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Research Article

# ROLE OF COLOUR DOPPLER SONOGRAPHY IN ADNEXAL MASSES

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## ABSTRACT

**Objective**: To evaluate the role of colour Doppler sonography in differentiating between benign and malignant adnexal masses. **Materials & Methods:** One hundred women diagnosed with adnexal masses underwent colour Doppler sonography. Resistance index (RI) and Pulsatility index (PI) were calculated in each case and lowest RI and PI obtained at any point in the mass were considered for analysis. Masses which were completely a vascular were considered as benign. Histopathological diagnosis was obtained in each case. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of colour Doppler were calculated. **Results:** Mean RI and Mean PI were significantly lower in malignant masses (0.34 & 0.95 respectively) as compared to benign masses (0.72 & 1.97 respectively). Out of 81 benign cases, Doppler could correctly diagnose 78 cases as benign, but labelled 3 cases as malignant which were actually benign. Out of 19 malignant cases, 16 cases were correctly diagnosed, whereas 3 cases were missed by Doppler. Our study showed a sensitivity of 84.2%, specificity of 96.3%, positive predictive value of 84.2%, negative predictive value of 96.3% and accuracy of 94% for colour Doppler. **Conclusion:** Colour Doppler sonography is helpful in differentiating benign from malignant adnexal masses.

**Keywords:** Colour Doppler, Adnexal mass, Sensitivity, Specificity.

## INTRODUCTION

Adnexal masses represent a spectrum of conditions from gynecological and non-gynecologic sources.[1] Adnexal masses present a diagnostic dilemma; the differential diagnosis is extensive, with most masses representing benign processes.[2 - 4] Most frequently, adnexal masses refer to ovarian masses or cysts; however, paratubal cysts, hydrosalpinx, and other non-ovarian masses are also included within the broader definition of adnexal masses.

Differentiation between benign and malignant ovarian masses is necessary because ovarian cancer is lethal and there are no proven screening techniques. Clinicians must consider the patient's medical profile (that is, risk factors, the size of the mass, clinical presentations) to critically evaluate the likelihood of an ovarian cancer. Diagnostic screening must include three components: an accurate medical history, a careful physical examination and judicious use of diagnostic procedures (for example ultrasonography, computed tomography).[5]

Various diagnostic modalities have been introduced over a period of time to diagnose and to differentiate between benign and malignant adnexal masses. Despite advances in diagnostic procedures, early detection and differentiation between benign and malignant adnexal masses still remains challenging.

Colour Doppler is a recent diagnostic modality in pre-operative assessment of adnexal masses. Colour

Doppler visually reflects the state of blood flow to the tumor. It is based on Folkman's theory of neovascularization[6] which states that tumor releases the factor known as tumor angiogenesis factor which stimulates rapid formation of new capillaries. Neovascularisation occurs in malignant tumors and results in lower pulsatile and resistance index.[7] Resistance index is defined as the maximum systolic velocity minus end diastolic velocity divided by maximum systolic velocity. Pulsatility index is defined as maximum systolic velocity minus end diastolic velocity divided by mean systolic velocity. Both indices increase with increasing distal vascular resistance and the two indices have a high correlation. A comparison of different studies shows that no standard has been established concerning which Doppler index to use or what cut off is most appropriate. However the resistivity index less than 0.4-0.8[8] and pulsatility index less than 1 are generally considered to be suspicious of malignancy. [8,9] Doppler ultrasound has yielded variable results in distinguishing benign from malignant mass with a sensitivity of 50-100% and specificity of 46-100%[10,11,12]. Different results are partly due to varying threshold values and corresponding trade-offs between specificity and sensitivity.

## MATERIALS AND METHODS

This prospective study was conducted at Lalla Ded Hospital, Government Medical College, Srinagar, over a period of one and half year.100 patients (Women in reproductive age group and postmenopausal women) diagnosed with adnexal masses on pelvic examination, conventional sonography and referred cases of adnexal masses to our hospital were included in the study. Prior to the study ethics committee permission was obtained from our college. An inform consent form was obtained from all the participants.

**Exclusion Criterion**

Unilocular anechoic small cyst (less than 5 centimeters) which resolves on follow up ultrasound examination, Tubal gestation, Masses that were found to arise from uterus .

All the patients were evaluated by colour Doppler ultrasonography using a Philips IU-22 machine with pulsed Doppler system and equipped with a colour velocity imaging system for colour blood flow codification. After characterizing masses by their morphology, colour velocity imaging gate was activated to identify blood flow. The resistance index and Pulsatility index were calculated in each case. The lowest pulsatility index and resistive index detected at any point in the mass were considered for analysis. The masses which were completely avascular with no blood flow were considered as benign.

The Doppler findings were considered suggestive of malignancy when:

Resistive index (RI) $\leq 0.45$[13]

Pulsatility index (PI) $<1.0$[8]

The definitive histopathological diagnosis was obtained in each case. Sensitivity, specificity, positive predictive valve, negative predictive value and accuracy of Colour Doppler ultrasonography were calculated.

