IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 20, Issue 11 Ser.4 (November. 2021), PP 08-17
www.iosrjournals.org

"Correlation of USG and MRI Findings in Adenexal Mass Lesion to Determine Accuracy of USG As A Screening Tool."

Dr. Harsh V Thakrar
(3rd year Resident in GCS medical college, Ahmedabad).

Dr. Asutosh Dave
(Professor & Head Department of Radio-diagnosis , GCS Medical College, Hospital and Research Centre , Ahmedabad).

Dr. Nikunj Desai
(Associate Professor Department of Radio-diagnosis , GCS Medical College, Hospital and Research Centre , Ahmedabad).

Dr. Ashutosh Agarwal *(3rd year Resident in GCS medical college, Ahmedabad).*
Dr. Anand Patel *(3rd year Resident in GCS medical college, Ahmedabad).*
Dr. Radhika Patel *(3rd year Resident in GCS medical college, Ahmedabad).*

Abstract
Aims & Objectives :-

- *To evaluate the role and efficacy of USG as a screening tool in adenexal lesions by comparing it with MRI findings.*
- *Discuss the relative merits of US and MR imaging in the evaluation of suspected ovarian neoplasm in various clinical settings.*
- *Describe the important criteria for imaging & diagnosis of adenexal masses.*

Material and Methods :-
Study was conducted in GCS medical college, Ahmedabad and included 72 women (mean age 39 years, range 19 to 84 years) with clinically suspected adenexal masses.
We performed trans-abdominal and trans-vaginal greyscale and colour Doppler examinations.
MRI was done using 1.5 tesla GE signa explorer machine including standard scan protocol. The adenexal masses were categorized as benign or malignant without knowledge of clinical details, according to the imaging features and the sensitivity and specificity of these modalities to correctly distinguish benign and malignant pathologies was calculated over a period of 12 months from jan 2020 to december 2020.
Inclusion criteria : *-*

- *Patient with lower abdominal pain.*

Exclusion criteria : *-*

- *Patients whose data is incomplete.*
- *Patient who have allergic reaction to contrast medium.*
- *Implanted electric and electronic devices are a relative contraindication to the magnetic resonance imaging, and in particular , heart pacemakers (especially older types) , insulin pumps , implanted hearing aids , neurostimulators , intracranial metal clips , metallic bodies in the eye.*

Result :-
The comparison of findings of USG with HPE has 78 % sensitivity,100 % specificity, 100 % Positive predictive value, 94.12 % Negative predictive value and 95 % diagnostic accuracy.
In comparison of MRI findings with HPE has 91 % sensitivity,100 % specificity,100 % Positive predictive value, 98 % Negative predictive value and 98.3 % diagnostic accuracy.
MRI was more specific than US.
Conclusion:- *MRI is more specific and accurate than US and Doppler assessment for characterizing adnexal masses. Women who clinically have a relatively low risk of malignancy but who have complex sonographic features may benefit from MRI.*

Keywords:- *Transabdominal ultrasonography, magnetic resonance imaging (MRI), histopathological examination (HPE), adnexal mass lesions, diagnostic accuracy*

Date of Submission: 05-11-2021 Date of Acceptance: 20-11-2021

I. Introduction

Adenexal masses pose a special diagnostic challenge to radiologist because benign adenexal masses greatly out number malignant ones. Determination of a degree of suspicion for malignancy is critical and is based largely on imaging appearance.

The two important modalities widely used for diagnosis of adnexal pathologies are ultrasound and magnetic resonance imaging [MRI]. Study aimed to compare MRI and ultrasound for identification of organ of origin and characterization of adnexal lesions

Endovaginal ultrasonography (US) is the most practical modality for assessment of ovarian tumors because it is readily available.

Adnexal masses are a common clinical problem ; an estimated 5 to 10% of women undergo surgery for suspicious adnexal masses, less than 25% of which prove to be malignant (8).

The benign or malignant nature of a clinically diagnosed adnexal mass is frequently not evident before surgical exploration and histological examination (7, 8).

