and evaluate the data.

Results: The mean age of patients was 41.57±11.69 years. Dynamic MRI has a 95% sensitivity, specificity, and diagnostic accuracy. 94.37% and 94.7% respectively.

Conclusion: Dynamic MRI is reliable and useful tool with high values of responsiveness, for detecting complicated indeterminate adnexal masses on Doppler considering histopathology as gold standard. Specificity and diagnostic accuracy are important.

Keywords: Dynamic MRI, Histopathology, Complex Adnexal Mass

INTRODUCTION

An adnexal mass is a growth of the ovary or fallopian tube. Complex adnexal masses present a diagnostic nightmare¹. The standard evaluation for adnexal masses as expected include proper history and examinations like tridimensional Ultrasonography, Doppler, CT, MRI as well as tumor markers, for example, alpha-fetoprotein, CA-125 and CA-19.9, as adjuvant methods^{2,3}.

However, without histopathology, a definitive diagnosis cannot be made. Other factors to be considered in evaluation includes family history of ovarian & Breast carcinomas and carrier state of BRCA 1 or 2 genes⁴. A local Research showed 46% universality of malignant adnexal mass of which on Doppler as, many as, 20% of complex adnexal masses remain undetermined. Gray scale or Doppler can be used as first modality for imaging^{1,5}.

Sonography or Doppler studies may sometimes be unable to differentiate between malignant and benign masses,⁶ though, it has high sensitivity and is of low cost but not very specific for heterogeneous masses. The alternative to surgery is follow up on serial ultrasound which may be difficult and remains inconclusive⁷.

Previously studies had been undertaken for assessing efficiency, of dynamic pelvic MRI⁸. In literature reviews, a broad spectrum of sensitivity and specificity as 80% 52% respectively of Doppler, and CT Scan, however these modalities may fail to show origin⁹.

Rationale of this study is to assess diagnostic perfection of dynamic MRI to differentiate complex adnexal masses, which remain borderline or indeterminate on Doppler studies. So, we want to conduct this study to see the extent of diagnostic information provided by Dynamic MRI as diagnostic tool, compared with Doppler studies¹⁰. MRIs being increasingly used because of its magnificent soft tissue characterization and of its multi planar imaging capability^{11,13}.

The objective of the study is to determine the diagnostic accuracy of Dynamic MRI for diagnosing of complex adnexal mass, indeterminate on Doppler considering histopathology as a gold standard.

MATERIAL AND METHODS

At the Department of Radiology, a cross-sectional investigation was done, Sheikh Zayed hospital, Lahore for six months after approval of synopsis by Ethical Committee. Sample size of 151 patients taken with 95% conviction level with 08% the error margin. Expected 20% prevalence of indeterminate adnexal masses was taken on Doppler studies taking sensitivity and specificity of MRI as 94.83% and 87.50% respectively. Sampling Technique was Non probability consecutive.

Inclusion Criteria: Patients of age between 20 to 60 years. Adnexal mass confirmed on ultrasonography. Heterogeneous, complex, indeterminate mass on Doppler.

Exclusion Criteria

- Patients with adnexal mass removed already.

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- Patients with confirmed Biopsy results should be reported,
- Patients with known gynecological malignancy or previous H/O treatment .
- H/o contrast-induced hypersensitivity,
- Magnetic resonance imaging (MRI) is contraindicated,(for example pace makers)
- Any chronic illness like chronic renal failure and chronic liver disease

After taking approval from hospital ethical committee, 90 patients was included with informed consent for this study fulfilling inclusion criteria and excluding all the confounding factors in exclusion criteria was enrolled in Sheikh Zayed hospital Lahore, Radiology Department. A detailed and relevant history was taken from all patients. All the subjects were undergone Doppler studies using GE Voluson Expert 730 machine and probe ranging 2-7 Hz. After this dynamic MRI was performed on every patient using GE-HDX 1.5 Tesla MR system with CTL coils and magnetic quantum gradients. Malignant mass is reported with the presence of contrast enhancement on T1-weighted post contrast images, high signal intensity on T2-weighted fat saturation images, papillary projection, solid components, septations more than 3mm, free fluid and lymphadenopathy. Results were compared with histopathology reports which are considered as gold standard. All this information along with demographic variables were recorded in the predesigned proforma. Reporting was done by researcher herself under supervision of consultant radiologist.

