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ORIGINAL ARTICLE

Efficacy of Doppler Ultrasound in Detection of Ovarian Malignancy

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ABSTRACT

Objective: To evaluate the accuracy of colour Doppler USG and b-mode USG preoperatively in detection of ovarian malignancy using histopathological diagnosis as gold standard

Methodology:

This cross-sectional study was conducted at Fauji Foundation hospital Rawalpindi from June, 2017 to Jan, 2020 after seeking the ethical approval from the hospital ethical committee A total of 96 female patients having adnexal masses on ultrasound were included in study. Enrollment in the study was subjected to written informed consent. Patients having adnexal mass of non-ovarian origin, patients not fit for surgery and lost to follow up were excluded from study. History taking and examination was followed by ultrasound and color-doppler of each patient. Color Doppler sonography was carried out with real-time ultrasound and Doppler scanner unit. All the included patients were undergone laparotomy after pre op workup. Histopathologies of all patients were traced. To avoid observer error, a designated trained operator performed doppler ultrasound from hospital own resource by using Toshiba Xario colour Doppler .Histopathology was also performed by hospital pathology laboratoty by trained histopathologist. All the included patients were undergone laparotomy after pre op workup. Histopathologies of all patients were traced .All the relevant findings were recorded in the pre-designed proforma. Data was entered and analysed in SPSS Version-26.

Result:

The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of Doppler with grayscale USG in detecting ovarian malignancy were calculated. The specificity was found to be 90.3% and sensitivity was 79.2%. Positive and negative predicative values were 92.9% and 73.1% respectively.

Conclusion:

Based upon the study findings, the Doppler USG's reliability can be established for detection of ovarian malignancies.

Keywords: Adnexal mass, Doppler, Ultrasonography, Ovarian malignancy

INTRODUCTION

Over decades, the ovarian cancers have emerged as a potential threat to life of women across the globe being the 7th most common cancer [1] and 5th most common cancer related deaths in females[2]. Early detection is crucial for life saving but as per data previously published the survival rate is 46.2% but in case of stage-I it can reach up to 90%[3]. Unfortunately, ovarian cancers mostly present at very advance stage contributing more to increased mortality rates.

Different modalities had been a choice when it came to prompt identification and categorization of ovarian malignancies. Ultrasound had ever since used for said purpose and various studies had reported this trend[4,5]. With the technical advancement in the form of Doppler added a new dimension to accurate diagnosis[6,7]. For the early detection of ovarian cancers, ultrasound and doppler have emerged as more useful modality[8]. It is also worth an integral option as differentiation of benign from the malignant hold critical importance for timely treatment[9]. For the lower-and-middle-income countries, where out of pocket expenses are more for provision of advance treatments, the early detection of ovarian cancers is need of time. The concept of present study was conceived considering the importance of these modalities so as to evaluate the diagnostic accuracy of colour Doppler USG and b-mode USG preoperatively in detection of ovarian malignancy in local population.

METHODOLOGY

This cross-sectional study was conducted at Fauji Foundation hospital Rawalpindi from June, 2017 to Jan, 2020 after seeking the ethical approval from the hospital ethical committee A total of 96 female patients having adnexal masses on ultrasound were included in study. Enrollment in the study was subjected to written informed consent. Patients having adnexal mass of non-ovarian origin, patients not fit for surgery and lost to follow up were excluded from study. History taking and examination was followed by ultrasound and color-doppler of each patient. Color Doppler sonography was carried out with real-time ultrasound and Doppler scanner unit. All the included patients were undergone laparotomy after pre op workup. Histopathologies of all patients were traced. To avoid observer error, a designated trained operator performed doppler ultrasound from hospital own resource by using Toshiba Xario colour Doppler. Histopathology was also performed by hospital pathology laboratory by trained histopathologist. All the included patients were undergone laparotomy after pre op workup. Histopathologies of all patients were traced .All the relevant findings were recorded in the pre-designed proforma. Data was entered and analysed in SPSS Version-26.

The masses were classified as suggestive of malignancy when the lowest calculated Pulsatility Index (PI) was <0.4. These indices later correlated with histopathological reports.

Data was entered and analysed in SPSS Version-26. Descriptive statistics were calculated for both qualitative and quantitative variables. For qualitative variables (marital status, parity), frequency / percentages were calculated. For all the quantitative variables like age, PI and RI, mean and +/- SD were calculated. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of grayscale USG alone and with colour Doppler were calculated, and the efficacy of colour Doppler study was adjudged using Chi-square test.