A reliable method to differentiate benign from malignant adenexal masses would allow for appropriate subspecialty referral, optimal preoperative planning and counselling of the patient. **Ultrasonography (US) is the accepted primary imaging technique for evaluating adnexal masses.** Many women need no other imaging if the mass has features indicating that it is clearly benign or if the US findings together with tumour markers and clinical assessment strongly indicate malignancy**. Magnetic resonance imaging (MRI) has been shown to have potential for characterizing adnexal masses,(**6 ,12) **and contrast-enhanced MRI has been reported to be more accurate than US for assessing them**.12–15 The previous studies have shown that MRI is superior in identifying endometriomas, dermoids and fibroids , However, it is unclear which patients with adnexal masses need further evaluation with MRI and which clinical or sonographic features are important in determining further assessment of adnexal masses. The aim of our study was to compare US and MRI in women with clinically suspected adenexal mass(es) and to determine which cases might benefit from MRI.

Magnetic resonance (MR) imaging is better reserved for problem solving when US findings are nondiagnostic or equivocal because, although it is more accurate for diagnosis, it is also more expensive. The signal intensity characteristics of ovarian masses allows for a more systematic approach to diagnosis. Mature cystic teratomas, cysts, endometriomas, leiomyomas, fibromas, and other lesions can be accurately diagnosed on the basis of T1-weighted, T2-weighted, and fat-saturated T1-weighted MR imaging findings (4 , 8).

II. Result

TABLE 1.
Details of descriptive data of study participants

PARAMETERS	MEAN +- SD
AGE	39.24 +- 10.41
MENOPAUSE STATUS	
PRE MENOPAUSE	48 (66.66 %)
POST MENOPASUE	24 (33.33 %)
LATERALITY OF THE DISEASE	
UNILATERAL	58 (80.5 %)
BILATERAL	14 (19.5%)

TABLE 2.
USG and MRI diagnosis in the 72 participants with adenexal masses

DIAGNOSIS		USG	MRI
BENIGN	SIMPLE OVARIAN CYST	16	15
	PAROVARIAN CYST	3	5
	HEMORRHAGIC CYST	12	14
	DERMOID CYST	8	6
	ENDOMETRIOMA	9	8
	ECTOPIC PREGNANCY	2	2
	HYDROSALPINX	6	4
	OVARIAN TORSION	3	5
	OVARIAN	4	2

	HYPERSTIMULATION SYNDROME		
MALIGNANT	**SEROUS CYSTADENOCARCINOMA OVARY**	**6**	**9**
	MUCINOUS CYSTADENOCARCINOMA OVARY	**3**	**2**
	TOTAL	**72**	**72**

The radiological diagnoses in the 72 participants are shown in Table 2 : 9 (12.5%) malignant masses & 63 (87.5%) benign lesions on USG and 11 (15.2 %) malignant masses & 61 (84.8 %) benign lesions on MRI.

TABLE 3.
Characterization of lesions on their USG and MRI features to compare the efficacy of both the modalities

		USG		**MRI**	
		FREQUENCY	**PERCENTAGE**	**FREQUENCY**	**PERCENTAGE**
	CYSTIC	**42**	**58.3**	**45**	**62.5**
	SOLID CYSTIC (COMPLEX)	**30**	**41.6**	**27**	**37.5**
	THICKNESS OF SEPTA (Lesion with septations - 32)				
	THICKNESS >3 MM	**14**	**43.7**	**10**	**31.2**
	THICKNESS <3 MM	**18**	**56.3**	**22**	**68.8**
	NODULE				
	PRESENT	**08**	**11.2**	**12**	**16.7**
	ABSENT	**64**	**88.8**	**60**	**83.3**
	ASCITES				
	PRESENT	**32**	**44.4**	**34**	**47.2**
	ABSENT	**40**	**55.6**	**38**	**52.7**
	DETAILS OF VASCULARITY				
	PRESENT	**24**		**-**	
	ABSENT	**48**		**-**	
	LYMPHADENOPATHY				
	PRESENT	**10**	**13.8**	**15**	**20.8**
	ABSENT	**62**	**86.2**	**57**	**79.2**
	ENHANCEMENT				
	PRESENT	**-**		**27**	
	ABSENT	**-**		**45**	

Among 72 cases, 60 cases underwent surgical procedures and histopathological diagnosis was obtained.

The remaining 12 cases were managed conservatively and radiological and clinical follow up was done for a year. All those 12 cases which were not operated had classical imaging findings and no significant change was seen or regression of lesion was seen on follow-up which was convincing enough to make a definite diagnosis radiologicaly.

