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RESEARCH ARTICLE

DIAGNOSTIC ACCURACY OF MR IMAGING IN CLINICALLY SUSPECTED PELVIC MASSES IN FEMALE: A PROSPECTIVE CROSS SECTIONAL STUDY

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ABSTRACT

Objective: Study was undertaken to evaluate the role of MRI in the evaluation of pelvic mass lesions, and performed clinico-pathological correlation.

Methods: The Prospective cross-sectional study was conducted in 60 female patients who were clinically suspected to have pelvic mass lesions or detected with a pelvic mass incidentally on USG in the hospitals attached to Govt. Medical College, Kota during the period from December 2014 to December 2015. Final diagnosis were obtained by histopathological correlation in near all cases. The imaging results were then compared with the pathological results to determine the sensitivity and specificity of magnetic resonance imaging for the determination of the nature of mass.

Results: Study was undertaken in 60 females age ranged between 11-75 years with mean age of 37.88 ± SD 15.5 in years. The 48 cases (80%) were benign and 12 cases (20%) were malignant. Most common lesions evaluated on imaging were uterine leomyoma. The maximum pelvic masses were arising from ovaries (56.67%). The consistency of masses was solid in 46.67% cases. The Sensitivity and Specificity of MRI in characterizing pelvic masses as benign was 97.92% and 91.67% respectively, and for malignant lesion 91.67% and 97.92% respectively. In diagnosing uterine mass, the values of Sensitivity and Specificity were 94.44% and 100% for benign and 100% & 94.44% for malignant respectively, In ovarian mass, 100% and 88.89% for benign and 88.89% & 100% for malignant ovarian masse respectively. All extrauterine and extraovarian mass cases were correctly diagnosed by MRI with 100% sensitivity and specificity.

Conclusion: Magnetic resonance imaging was highly accurate in characterising the pelvic masses as benign and malignant.

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INTRODUCTION

Pelvic pathologies presenting as masses are common among the female population; their exact localization and characterization is of paramount importance as it dictates the subsequent management for the patient. (Givens *et al*., 2009) MRI has become an important modality in the evaluation of female pelvic lesions. The claimed advantages of MRI include lack of radiation exposure, multiplanar imaging capability, ability in tissue characterization, tissue specificity, better localization of the mass origin and determining their anatomical relationship to adjacent pelvic structures. (Tanaka *et al*., 2007; Mohaghegh and Rockall, 2012) Its sensitivity in detecting ovarian masses has been reported as 100%, can also discriminate vessels without the need of intravenous contrast medium and is also useful in young females who do not agree for further evaluation of the masses by either TVS or CT scan. (Amelie *et al*., 2011; Spencer and Ghattamaneni, 2010; Spencer *et al*., 2010) Although similar studies have been conducted by other researchers, but we believed it was important to conduct it again because to the best of our knowledge, none of the studies have been reported, which closely investigate sensitivity and specificity of benign and malignant mass lesions of ovary, uterus and extrauterine /extraovarian region separately. In this study we are attempting to evaluate pelvic masses by magnetic resonance imaging for better tissue delineation and the same is confirmed by histological correlation. Our aim is to evaluate the accuracy of MR imaging in the detection and characterization of pelvic mass lesions and to determine which morphologic features are most predictive of malignancy.

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MATERIALS AND METHODS

The prospective cross-sectional study was conducted in 60 female patients who were clinically suspected to have pelvic mass lesions or detected with a pelvic mass incidentally on USG in the hospitals attached to Govt. Medical College, Kota during the period from December 2014 to December 2015. MRI was performed to evaluate the pelvic masses; patients were imaged on 1.5T Philips ACHIEVA machine with moderately filled bladder after fasting for at least 3-4 hours. Once the patient lied on her back with a pelvic or torso phased-array coil wrapped tightly around her hip. The sequences were obtained from the mid symphysis pubis to the renal hilum or beyond if necessary to cover the larger pelvic masses. Masses were characterised based on various factors such as size, location, consistency, thickness and enhancement of walls, internal enhancement, thickness of septae (more or less than 3mm), presence of mural nodule and papillary projections, as well as on signal characteristics. Both T1W & T2W MRI were evaluated in axial, sagittal and coronal planes. T1W images shows excellent contrast between the pelvic organs and adjacent fat help in optimal detection of lymph nodes and are necessary for tissue and fluid characterization (essential for hemorrhagic and fat containing lesions). T2W images sequences mandatory for the zonal anatomy of the uterus and vagina and allow the identification of normal ovaries. In addition T2W images are generally superior in depicting pathologic conditions of uterus and ovaries. The selective application of fat saturation imaging was done to differentiating fat, blood and proteinaceous fluid in hyper intense lesions in T1W images. Post contrast axial, coronal and sagittal T1 weighted images with fat saturation were obtained after giving the patient a dose of 0.1 mmol/kg of Gadolinium for detection of enhancement in solid lesions or lesion components whenever required. Information collected was tabulated to analyze observations and statistical analysis of the data on the basis of history, ultra sonographic, MRI findings was done. Cases were followed up; histopathological diagnosis was considered final and was obtained by biopsy or FNAC of mass. Borderline tumors were classified as malignant tumors. Follow up sonography was done in cases managed conservatively by drugs or by radiotherapy or in cases of spontaneous resolution. The MRI findings were compared with histopathological diagnosis. Descriptive statistical values, including accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were determined in benign and malignant pelvic mass cases for MRI diagnosis. The patients were followed up to co-relate the findings with clinical outcome or operative findings and histopathology wherever possible.

