Original Article

A Study Of Correlation Between Grayscale Ultrasound And Doppler Flow Imaging Findings With Histopathological Examination Findings To Differentiate Malignant And Benign Adnexal Masses

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Abstract

Aim and Background: The objective of this study correlation between Grayscale ultrasound and Doppler flow imaging findings with Histopathological examination findings to differentiate malignant and benign adnexal masses. Out of all the adnexal pathologies, only 2/3 rd cases usually present with clinical symptoms. Remaining 1/3 rd of cases are diagnosed incidentally by ultrasound screening. Fortunately, the benign adnexal conditions far outnumber the malignant lesions. **Materials and Methods:** This is prospective type of study conducted in Meenakshi Medical College Hospital and Research Institute for a period of one and half years. Female patients with complaints of lower abdominal pain, menstrual irregularity referred from the department of gynaecology, surgery, general medicine from our and other hospitals to our Department of Radiodiagnosis at Meenakshi Medical College Hospital & Research Institute. After getting informed consent and detailed clinical history from the patients, all the subjects were scanned with Gray-Scale sonography using 3.5-5 MHZ and 8 MHZ probes for transabdominal and transvaginal scans respectively and subsequently Color and Spectral Doppler examination was done. **Results:** In this study, 50 female patients with clinically suspected adnexal masses were evaluated by transabdominal Ultrasound or transvaginal ultrasound with Doppler flow Imaging to detect and characterize adnexal masses. This study reveals certain morphological features assessed by combined grey scale ultrasound and colour Doppler includes the large size (>10 cms), irregular surface contour, solid, multilocular echogenicity, thick septations, internal papillary projections, low resistance blood flow (PI<1.0, RI<0.4) were statistically significant for malignant tumours. **Conclusion:** In the present study we conclude that the combined approach using both Transabdominal & Transvaginal ultrasound with Doppler gives the best results to differentiate malignant and benign adnexal masses conformation with histopathological examination.

Key words: Histopathological examination, Grey scale Ultrasound, Doppler Flow imaging

1. Introduction

Adnexa (uterine appendages) are the most closely related structure adjacent to the uterus that includes ovaries, fallopian tubes and ligaments. Adnexal mass represents the broad spectrum of conditions from gynaecologic and non-

gynaecologic sources. It is considered the most common disease in gynaecology. It varies from benign conditions like functional cysts to malignant masses like ovarian cancer[1].

The age-specific incidence rate for ovarian cancer increases from 35 years and peaks by 55-64 years[2]. The major drawback is most of the patients are asymptomatic, presents at late stages & responds poorly to treatment [3]. Regardless of the advances in treatment, ovarian cancer has consistently the highest case fatality ratio of all gynecological malignancies, with a 5-year survival rate of 40-50% of all stages of malignancy[4].

The early and accurate diagnosis of ovarian malignancy is of grave clinical importance because prognosis entirely depends on early diagnosis. A preoperative diagnosis of malignancy can guide the gynecologist to refer the patient to a gynecological oncologist for appropriate therapy which is known to improve survival period of the patient (junior et 1999) [5].

Besides, benign adnexal cysts (such as endometrioma, mature cystic teratoma, and paraovarian cysts) are also significant to diagnose correctly because it may turn as a risk factor for infertility, ovarian torsion. Therefore adnexal masses need to be evaluated as benign or malignant, hence to provide better treatment. Ultrasonography is the primary imaging modality used for identification of adnexal mass. Because it is widely available, cost-effective, harmless and non-invasive procedure and high sensitivity in the detection of masses [6].

Spectral Doppler analysis with low PI (<1.0) or RI (0.4) indicates malignancy. Transabdominal USG is helpful for evaluating larger masses or those located superiorly or laterally in the pelvis where transvaginal USG provides optimal visualization of most adnexal diseases. Doppler USG is useful in masses with an apparent solid area or septations [7].

Other imaging modalities such as computed tomography (CT), positron emission tomography, or magnetic resonance (MR) scanning can be helpful in various aspects. Computed tomography can help to assess staging, the extent of disease in patients before and after primary cytoreductive surgery. Magnetic resonance has an essential role in the characterization of indeterminate adnexal masses. It may be used as an adjunct imaging modality when the initial ultrasound characterization of an adnexal mass as benign or malignant is inconclusive.

In this study, we characterized the adnexal masses with combined grey scale and Doppler flow imaging to identify the malignant potential of the lesion. Then correlated the USG findings with the final histopathological diagnosis. The sensitivity, specificity and positive and negative predictive values were calculated to assess the accuracy of the involved modalities, to discriminate benign from malignant adnexal masses.