Out of 60 cases the lesions were classified as benign and malignant in both ultrasound and MRI. **For statistical purpose the lesions were divided as either benign (Disease absent) or malignant (Disease present) in both ultrasound and MRI and compared with histopathological diagnosis.**

The sensitivity, specificity, accuracy, positive and negative predictive value was calculated for both the modalities to correctly classify the lesion as either benign or malignant.

Out of 60 lesions, 12 lesions turned out to be malignant in histopathological diagnosis. Out of 60 lesions 11 lesions were classified as malignant by MRI and 9 lesions as malignant by ultrasound. As such one lesion in MRI and 3 lesions in ultrasound are under-diagnosed as benign lesions which turned out to be malignant on histopathology. One lesion under diagnosed in MRI was case of solid ovarian tumor which was misdiagnosed as broad ligament fibroid.

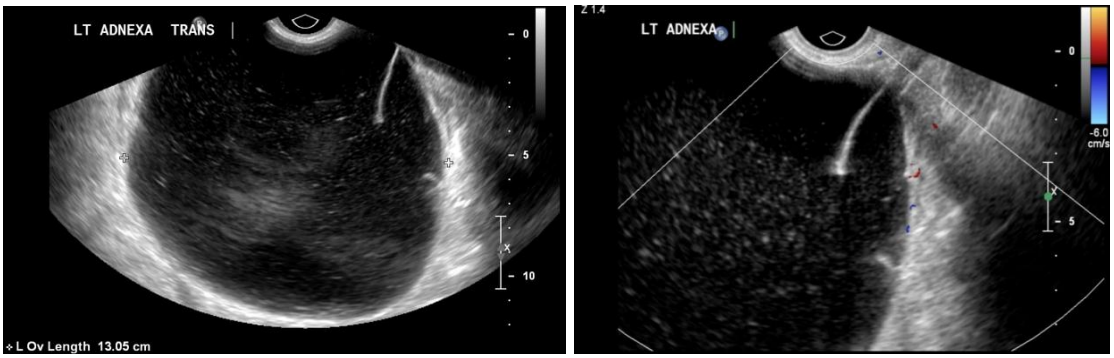
Similary out of 60 lesions, 48 lesions turned out to be benign in histopathological diagnosis. Out of 60 lesions 49 lesions were classified as benign by MRI and 51 lesions as benign by ultrasound. As such one lesion in MRI and 3 lesions in ultrasound are misdiagnosed as benign lesions which turned out to be malignant on histopathology. One such case was of ovarian cystadenoma which turned out as malignant.

The comparison of findings of USG with HPE has 78 % sensitivity,100 % specificity, 100 % Positive predictive value, 94.12 % Negative predictive value and 95 % diagnostic accuracy (6).

In comparison of MRI findings with HPE has 91 % sensitivity,100 % specificity,100 % Positive predictive value, 98 % Negative predictive value and 98.3 % diagnostic accuracy(6,7).

