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Sonological accuracy in defining various benign and malignant ovarian neoplasm with doppler and histopathological correlation

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Abstract

Introduction: Ovarian carcinoma represents the 6th most common female cancer and 4th leading cause of death due to cancers in women. It is seen predominantly after the third decade. Ovarian tumors is not a single entity but a complex wide spectrum of neoplasm involving a variety of histological tissues, ranging from epithelial tissues connective tissue, specialized hormone secreting to germinal and embryonic cells. The most common are the epithelial tumors forming 80% of all tumors in which 80% are benign and 20% malignant.

Aim: To analyse sonological accuracy in defining various benign and malignant ovarian neoplasm with doppler and histopathological correlation.

Materials and Methods: The present prospective study was conducted in the Department Of Radio-Diagnosis, at Muzaffarnagar Medical College from April 2019 to September 2020. The study group was consisted of 30 patients, referred from Gynecology and Surgery Department for a period of 18 months, to evaluate ovarian neoplasms.

Results: Maximum subjects were in the age group of 41-50 years (30%) followed by 51-60 (26.67%) as well as 20-30 years (26.67%). Pain along with abdominal swelling was revealed in 63.3% of the subjects. Abdominal swelling and pain was reported among 13.3% and 23.3% of the subjects respectively. According to histopathological diagnosis; benign and malignant lesion was reported among 56.7% and 43.3% of the subjects respectively. Sensitivity, specificity, positive predictive value and negative predictive value of B Mode Ultrasonography was 92.80%, 51.74%, 55.80% and 93.08% respectively and sensitivity, specificity, positive predictive value and negative predictive value of Doppler flow was 93.50%, 90.60%, 88.85% and 92.50% respectively when histopathological diagnosis was considered as gold standard.

Conclusion: An area of overlap exists between the range of values of benign and malignant masses with both on morphologic as well as haemodynamic assessment. In the overall scenario, Doppler flow is more accurate followed by B mode USG in predicting the nature of a mass.

Keywords: sonological accuracy, malignant ovarian neoplasm, doppler, histopathological correlation

Introduction

Ovarian carcinoma represents the 6th most common female cancer and 4th leading cause of death due to cancers in women. It is seen predominantly after the third decade. Ovarian tumors is not a single entity but a complex wide spectrum of neoplasm involving a variety of histological tissues, ranging from epithelial tissues connective tissue, specialized hormone secreting to germinal and embryonic cells. The most common are the epithelial tumors forming 80% of all tumors in which 80% are benign and 20% malignant. Out of malignant tumors, 90% are epithelial in origin. 80% of the primary tumors are from ovary and 20% are metastases from breast, GIT and colon. Malignancy of ovaries is the 2nd most common of all genital cancers. In the developing countries like India, ovarian cancer accounts for 10-15% of all gynecological cancers. A woman may develop ovarian cancer in the ratio of 1:70 to 1:100 in her lifetime [1].

Risk factors: Risk factors that predispose to ovarian cancer are [1, 2]:

- Low Parity
- Decreased Fertility
- Delayed Child bearing
- Familial predisposition
- High Dietary Fat
- Industrial Pollution
- Smoking
- Obesity
- Association with colon, breast and endometrial carcinoma
- Use of talc in perineum
- Genetic predisposition to BRCA-A and BRCA-2 mutation

Ovarian cancer has highest mortality rate among all gynaecological malignancies due to late diagnosis. Due to lack of early clinical symptoms, around 60%- 70% of women have advance disease (stage III or IV) at the time of diagnosis [3]. USG findings correlate morphologic images with gross macroscopic pathologic features of ovarian masses. However, when morphologic features alone are

applied to the prediction of ovarian malignancy, there is tendency to over diagnose malignant tumors because of a substantial overlap between malignant and benign masses. Therefore, addition of color Doppler imaging with pulsed Doppler spectral analysis improves the characterization of ovarian masses by means of quantitative blood flow measurements obtained from tumor vessels and so increases sensitivity and specificity of characterization of ovarian masses [4]. Hence the present study was conducted to analyse sonological accuracy in defining various benign and malignant ovarian neoplasm with Doppler and histopathological correlation.