## REULTS

The mean age of patients enrolled in the study was 37.5 years. 21 cases were postmenopausal and 79 cases were premenopausal. On histopathological examination, 81 cases were found to be benign and 19 turned out to be malignant. Blood flow was detected in 75 masses using Doppler whereas 25 masses were avascular and despite efforts no vessel could be identified for obtaining Doppler waveform. These avascular masses were considered as benign. Among 81 benign masses, blood flow was seen in 57 cases (70.37%) whereas 18 out of 19 (94.73%) malignant masses were vascularised (p value <0.001).

**Table 1: Vascularity of Masses**

| HPE | Present | | Absent | | p value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Malignant | 18 | 94.75 | 1 | 5.26 | <0.001 (Sig) |
| Benign | 57 | 70.37 | 24 | 29.62 | |

Mean RI for benign adnexal masses was 0.72 and for malignant masses it was 0.34.Mean PI for benign and malignant adnexal masses was 1.97 and 0.95 respectively.

**Table 2: Mean RI and Mean PI in Benign and Malignant Adnexal Masses**

| | | n | Mean | 95% Confidence Interval for Mean | | p value |
|---|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound | |
| Doppler_RI | Malignant | 18 | 0.34 | 0.30 | 0.39 | <0.001 (Sig) |
| | Benign | 57 | 0.72 | 0.68 | 0.76 | |
| Doppler_PI | Malignant | 18 | 0.95 | 0.71 | 1.18 | <0.001(Sig) |
| | Benign | 57 | 1.97 | 1.83 | 2.11 | |

Using Doppler study, 78 benign cases were correctly diagnosed whereas 3 cases were misdiagnosed as malignant which were actually benign.16 out of the 19 malignant cases were correctly diagnosed and 3 malignant cases were missed by Doppler

**Tabel 3: Histopathological Diagnosis in comparison with Doppler**

| Doppler Inference | Malignant | | Benign | | p value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Malignant | 16 | 84.2 | 3 | 3.7 | <0.001 (Sig) |
| Benign | 3 | 15.8 | 78 | 96.3 | |

The sensitivity, specificity, positive predictive value ,negative predictive value and accuracy of colour Doppler was 84.2%.96.3%, 84.2%,96.3%and 94 % respectively.

## DISCUSSION

The management of adnexal masses is a common and controversial clinical problem.[14] The differential diagnosis of benign from malignant tumors is essential in order to decide the optimal approach in each case.

Ultrasound has been extensively used in the pre-operative evaluation of adnexal masses. It has been shown to be sensitive but not specific. Most studies have reported false positive rates higher than 20%.[15]

Recently Colour Doppler with pulsed Doppler waveform analysis has been used as a tool to identify neovascularity in malignant masses. Folkman et al[6] demonstrated that tumor angiogenesis factors are essential for the promotion of neovascularization in malignant tumours[6,16]. Doppler waveform analysis provides high sensitivity and specificity and is superior to other methods for pre-operative evaluation of ovarian masses. It can accurately discriminate between malignant and non-malignant ovarian tumors using a simple measurement of the pulsatility index (PI) and resistivity index (RI) in the newly formed intra-tumoral vessels.

In the present study, 94.73% of malignant masses were found to be vascular compared to 70.37% of benign masses In a study done by JL Alcazar et al[13], 98.2 % of malignant tumors and 60.57% of benign tumors were vascular. Using Doppler study, malignant neoplasms offered a lower resistance to blood flow as measured by resistance index (RI) and pulsatility index (PI). Mean RI and PI were significantly lower in malignant masses compared to malignant masses (p value <0.001). Mean RI for benign and malignant masses in the present study was 0.72 and 0.34 while mean PI for benign and malignant adnexal masses was 1.95 and 0.97 respectively. UM Hamper et al[8] had obtained mean RI for benign and malignant masses at 0.77 & 0.50 and mean PI of 1.93 & 0.77 respectively. Fleischer et al[17] also described a significant difference between PI values of benign (1.8±0.8) and malignant masses (0.8±0.6). Timor Tritsch et al[18] have observed PI and RI values for benign and malignant ovarian tumours by using colour Doppler sonography as 1.17 & 0.64 respectively for benign and 0.52 & 0.39 respectively for malignant tumours. Despite different opinions regarding cut off values, all authors agree that recognition of angiogenesis as a reference point for malignant changes within the ovary, has proved to be a highly sensitive parameter. Although cut off values presented in different studies have been criticized, these thresholds are used for statistical analysis.

Our study suggested colour Doppler sonography as a precise tool with higher sensitivity and specificity for pre-operative characterisation and discrimination of benign from malignant adnexal masses. Sensitivity, specificity, positive predictive value, negative predictive value of colour Doppler in the present study

was 84.2%, 96.3% , 84.2% and 96.3% respectively. Our results are consistent with the studies of Fleischer et al[17], Timor Tritsch et al[18.]

## CONCLUSION

Colour Doppler sonography has added to the understanding and characterization of the adnexal lesions, based on its depiction of the vascularity of the masses. Doppler study is effective in the differentiation of adnexal masses.

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