ORIGINAL ARTICLE

Role of Transvaginal Colour Doppler in Adnexal Masses

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Abstract

This prospective study was conducted in the Department of Obstetrics and Gynaecology, SMGS hospital on 80 patients having adnexal mass to assess the diagnostic accuracy of B- mode ultrasonography and colour Doppler in differentiating benign and malignant adnexal masses and to correlate imaging findings with intraoperative details/histopathologic diagnosis. A detailed history was recorded in each case and thorough general physical, local and systemic examination was carried out and followed by investigations. Transvaginal sonography was performed using high frequency vaginal transducer of 7.5 mega hertz. Mass was characterized according to sassone score. The histo-pathological findings were correlated with TVS colour Doppler and laparotomy findings. Sassone's scoring was done with B Mode sonography and sensititivity, specificity, positive predictive value and negative predictive value were found as 90.4%, 79.6%, 61.2%, 95.9% respectively by taking cut off of score 9 for high risk of malignancy. The mean PI value of malignant masses was 0.711±0.168 which was lower as compared to benign masses ($p<0.0001$).The mean RI value of malignant masses was 0.338±0.110 which was lower as compared to benign masses ($p<0.0001$).The mean PSV value of malignant masses was 32.56±10.56 which was higher as compared to benign masses ($p<0.0001$). Sensititivity, specificity, positive predictive value and negative predictive value of colour Doppler in differentiating benign and malignant masses were calculated after considering all the parameters as 90.2%,98.3%,95% and 96.6% respectively.

Key Words

Transvaginal colour Doppler, adnexal masses, B-mode sonography

Introduction

The term adnexa is derived from a Latin word meaning "appendage". The adnexa of uterus include ovaries, fallopian tubes and structures of the broad ligament. Adnexal mass is defined as enlarged structure in the uterine adnexa that can either be palpated on bimanual examination or visualized using radiological imaging.(1) It includes benign lesions like tubo-ovarian abscesses of different origin especially PID, endometriosis, ectopic pregnancy, uterine tumors when pedunculated, polycystic ovaries, benign ovarian neoplasm and malignant lesions including ovarian malignancies, fallopian tube malignancies and metastasis from other sites like breast and lungs.

Various diagnostic modalities have been introduced over a period of time to diagnose adnexal masses and to differentiate benign and malignant adnexal masses. Physical examination is first and basic modality to diagnose the adnexal mass. Though it can give a general idea about size, shape, sight, laterality, mobility and lymph nodes but alone it cannot lead to any conclusion. Besides size of the mass, obesity may limit the use of physical examination. (2) Sensitivity of abdominal ultra sound in detecting ovarian CA is 80%. Specificity in differentiating benign and malignant cyst is poor.(3)

Pelvic and abdominal CT Scanning has proven utility in management of patient with pelvic masses. It provides valuable information regarding disease volume, response to therapy, diagnosis of recurrent disease and other organ involvement. The ability to image solid lesion < 1-2 cm is

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limited.(4) It has got advantage in late stage of disease for staging of the tumor and has limited value in initial assessment of adnexal masses. Similar to CT scan, MRI scanning of pelvis can provide remarkably detailed visual images and has been used to distinguish between various forms of benign ovarian neoplasm.(5) Limitations of MRI are high equipment and implementation costs.

Transvaginal Colour Doppler is a recent diagnostic modality in pre-operative assessment of adnexal masses. Close proximity of high frequency vaginal probe allows greater resolution of architectural detail. The greater enhancement allows better distinction of morphological characteristic of ovary like ovarian volume, cyst wall thickness, and presence of septa or papillary growth. These features can be used to assess risk of malignancy.(6) Colour Doppler visually reflects the state of blood flow to the tumor. It is based on FOLKMAN'S Theory of neovascularisation which states that tumor releases the factor known as tumor angiogenesis factor which stimulates rapid formation of new capillaries. Neovascularity is required for tumor to grow beyond few millimeters.(7) Colour Doppler sonography depicts tumor neovascularity by detecting increased diastolic flow.8 Tumor vessels can be differentiated from the normal vessel by irregular course, lack of muscle media, arterio-venous shunting and pooling in amorphous tumor lakes.9

Colour Doppler sonongraphy can be performed using either abdominal or vaginal probes. Any sonographic evaluation of adnexal mass begins with its morphologic analysis. The mass should be characterized as:

- Predominantly cystic, complex and solid
- Assessed internal structure for presence of papillary projections septations and ecogenicity.
- Parital wall thickness

Secondary to characterization of mass by their morphology, colour Doppler sonography evaluates following parameters:

- Vessel location.
- Relative impedance
- Velocities
- Notch in wave form.