The SPSS Version 20 used to analyze all data recorded. Qualitative Data like characters of masses (benign vs. malignant) on MRI and histopathology was presented as frequency and percentage. Quantitative variable i.e. age and size of mass was presented as mean +/- SD. Sensitivity, specificity, PPV, NPV, and diagnostic accuracy for Doppler studies and dynamic pelvic MRI was calculated with 2x2x table.

RESULTS

A total of 151 cases were included in this investigation. The patients' average age was 41.5711.69 years, with the lowest and highest ages of 20 and 60 years, respectively. The average size of the patients' adnexal masses was 1.480.61 cm in this study, with minimum and highest values of 0.5 and 2.5 cm, respectively. In our study the MRI diagnosed positive adnexal masses among 80(53%) patients and it diagnosed negative adnexal masses among 71(47%) patients (Table 1).

In our study the histopathology diagnosed positive adnexal masses among 80(52.98%) patients and it diagnosed negative adnexal masses among 71(47.02%) patients (Fig.1).

The study results showed that the sensitivity, specificity, PPV, NPV and distinctive perfection of MRI for diagnosing adnexal masses was 95%, 94.37%, 95%, 94.37% & 94.7% respectively taking histopathology as gold standard (Table 2).

The study results showed that in patients with age ≤40 years the sensitivity, specificity and diagnostic accuracy of MRI for diagnosing adnexal masses was

100%, 92.11% & 96.05% respectively taking histopathology as gold standard. Similarly in patients with age >40 years the sensitivity, specificity and diagnostic accuracy of MRI for diagnosing adnexal masses was 90.48%, 96.97% & 93.33% respectively taking histopathology as gold standard (Table 3).

Table 1: Frequency distribution of MRI for diagnosing complex adnexal masses

MRI	Frequency	%age
Positive	80	53.0
Negative	71	47.0
Total	151	100.0

Table 2: Comparison of MRI with histopathology for diagnosing complex adnexal masses

MRI	Histopathology		Total
	Positive	Negative	
Positive	76	4	80
Negative	4	67	71
Total	80	71	151

Sensitivity: 95%, Specificity: 94.37%
 PPV: 95%, NPV: 94.37%
 Diagnostic accuracy: 94.7%

Table 3: Comparison of MRI with histopathology for diagnosing complex adnexal masses stratified by age

Age (Years)	MRI	Histopathology		Total
		Positive	Negative	
≤ 40	Positive	38	3	41
	Negative	0	35	35
> 40	Positive	38	1	39
	Negative	4	32	36

MRI	Age (years)	
	≤ 40	> 40
Sensitivity	100%	90.48%
Specificity	92.11%	96.97%
PPV	92.68%	97.44%
NPV	100%	88.89%
Diagnostic accuracy	96.05%	93.33%

Table 4: Comparison of MRI with histopathology for diagnosing complex adnexal masses stratified by mass size

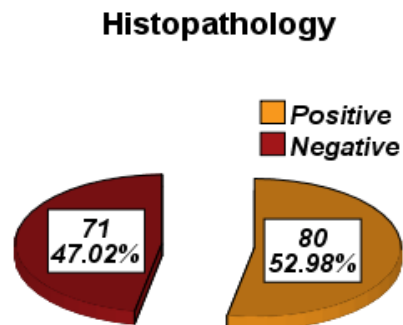
Mass size(C M)	MRI	Histopathology		Total
		Positive	Negative	
≤ 1.5	Positive	38	1	39
	Negative	1	41	42
> 1.5	Positive	38	3	41
	Negative	3	26	29

