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Roleof diffusion weighted MRI in differentiating benign versus malignant female pelvic masses and its pathological correlation

Sangeeta Saxena[1], DharmrajMeena[2] ,*Mayank Choudhary[3] , Harshverdhan Khokhar[4]
[1]Professor and Head,[2]Professor,[3]Resident Doctor,[4]Assistant Professor
[1234]Department of Radiodiagnosis,Govt.Medical College KOTA324010
*Corresponding author:*MayankChoudhary*

***Abstract**: Uterine and adnexal masses have been a leading cause of morbidity and mortality in women worldwide.The role of MRI in gynaecological conditions has evolved during the past two decades, determining whether a clinically diagnosed pelvic mass is benign / malignant is frequently not possible until surgical exploration and histologic examination are performed.Consequently it may not be possible to decide preoperatively whether conservative or radical surgery is appropriate.Advancements in MRI techniques, such as diffusion weighted (DWI) and dynamic contrast enhanced MRI (DCE-MRI) can provide further information to help to increase diagnostic confidence. **DWI** provides a tissue contrast, based on the differences of water mobility in different tissues. In highly cellular tissues such as tumour tissues, diffusion of water protons is restricted. **Dynamic contrast enhanced imaging (DCE)** depends on tumourneovascularisation and it provides valuable information about tumourperfusion.The purpose of this study is to prospectively assess the diagnostic ability of diffusion-weighted imaging (DWI) in characterizing of female pelvic masses.*

***Keywords:**Diffusion weighted, Dynamic contrast enhanced, Uterine and adnexal, MRI.*

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I. Introduction

Uterine and adnexal masses have been a leading cause of morbidity and mortality in women worldwide.These masses were earlier identified by digital per vaginal examination. The conventional radiographic examinations gave insufficient diagnostic information. Invasive radiological examinations like hysterosalphingography gave only overview information.

Over the time various modalities Ultrasound [USG], computed tomography [CT], nuclear imaging have been developed to diagnose the uterine and adnexal masses and help in the management. With the advent of state of art imaging equipment, the uterine and adnexal masses are being increasingly diagnosed at an earlier stage or sometimes in asymptomatic individuals. The advantage of magnetic resonance imaging (MRI) over alternative imaging modalities is that it can provide additional information on soft tissue composition based on specific tissue relaxation times and allows multiplanar imaging at large field of view to define the origin and extent of pelvic pathology[1]

The role of MRI in gynaecological conditions has evolved during the past two decades, determining whether a clinically diagnosed pelvic mass is benign / malignant is frequently not possible until surgical exploration and histologic examination are performed.Consequently it may not be possible to decide preoperatively whether conservative or radical surgery is appropriate.

A reliable method with which to differentiate a benign from a malignant adnexal mass would provide a basis for optimal preoperative planning and may also reduce the number of unnecessary laparotomies patients undergo for benign diseases.It is useful not only for establishing the diagnosis but also for proper care of patients with accurate gynaecologic conditions.

In order to increase the accuracy in differentiation between benign and malignant, more recent functional MR techniques such as DCE-MRI and DWI have been investigated

Advancements in MRI techniques, such as diffusion weighted (DWI) and dynamic contrast enhanced MRI (DCE-MRI) can provide further information to help to increase diagnostic confidence. **DWI** provides a tissue contrast, based on the differences of water mobility in different tissues. In highly cellular tissues such as tumour tissues, diffusion of water protons is restricted. **Dynamic contrast enhanced imaging (DCE)** depends on tumourneovascularisation and it provides valuable information about tumour perfusion.[2] The purpose of this study is to prospectively assess the diagnostic ability of diffusion-weighted imaging (DWI) in characterizing of female pelvic masses.

II. Materials and Method

The subjects of this study were 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, Kotaduring the period from July 2016 to October 2017.
Sample size: The study was conducted on 50 cases.
Type of study: Prospective cross-sectional study

INCLUSION CRITERIAS :
1. Clinically suspected cases of pelvic mass lesions
2. Pelvic mass lesions found incidentally on USG

EXCLUSION CRITERIAS:
1. Patients with contraindications to MRI such as Internal cardiac pacemaker, Implantable cardiac defibrillator, Cochlear and ocular implant ,MR incompatible metallic implant, aneurysm and haemostatic clips
2. History of allergy to contrast.

For MRI, 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 ortorso 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, internal enhancement, thickness of septae (more or less than 3mm), presence of mural nodule and papillary projections, as well as on signal characteristics and either mass show diffusion restriction or not.