The vessels must be localized as peripheral or central analysis of wave flow is done using two standard indices first is Resistive Index and second one is Pulsatility Index. Notch in the wave flow during diastole indicates momentary resistance to forward flow and is usually a sign that vessel has muscular coating. Notch is absent in malignancy. TVS with color flow imaging is a promising tool in distinguishing benign from malignant lesion and it increases specificity and sensitivity of B- mode ultra sound many fold in predicting malignancy in adnexal masses.

Material and Methods

This prospective study was conducted in the Department of Obstetrics and Gynaecology, SMGS hospital in collaboration with the Department of Radio Diagnosis. A total of 80 patients having adnexal mass and fulfilling our inclusion criteria were included in the study for a period of one year.

Inclusion Criteria:Those patients who were diagnosed with adnexal masses on pelvic examination, conventional sonography or referred as case of adnexal mass.

Exclusion Criteria: Unmarried females,Unilocular enechoic cyst which resolved on follow up USG, Masses that were found to arise from uterus intraoperatively, Patients who were not able to perform histopathology and were lost in study.

Pre-procedural work up: A detailed history was recorded in each case and thorough gernal physical, local and systemic examination was carried out and recorded in proforma devised for the study.

Following investigations were done: ABO & RH, HB, BT, CT, TLC, DLC, Platelet count, Blood Sugar (fasting), Chest X-ray, ECG, HIV-1&2, HBsAg

Ultra sound Examination:After explaining the procedure and its purpose, verbal consent of the patient was taken. Transvaginal sonography was performed using high frequency vaginal transducer of 7.5 mega hertz.

Thorough pelvic survey was obtained. Adnexal mass side and site of origin was noted. Mass was characterized according to sassone score.

Ultrasound score = SUM (all 4 features):A score > 9 was associated with an increased risk of malignancy. Patients in study group who were confirmed of having adnexal mass on transvaginal sonography and who required further evaluation underwent laprotomy with voluntary consent. The origin of mass was identified. The condition of uterus, tubes and ovaries were noted. The mass was measured and it was examined macroscopically for shape, surface, consistency and areas of sub capsular hemorrphage. Cut section of specimen was examined for type of fluid, presence or absence of septae, hemorrhages, papillary excrescences, solid nodule etc.

Intraoperative adhesions of mass to other structures and distant metastasis if any were recorded. The specimen obtained was sent for histo-pathological examination in formalin solution. The histo-pathological findings were correlated with TVS colour Doppler and laparotomy findings.

All data obtained was noted on a predesigned proforma in the end, results were put in tabulated form, analyzed and inferences drawn as per objectives of the study. Diagnostic discriminator utility was assessed using computer software Epi-infoversion 6.0. Sensitivity, specificity, positive predictive, negative predictive value and likelihood ratios value of B-mode alone and colour Doppler was calculated

Result

The present study was conducted to evaluate role of transvaginal colour Doppler in diagnosis of adnexal masses. A total of 80 patients fulfilling the inclusion criteria were included in the study and in all of them transvaginal colour Doppler sonography was performed. All these cases underwent exploratory laparotomy following TVS. Histopathological confirmation of diagnosis was obtained in all cases. The sonographic results were correlated with laparotomy findings and histopathology. Following observations were made.

Maximum number of cases 34 (42.50%) were in a group of 30-39 years followed by 21 cases (26.25%) in the age group 20-29 years. There were 13 (16.25%) cases in 40-49 years and 12 cases (15%) in age group 50 and above.