Materials and Methods

- The present prospective study was conducted in the Department Of Radio-Diagnosis, at Muzaffarnagar Medical College from April 2019 to September 2020.
- The study group consisted of 30 patients, referred from Gynecology and Surgery Department for a period of 18 months, to evaluate ovarian neoplasms.
- Patients were enrolled in the study after obtaining written informed consent and approval from Institutional Ethical Committee.
- Using B-mode Ultrasonography machines - Alpinion E-Cube 8 C 1-6 CT Hz probe, V3 3-10 Hz probe and Samsung H60 1-7 AD Hz Probe, EVN 4-9 Hz probe, color Doppler and spectral Doppler were performed.
- TVS was also performed. B-mode morphological criteria was used for the present study.
- Flow results were recorded as being absent or present and further as normal or abnormal. Vessel location arrangement and morphology were noted.
- Spectral Doppler analysis was performed by calculating resistive index (RI) and pulsatility index (PI) values and the lowest value recorded in the masses were noted.
- RI <0.4 and PI <1 were taken as cutoff for ovarian malignancy.
- Patients excluded from the study were those having:
- Anechoic cyst which resolved on follow-up study.
- Pelvic mass of uterine origin determined either per-operatively or on histopathology report.
- Patients lost during follow-up.
- Patients beyond the 10th day of menstrual cycle- as low resistance flow of corpus luteum may mimic that it is associated with malignant neoplasms.

Observations and Results

Table 1: Age distribution among the study subjects

Age Group (in years)	N	%
20-30	8	26.67
31-40	2	6.67
41-50	9	30.00
51-60	8	26.67
>60	3	10.00
Total	30	100
Mean±SD	44.47±12.82	

The present prospective study was conducted in the Department of Radio-Diagnosis, Imaging at Muzaffarnagar Medical College from April 2019 to September 2020. The study group comprised of 30 patients, referred from Gynecology and Surgery Department to evaluate ovarian neoplasms. Maximum subjects were in the age group of 41-50 years (30%) followed by 51-60 (26.67%) as well as 20-30 years (26.67%). Minimum subjects were in the age group of 31-40 years (6.67%) followed by >60 years (10%) as shown in table 1.

Table 2: Education among the study subjects

Education	N	%
10th	5	16.67
12th	3	10.00
Graduate	11	36.67
Postgraduate	11	36.67
Total	30	100

Most of the subjects have done either graduation or post-graduation (73.34%) as shown in table 2.

Table 3: Religion among the study subjects

Religion	N	%
Hindu	20	66.67
Muslim	10	33.33
Total	30	100

Table 3 shows the religion among the study subjects. 66.67% of the subjects were Hindu while 33.33% of the subjects belonged to Muslim religion.

Table 4: Location of the study subjects

Location	N	%
Rural	14	46.67
Urban	16	53.33
Total	30	100

Table 4 shows the location among the study subjects. 46.67% of the subjects were from rural area while 53.33% of the subjects belonged to urban area.

Table 5: Symptoms among the study subjects

Symptoms	N	%
Abdominal Swelling	4	13.3
Pain	7	23.3
Pain, Abdominal Swelling	19	63.3
Total	30	100

Table 5 shows the symptoms among the study subjects. Pain along with abdominal swelling was revealed in 63.3% of the subjects. Abdominal swelling and pain was reported among 13.3% and 23.3% of the subjects respectively.

Table 6: Histopathological diagnosis among the study subjects

Diagnosis	N	%
Benign	17	56.7
Cystic teratoma	1	3.33
Endometrioma	2	6.67
Hemorrhagic Cyst	1	3.33
Inflammatory Lesion	6	20.00
Mucinous Cystadenoma	1	3.33
Serous Cystadenoma	6	20.00
Malignant	13	43.3
Clear cell carcinoma	2	6.67
Dysgerminoma	1	3.33
Mucinous carcinoma	4	13.33
Serous carcinoma	6	20.00

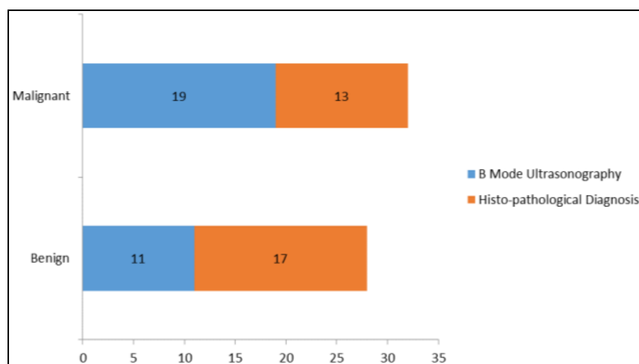
According to histopathological diagnosis; benign and malignant lesion was reported among 56.7% and 43.3% of the subjects respectively. Among the benign lesions, most common were inflammatory lesion as well as serous cystadenoma (20%). Among the malignant lesions, serous carcinoma were reported among 20% of the subjects (table 6).