MRI PROTOCOL:

- In both T1W & T2W MRI in axial, sagittal, coronal planes were evaluated. T1W images offer excellent contrast between the pelvic organs and adjacent fat allow optimal detection of lymph nodes and are necessary for tissue and fluid characterization (essential for hemorrhagic and fat containing lesions). TR(500-700ms) / TE(12-14ms)
- T2W images sequences were needed to demonstrate the zonal anatomy of the uterus and vagina and to facilitate the identification of normal ovaries. In addition T2W images usually superior in depicting pathologic conditions of uterus and ovaries. TR(4000-5000ms) /TE(100ms)
- A diffusion-weighted sequence with a highest b-value of 500- 1000 s/mm2 - for detection (not staging) of lymph nodes and detection of peritoneal deposits whenever required and to know the nature of mass lesion whether it is benign or malignant.

III. Result

There were 50 cases out of 31(62%) benign and 19 (38%) malignant mass cases. maximum patients belong to 41-50 years age group (26%).Malignant lesions were most common in 41-50 age group (31.6%) and benign lesions in 41-50 years age group (22.6%).Youngest patient was 16 years old and oldest was 80 years old. [Table 1]

Most common benign masses were Leiyomyoma (including uterine cervical and broad ligament leiyomyoma) 17 out of 31 cases (54.8%) was the single largest group followed by Serous cystadenoma 6 (19.4%) and Tubo-ovarian abscess 4 out of 31 (13%).[Table 2]

Most common Malignant masses were Carcinoma Cervix 6 out of 19 cases (31.6%) was the single largest group followed by Serous Cystadenocarcinoma 3 out of 19 (15.8%).[Table 3]
Ascites was present in 68.4 % of malignant and 3.2% of benign pelvic mass cases.[Table 4]
Peritoneal metastatic deposits were seen in 5 out of 19 (26.3%) malignant pelvic mass cases.[Table 5]
In our study sensitivity, specificity, PPV, NPV and diagnostic accuracy in uterine massesfor diffusion weighted MRI were 100%, 82.35%, 76.92 %, 100% and 88.88% respectively.[Table 6]
In our study sensitivity, specificity, PPV, NPV and diagnostic accuracy in ovarian masses for diffusion weighted MRI were 100%, 78.57%, 75 %, 100% and 86.95% respectively.[Table 7]
Cut-off ADC Value is obtained by preparing ROC curve., cut-off value is 1.045 for uterine masses above this value masses are benign and below this masses are malignant . AUC – 0.947 (0.845 - 1) P value- <0.001[Figure 1]
Cut-off ADC Value is obtained by preparing ROC curve., cut-off value is .86 for ovarian masses above this value masses are benign and below this masses are malignant . AUC – 0.917 (0.790 - 1) P value- <0.001[Figure 2]

IV. Discussion

The present study was undertaken to evaluate the pelvic masses in female to differentiate malignant and benign diagnosis by using Conventional MRI and Diffusion weighted MRI modalities. Near all cases histopathological correlation was done and final diagnosis were obtained correlating biopsy or FNAC reports of mass.

The age range of patients was between 16-80 years with mean age of 42.56 ± SD 16.53 in years, for benign pelvic masses mean age was 34.48±13.31 and for malignant masses mean age was 55.74±12.38. This predicts that with advancing age there are increase in chances of malignancy.

Most common pelvic mass cases were detected in 41-50 years of age group. for benign pelvic masses mean age was 34.48±13.31 years and for malignant masses mean age was 55.74±12.38. Our results found near similar to study of A. N. D. Dwivedi et al., (2013).[3] 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 more than 60 years of age (11/17, 64.7%).

Ascites was found in 68.4 % malignant and 3.25% benign pelvic mass cases. All malignant masses with ascites were ovarian in origin which is in concordance with study done by Shen-Gunther J et al (2002).[4] 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.