2. Materials and Methods

This is prospective type of study conducted in Meenakshi Medical College Hospital and Research Institute for a period of one and half years from January 2017 To September 2018. The sample received from Female patients with complaints of lower abdominal pain, menstrual irregularity referred from the department of gynaecology, surgery, general medicine from our and other hospitals to our Department of Radiodiagnosis at Meenakshi Medical College Hospital & Research Institute. In this study, 50 female patients with clinically suspected adnexal masses were evaluated by transabdominal Ultrasound or transvaginal ultrasound with Doppler flow Imaging to detect and characterize adnexal masses.

After getting informed consent and detailed clinical history from the patients, all the subjects were scanned with Gray-Scale sonography using 3.5-5 MHZ and 8 MHZ probes for transabdominal and transvaginal scans respectively and subsequently Color and Spectral Doppler examination was done. Transabdominal USG was done in all cases, followed by transvaginal sonography (TVS) wherever necessary. TVS was not performed in patients who were not willing to undergo TVS and virgin patients with the adnexal mass.

The following characteristics of adnexal masses were recorded:

Site; laterality (unilateral/bilateral), Size, Surface contour (smooth/irregular), Type of lesion-- [unilocular, unilocular with fibrin strands, unilocular with internal echoes, unilocular solid, solid, multilocular, multilocular with internal echoes, multilocular with solid, solid), Papillary projections, Septations (thin, thick, none), Associated findings (fluid in cul-de-sac and ascites) If possible, a Specific diagnosis was made, e.g Dermoid cyst, Ectopic pregnancy.

Following Grey scale examination of mass, Color flow imaging was done to assess the vascularity of the mass. if no blood flow was detected, the tumour was considered avascular tumour. After Color Doppler examination, the masses were evaluated on Spectral Doppler. A range gate was placed across an appropriate vessel and the flow velocity waveform was displayed. In the absence of arterial flow, the mass was considered as benign while in the presence of arterial flow, the mass was considered malignant if RI $\leq$ 0.4, PI $\leq$ 1.0 Pulsatility Index (PI) = Peak systolic flow –end diastolic flow / mean systolic flow.

Resistance Index (RI) =Peak systolic flow-end diastolic flow/peak systolic flow.

Based on this morphologic characteristic on Grayscale US and Doppler findings, the masses were classified as benign or malignant. Scanning was performed using Voluson S6 pro ultrasound machine equipped with a colour and pulsed Doppler and a 3.5 MHZ transabdominal and 8 MHZ transvaginal transducers.

Statistical software: The Statistical software SPSS 21.0, was used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs, tables etc**.**

3. Results

Age distribution based on the Histopathological Changes

Table.1. Indicates that the maximum number of malignant cases were in the age group of more than 45 years and the maximum number of benign cases were in the age group of fewer than 45 years Pearson chi- square : 0 .14 (significant).

Age in years	**Histopathological Diagnosis**		**Total**
	Benign	**Malignant**	
16-25	5(11.1%)	1(20%)	6(12%)
26-36	9(20%)	0(0%)	9(18%)
36-45	17(37.8%)	0(0%)	17(34%)
46-55	8(17.8%)	1(20%)	9(18%)
56-65	5(11.1%)	1(20%)	6(12%)
66-75	1(2.2%)	2(40%)	3(6%)
Total	45(100%)	5(100%)	50(100%)
Pearson chi- square	.14		

Distribution of cases according to size of the lesion

In the present study, 60% of malignant cases were measured more than 10 cms in size as compared to 9 % of benign cases. 49 % of benign masses were 5-10 cms in size as compared to 40 % of malignant cases. 42% of benign cases were less than 5 cms in size. Pearson chi-square : 0.005 (significant). **(Table.2)**

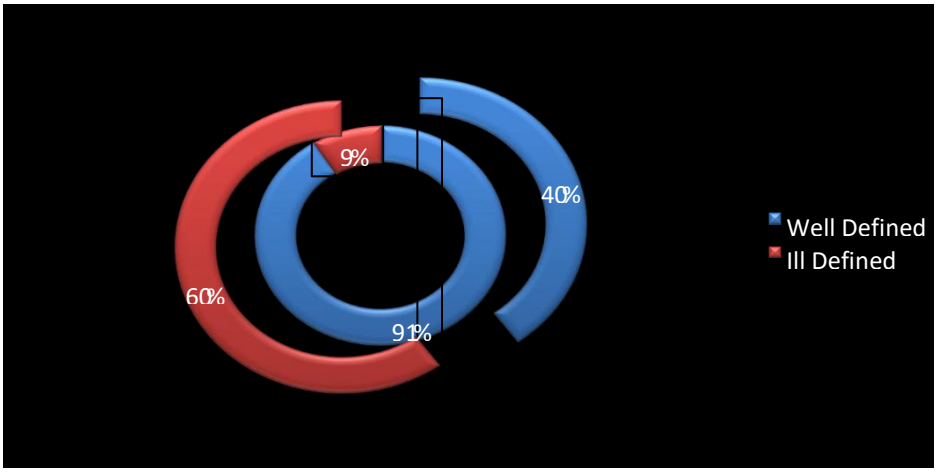
Table.2. Distribution of cases according to size of the Lesion