Out of 21 malignant masses, 10 (47.61%) were in age group 50 and above. Maximum number of malignant cases was in age group 50 and above. Maximum number of benign tumors was in age group 30-39.

Main complaint in 52 cases (65%) was abdominal pain, followed by menstrual disorder in 27 cases (33.75%).

Correlation of B Mode ultrasonography (Sassone Score) with histopathological diagnosis is shown in *Table No. 1*.

Diagnostic accuracy of B mode in diagnosing malignant masses is:Sensitivity-90.4% (0.681-0.983); PPV-61.2%(0.422-0.775) & Specificity-79.6% (0.667-0.886) NPV-95.9%(0.848-0.992)

The mean PI value of malignant masses was 0.711±0.168 which was lower as compared to benign masses 1.35±0.378. The mean RI value of malignant masses was 0.338±0.110 which was lower than benign 0.574±0.126. The mean PSV value of malignant masses 32.56±10.56 which was higher than benign masses 12.92±3.109.

Correlation of pulsatility index and histopathology is shown in *Table No. 2*.

Diagnostic accuracy of pulsality index in diagnosis of malignant masses:-Senstivity-85.71% PPV-69.2% & Specificity-86.4%,NPV-94.4%

Feature	Finding	Points
Inner wall structure	smooth	1
	irregularities = 3mm	2
	papillarities > 3mm	3
	lesion mostly solid (not applicable)	4
wall thickness in mm	thin (= 3mm)	1
	thick (> 3mm)	2
	lesion mostly solid (not applicable)	3
septa in mm	no septa	1
	thin (= 3mm)	2
	thick (> 3mm)	3
echogenicity	Sonolucent	1
	low echogenicity	2
	low echogenicity with echogenic core	3
	mixed echogenicity	4
	high echogenicity	5

Correlation of resistive index and histopathology is shown in *Table No. 3*. Diagnostic accuracy of resistive index in diagnosing malignant adnexal masses:Sensitivity -80.9% (0.574-0.937); PPV-80.9% (9.574-0.937). Specificity-93.2% (0.827-0.978) NPV-93.2% (0.827-0.978)

Correlation of diastolic notch with histopathology is shown in *Table No. 4*. Diagnostic accuracy of diastolic notch in diagnosing malignancy adnexal masses:Sensitivity -95.2% (0.741-0.997), PPV-80.0% (9.586-0.923) and Specificity-91.52% (0.805-0.968), NPV-98.16% (0.89-0.994).

Correlation of vessel localization and histopathology is shown in *Table No. 5*.

Diagnostic accuracy of vessel localization in diagnosing malignancy adnexal masses: Sensitivity -90.47% (68.17-98.33), PPV-82.60% (60.45-44.27) and Specificity-93.22% (82.72-97.80)), NPV-96.49% (86.03-99.38)

Diagnostic accuracy of colour doppler in diagnosing malignancy adnexal masses: Sensitivity -90.2% (68.17-98.33), PPV-95% (73.05-99.73) and Specificity-98.3% (89.70-99.91), NPV-96.6% (87.45-99.41)

Discussion

In our study, mean age of patients with carcinoma

Table. 1 Correlation of B Mode Ultrasonography (Sassone Score) with Histopathological Diagnosis

	Histopathological diagnosis		
USG (Sassone's score)	**Malignant No.**	**Benign No.**	**Total No.**
=9	19	12	31
<9	2	47	49

Table.2 Correlation of pulsatility index and histopathology

	Histopathological diagnosis		
Pulsalitity index	**Malignant No.**	**Benign No.**	**Total No.**
=1	18	8	26
>1	3	51	54

Table.3 Correlation of resistive index and histopathology

	Histopathological diagnosis		
Diastolic notch	**Malignant No.**	**Benign No.**	**Total No.**
Absent	20	5	25
present	1	54	55

Table.4 Correlation of diastolic notch with histopathology

	Histopathological diagnosis		
Resistive index	**Malignant No.**	**Benign No.**	**Total No.**
=0.4	17	4	21
>0.4	4	54	59