Table 7: Comparison of B Mode Ultrasonography with Histopathological diagnosis

		Histopathological diagnosis		Total
		Benign	Malignant	
B Mode Ultrasonography	Benign	9	2	11
	Malignant	8	11	19
	Total	17	13	30
Chi Square Test		9.38		
p value		0.005*		
Sensitivity		92.80%		
Specificity		51.74%		
+ve predictive value		55.80%		
–ve predictive value		93.08%		

*: statistically significant

Table 7, graph 1 compares the diagnosis of B Mode ultrasonography with histopathological diagnosis (gold standard). B Mode ultrasonography predicts benign lesion in 11 cases, out of which 2 were malignant as revealed by histopathological diagnosis. B Mode ultrasonography predicts malignant lesion in 19 cases, thereby overestimating malignant lesion in 6 cases when compared with histopathological diagnosis. Sensitivity, specificity, positive predictive value and negative predictive value of B Mode ultrasonography was 92.80%, 51.74%, 55.80% and 93.08% respectively when histopathological diagnosis was considered as gold standard.



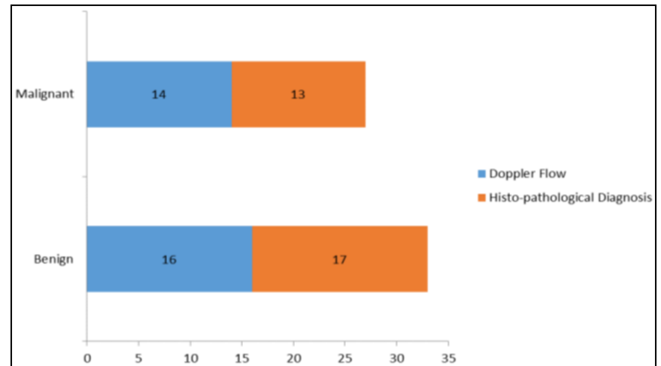
Graph 1: Comparison of B Mode Ultrasonography with Histopathological diagnosis

Table 8: Comparison of Doppler flow with Histopathological diagnosis

		Histopathological diagnosis		Total
		Benign	Malignant	
Doppler Flow	Benign	15	1	16
	Malignant	2	12	14
	Total	17	13	30
Chi Square Test		16.81		
p value		. <0.01*		
Sensitivity		93.50%		
Specificity		90.60%		
+ve predictive value		88.85%		
–ve predictive value		92.50%		

*: statistically significant

Table 8, graph 2 compares the diagnosis of Doppler flow with histopathological diagnosis (gold standard). Doppler flow predicts benign lesion in 16 cases, out of which 1 was malignant as revealed by histopathological diagnosis. Doppler flow predicts malignant lesion in 14 cases, thereby overestimating malignant lesion in only 1 case when compared with histopathological diagnosis. Sensitivity, specificity, positive predictive value and negative predictive value of Doppler flow was 93.50%, 90.60%, 88.85% and 92.50% respectively when histopathological diagnosis was considered as gold standard.



Graph 2: Comparison of Doppler flow with Histopathological diagnosis

Discussion

The ovarian malignancy is the third leading cause of cancer in females in population based cancer registry of the Indian district (year 2009). Therefore early diagnosis and management of ovarian tumors has significant clinical importance. Effective evaluation of ovarian malignancy using Color and Spectral Doppler has been a subject of challenge as its implication [5].

USG, because of being relatively inexpensive, noninvasive, and widely available, is considered to be the method of choice of investigation in the initial evaluation of suspect adnexal masses. Transabdominal USG, and/or endovaginal USG, should be performed for the evaluation of adnexal masses. Color Doppler with spectral analysis using indices such as PI and RI is of immense value in yielding better characterization of ovarian neoplasm. It is factually correct that low impedance to blood flow with high velocity is suggestive of malignancy, whereas moderate to high impedance to blood flow is correlated to benign tumors. Resistive indices less than 0.4– and pulsatility indexes less than 1.0 are generally considered to be suspicious for malignancy [5].

The present study aimed at assessing and differentiating benign and malignant ovarian neoplasms with the help of B-mode ultrasonography in conjunction with Color Doppler and Spectral Doppler and to correlate the imaging findings with histopathologic findings. The newly formed tumoral vessels are devoid of muscular layer, have low impedance-high velocity flow, and thus the resistance measured by color flow indices such as resistance indices (RI) and pulsatility indices (PI) are low, which can be used as predictors of ovarian malignancy.

Age Group

Maximum subjects were in the age group of 41-50 years (30%) followed by 51-60 (26.67%) as well as 20-30 years (26.67%). Minimum subjects were in the age group of 31-40

years (6.67%) followed by >60 years (10%) in the present study. Age is the most important independent risk factor for ovarian cancer in the general population Thus, adnexal masses in postmenopausal women are more likely to be malignant than those in premenopausal women. In our study also, we noted that the risk of malignancy increased with increasing age.

Symptoms

In the present study, pain along with abdominal swelling was revealed in 63.3% of the subjects. Abdominal swelling and pain was reported among 13.3% and 23.3% of the subjects respectively.

