Original Research Article

Access the diagnostic reliability and imaging evaluation of adnexal masses diagnosis ultrasonography, magnetic resonance imaging and computed tomography

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ABSTRACT

Background: Objective of the study was to evaluate role of diagnostic reliability of morphological characteristic of ovarian and adnexal masses to compare and correlated in sensitivity of ultrasonography, computed tomography, magnetic resonance imaging (USG with CT and MRI).
Methods: This study was conducted in department of radiodiagnosis, Sri Aurobindo medical college and PG institute, Indore from August 2019 to September 2020. A total of 100 OPD patients of adnexal masses including both premenopausal and postmenopausal women. All 100 patients had undergone sonographic assessment and CA-125 levels were assessed; where 70 patients were correlated with CT and 30 patients were correlated with MRI with a standardized research protocol
Results: A total of 100 patients included in the study. The mean age was 42.05±2.3. 68 (68%) patients were Premenopausal and 32 (32%) patients post-menopausal. 19 (19%) of patients had family history of ovarian carcinoma, whereas 81 (81%) of patients had negative family history of ovarian carcinoma. 32 (47%) patients in premenopausal group had increased Ca-125 levels, whereas 18 (56.2%) patients in postmenopausal had increased Ca-125 levels.
Conclusions: MRI proved to be highly sensitive and accurate in differentiating benign and malignant lesions of adnexal masses which were indeterminate on ultrasonography examination. Thus, MRI can be considered as second most confirmatory tool followed by tissue diagnosis in women with indeterminate masses.

Keywords: Ultrasonography, Computed tomography, Magnetic resonance imaging

INTRODUCTION

Adnexal mass lesions are common among women of all age groups and very common among the reproductive age group. Adnexal masses pose a special dilemma to the attending gynecologist because the differential diagnosis is often difficult and complex. Also, the nature of the adnexal mass needs to be ascertained, whether benign or malignant, so that patient gets the appropriate treatment for the condition. Adnexal masses are a quite common clinical problem. Around 5-10% women undergo surgery for suspicious adnexal masses, but only 25% or less are malignant.[1] Sometimes 50-60% of benign cases are operated unnecessarily on the basis of suspicious ultrasonographic findings.[2] Adnexal masses present as a special diagnostic challenge when imaging findings cannot be categorized into benign or malignant pathology.[3] USG, CT, MRI are currently available imaging modalities to evaluate adnexal masses. Ultrasonography is the first-line imaging modality for assessment of adnexal masses as it is readily available and has a high negative predictive value for evaluation the morphological characteristics like non-fatty solid (vascularized) tissue, thick septation and papillary projection. While transabdominal US is help for larger

masses or those located superiorly or laterally in the pelvis, transvaginal US provides optimal visualization of most adnexal disease. Real-time US observations contribute to improved characterization and suggest value in recording video clips.[4] Two-dimension US remains the mainstay for pelvis US, though three-dimensional US is being used with increasing frequency.[3] Determination of a degree of suspicion for malignancy in an adnexal mass is the most critical step after identification of the mass and has a profound effect on patient survival. Color flow imaging and spectral Doppler have a promising role in the evaluation of adnexal masses. Doppler examination was once thought to be the key in distinguishing between benign and malignant masses because the vascular characteristics with in a malignant neoplasm often differ from those of a benign neoplasm. Color Doppler ultrasonography helps evaluate solid, vascularized components in a mass. Spectral Doppler waveform characteristics (e.g., Resistive index, pulsatility index) correlate well with malignancy but add only little information to morphological characteristics. Among women with ovarian masses, CT has been used primarily in patient with ovarian malignancies to provide staging information, to detect persistent our recurrent disease and to demonstrate tumor response to therapy, while its role in detecting and characterizing adnexal masses was more limited mainly due to poor soft tissue characterization and the disadvantages of irradiation specially if used in young patients. However, with introduction of multidetector-row computed tomography (MDCT) there is substantial reduction in examination time and the ability to obtain near- isotropic data, allowing the creation of 2 multiplanar reformatted images in any plane, with spatial resolution identical of to that of original scanning plane, as well as the creation of high-quality 3D- reconstructing.[5] It can also help in evaluating extent of the disease before and after primary cytoreductive surgery. MRI is more beneficial when, US findings are non-diagnostic or equivocal, because of its multi planer imaging capability, better soft tissue delineation and characterization in differentiating hemorrhage, fat and collagen tissue contains in adnexal mass; but it is a more expensive modality. MRI is a valuable tool in characterizing a complex cystic ovarian mass as an endometrioma and my detect signs of relatively rare malignant degeneration within it. In the pelvis, MRI has been shown to have a 91-93% overall accuracy for differentiating benign from malignant adnexal tumors particularly when gadolinium-enhanced techniques are used.[6]

Aim of the study was to evaluate role of diagnostic reliability of morphological characteristic of ovarian and adnexal masses to compare and correlated in sensitivity of USG with CT and MRI.

