The Professional Medical Journal
www.theprofesional.com

DOI: 10.29309/TPMJ/2019.26.02.3080

ORIGINAL PROF-0-3080

ADNEXAL MASSES;

TO COMPARE THE DIAGNOSTIC ACCURACY OF TRANSABDOMINAL ULTRASONOGRAPHY AND CONTRAST ENHANCED MAGNETIC RESONANCE IMAGING, IN THE CHARACTERIZATION OF ADNEXAL MASSES.

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Article received on:
20/10/2017
Accepted for publication:
20/10/2018
Received after proof reading:
31/01/2019

ABSTRACT... Objectives: To compare the diagnostic accuracy of transabdominal ultrasonography and contrast enhanced magnetic resonance imaging, in the differentiation of benign and malignant adnexal masses. **Study Design:** A prospective comparative study. **Place and Duration of Study:** Armed Forces Institute of Radiology and Imaging (AFIRI), Rawalpindi from 16 Jun 2015 to 15 Jun 2016. **Methodology:** 61 female patients with adnexal masses, irrespective of age, were evaluated with transabdominal ultrasonography and contrast enhanced magnetic resonance imaging (MRI). This was followed by surgery (either laporotomy or laproscopy) or ultrasound guided biopsy and then histopathology to characterize them as benign or malignant masses. **Results:** Diagnostic accuracy of contrast enhanced MRI for characterization of adnexal masses was 90.1%, while that of transabdominal ultrasonography was 72.1 %. Sensitivity and specificity of transabdominal ultrasonography was 100 % and 54 % respectively while positive predictive value was 58.5 % and negative predictive value was 100 %. Sensitivity and specificity of MRI was 95.8 % and 86.4 % respectively while positive predictive value was 82.1% while negative predictive value was 96.9 %. **Conclusion:** Contrast enhanced MRI has a superior diagnostic accuracy as compared to transabdominal ultrasonography in the characterization of adnexal masses into benign and malignant, which influences the mode of treatment and clinical outcome.

Key words: Adnexal Masses, Diagnostic Accuracy, Magnetic Resonance Imaging, Transabdominal Ultrasonography.

Article Citation: Sultana N, Nasrullah F, Hameedi S. Adnexal masses; to compare the diagnostic accuracy of transabdominal ultrasonography and contrast enhanced magnetic resonance imaging, in the characterization of adnexal masses. Professional Med J 2019; 26(2):202-207.
DOI: 10.29309/TPMJ/2019.26.02.3080

INTRODUCTION

Adnexus is derived from the latin word "adnectere" which means "to tie together".[1] In radiology, adnexa (singular adnexus) refers to ovaries and its surrounding structures like fallopian tubes, broad ligaments and surrounding vessels and nerves.[2] Adnexal masses are lumps in the tissue of the adnexa of the uterus[3] and represent one of the most commonly encountered conditions in the outpatient department. They pose a diagnostic dilemma with an extensive differential diagnosis[4-6] encompassing a large number of benign, malignant and borderline disorders. The malignancy risks depend principally on age, menopausal status, symptoms, imaging features and tumor markers.

Benign adnexal masses are more common in younger age groups[7] however 4-24 % masses in premenopausal patients are malignant. 39-63 % masses found in postmenopausal patients are malignant.[8-9] Benign adnexal masses include paraovarian cysts, peritoneal cysts, endometriomas, hydrosalpinx and cystic neoplasms like cystadenomas.[10] Complex adnexal masses include dermoid cyst, endometriosis, tubo-ovarian cyst, ectopic pregnancy and malignant ovarian neoplasms.[11]