III. Discussion

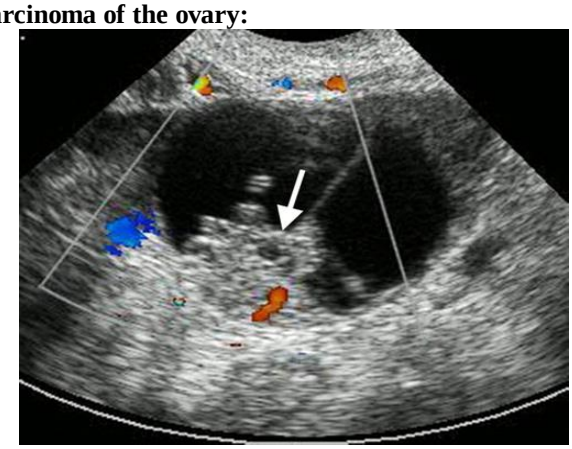
CASE 1
Case of Mucinous cystadenoma : -



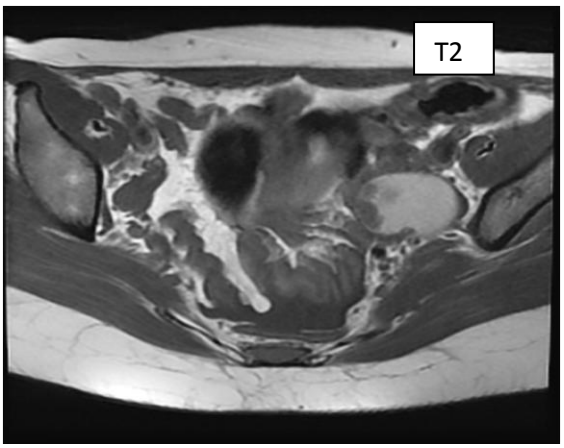
Large unilocular cystic lesion in the left ovary with low level internal echoes and incomplete avascular septations. There are no papillary projections or solid components.

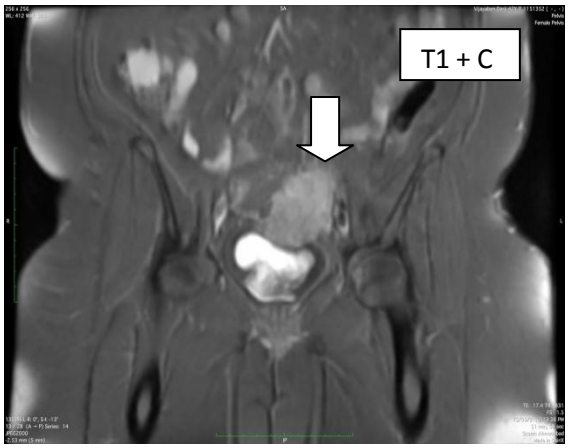
Presence of well defined altered signal intensity lesion with internal septation is noted involving left adenexal region.
Left ovary is not visualized separetly from the lesion.
It appears hypointense on T1W images and hyperintense on T2W images.
There was no evidence of any diffusion restriction or contrast enhancement.
There is preserved fat plane with adjacent organs.

CASE 2.
Case of Serous cystadenocarcinoma of the ovary:



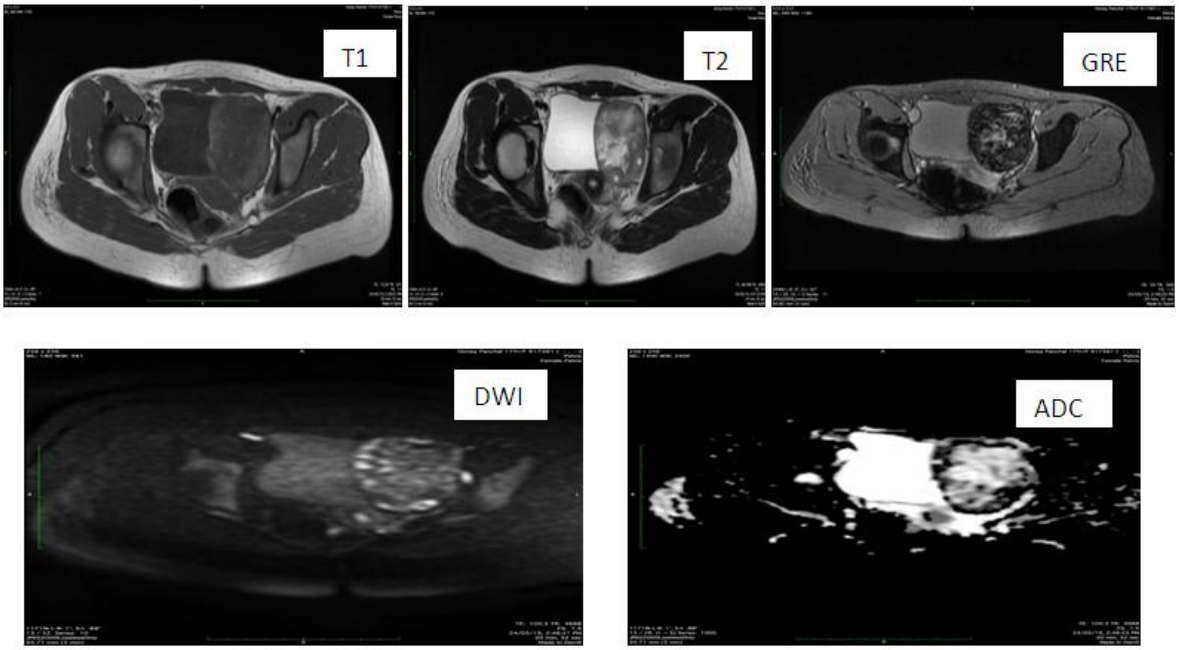
Transvaginal color Doppler US scan demonstrates a complex ovarian cyst with septum and a solid nodule (arrow). There is flow within the solid nodule, typical of malignancy.