METHODS

This study was conducted in department of radiodiagnosis, Sri Aurobindo medical college and PG institute, Indore from August 2019 to September 2020. A total of 100 OPD patients of adnexal masses including both premenopausal and postmenopausal women. All 100 patients had undergone sonographic assessment and CA-125 levels were assessed; where 70 patients were correlated with CT and 30 patients were correlated with MRI with a standardized research protocol. We included patients who presented with at least one adnexal mess detected in a previous ultrasound. In case of bilateral adnexal masses, we included the mass with the most complex ultrasonic morphology. If both masses had similar ultrasonic morphology, we included the largest one or the one most easily accessible by trans abdominal and trans vaginal ultrasound. A written and informed consent was taken from the all patients before subjecting them to all the modalities was taken. Used information from the international ovarian tumor analysis (IOTA) data base 2013 for characterization of these masses.[7]

Inclusion criteria

Patients with a clinical history of lower abdominal pelvic pain, pelvic mass, bleeding per vagina, irregular mensuration and family history of ovarian malignancy were included in the study.

Exclusion criteria

Pregnant women with adnexal masses and ectopic pregnancies and those who did not have surgical removal of the mass within 120 days after the ultrasound examination were excluded from the study.

Procedure

Patients were subjected to trans-abdominal and trans-vaginal sonography scan on PHILIPS IU- 22 sonography machine using 1-5 MHz transabdominal probe and 5-9 MHz transvaginal probe and lesions/masses were categorized on the basis of sonographycological characteristics and color Doppler benign, malignant and inconclusive lesions. Patients with an adnexal mass underwent a slenderized gray scale and Doppler ultrasound examination. Only patients who were operated on ≤120 days after the ultrasound examination were included, the outcome variable being the histological diagnosis of the mass. The decision of whether or not to operate was made by local clinicians on the basis of the results of the ultrasound examination, the clinical picture and the local management protocols. CA 125 results were not available to the ultrasound examiner at the time of the ultrasound examination. The ultrasound information was recorded prospectively in the proforma and was kept aside so that it could not be changed thereafter.

CT was done on SEIMENS SOMATOM 64 SLICE MDCT machine and the extent and characteristic of the adnexal masses was done. The protocol included scanning the abdominal covering the area from the diaphragm to the symphysis pubic (craniocaudal), during

the portal phase (tome delay 70s), after the intravenous administration of 120 ml of nonionic iodinated contrast material (320 mg l/ml), at a flow rate of 3 ml/s. the following parameters were used: detector collimation of 16x0.075 mm, slice thickness 0.8 mm; reconstruction interval 0.5 mm, Kv 120, rotation time 0.5 s and pitch of 1.2. Both dose modulation (DOM) and automatic current settings (dose right) were used, and the mean mAs per rotation for each scan was calculated at 110. The main advantage of the images was the evaluation of the volume of the tumor, as well as of extent of the disease, as seen during surgery, which there for used useful in preoperative planning. MRI was done on 1.5 tesla Seimens Megeneton symphony Tim technology (18 CHANAL) machine covering the area from the iliac crests to the symphysis pubic, or the ovarian mass, if larger; axial, sagittal and coronal turbo spin echo T2-weighted images (TR/TR, 4000/120 MS; slice thickness 5 mm; intersection gape 0.5 mm; four excitations) and fat suppressed, contrast enhanced spin echo T1- weighted images, in the best plane to study adnexal mass and the same parameters as the pre-contrast sequences. Patients were instructed to fast 4 hours prior to the examination. Immediately before MRI, all patients were given 1 mg of intramuscular glucagon. A reduction in bowel peristalsis was achieved by intramuscular injection of 20 mg of hyoscine- N-butyl bromide. Coronal and axial T1-weighted spin-echo images (TR/TE, 700/20), axial and sagittal T2- weighted fast spin-echo images (TR/effective TE, 4,500/80), and coronal STIR images (TR/TE, 3,000/30; inversion time, 165 msec) were obtained with a 256x256 matrix, a 5 to 6 mm slice thickness, and a 30 cm field of view, before and after intravenous administration of gadolinium chelate compounds of 0.2 mmol/kg.