RESULTS

A total of 60 women participated in this study, 48 (80%) were benign and 12 (20%) were malignant. The age ranged between 11-75 years with mean age of participants was 37.88±15.5 in years. Maximum patients of pelvic masses belong to 41-50 years age group (23.33%). Malignant lesions were most common in >60 years age group (33.33%) and benign lesions in 21-30 years age group (22.92%). Out of 60 pelvic masses; 34 cases were from ovary, 20 were from uterus, 6 cases were extraovarian extrauterine. The histopathologic diagnoses are detailed in Table 1. Most common lesions evaluated on imaging were uterine leomyoma. The maximum pelvic masses were arising from ovaries (56.67%). The consistency of masses was solid in 46.67% cases. Maximum pelvic masses were > 5cm in size 54 out of 60 cases (90%), All malignant mass cases 12 out of 12 (100%) and 87.5% benign mass cases 42 out of 48 were more than 5cm in size. Most common benign masses were leomyoma 16 out of 48 cases (33.33%), most common malignant masses were serous cystadenocarcinoma 4 out of 12 cases (33.33%). Most common symptom in the cases presenting with pelvic mass was pain abdomen (46.67%). Ascites was found in 58.33 % malignant and 18.75% benign pelvic mass cases. Out of 48 histopathologically proven benign masses MRI accurately picked up 47, giving a sensitivity of 97.92% and specificity of 91.67%. Of the other one case which was reported as a leomyosarcoma, turned out to be a leomyoma with degenerative changes on histopathology. Out of 12 histopathologically proven malignant masses 11 were accurately picked up by MRI, giving a sensitivity of 91.67%. The only false negative was the ovarian mucinous cystadenocarcinoma of a teenaged female incorrectly categorised as an ovarian mucinous cystadenoma.

Table 1. Histopathological Diagnosis

Histopathological Diagnosis	Frequency
Benign (48)	
Teratoma/Dermoid	8
Endometrioma	5
Serous Cystadenoma	4
Mucinous cystadenoma	1
Hemorrhagic cyst	3
Ovarian torsion	2
Steroid cell tumor	1
Fibroma	1
Hydrosalpinx/PID	4
Leomyoma	16
Endometrial polyp	1
Haematometra	1
Retroperitonial dermoid	1
Malignant (12)	
Serous Cystadenocarcinoma	4
Mucinous Cystadenocarcinoma	1
Metastatic Cystadenocarcinoma	2
Endometrioid Carcinoma	1
Undifferentiated carcinoma	1
Ca cervix	2
Chordoma	1
TOTAL	60

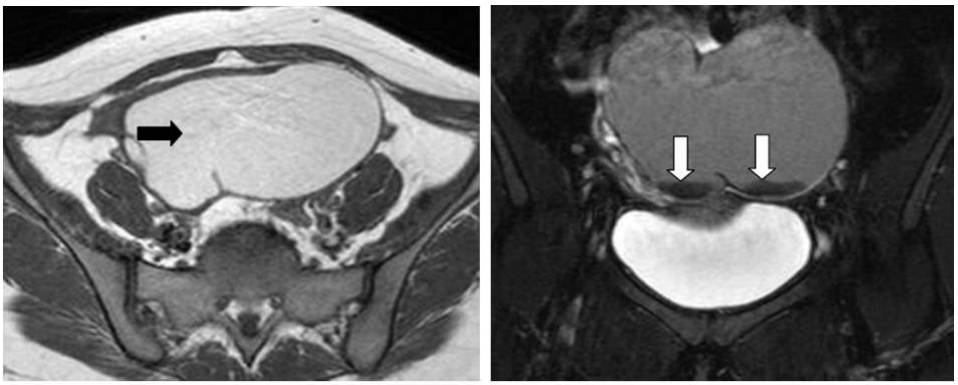
In our study the sensitivity, specificity, PPV and NPV of the MRI for the assessment of benign pelvic lesion was 97.92%, 91.67%, 97.92%, and 91.67% respectively, and for malignant lesion 91.67%, 97.92%, 91.67%, and 97.92% respectively. Diagnostic accuracy was 96.67%. Diagnostic test statistics for benign and malignant pelvic masses of ovary, uterus and extrauterine extraovarian are listed in Table 2.