RESULTS

This cross-sectional study was carried out on 96 female aged 15-79 years. The mean age of the study participants was 46.63 ±14.6. Among the 96 participants, the mean parity was 3.35 ±2.50. Table-I presents the data pertaining to parity.

Table-1: Parity Status of Study Participants

Parity	Frequency (n)	Percent (%)
Nulliparous	23	24.0%
Multipara	52	54.2%
Grand multipara	21	21.9%
Total	96	100.0%

Based upon the statistical analysis, Table-II presents the specificity and sensitivity of Doppler USG in comparison to histopathology (Gold Standard). The specificity was found to be 90.3% and sensitivity was 79.2%. Positive and negative predicative values were 92.9% and 73.1% respectively.

Table-2: Doppler USG Diagnostic Accuracy in Comparison to Histopathology (Gold Standard)

Doppler usg findings * histopathology crosstabulation					
			Histopathology		Total
			Benign	Borderline or malignant	
Doppler usg findings	Benign	Count	65	5	70
		% within doppler usg findings	92.9%	7.1%	100.0%
		% within histopathology	90.3%	20.8%	72.9%
	Suspicious	Count	7	19	26
		% within doppler usg findings	26.9%	73.1%	100.0%
		% within histopathology	9.7%	79.2%	27.1%

DISCUSSION

Ovarian cancer is the seventh most common cancer in the world and the leading cause of death from any gynecological malignancy. Ovarian cancer when detected at an early stage has greater than 90% survival rate. It is frequently challenging to diagnose and characterize an ovarian mass at an early stage due to periodic asymptomatic physiological changes, atypical symptoms and insidious onset of the disease.[1]

Ultrasound is widely used as a preferred investigation for initial evaluation of the suspected adnexal masses because it has emerged as a relatively inexpensive, noninvasive and widely available technique. Sonographic evaluation of adnexal mass is based on external contour, internal consistency, size, ascites and peritoneal implants. Studies have shown that by studying the morphological features of ovarian masses by ultrasound, a reliable differentiation of benign and ovarian masses can be done. Color doppler with spectral analysis such as PI and RI improves characterization of ovarian neoplasm by means of quantitative blood flow measurements obtained from tumor vessels.[10] It is the matter of the fact that low impedance to blood flow with high velocity is indicative of malignancy whereas moderate to high impedance to blood flow is suggestive of benign tumors. 92 % of malignant tumors in Taori Kb et al study showed blood flow; conversely absence of blood flow is equally important that suggest the benign nature of tumor.[6]

Pulsitility index is calculated as PI= peak systole – end diastole / mean peak value. It is of particular importance in arteries in which there is reversible of diastolic flow and can be calculated from frequency trace without any need of beam vessels angles. There is no muscular layer in the newly formed tumoral vessels and these vessels have low impedance and high velocity flow, therefore the PI calculated in such vessels are low. In different studies PI of < 1 is considered as suggestive of malignancy .In a study conducted on 628 patients, Kurjak et al.[11] found and proposed the PI of <1 for all malignant ovarian tumors and it was supported by Valentin et al.[12]and Fleisher et al. in later studies.[13] However to optimize the study in terms of sensitivity and specificity, we, in our study took the cut off value as <0.4.

As per the analysis of present study , the mean age of participants were 46.63 +/_ 14.67. Literature does report age to be one of the most critical variable and risk factors for ovarian cancers. Findings from another study showed 68.6% of the benign lesions were reported in premenopausal females[14]

The findings of our study present the sensitivity to be 79.2% and specificity as 90.3%. These findings were nearly in line with those reported in another study where sensitivity was found to be 86.2% and specificity 97.58%[15]. However our findings are not favored by few other previous researches .[16] it may be due to the reason that although the studies previously reported erratic values in terms of sensitivity, specificity and positive predictive value[17] but better values in current times are attributed to the major technological advancement.

In another study conducted by Shah Dharita and Shah Sandip in India, B-mode USG achieved a sensitivity of 87.5%, a specificity of 45.45% , and a PPV of 61.4%, but when Pulsitility index and Resistance index were included, more acceptable values of sensitivity at 97.5% , specificity at 84.1 %, and positive predictive value at 84.78% were obtained.[18]

CONCLUSION

Hence we recommend that color Doppler ultrasound may be used in combination with grayscale USG as the first modality of choice for all patients presenting with ovarian masses. It will help in making a better diagnosis and may prevent unnecessary use of advanced imaging in a subgroup of patients.

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