Presence of well defined solid cystic lesion with internal spiculated altered signal intensity solid component is noted involving left adenexal region.
Left ovary is not seen separately from the lesion.
The lesion was hypointense on T1WI and hyperintense with internal hypointense solid component on T2W and STIR images.
It shows diffusion restriction on DWI.
No evidence of any blooming on GRE images.
On post contrast study, the lesion shows heterogeneous enhancement.

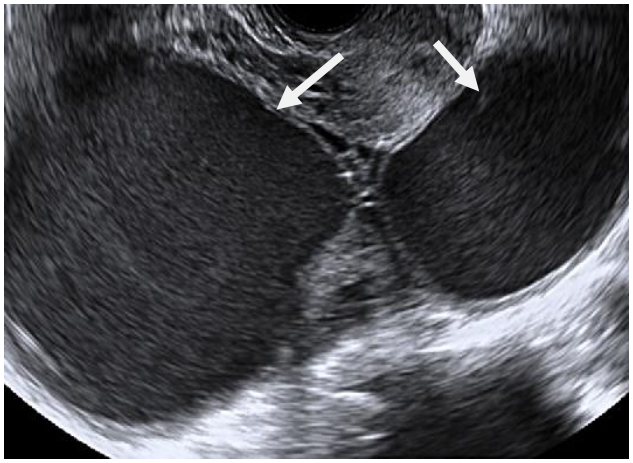
CASE 3.
Case of ovarian torsion



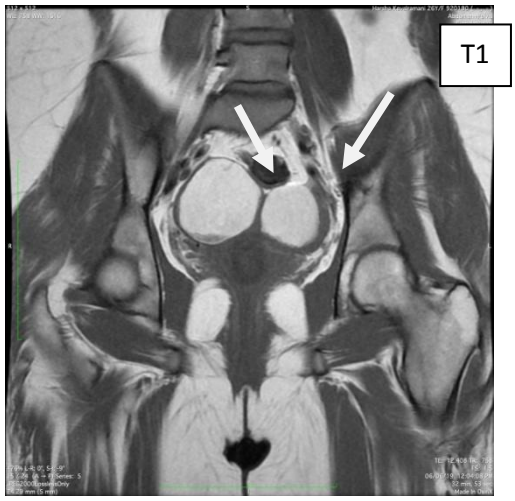
Left ovary appears to be grossly enlarged in size and shows peripherally arranged follicles along with T2W hyperitense central stroma within.
There is also presence of peripheral flow void noted suggesting vascular padicles.
Right ovary appears to be normal.
Uterus, cervix and vagina appear to be normal.
Mild free fluid is noted in pelvis.

The main feature of torsion is ovarian enlargement due to venous/lymphatic engorgement, edema, and hemorrhage.
Secondary signs include free pelvic fluid, an underlying ovarian lesion, reduced or absent vascularity and a twisted dilated tubular structure corresponding to the vascular pedicle.

CASE 4.
Case of endometrioma



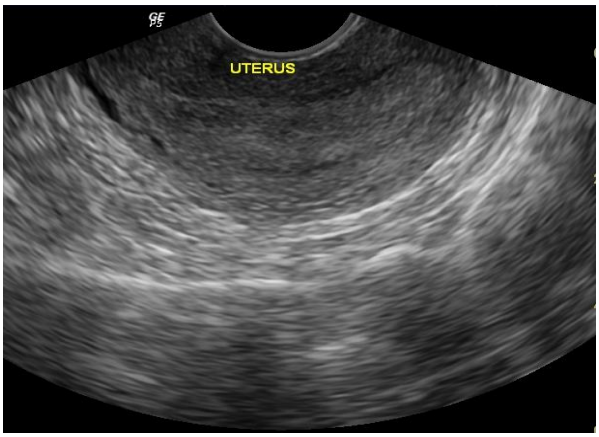
Ultrasound image of bilateral endometriomas with both ovaries (White arrow) adherent to each other (kissing ovaries) and posteriorly to the uterus.