MRI	Mass size (cm)	
	≤ 1.5	> 1.5
Sensitivity	97.44%	92.68%
Specificity	97.62%	89.66%
PPV	97.44%	92.68%
NPV	97.62%	89.66%
Diagnostic accuracy	97.53%	91.43%

The study results showed that in patients with adnexal mass size ≤1.5 cm the sensitivity, specificity and diagnostic accuracy of MRI for diagnosing adnexal masses was 97.44%, 97.62% & 97.53% respectively taking histopathology as gold standard. Similarly in patients with

adnexal masses >1.5 cm, the sensitivity, specificity and diagnostic accuracy of MRI for diagnosing adnexal masses was 92.68%, 89.66% & 91.43% respectively taking histopathology as gold standard (Table 4).

Fig 1: Frequency distribution of histopathology for diagnosing complex adnexal masses



DISCUSSION

This cross-sectional study was conducted in the Department of Radiology, Sheikh Zayed Hospital, Lahore, to evaluate the diagnostic accuracy of Dynamic MRI in the diagnosis of complex adnexal masses that were inconclusive on Doppler, with histology as the gold standard.

In clinical practice, adnexal masses, both painful and asymptomatic, are a regular occurrence. The ability to accurately diagnose an adnexal mass as benign or malignant is critical in avoiding unneeded drastic surgery, especially in postmenopausal women, and can enable young women who want to save their reproductive potential choose conservative treatment¹⁴.

The sensitivity, specificity, PPV, NPV, and diagnostic accuracy of MRI for diagnosing adnexal masses were 95%, 94.37%, 94.37% and 94.7% respectively, using histology as gold standard. Some of the research are presented below, with results that support our hypothesis.

A study has reported that the Trans-abdominal Doppler ultrasonography has a sensitivity 85.18%, specificity 80.56%, positive predictive value 86.79%, negative predictive value 78.38%, and accuracy of 83.33 percent in assessing adnexal masses, while MRI with contrast showing sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 94.83 percent, 87.50 percent, 90.32 percent respectively⁵.

Faten M Salem et al¹⁵ showed that utilizing ultrasonography and color Doppler tests with a grading system was helpful in distinguishing between a benign and malignant adnexal tumor. A computed tomography scan has been demonstrated to be helpful in determining the extent of the disease and arranging treatment. In challenging cases, MRI proved helpful in identifying adnexal masses.

Doppler study and CT scan have a wider range in sensitivity 80% and specificity 52% in the literature, but these modalities may not be effective in indicating origin, i.e., ovarian or juxtaterine, and to distinguish between indeterminate adnexal masses⁹.

Saroja Adusumilli et al in their study reported that sensitivity of MRI for identifying adnexal masses was 100% and its specificity for benign disease was 94%. Study results showed an excellent agreement between MRI and the final diagnosis for determining the origin ($\kappa = 0.93$), tissue content ($\kappa=0.98$), and tissue characteristics ($\kappa = 0.91$) of a mass. Whereas, ultrasonography depicted poor agreement with the final diagnosis for the origin ($\kappa = 0.19$) and tissue content ($\kappa = 0.33$) of a mass¹³.

MRI has been shown in several studies to be an important problem-solving tool for determining the pelvic mass origin and then characterizing an adnexal mass, particularly in patients with ambiguous disease. Local invasion can also be detected with MRI^{15,16}.

Contrast-enhanced MRI improve on sensitivity to 81% and specificity to 98% in comparison to unenhanced MRI sensitivity and specificity i.e., 76% and 97% respectively, in the diagnosis of ovarian mass according to a study by Iyer VR et al¹⁸.

According to the published research, the accuracy with MRI interpretation in distinguishing benign tumors from malignant using only conventional sequences is around 80%¹⁹⁻²².

CONCLUSION

This study and data analysis concluded that the dynamic MRI is authentic and useful tool with high values of sensitivity, specificity and diagnostic accuracy for detecting complex adnexal masses, indeterminate on Doppler considering histopathology as gold standard.

Conflict of interest: None

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