Size in cms	**Histopathological Diagnosis**		**Total**
	Benign	**Malignant**	
<5	19(42.2%)	0(0%)	19(38%)
5-10	22(48.2%)	2(40%)	24(48%)
>10	4(8.9%)	3(60%)	7(14%)
Total	45(100%)	5(100%)	50(100%)
Pearson chi-square	0.005		

Distribution of cases based on Surface Contour

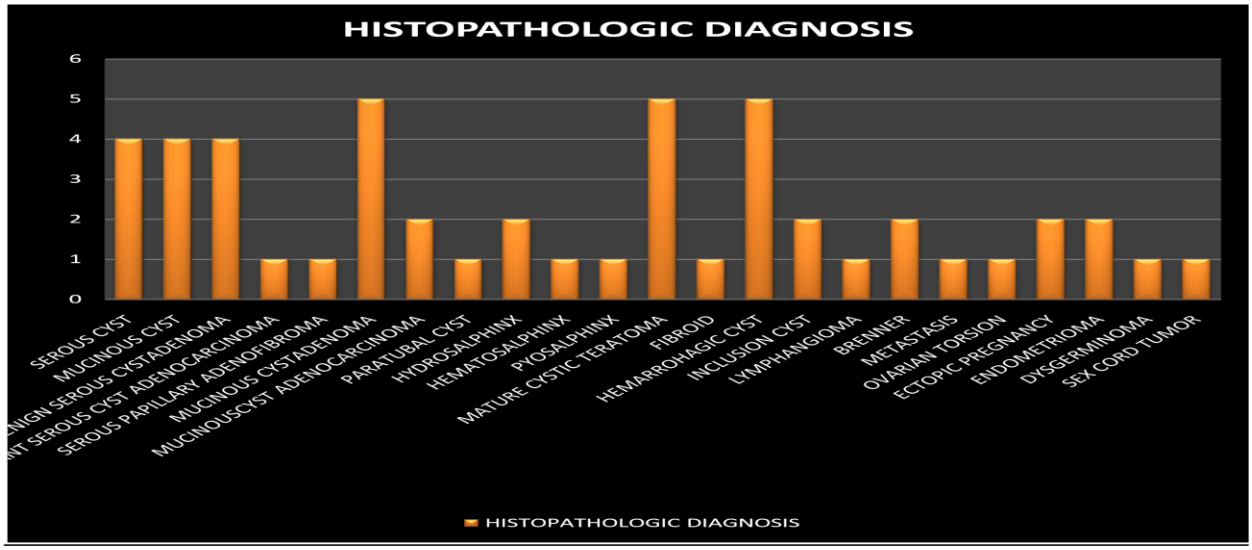
The study shows 91 % of benign lesions have well-defined border and remaining 9 % have an ill-defined border. 60% of malignant lesions have an ill defined border and 40 % have well defined border. Pearson chi-square-0.016 (significant). **(Figure.1)**

Figure1. Distribution of cases based on Surface Contour



Distribution of Adnexal Masses based on Histopathological diagnosis

In total 50 adnexal masses, 5 were diagnosed as mucinous cystadenoma of ovary, mature cystic teratoma, hemorrhagic cyst each, 4 were diagnosed as serous cyst, benign serous cystadenoma, mucinous cyst each, 2 were diagnosed as hydrosalpinx, inclusion cyst, Brenner, ectopic pregnancy, endometrioma, mucinous adenocarcinoma each, and one was diagnosed as serous papillary adenofibroma, paratubal cyst, serous cystadenocarcinoma, hematosalpinx, pyosalpinx, broad ligament fibroid, lymphangioma, ovarian metastasis, ovarian torsion, dysgerminoma and dysgerminoma each. **(Figure.2)**



Comparison with Histopathology Report, Combined Grey Scale with Doppler Imaging

Table.3. indicates that the out of 50 cases, In comparison with histopathology report, combined grey scale with Doppler imaging found 44 benign cases and 4 malignant cases correctly. One benign and malignant mass was found wrong. In the present study, we found that USG with Doppler had the Sensitivity of 80%, specificity of 97 %, the positive predictive value of 80 % and negative predictive value of 97 % for discriminating between benign and malignant adnexal masses.