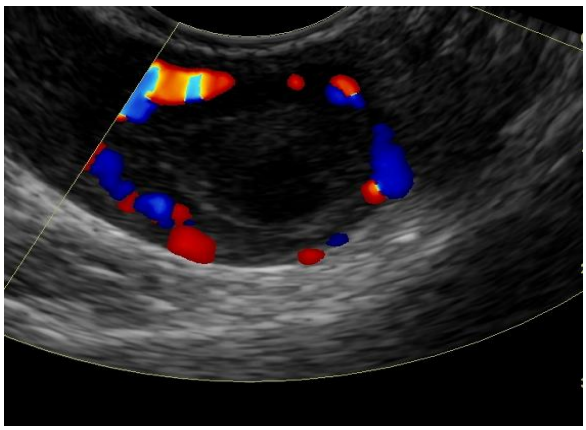


Presence of an altered signal intensity lesion is noted in left adenexa which appear to be smooth and well defined and appear hyperintense on T1WI and hypointense on T2W images.
Similar characteristic lesion is noted in right adenexa.

Typically the lesions appears hyperintense on T1WI while acute hemorrhage occasionally appears hypointense and typically hypointense on T2WI owing to the presence of deoxyhemoglobin and methemoglobin (shading sign), which is very suggestive of endometrioma.

CASE 5.
Case of Ectopic pregnancy





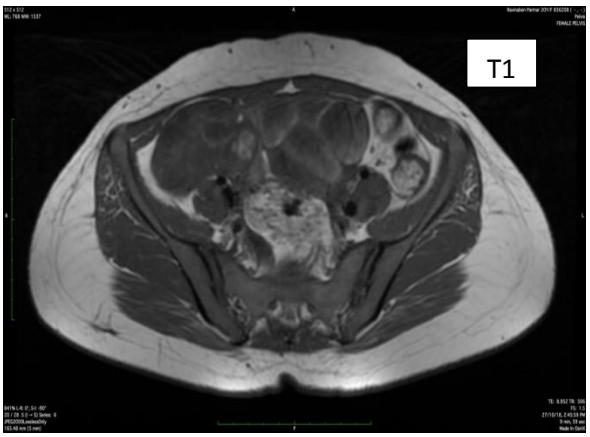
Uterus is anteverted and normal in size and echopattern.Decidual reaction noted , however no e/o intrauterine G-sac noted.
Presence of well defined mixed echogenic lesion , predominantly hypoechoic with minimal vascularity is noted in left adnexa.
Mild free fluid is noted in interbowel and pelvic region.

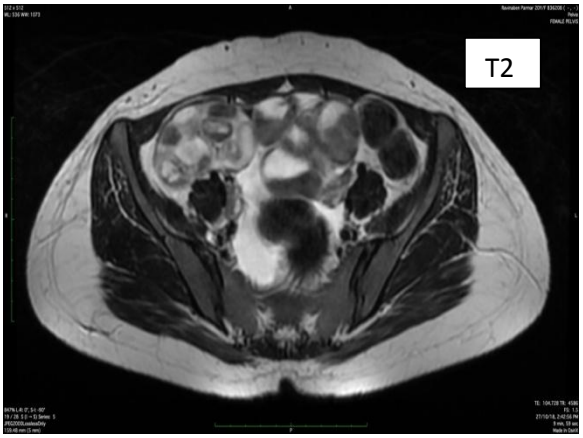
Presence of altered signal intensity lesion is noted in left adenexal region , which appears hypointense with few internal hyperintense areas on T1W images and hyperintense on T2W images.
On DWI the lesion shows peripheral diffusion restriction.
On SWAN images foci of blooming are noted (White arrow).
Free fluid in pelvic region and in both paracolic gutters.

Ultrasound and MRI features are in favour of ruptured ectopic pregnancy.

CASE 6.
Case of OHSS (Ovarian hyperstimulation syndrome).

Symmetric enlargement of both ovaries with cysts of varying size in a spoke wheel pattern.





Presence of multiloculated thin walled cystic lesions are noted in both adenexa region.
Both ovaries are not visualized separately from the lesion.
There is no enhancing nodule or calcification is noted.