Histopathological Diagnosis

According to histopathological diagnosis; benign and malignant lesion was reported among 56.7% and 43.3% of the subjects respectively. Among the benign lesions, most common was serous cystadenoma, found among 20% of the subjects. Among the malignant lesions, serous carcinoma was reported among 20% of the subjects respectively in this study.

B Mode Ultrasonography diagnosis

In our study, B Mode Ultrasonography predicts benign lesion in 11 cases, out of which 2 were malignant as revealed by histopathological diagnosis. B Mode Ultrasonography predicts malignant lesion in 19 cases, thereby overestimating malignant lesion in 6 cases when compared with histopathological diagnosis. Sensitivity, specificity, positive predictive value and negative predictive value of B Mode Ultrasonography was 92.80%, 51.74%, 55.80% and 93.08% respectively when histopathological diagnosis was considered as gold standard.

Potential pitfall of B Mode USG for ovarian masses include inter observer variation, experience of radiologist and inability to compare previous USG imaging as it is real time modality. These can lead to diagnostic overcalls and undercalls [6, 7]. Also the sensitivity of morphologic analysis with US in predicting malignancy in ovarian tumors has been shown to be 85%–97%, whereas its specificity ranges from 56% to 95% and therefore, had the limited usefulness of sensitivity in individual patients because of low specificity and PPV [8, 9].

Doppler flow Diagnosis

In our study, Doppler flow predicts benign lesion in 16 cases, out of which 1 was malignant as revealed by histopathological diagnosis. Doppler flow predicts malignant lesion in 14 cases, thereby overestimating malignant lesion in only 1 case when compared with histopathological diagnosis. Sensitivity, specificity, positive predictive value and negative predictive value of Doppler flow was 93.50%, 90.60%, 88.85% and 92.50% respectively when histopathological diagnosis was considered as gold standard.

It can be summarized from the present study that Doppler scan (Colour + Spectral) is the modality of choice for the patients with adnexal masses to establish the diagnosis of ovarian malignancy.

Conclusion

The present study evaluates ovarian mass by B Mode Ultrasonography and Doppler flow considering histopathological examination of post-operative specimen as gold standard. The purpose of this work was to study the morphological characteristic of ovarian masses by B mode. USG and change of spectral Doppler wave form characteristic (RI/PI) of ovarian masses and differentiate them into benign and malignant lesions with a correlation of histopathological finding. The morphologic scores of benign masses are comparatively lower than that of malignant masses. A mass showing absence of color flow signals on color Doppler is more likely to be benign, though reverse is not true. Low resistance to blood flow with low pulsatility and resistive indices is a feature of malignant masses. High resistance blood flow with high PI and RI values is suggestive of benign masses. An area of overlap exists between the range of values of benign and malignant masses with both on morphologic as well as haemodynamic assessment. In the overall scenario, Doppler flow is more accurate followed by B mode USG in predicting the nature of a mass.

References

1. VG Padbidri, Shirish N Dafary. Shaw's Text Book of Gynecology, 14th Edition, 238-284.
2. Poonam P. A comparative study of benign and malignant ovarian tumors in tertiary care center. IAIM. 2017; 4(7):144-150.
3. Salem S, Wilson SR. Gynaecological ultrasound In Rumack Carol M. Diagnostic Ultrasound 3rd edition volume 1. Missouri: Elsevier Inc, 2005, 563.
4. DePriest PD, Shenson D, Fried A, Hunter JE, Andrews SJ, Gallion HH, *et al*. A morphology index based on sonographic findings in ovarian cancer. Gynecol Oncol. 1993; 51(3):7-11.
5. Goyal M, Agarwal VK. Diagnostic accuracy of B-mode USG and Doppler scan for ovarian lesions. J Clinical Diagnostic Res: JCDR. 2016; 10(9):01-04.
6. Shah D, Shah S, Parikh J, Bhatt CJ, Vaishnav K, Bala DV, *et al*. Doppler ultrasound: a good and reliable predictor of ovarian malignancy. J Obstet Gynaecol India. 2012; 63(3):186-189.
7. Patel MD. Pitfalls in the sonographic evaluation of adnexal masses. Ultrasound Q. 2012; 28(1):29-40.
8. Sehgal N. Efficacy of color Doppler ultrasonography in differentiation of ovarian masses. J Mid-life Health. 2019; 10(1):22.
9. Stein SM, Laifer-Narin S, Johnson MB, Roman LD, Muderspach LI, Tyszka JM, *et al*. Differentiation of benign and malignant adnexal masses: relative value of gray-scale, color Doppler, and spectral Doppler sonography. AJR Am J Roentgenol. 1995; 164(2):381-6.