All patients with peritoneal deposits were malignant masses; all were originate from ovaries similar to the results found by A. Guerra et al., (2008).[5]

The sensitivity , specificity ,PPV , NPV and diagnostic accuracy of the DW MRI for the assessment of uterine lesions were 100%, 82.35%, 76.92%, and 100% and 88.88 % respectively.Cut-off value of ADC for uterine masses derived from ROC curve was 1.045 x10-3 mm2/sec.(P value <.001 means this is statistically significant)

Our study is in near agreement with**Chen J et al** in 2010. The sensitivity and specificity were 100% and 84.8% .The mean ADC value of cervical carcinoma (1.110 ± 0.175 x 10^{-3}mm ^{2}/s) was significantly lower than that of normal cervical tissue (1.5930.151 x 10^{-3} mm ^{2}/s) (P<0.001). The optimal ADC threshold values for distinguishing between normal cervical tissue and cervical carcinoma was 1.359 x 10^{-3}mm ^{2}/s.[6]

The sensitivity , specificity ,PPV , NPV and diagnostic accuracy of the DW MRI for the assessment of ovarian lesions were 100%, 78.5%, 75%, and 100% and 86.95 % respectively.

Cut-off value of ADC for ovarian masses derived from ROC curve was 0 .86x10^{-3} mm^2/sec.(P value <.001 means this is statistically significant)

Our study is in near agreement with **Nasr E et al.** That suggested In 2014demonstrated the addition DWI to conventional MR imaging can help in differentiation of benign and malignant adnexal masses. Sensitivity of DWI MRI was was 100% , specificity was (75%) ,accuracy was 86.9%. for MRI, while that of DWI was The mean ADC values for malignant lesions were 0.84 x 10^{-3} ± 0.1SD mm^2/sec, while that for benign lesions were 1.8 x 10^{-3} ± 0.5SD mm^2/sec with cutoff value of 1.2 x 10^{-3} mm^2/sec (p=0.005) [7]

V. Tables and Figure

Table-1: Age Wise Distribution of Cases

Age Group	Benign		Malignant		Total	
	No.	%	No	%	No.	%
< 10 Years	0	0	0	0	0	0
11-20 Years	4	12.9	2	10.5	6	12
21-30 Years	5	16.1	3	15.8	8	16
31-40 Years	5	16.1	4	21.1	9	18
41-50 Years	7	22.6	6	31.6	13	26
51-60 Years	3	9.7	2	10.5	05	10
>60 Years	7	22.6	2	10.5	09	18
Total	31	100	19	100	50	100

Table –2Benign mass lesions on histopathological diagnosis

Benign lesions on Histopathological examination	Frequency	Perecentage
Adenomyosis of uterus	1	3.2
Broad ligament leiyomyoma	1	3.2
Cervical leiyomyoma	2	6.5
Endomrtrioma	1	3.2
Uterine leiyomyoma	14	45.1
Haemorrhagic ovarian cyst	1	3.2
Ovarian dermoid	1	3.2
Serous cystadenoma of ovary	6	19.4
Tubo-ovarian abcess	4	13
Total	31	100.0

Table – 3 Malignant mass lesions on histopathological diagnosis

Malignant lesions on Histopathological examination	Frequency	Percentage
Adenocarcinoma of ovary	1	5.3
Carcinoma cervix	6	31.6
Choriocarcinoma of uterus	1	5.3
Endomatrial carcinoma	1	5.3
Metastatic adenocarcinoma of ovary	1	5.3
Papillary adenocarcinoma of ovary	2	10.5
Recurrent leiomyosarcoma of uterus	2	10.6
Serous cystadenocarcinoma of ovary	3	15.8
Undifferentiated adenocarcinoma of ovary	2	10.5
Total	19	100.0

Table-4For presence of Ascites

ASCITES	**Benign**		**Malignant**		**Total**	
	No.	**Percent**	**No**	**percent**	**No**	**Percent**
PRESENT	**1**	**3.2**	**6**	**31.6**	**7**	**14**
ABSENT	**30**	**96.8**	**13**	**68.4**	**43**	**86**
TOTAL	**31**	**100**	**19**	**100**	**50**	**100**

Table- 5For Peritoneal deposits

Metastatic peritoneal deposit	**Benign**		**Malignant**		**Total**	
	No.	**Percent**	**No**	**percent**	**No**	**Percent**
PRESENT	**0**	**0**	**5**	**26.3**	**5**	**10**
ABSENT	**31**	**100**	**14**	**73.7**	**45**	**90**
TOTAL	**31**	**100**	**19**	**100**	**50**	**100**

Table- 6 For Uterine masses

	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
Conventional MRI	100%	94.11%	90.99%	100%	96.29%
DWI MRI	100%	82.35%	76.92%	100%	88.88%

Table- 7For Ovarian masses

	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
Conventional MRI	88.88%	100%	100%	93.33%	95.65%
DWI MRI	100%	78.57%	75%	100%	86.95%