The basic goal of imaging in a patient with adnexal lesion is to identify a malignant adnexal mass which requires further evaluation and active management. Imaging modalities play a valuable role in evaluating adnexal masses.[12] Ultrasonography has achieved the role of a fundamental initial modality for evaluation

of adnexal masses having a sensitivity and specificity above 90 %.[13] CT is the investigation of choice for planning further management when the disease appears to have metastasized.[14] MRI, although a relatively newer modality, has emerged as a forerunner for complex cases due absence of ionizing radiations and excellent soft tissue contrast.[15] It also provides accurate information about the presence of fat, hemorrhage, fibrous tissue, collagen or fluid within any lesion. Thus, it also plays a role in determining the composition of different tissues in any pelvic mass and can differentiate benign from malignant ovarian tumors with an overall accuracy of 88 to 93 %.[16]

The objective of this study is to compare the diagnostic accuracy of transabdominal ultrasonography and contrast enhanced MRI for the differentiation of benign from malignant adnexal masses, keeping hisopathology as gold standard. Being a comparative study, it is my hypothesis that contrast enhanced MRI has greater diagnostic accuracy for the precise characterization of adnexal masses. This would be confirmed on findings of histopathology. If this is established, it would provide the clinicians accurate pre-operative information regarding the mass and also affect the treatment planning and management given to the patient.

METHODOLOGY

This prospective comparative study was conducted in Armed Forces Institute of Radiology and Imaging (AFIRI), Rawalpindi, from 16 June 2015 to 15 June 2016. 78 patients, fulfilling the inclusion criteria, were referred to our institute from gynecology department during this period. These patients were approached for our study. Out of these 78 women, 4 could not undergo MRI due to claustrophobia. 9 did not correspond further and no further data was obtained from them. 4 patients did not give consent for any interventional procedure. The remaining 61 women were the subjects of this study. Non-probability, purposive sampling was done. The study was approved by Institute's Ethical Committee for research.

Informed written consent was taken from the patients and objective of the study was explained to every subject included in the study. Female patients, irrespective of age, having adnexal mass, were included in the study. Patients who have already undergone biopsy and histopathology, post-operative patients, patients having any MRI incompatible metallic devices in their body and those having claustrophobia were excluded from study. Transabdominal ultrasound was performed with a 4 MHz transducer using both grey scale and spectral color Doppler, taking multiple views in different imaging planes. The patient was lying supine during the examination with full urinary bladder to provide better acoustic window. MRI was performed on 1.5 T magnet scanner machine. Multiplanner, multisequential, images were obtained from renal hilum to pubic symphysis, both plain and after IV administration of contrast medium. The results of the study were interpreted by consultant radiologists.

Malignancy was assumed if any one or more than one of under mentioned findings were seen:

- Solid lesion or heterogeneous lesion having solid component
- Thick walled cystic lesion (wall > 3 mm)
- Thick internl septations (septa > 3mm)
- Multiple septations
- Irregular, nodular or papillary projections
- Spread to surrounding organs or pelvic wall
- Evidence of spread of tumor to peritoneum, mesentery, or omentum
- Central enhancement / vascularity in the mass
- Enlarged lymph nodes (measuring more than 1 cm in short-axis diameter)

The lesion was labeled benign when none of the above mentioned findings were seen.

When one or more findings were observed, the lesion was declared as malignant. These results on ultrasonography and MRI were compared with the findings of histopathology and true positive, true negative, false positive and false positive cases were determined. The positive predictive value, negative predictive value and diagnostic accuracy was calculated for both ultrasonography and contrast enhanced MRI. Information regarding the menopausal status was obtained and benign to malignant ratio was devised in both pre and post menopausal patients.

Results were kept confidential and only concerned patients were informed. Collected data was analyzed through computer software SPSS11.