The most important step in evaluation of adenexal masses is to determine whether the mass is benign or malignant as it has important role in treatment procedure and to decide whether patient needs surgery. In our study 72 female patients with adnexal masses were studied by ultrasound and MRI modalities. Among 72 cases, 60 cases underwent surgical procedures and histopathological diagnosis was obtained.

In our present study, the mean age was 39 years and the most commonly affected age group was 21-46 years. This was similar to other studies done by Aruna et al (14) where mean age was 30 years and Al-Shukri et al (16) years. However the mean age was much higher 46 years in Adusumilli et al (17). Benign cysts are much more common in reproductive age group, while the malignant lesions are more common in the postmenopausal age group. In our study predominant pathologies are benign lesions and hence mean age was lesser.

The three most important things that were noted for assessment of adenexal masses in our study were
1. Origin of mass
2. Characterization of mass
3. Classification of mass as either benign or malignant.

The first step in diagnosis of adenexal mass is to ascertain the origin of mass.

In our study there was excellent result seen on MRI to ascertain the origin of a mass. In our study the origin of mass was wrongly interpreted in MR only in two cases. One such case was a large solid ovarian tumor which was misinterpreted as broad ligament fibroid . In this case the mistake could have been avoided if normal separate ovary could have been visualised. But however they were not visualized separately as the ovary was smaller and was seen displaced by the larger lesion. The signal intensity of fibroid is exactly similar (T2 hypointense solid nature) to solid ovarian tumor which made the diagnosis difficult.

Two cases of hydrosalphinx were misdiagnosed as ovarian lesions on ultrasound as ovary was not separately visualised and as both of them look similar sonologically.

In some cases, severely scarred hydrosalphinx may mimic complex ovarian lesion. They suggested that the pitfalls in the diagnosis of hydrosalpinx included paratubal, paraovarian, or perineural cysts and these may be better delineated in MRI.

The second most important step is characterization of mass (1, 4). In our study MRI had excellent agreement whereas ultrasound had good agreement.

MRI correctly revealed the tissue content of all masses except one case of endometriotic cyst which was diagnosed as complex adnexal mass in MR which was found to be completely cystic post surgery. MR with excellent soft tissue characterization properties helps in identifying specific tissue characteristics such as fat, hemorrhage, fluid and fibrous tissue.

Ultrasound on the other hand had less agreement compared to MR but it was stastically insignificant. Few cases of hemorrhagic cyst, endometrioma and dermoid were misdiagnosed as complex adnexal masses due to their varied appearance in ultrasound.

Douglas et al(5) in their study of characterization of adnexal lesions through ultrasound stated that endometriotic cysts can have a diffuse appearance and similar findings via sonography can overlap in other

lesions like haemorrhagic cysts, dermoid cysts and other lesions. Sugimura et al(15)stated in his study of multimodality imaging of ovarian cystic lesions that sonographically, endometriotic lesions can have a varied appearance and on MRI it can be revealed whether it contains blood products or not with the high signal intensity on T1 weighted images and intermediate to low signal intensity on T2 weighted images.

The third important step is the ability to say whether the lesion is benign or malignant. Guerra et al(13)observed in their study of 161 patients that MRI had high sensitivity, specificity and accuracy of 98%, 93% and 95% to differentiate between benign and malignant adnexal lesions. Dodge et al(5) in meta analysis found that the sensitivity and specificity of MRI for diagnosis of malignancy can reach 92% and 88%, respectively. Aruna et al (14) observed that MR imaging had a sensitivity of 100% and specificity of 97.7% whereas ultrasound had a sensitivity of 80% and specificity of 95%.

The sensitivity and specificity of MRI in our study was 91% and 100% which was nearly similar to above studies. The sensitivity and specificity of ultrasound was 78 % and 100 % which is slightly lesser to MRI , however the diagnostic accuracy of USG vs MRI is 95 % Vs 98% which after applying statistical test turned out to be statistically insignificant.

IV. Conclusion

Adenexal masses are commonly encountered pathologies in the reproductive age group and are most often of ovarian origin.