Figure 1 ROC Curve for uterine masses

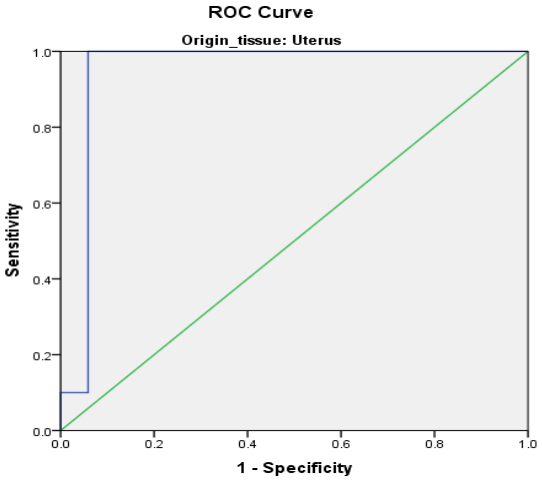
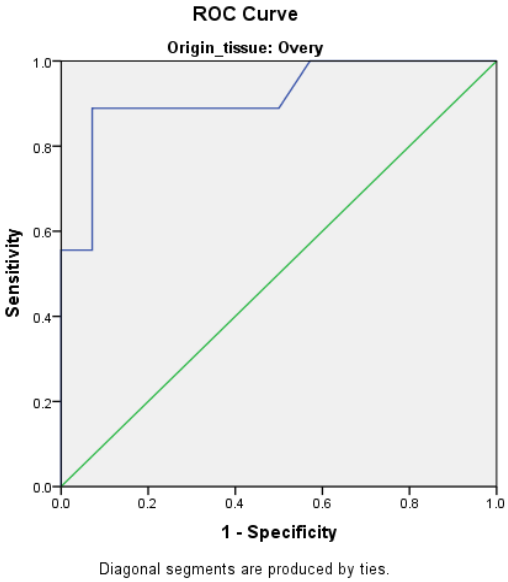
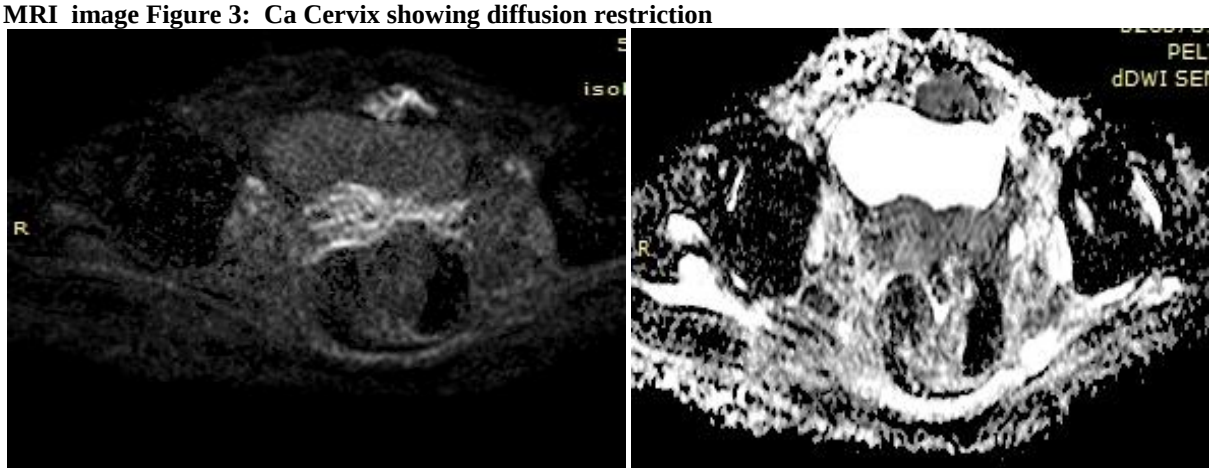