Finding were recorded on a Proforma and provisional diagnosis was made. The combination of ultrasonographic tumor morphology and serum CA 125 value improves the differentiation of women at risk of ovarian cancer from those with benign adnexal lesions. These finding should be helpful in determining which patients can be followed without surgery, which patients are likely to have a benign ovarian tumor, and which patients are at high risk of ovarian malignancy and should be referred for sub-specialty care. The Ca-125 referral level in premenopausal women was taken more than 67 units/mL as cut-off and in postmenopausal women was taken to more than 35 units/mL as cut-off.

Final diagnosis was confirmed by fine needle aspiration cytology (FNAC)/histopathology/laparoscopy/post-operatively.

RESULTS

A total of 100 patients included in the study. The mean age was 42.05±2.3. 68 (68%) patients were pre-menopausal and 32 (32%) patients post-menopausal. 19 (19%) of patients had family history of ovarian carcinoma, whereas 81 (81%) of patients had negative

family history of ovarian carcinoma. 32 (47%) patients in premenopausal group had increased Ca-125 levels, whereas 18 (56.2%) patients in postmenopausal had increased Ca-125 levels (Table 1).

Table 1: Demographical characteristics.

Variables	N=100 (%)
Mean age (year)	
18-60	42.05±2.3
Premenopausal	68 (68)
Postmenopausal	32 (32)
Family history of carcinoma ovary	
Positive cases	19 (19)
Negative cases	81 (81)
Ca-125 levels (units/ml)	
Pre-menopausal >67	32 (47)
Post-menopausal >35	18 (56.2)

On basis of sono-morphological characteristics and color Doppler finding of adnexal masses were provisionally diagnosed as malignant, as benign and inconclusive (Table 2).

Table 2: Categorization of adnexal masses on basis of sonomorphological characteristics.

USG characteristics	No. of patients
Unilocular cyst	51
Presence of solid component with largest diameter of <7 mm	36
Presence of acoustic shadow	10
Smooth multilocular tumor with largest diameter <100 mm	22
Irregular solid tumor	14
Presence of ascites	11
At least 4 papillary projections	6
Irregular multilocular solid tumor with diameter >100 mm	8
No blood flow (color score 1)	61
Very strong blood flow (color score 4)	15

CT/MRI finding, presence of lymph nodes and peroneal implants, adnexal masses were provisionally diagnosed as benign. As malignant and inconclusive (Table 3).

On histopathological/FNAC/laparoscopic findings 25 patients were malignant, whereas 75 adnexal masses were benign (Table 4).

For imaging modality, malignancy was considered to be depicted successfully true positive if it appeared to be suspicious for or highly suggested of malignancy with that modality. Lesion considered probably benign that proved malignant at biopsy was classified as false negative finding for the modality (or modalities) with which they appeared probably benign.

Table 3: Categorization of adnexal masses on basis of morphological characterization of CT/MRI.

Criteria on CT/MRI	No. of patients
Size (cm)	
<4	63
>4	30
Solid components	
No	16
Solid part with heterogeneous enhancement	13
Cystic mass	
Simple mass	50
With vegetations and internal structures	25
Thickness of wall/septa (mm)	
<3	63
>3	22
Lobulated mass	
No	68
Yes	20
Calcifications	
Wall of cyst, dense	19
Tiny, amorphic	10
Necrosis	
No	68
Yes	05
Papillary projections	
No	65
Yes, with heterogenous enhancement	14
Tumor vessels	
No	73
Yes, with heterogenous enhancement	17
Lymph nodes	
Normal (<1 cm short axis)	61
Enlarged (>1 cm short axis)	12
Peritoneal implants	
No	83
Yes	05

Table 4: Classifications of adnexal masses on basis of final diagnosis.

Classification	Diagnosis	Menopausal status		Total no. of patients
		Pre-menopausal	Post-menopausal	
Benign	Simple ovarian cyst	07	03	10
	Endometrioma	06	01	07
	Hemorrhagic cyst	09	03	12
	Mature cystic/teratoma dermoid	06	02	08
	Ovarian cystadenoma	09	02	11
	Ovarian fibrothecoma	03	01	04
	Hydrosalpinx/pyosalpinx	05	02	07
	Tubo-ovarian abscess/complex	03	02	05
	Polycystic ovary	08	00	08
	Ovarian torsion	03	00	03
Malignant	Serous adenocarcinoma	00	05	05
	Mucinous adenocarcinoma	03	02	05
	Granulose cell tumor	02	02	04
	Papillary adenocarcinoma	00	04	04
	Kruk Enberg tumors	04	0	04
	Metastasis	00	03	03

Table 5: Statistical analysis of USG and CT/MRI in detecting malignancy.