RESULTS

The age range in this study was from 18 to 58 years, with mean age of the study population being 36 years. Majority of the patients were in the 31 – 45 years age group, as shown in Table-I. Most of the lesions were less than 4 cm in size, with the mean size of the lesion being 3.41 cm ± 1.61 SD. On transabdominal ultrasonography, 20 cases (32.7 %) cases were declared benign, whereas 41 cases (67.2 %) were described as malignant. On contrast enhanced MRI, 32 lesions (52.4 %) were diagnosed as benign, while 29 lesions (47.5 %) were recognized as malignant. Histopathology established 37 patients (60.6 %) having benign lesions, while 24 patients (39.3 %) as having malignant lesions. Out of the benign lesions (37 cases), 29 (78.3 %) were premenopausal, while 8 (21.6 %) were postmenopausal. Out of the malignant lesions (24 cases), 9 (37.5 %) were premenopausal, whereas 15 (62.5 %) were postmenopausal. The benign to malignant ratio was 1.54, being 3.22 in premenopausal and 0.53 in postmenopausal patients. On histopathology, the most common benign lesion was cystadenoma, comprising 27.0 % of the total benign lesions. The most common malignant lesion was serous cystadenoma, comprising 33.3 % of the total malignant lesions.

For transabdominal ultrasonography, the sensitivity was calculated to be 100 %, whereas specificity was 54.0 %. The positive predictive value was 58.5 % while the negative predictive value was 100 %. For contrast enhanced MRI, the sensitivity was calculated to be 95.8 %, whereas specificity was 86.4 %. The positive predictive value was 82.1 % while the negative predictive value was 96.9 %. The diagnostic accuracy of transabdominal ultrasonography for characterization of adnexal masses was 72.1 % while that of contrast enhanced MRI was 90.1 %.

Age (Years)	No of Cases	Percentage
16 – 30	20	32.8 %
31 – 45	24	39.3 %
46 – 60	17	27.8 %

Table-I. Percentage of patients according to age distribution (n = 61)

Diagnosis on Histopathology	Age		Ultrasound		MRI		Histopath	
	Premeno-pausal	Postmeno-pausal	Benign	Malignant	Benign	Malignant	Benign	Malignant
Cystadenoma	7	3	8	2	9	1	10	-
Hemorrhagic Leuteal Cyst	2	3	4	1	4	1	5	-
Mature Cyst Teratoma/ Dermoid Cyst	8	-	5	3	8	-	8	-
Tubo Ovarian Abscess	2	2	-	4	2	2	4	-
Pedunculate Leiomyoma	5	-	3	2	5	-	5	-
Infarcted Ovary	1	-	-	1	-	1	1	-
Endometrioma	4	-	-	4	3	1	4	-
Serous Cyst Adenocarcinoma	2	6	-	8	-	8	-	8
Mucinous Cyst Adenocarcinoma	1	6	-	7	-	7	-	7
Endometrioid Cell CA	-	3	-	3	-	3	-	3
Dysgerminoma	2	-	-	2	-	2	-	2
Malignant Germ Cell Tumor	1	-	-	1	-	1	-	1
Borderline Tumors	2	-	-	2	1	1	-	2
Granulosa Cell Tumor	1	-	-	1	-	1	-	1

Table-II. Summary of results obtained on histopathology, transabdominal ultrasonography and contrast enhanced MRI (n = 61)

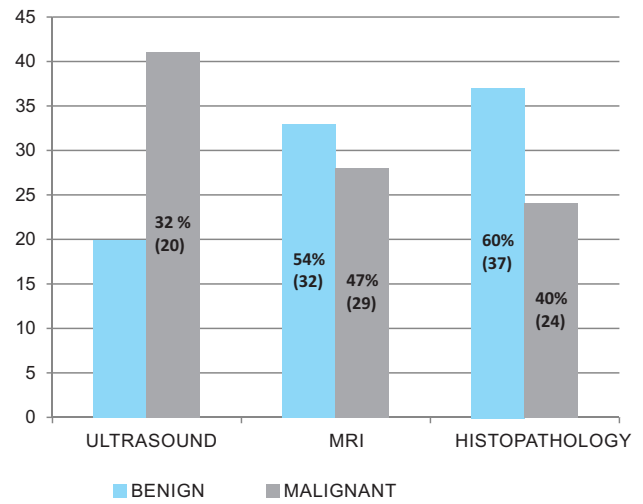

Figure-1. Graphical representation of benign and malignant cases on histopathology, transabdominal ultrasonography and contrast enhanced MRI (n = 61)