Table.5 Correlation of vessel localization and histopathology

	Histopathological diagnosis		
Vessel localization	**Malignant No.**	**Benign No.**	**Total No.**
Central	19	4	23
peripheral	2	55	57

Table.6 Histopathology correlation with colour Doppler

	Histopathological diagnosis		
Colour Doppler diagnosis	**Malignant No.**	**Benign No.**	**Total No.**
Malignant	19	1	20
Benign	2	58	60

was 49.9 years similar to study by Deland M (10) *et al* who found mean age of 50 years. In our study, Sassone's scoring was done with B Mode sonography and sensititivity, specificity, positive predictive value and negative predictive value were found 90.4%, 79.6%, 61.2%, 95.9% respectively by taking cut off of score 9 for high risk of malignancy. Our results are comparable to study by Gupta *et al* (11)who found sensititivity, specificity, positive predictive value and negative predictive value as 96.7%, 71.4%, 62.5% and 97.8% respectively. In our study, the mean PI value of malignant masses was 0.711±0.168 which was lower as compared to benign masses1.35±0.378 ($p<0.0001$), which is similar to study by Hamper UM *et al* (12) who found the mean PI value of malingnant masses as 0.77±0.33 and benign masses as 1.93±1.02. The mean RI value of malignant masses was 0.338±0.110 which was lower as compared to benign masses0.574±0.126 ($p<0.0001$), which is similar to study by Madan R *et al* (13) who found the mean RI value of malignant masses as 0.41±0.15 and benign masses as 0.51±0.11. The mean PSV value of malignant masses was 32.56±10.56 which was higher as compared to benign masses12.92±3.109 ($p<0.0001$), which is similar to study by Madan R *et al* (13) who found the mean PSV value of malignant masses as 23.92±13.6 and benign masses as 12.74±8.4. In our study by taking cut off of pulsatility index =1 as high risk of malignancy, diagnostic accuracy of PI in diagnosis malignant masses as

sensititivity 85.71%, specificity 86.4%, positive predictive value 69.2% and negative predictive value 94.4% which is similar to study by Madan *et al* (13) who found sensititivity 96%, specificity 37.5%, positive predictive value 54.5% and negative predictive value 92.3%. In our study by taking cut off of Resistive index =0.4 as high risk of malignancy, diagnostic accuracy of RI in diagnosis malignant masses as sensitivity 80.9%, specificity 93.2%, positive predictive value 80.9% and negative predictive value 93.2% which is similar to study by Madan *et al* (13) who found sensitivity 64%, specificity 90.62%, positive predictive value 84.2% and negative predictive value 92.3%. In our study by taking cut off of Peak Systolic Velocity =15cm/sec as high risk of malignancy, diagnostic accuracy of PSV in diagnosis malignant masses as sensitivity 85.71%, specificity 86.4%, positive predictive value 69.2% and negative predictive value 94.4% which is similar to study by Alcazar *et al* (14) who found sensitivity 76%, specificity 95 %, positive predictive value 87% and negative predictive value 97 %.

In our study sensititivity, specificity, positive predictive value and negative predictive value of absent diastolic notch in differentiating benign and malignant masses were found as 95.2%,91.52%,80% and 98.16% resp. which is similar to study by Madan *et al* (13). In our study sensititivity, specificity, positive predictive value and negative predictive value of central vascularity in differentiating benign and malignant masses were found as 90.47%,93.22%,82% and 96.4% resp. which is similar to study by Madan *et al* (1)3. Finally, sensititivity, specificity, positive predictive value and negative predictive value of colour Doppler in differentiating benign and malignant masses were calculated after considering all the parameters as 90.2%,98.3%,95% and 96.6% resp. which is similar to studies by Fleisher AC *et al* (15) and Alcazar *et al* (14) who found sensititivity, specificity, positive predictive value and negative predictive value as 85%,93%,83% and 98% respectively and 87%,84.2%%,89% and 82% respectively.

Conclusion

Sensititivity, specificity, positive predictive value and negative predictive value of colour Doppler in differentiating benign and malignant masses were calculated after considering all the parameters as 90.2%,98.3%,95% and 96.6% respectively in the current study .

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