DISCUSSION

Preoperative characterization of pelvic lesions has important implications. Firstly, it is of very important for the gynecologist or general surgeon to know before surgery whether the lesion is benign or malignant, as this makes them able to perform the most appropriate surgical procedure.

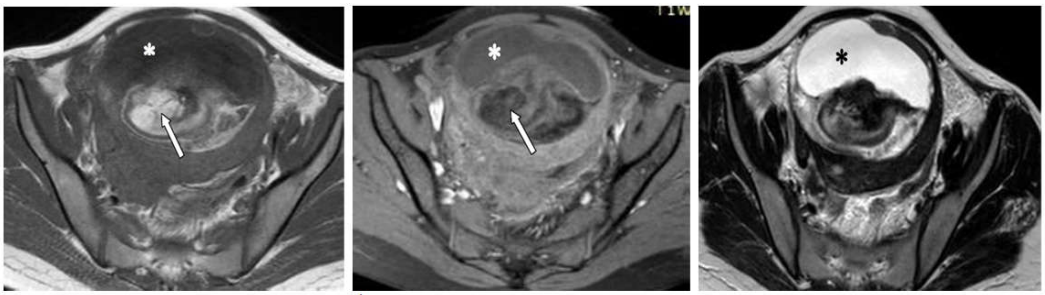
Table 2. Diagnostic Test Statistics

MRI	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
Benign pelvic mass cases	97.92%	91.67%	97.92%	91.67%	96.67%
Malignant pelvic mass cases	91.67%	97.92%	91.67%	97.92%	96.67%
Benign ovarian mass cases	100.00%	88.89%	96.15%	100.00%	97.06%
Malignant ovarian mass cases	88.89%	100.00%	100.00%	96.15%	97.06%
Benign uterine mass cases	94.44%	100.00%	100.00%	66.67%	95.00%
Malignant uterine mass cases	100.00%	94.44%	66.67%	100.00%	95.00%
Extrauterine and extraovarian mass	100.00%	100.00%	100.00%	100.00%	100.00%



a. b.

Fig.1 (a.) T1-weighted spin-echo MR image reveals a mass in the right ovary with uniform high signal intensity and a discrete wall (black arrow). (b) On a T2-weighted MR image, the mass demonstrates hyperintense cystic lesion with a heterogeneous fluid-fluid level and shading (white arrows)



a. b. c.

Fig.2 (a,b) Axial T1W image shows a large solid cystic pelvic lesion with hyperintense signal which shows signal drops out on the fat sat T1W image (white arrow) and hypointense cystic component (asterisk). (c) Axial T2W images shows hyper intense cystic component (asterisk). Findings are consistent with the diagnosis of Mature teratoma

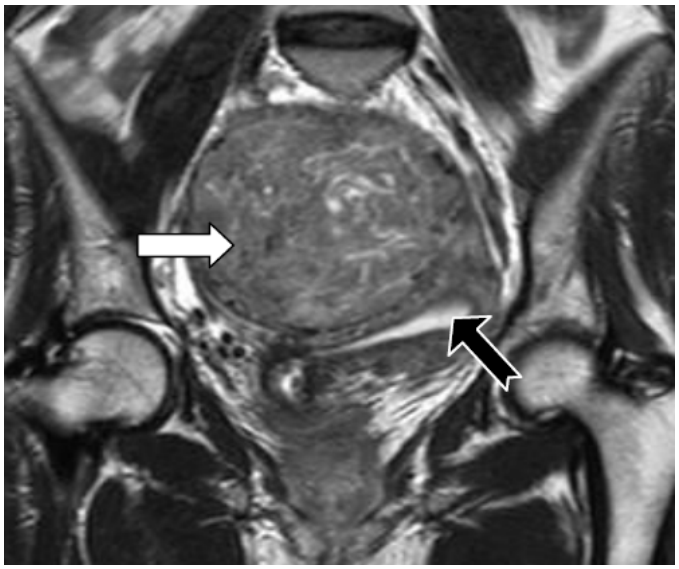


Fig.3. Coronal T2-weighted image allows adequate visualization of the uterine cavity (black notched arrow), demonstrating large heterogenous hypointense interstitial fibroid (white arrow) and the absence of thickening of the junctional zone