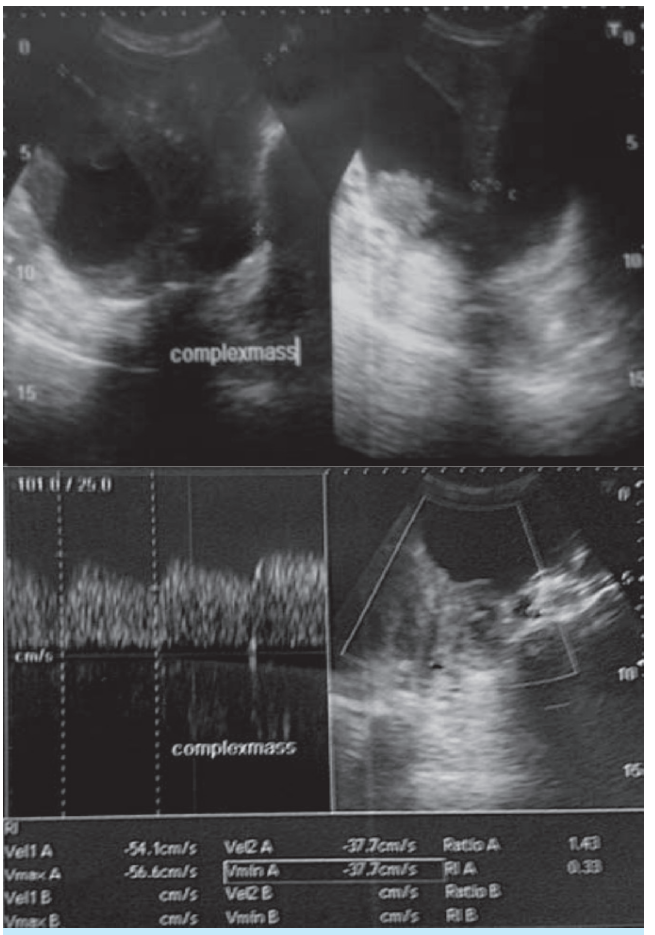

Figure-2 A. USG image of 72 yrs old pt showing large complex mass with solid and cystic components having low impedance flow, diagnosed to be malignant mass on USG

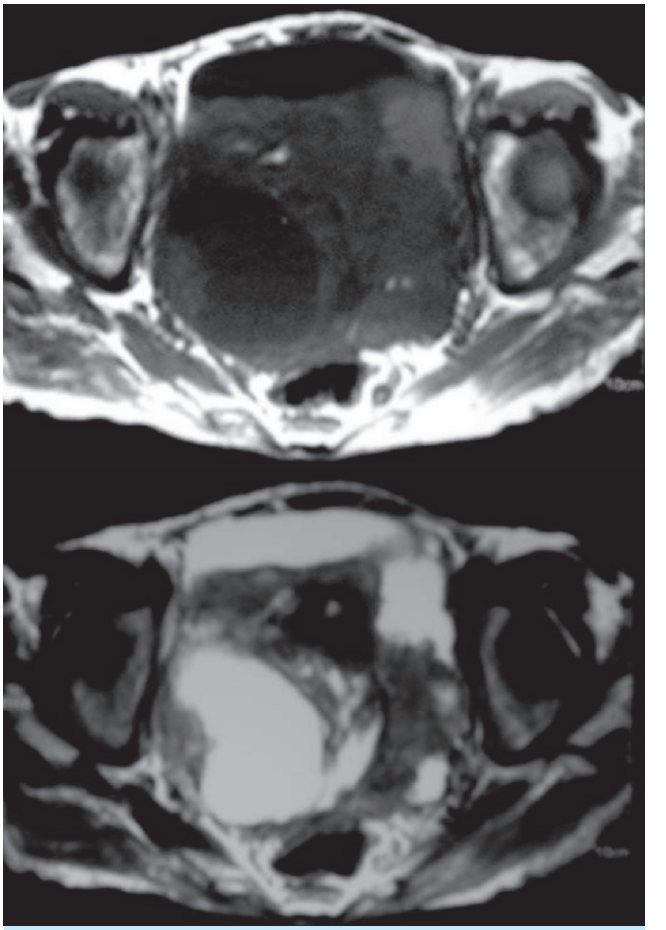

Figure-2 B. T1 and T2 weighted MR Images of the same patient confirming the findings of USG. It was diagnosed as malignant mass on MRI. Histopathology confirmed it as mucinous cystic adenocarcinoma