Even though ultrasound is used as screening tool for diagnosing pelvic masses, MRI is superior to ultrasound in identifying origin characterization and benignity of adenexal lesions. Still we realized there were few pitfalls in diagnosing adenexal masses in MRI. The first was in characterization of large clear cystic lesion. MRI could not categorize the lesion is whether a simple ovarian/ adenexal cyst or benign cystic neoplasm as both of them could be unilocular, completely cystic and without any other specific characteristics. The second was in characterization of cystic mass with intermediate wall and septa thickness without any ascites or other features of malignancy. Both benign and malignant cystic neoplasm could present in this way and hence MRI could not completely rule out malignancy in such cases.

The results conclude that MRI had high sensitivity, accuracy value than USG. MRI is dominant in diagnosis and characterization of adnexal mass lesion than ultrasonography , however in our study near equal accuracy was found between USG and MRI thus ultrasound should be preferred as a primary modality for detecting and characterizing suspected adnexal masses. **It should be the main triage method before treatment.**

References

[1]. Aslam Sohaib SA, Ahju Sahdev, Philippe Van Trappen, Ian J Jacobs, Rodney H Reznek. Characterization of Adnexal Mass Lesions on MR Imaging. AJR. 2003; 180:1297-1304.

[2]. Dottino PR, Levine DA, Ripley DL *et al*. Laparoscopic management of adnexal masses in premenopausal and postmenopausal women. Obstet Gynecol 1999; 93:223-8.

[3]. Tsili AC, Tsampoulas C, Charisiadi A, John Kalef-Ezra, Dousias V, Paraskevaidis E *et al*. Adnexal masses: Accuracy of detection and differentiation with multidetector computed tomography. Gynecologic Oncology. 2008; 110:22-31.

[4]. Lee SI. Radiological reasoning: Imaging characterization of bilateral adnexal masses. Am J Roentgenol. 2006; 187:S460-6.

[5]. Douglas L Brown, Kika M Dudiak, Faye C Laing. Adnexal Masses: US Characterization and Reporting. Radiology. 2010; 254(2):342-354.

[6]. Yamashita Y, Torashima M, Hatanaka Y, Harada M, Higashida Y, Takahashi M *et al*. Adnexal masses: accuracy of characterization with transvaginal US and precontrast and postcontrast MR imaging. Radiology. 1995; 194:557-65.

[7]. Bazot M, Nassar-Slaba J, Thomassin-Naggara I, Cortez A, Uzan S, Darai E. MR imaging compared with intraoperative frozen-section examination for the diagnosis of adnexal tumors; correlation with final histology. Eur Radiol. 2006; 16:2687-99.

[8]. American College of Radiology. ACR Appropriateness Criteria 2008: clinically suspected adnexal mass. American College of Radiology Web site. Available at

[9]. Sohaib SA, Mills TD, Sahdev A, et al. The role of magnetic resonance imaging and ultrasound in patients with adnexal masses. ClinRadiol. 2005; 60: 340–8.

[10]. Madan R, Narula MK, Chitra R, Bajaj P. Sonomorphological and color doppler flow imaging evaluation of adnexal masses. Indian J Radiol Imaging. 2004;14(2): 365-72.

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

[12]. Scoutt LM, McCarthy SM, Lange R, Bourque A, Schwartz PE. MR evaluation of clinically suspected adnexal masses. J Comput Assist Tomogr. 1994; 18(3):609–618.

[13]. Guerra A, Cunha T.M, Felix A, Magnetic Resonance Evaluation of Adnexal Masses Acta Radiologica. 2006; 49(6):700-9.

[14]. Aruna K, Sumana C. Diagnosis of Adnexal Masses – Using Ultrasound and Magnetic Resonance Imaging for Proper Management. Asian Pac. J. Health Sci. 2016; 3 (4):279-284.

[15]. Sugimura K, Okizuka N, Imaoka J, Kaji Y, Takahashi K et al: Pelvic endometriosis detection and diagnosis with chemical shift MR imaging. Radiology 1993; 188 (2);

[16]. Al-Shukri M, Mathew M, Al-Gafri W et al. A Clinicopathological Study of Women with Adnexal Masses Presenting with Acute Symptoms. Ann Med Health Sci Res. 2014; 4(2): 286–288.

[17]. Adusumilli S, Hussain HK, Caoili EM, Weadock WJ. et al: MRI of Sonographically Indeterminate Adnexal Masses. American journal of roentgenology. 2006; 187(3): 732–740.