Secondly, clinical and laboratory data are not always specific enough for the characterization of the malignant nature of these lesions, especially in premenopausal women. (Hricak *et al*., 2000) In this study, we found that MRI is a suitable method for differentiating between malignant and benign pelvic lesions with high accuracy (96.67%), and our data correspond with previously published data that describe accuracies ranging from 83 to 94%. (Hricak *et al*., 2000; Mehreen Rasool *et al*., 2013; Tushar Prabha *et al*., 2014) The pelvic MRI scans of 60 patients were evaluated, and the MRI results were compared with histological results. Some authors consider the size of the lesion (>4 cm) as a criterion of malignancy, (Yamashita *et al*., 1995; Stevens *et al*., 1991; Forstner *et al*., 1995) but it was not included as such in our study, we agree with others that lesion size (>4 cm) when combined with other imaging findings does not further contribute to the prediction of malignancy. (Hricak *et al*., 2000) Most common pelvic mass cases were detected in 41-50 years of age group. Most common benign were observed within 21-30 years of age group and malignant mass cases were observed in more than 60 years of age group. Our results found similar to study of Dwivedi *et al*. (2013) In their study they observed that benign adnexal masses were maximum in the age group 20 - 39 years (56/97, 57.7%), while malignant masses were mainly found in women ≥60 years of age (11/17, 64.7%). Most common observed symptoms were pain abdomen (46.67%). Safia *et al*. (2010) also suggested the most common symptom in patient with pelvic masses was pain or abdomino-pelvic discomfort which was present in 63.6% cases. Ascites was found in 58.33 % malignant and 18.75% benign pelvic mass cases. All malignant masses with ascites were ovarian in origin which is in concordance with study done by Shen-Gunther *et al*. (2002) Their study indicated that the presence of ascites on preoperative physical examination or imaging study was highly predictive of ovarian malignancy in women with a pelvic mass. The sensitivity in diagnosis of endometrioma (5/5) and dermoid cyst (8/8) was 100% were in agreement with Scoutte and McCarty *et al.* (1994) and Dwivedi *et al*. (2013) (Fig.1 and Fig. 2) These findings also correlate with Jain KA, Jeffery *et al*. (Jain *et al*., 1993) who concluded that when fat suppression technique used MRI is superior in detection and differentiation of haemorrhagic masses from the dermoids (fat containing masses). The sensitivity in diagnosis of fibroid was 100% (17/17) these results was in agreement with Dwivedi *et al*. (2013) who state that MRI was the best imaging modality to identify fibroids with 83.3% sensitivity, 100% specificity and 99.1% accuracy. (Fig.3)

All extrauterine and extraovarian mass cases were correctly diagnosed by MRI with 100% sensitivity and specificity. Similar results were obtained by Saleha anwar *et al.* (2014), she found the sensitivity and specificity of MRI for the assessment of extra uterine/extra ovarian mass were 66.6% and 100% respectively. The only false negative was the ovarian mucinous cystadenocarcinoma of a 17 year female incorrectly categorised as an ovarian mucinous cystadenoma. The mass was a large abdomenopelvic cystic lesion with few septation and showed diffuse low signals on T1-weighted images and variable high signals on T2-weighted images. There was no supportive evidence of enlarged nodes or presence of ascites to label this case as malignant. Considering the age of the patient and signal intensities demonstrated on T1 and T2-weighted images, this particular case was reported as ovarian mucinous cystadenoma. A case of leomyoma with degenerative changes false positively given as leomyosarcoma in 42 year female. It was very large lobulated and heterogeneously enhancing mass lesion with heterogenous signal intensity on T1 and T2 sequences and as clinical history suggestive of sudden increase in size of mass this case.

Conclusion

- Results indicated higher capability of MRI for the diagnosis of dermoid, hemorrhagic cyst and pretreatment assessment of pelvic malignancies; also it is problem solving tool in cases of indeterminate pelvic masses on USG.
- The major contribution of MRI in evaluating pelvic pathologies lies in its ability to determine whether a solid mass is truly ovarian or uterine in origin and to accurately identify extrauterine extraovarian masses. It precisely defines the internal architecture of ovarian masses.
- Ascites is an ancillary inclusion criterion of malignancy, but is present in some (18.37%) benign pelvic lesions as well.

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Conflicts of interest

The authors declare that they have no competing interests.

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