DISCUSSION

Tumor of the ovary, fallopian tube or surrounding connective tissue, represents an adnexal mass and is a common gynecological problem.[17] Females of all ages, from fetuses to elderly, may develop an adnexal mass.[18] However, the etiology of adnexal masses is widespread, ranging from physiologically normal luteal cysts to ovarian cancers.[19] The prevalence of ovarian cancer is low, responsible for only about 3 % of all cancers in women[20] and accounting for a lifetime risk of 1.3 %.[21]

Thus, it is very important to accurately differentiate between benign and malignant adnexal masses, to avoid unnecessary surgical procedures and to deliver optimal care to those who are likely to harbor an ovarian cancer.[22] Ultrasonography has

emerged as a firstline investigation for adnexal masses, as it is safe, easy to perform, non-invasive and widely available. MRI has the ability to produce high definition images and has the added benefits of non-invasiveness, absence of ionizing radiations, low complication rates and high soft tissue contrast.

Few studies have been done which reveal the comparison between the diagnostic accuracy of transabdominal ultrasonography and contrast enhanced MRI to characterize the adnexal masses into benign or malignant categories. A study was conducted by Mughleri et al [(3)] at Radiology Department Pakistan Institute of Medical Sciences, to compare the diagnostic accuracy of doppler ultrasonography and Contrast enhanced MRI, to characterize the adnexal masses into benign and malignant. The study showed that contrast enhanced MRI is a more accurate investigation as compared to transabdominal doppler ultrasonography for differentiating the malignant and benign adnexal masses. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of transabdominal ultrasonography in assessing adnexal masses are 85.18%, 80.56%, 86.79%,78.38% and 83.33% respectively while for contrast enhanced MRI, was 94.83%, 87.50%, 93.22%, 9032% and 92.22% respectively.

Another study was conducted by Arunakumari B et al[23] in Hyderabad, India, to compare the findings of ultrasonography and MRI in adnexal mass lesions with clinical outcome or operative findings. The study recommended ultrasonography as a primary modality for diagnosing pelvic adnexal masses. The same study indicated that MRI is superior to ultrasonography and can be used in assessment of problematic cases.

In our study, diagnostic accuracy for characterization of adnexal masses, of contrast enhanced MRI was 90.1 %, which was much greater than the diagnostic accuracy of transabdominal ultrasonography, being 72.1 %. The sensitivity, specificity, positive predictive value and negative predictive value of transabdominal ultrasonography in assessing adnexal masses was 100%, 54%, 58.5% and 100 % respectively while for contrast enhanced MRI, was 95.8%, 86.4%, 82.1% and 96.9% respectively. Hence, the results of our study are similar to the studies mentioned above and reaffirm theses studies. Few minor differences in results are seen, which may be due to difference in sample size and sample population.

CONCLUSION

Contrast enhanced MRI has a superior diagnostic accuracy as compared to transabdominal ultrasonography in the characterization of adnexal masses into benign and malignant, which influences the mode of treatment and clinical outcome. Transabdominal ultrasonography can be used as a first line modality, however work up of adnexal masses must include contrast enhanced MRI for further evaluation.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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1	Nasira Sultana	Principal author, Proposed topic, basic study design, data collection.	
2	Faran Nasrullah	Co-author, Methodology and manuscript writing, Literature review.	
3	Shahlisa Hameedi	Co-author, Data collection, Statistical analysis & interpretation of results.