Figure 2 ROC Curve for Ovarian masses

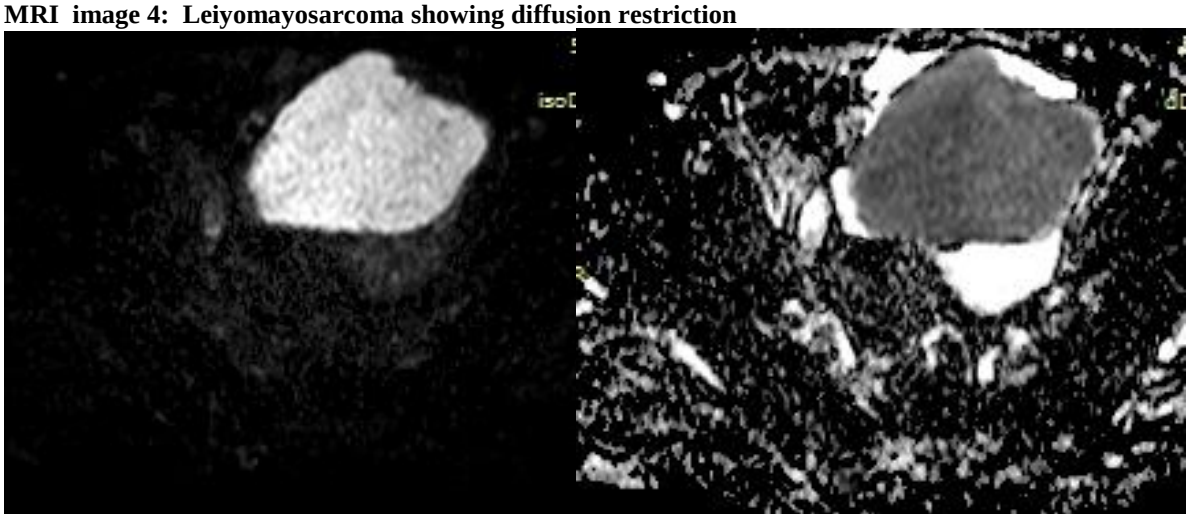


MRI image Figure 3: Ca Cervix showing diffusion restriction



DWI **ADC**

MRI image 4: Leiyomayosarcoma showing diffusion restriction



DWI **ADC**

VI. Conclusion

After going through our observation and preceding discussion we conclude that Conventional MRI should be use as initial modality in the workup of every woman suspected of having a indefinite pelvic mass. For cases suspicious by Conventional MRI , DWI MRI and ADC calculation should consider for more specific diagnosis because it may obviate the need for surgery or otherwise change management by identification of benign aetiology.

- Conventional MRI , DWI MRI and ADC values MRI , there was no significant difference between all three methods in characterising both ovarian and uterine mass cases of pelvis so we should use them as a combined method of MRI to characterise pelvic masses to improve diagnostic accuracy
- MRI is relatively safe, nonoperator dependent, has high signal noise ratio and it is an excellent modality for characterisation of pelvic malignancies, it has superior soft tissue contrast and large field of view.
- 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 extrauterineextraovarian masses. It precisely defines the internal architecture of ovarian masses.
- Diffusion weighted imaging is problem solving tool in cases of indeterminate pelvic masses on Conventional MRI. Diffusion weighted MRI particularly useful for pregnant and renal failure patient where we can't use contrast material.
- Ascites is an ancillary inclusion criterion of malignancy, but is present in some (3.25%) benign pelvic lesions as well.

Reference

[1]. Saini A, Dina R, Meindoe GA, Soutter WP, Gishen P, desouza NM. Characterization of adnexal masses with MRI. AJR Am J Roentgenol. 2005; 184(3): 1004-9.

[2]. Hricak H, Chen M, Coakley FV, Kinkel K, Yu KK, Sica G, et al complex adnexal masses: detection and characterization with MR imaging - multivariate radiology analysis 2000; 214(1): 39-46.

[3]. AmitNandanDharDwivedi, Shivi Jain, Ram Chandra Shukla, Madhu Jain, ArvindSrivastava, AshishVerma et al. MRI is a state of art imaging modality in characterization of indeterminate adnexal masses.J. Biomedical Science and Engineering. 2013; 6: 309-313.

[4]. Shen-Gunther J, Mannel RS. Ascites as a predictor of ovarian malignancy.GynecolOncol. 2002; 87(1):77-83.

[5]. A. Guerra, T. M. Cunha & A. Félix (2008) Magnetic Resonance Evaluation of Adnexal Masses, ActaRadiologica, 2008; 49:6, 700-709.

[6]. Chen J ,Zhang Y, Liang B, Yang Z Eur J Radiol.2010 Jun; 74(3) : e1001-6 doi:10.1016/j.ejrad.2009.04.025. Epub 2009 May 13.

[7]. Nasr E, Hamed I, Abbas I, Nagat M. Dynamic contrast enhanced MRI in correlation with Diffusion weighted MRI for characterisation of ovarian masses. ESRN:2014;45(3):975-85.

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