Final Data	USG (%)	CT/MRI (%)
Sensitivity	85.71	88.90
Specificity	98.34	98.37
NPV	96.72	96.78
PPV	92.32	94.13
Accuracy	95.95	96.21

NPV: Negative predictive value; PPV: positive predictive value

Sensitivity and specificity of USG and CT and/MRI in detecting malignancy was 85.71, 98.34, 88.90 and 98.37%. NPV was 96.72% USG and 96.78% CT/MRI. PPV was 92.32% USG and 94.13% CT/MRI respectively, with diagnostic accuracy 95.95% and 96.21% (Table 5).

DISCUSSION

Positive family history of adnexal malignancy present in 19 (19%) of patients and negative family history of adnexal malignancy 81 (81%). In this study 18/32 post-menopausal women had Ca-125 levels of >35 units/mL of which 16 were diagnosed to have malignancy (sensitivity 92% and specificity 84%). In the premenopausal women taking >67 units/mL of Ca-125 as cut-off, sensitivity and specificity was less 54.5% and 52% respectively. Many benign masses such as endometrioma, dermoid, cystadenoma, fibrothecoma and tobo-ovarian masses also revealed increases Ca-125 levels. Our finding was in conjunction with the studies of John and Milan et al.[8,9] In this study sensitivity of USG in detecting malignancy was 85.71% with accuracy of 95.95%. Timmerman et al study reported sensitivity of ultrasound alone as 93% with accuracy of 85.9%.[10] In their study, they also showed that highly experienced operators using subjective impression as the basis to define malignancy gave a sensitivity and specificity of 96% and 90%, respectively. For less experienced operators, the corresponding value was 86 and 80%. Specificity of USG in present study was 98.34%. As reported by Kaijser et al.[7] Features suggestive of malignancy on contrast enhanced CT or MRI included demonstration of solid, solid/cystic enhancing masses (>4 cm in maximum diameter) with papillary projection and irregular thick wall and septa (>3 cm) into a cystic lesion (the number of septa and the number and dimension of the vegetations can be suggestive of malignancy). Secondary features included the presence of necrosis in a solid mass and intra-tumoral hemorrhage. Early enhancement and heterogeneous pattern can be suggestive of malignancy. Finally, the ancillary criteria of involvement of pelvic organs or the sidewall, ascites and lymphadenopathy were carefully evaluated to distinguish benign from malignant disease.[11] We found that MRI had high sensitivity, specificity and PPV for detection of malignant and inconclusive adnexal masses. Among total

study populations, the sensitivity of MRI/CT was 88.90% with accuracy of 96.21% which was in concordance with study of valentine et al.[11] Who reported sensitivity of 88-94% with accuracy of 91-95%. Specificity of detecting malignancy in 98.37% which is in concordance with the study of Iyer et al they reported specificity of CT as 87% of contrast enhanced MRI as 98%.[12] All the lesions in this study were further correlated with either histopathology fine needle aspiration or postoperative laparoscopy; where finally 25% (25 out of 100 patients) turned out to be definitively malignant. These adnexal masses were confirmed to 25 (25%) malignant and 75 (75%) benign on histopathology/fine needle aspiration cytology/laparoscopy. The combination of clinical examination, USG and CT/MRI was the most sensitive, in depicting malignant foci. This combination was significantly better than the combination of clinical examination and CT/MRI alone. Clinical examination with USG andCa-125 was more accurate overall in postmenopausal women than clinical examination alone or CT/MRI alone or Ca-125 levels alone. One of the limitations of this study was that USG performed without being blinded to clinical findings and CT/MRI was performed without being blinded to clinical or USG findings.

CONCLUSION

USG still remains the primary imaging modality in ovarian masses but MRI enables a specific diagnosis to be made for certain pathological types and has greater specificity in the diagnosis of malignancy, differentiating benign from malignant adnexal tumors. MRI should be used for characterization of ovarian masses when USG results are in determinate of or equivocal, especially when tumor markers are normal or in young patients when conservative surgery is suggestive. MRI is useful for definitively diagnosing many common benign adnexal lesions.

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