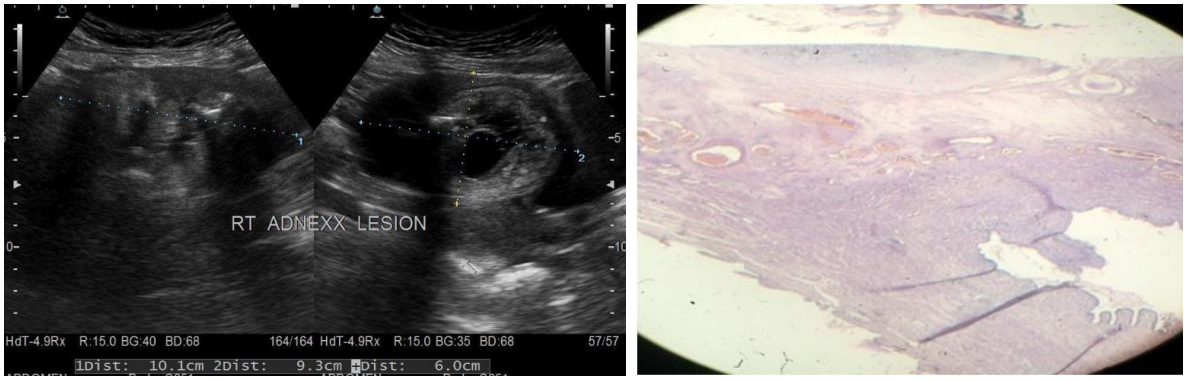
Table.3. Comparison with Histopathology Report, Combined Grey Scale with Doppler Imaging

Combined Grey Scale with Doppler Imaging	**Histopathological Changes**	
	Benign	**Malignant**
Benign	44	1
Malignant	1	4

Transabdominal sonogram

Figure.3. Transabdominal sonography showing a large mixed echogenic mass lesion with internal calcifications which produce post acoustic shadowing, in right adnexa and histopathological examination, diagnosed as mature cystic teratoma.

Figure.3. Transabdominal Sonogram and Histopathological changes



4. Discussion

Based on the histopathological report, out of 50 cases, 45 adnexal masses were benign, 5 were malignant . In total 45 benign masses, 16 were Ovarian cysts. (Of these Serous cysts -4, Mucinous cyst-4, Hemorrhagic cysts-5, Paratubal cyst-1, Endometrioma -2), 5 Mature cystic teratoma, 4 Serous cystadenomas, 4 Mucinous cystadenomas, 2 Ectopic pregnancy, 2 Inclusion cyst, 2 Brenner tumour, 2 Hydrosalpinx and 1 Fibroma, 1 lymphangioma, 1 was Serous papillary adenofibroma, 1 was Broad ligament fibroid, 1 Pyosalpinx, 1 Hematosalpinx, and 1 Ovarian torsion. The most important sonographic features that indicate ovarian torsion are twisted vascular pedicle, lack of arterial/venous flow in the enlarged ovary. However viable twisted ovaries may show central venous blood flow which may lead to incorrect diagnosis. In this circumstances, local tenderness of affected ovary can be elicited in comparison with other adjacent structures by transvaginal ultrasound which can narrow down the diagnosis [8].

Out of five malignant cases, one was Serous cystadenocarcinoma, two were Mucinous cystadenocarcinoma, one was Secondary ovarian metastasis and another one was Dysgerminoma. Benign cases far outnumber the malignant ones. Though Doppler plays a major role in differentiating benign and malignant lesion. In addition, it considered being important in diagnosing acute pelvic conditions like ectopic pregnancy and ovarian torsion. Ectopic pregnancy usually exhibits multiple small vessels arranged peripherally (ring of fire) showing high velocity and low impedance flow (RI=0.36-0.45). The sensitivity of Transvaginal colour Doppler in the diagnosis of ectopic pregnancy has been analysed in several studies, ranging from 73-96%, with a specificity of 87-100% [9-11].

In this study, out of 45 benign cases, combined ultrasound with Doppler imaging diagnosed 44 cases of benign lesions correctly. And out of 5 malignant cases, it diagnosed 4 cases correctly. The result of the study shows that USG with Doppler imaging has a sensitivity of 80%, specificity of 97%, the positive predictive value of 80% and negative predictive value of 97% to discriminate between benign and malignant lesions.

5. Conclusion

Ovarian cancer is the most common lethal gynaecological malignancy. Even though the histopathologic report is the gold standard for diagnosis, ultrasound is the primary modality to evaluate the adnexal masses. Transvaginal ultrasound depicts sonomorphological characteristics of a mass better than Transabdominal ultrasound. Grayscale ultrasound combined with Color and Spectral Doppler to achieve better characterization and discrimination between benign and malignant adnexal masses. The present study signifies all the grey scale and Doppler features including size, age, consistency, papillary projections, septa, vascularity etc assessed in the study as statistically significant in

differentiating benign from malignant masses. Transvaginal colour flow imaging can be used to screen for early ovarian cancer or indeterminate small ovarian lesions.

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