Original Research Article

Sonomorphology and colour flow Doppler studies in differentiating between benign and malignant ovarian masses

Shyamala Jothy M.*, Anju Padmasekar

Department of Obstetrics and Gynecology, RajaMirasudhar Hospital, Government Thanjavur Medical College, Thanjavur, Tamilnadu, India

*Correspondence:
Dr. Shyamala Jothy M.,
E-mail: drmsjothy@gmail.com

ABSTRACT

Background: Ovarian cancer is the most frequent cause of death from Gynaecological malignancies in the world. Most patients with epithelial ovarian cancer are asymptomatic in early stage disease and usually present with stage III or IV disease. There are various screening methods for detection of ovarian cancer like bimanual pelvic examination, ultrasound examination (TVS and TAS) with or without color Doppler flow imaging and measurement of various circulating proteins like CA 125. The Purpose of a study is to determine optimal cut off point for a morphological scoring system and color flow directed Doppler values to differentiate benign and malignant ovarian masses.
Methods: This study was done at Department of obstetrics and Gynaecology, Government Rajah Mirasudhar Teaching Hospital attached to Government Thanjavur Medical College, Thanjavur, Tamilnadu, India during the period of June – 2011 to October – 2012. This study consisted of 73 patients, 3 patients were not operated as they were not fit for surgery for medical reasons. Hence 70 patients were included in the study. A note was made of their main symptoms at admission, Parity, menopausal status, family history of carcinoma. Patients admitted with diagnosis of ovarian masses and clearly ovarian by sonomorphology and surgery were only included in this study. Morphological Score, RI and PI were calculated. All patients underwent exploratory laparotomy with surgical removal of the tumor. The final diagnosis obtained based on HPE were classified as either benign or malignant. The score of each mass and the Doppler values were assessed individually and in combination with regard to its relationship to final diagnosis.
Results: In summary the resistance to flow measurement obtained by Doppler had a higher sensitivity and specificity compared to the morphological scoring system in differentiating benign and malignant ovarian masses. The combination of morphological score and Doppler Measurements improved the specificity positive predictive value for differentiating benign and malignant ovarian masses.
Conclusions: The combination of ultrasound and Doppler values is better in differentiating benign from malignant ovarian masses. The cut off point for ultrasound guided morphological scoring system was 4 and Doppler velocimetry for differentiating benign and malignant ovarian masses was a RI of 0.55 and PI of 0.8

Keywords: HPE, PI, RI, Ultrasonography

INTRODUCTION

Ovarian cancer is the most frequent cause of death from gynaecological malignancies in the world. Ovarian cancer has a prevalence of 50 /100,000 and an annual incidence rate of 14/100,000. Despite advances in treatment and attempts at early diagnosis, long term survival is bleak, with only 40 % of patients surviving 5 years. A women's risk of having ovarian cancer[4] at birth in her life is 1-1.5% and dying from ovarian cancer is

0.5%. Most patients with epithelial ovarian cancer are asymptomatic in early stage disease and usually present with stage III or IV disease. Their 5yr survival is <25%. The minority of patients discovered with early stage disease have 5year survival rate of 80-90%. There are various screening methods[15] for detection of ovarian cancer like bimanual pelvic examination, ultra sound examination (TVS and TAS)[3,5,7,10,23,28,30] with or without colour Doppler flow imaging[2,11-13,17,19,22,25,27,29] and measurement of various circulating proteins like CA 125.[1,6,8,20] In analyzing the screening test by measuring CA 125 level and performing transvaginal ultrasound examination[26] appears to provide the highest specificity and positive predictive value for the detection of ovarian cancer.

The aim of the study was to determine optimal cut off point for a morphological scanning system and colour flow directed Doppler values to differentiate benign and malignant ovarian masses and to evaluate the above methods in differentiating benign from malignant ovarian masses.

METHODS

This study was done at RMH Thanjavur during the period of June 2011 to November 2012. This study is a prospective study. This study consisted of 73patients, 3 patients were not operated as they were not fit for surgery for medical reasons. Hence 70 patients were included in the study (3-bilateral). A note was made of their main symptoms at admission, parity, menopausal status, family history of carcinoma.

Inclusion Criteria

Patients admitted with diagnosis of ovarian masses and clearly ovarian by sonomorphology and surgery were only included in this study.

Exclusion Criteria

- Ovarian masses in pregnant women - as low RI associated with pregnancy may alter the RI on Doppler.
- Patients beyond the 10th day of menstrual cycle - as low resistance flow of corpus luteum may mimic that it is associated with malignant neoplasms (Table 1).
- Transabdominal Doppler using a Toshiba machine with a 3-5 mHz as performed on all these patients after preliminary ultrasound. CFM was used to identify vessels in the tumor. Then the sampling point is identified and spectral waveforms of the vessels and several measurements like peaksystolic and end diastolic velocity from the wall, septum, papillations (if present), solid focus (or) echogenic core were taken. RI and PI were calculated. The lowest value obtained was included in the study.
- All patients underwent exploratory laparotomy with surgical removal of the tumor. The final diagnosis obtained based on HPE was classed as either benign or malignant. Borderline tumors were considered malignant. The score for each mass and the Doppler values were assessed individually and in combination with regard to its relationship to the final diagnosis.

RESULTS

It is evident that there is a significant difference in the mean values of benign (2.40) and malignant (4.87) ovarian tumors, but the range of score values was similar. This suggests that some of the benign tumor score is high while a few malignant tumors had low scores. 93% (58/62) of benign tumors had score <4 while 75% (6/8) of malignant tumors had score ≥4.80 % (50/62) of benign tumors had score <3 while 87.5% (7/8) of malignant tumors had score ≥3. Hence it is evident that most of the benign tumors had score in lower range and most malignant tumors in the higher range.

Table 1: Morphological score.

Parameter	0	1	2	3
Wall structure	Smooth/small irregularities < 3mm	-	Solid	Papillary Projection>3mm.
Shadowing	Present	absent	-	-
Septae	None (or) thin < 3mm	Thick > 3mm	-	-
Echogenicity	Sonolucent (or) low level echoes or echogenic core*	-	-	Mixed (or) high

Total score range between 0-8. *Includes echogenic masses such as mature cystic teratoma.

Table 2: Score value.

HPE	No.	Range of score values	Mean
Benign	62	0-7	2.40
Malignant	8	1-8	4.87

Using the cut off value of ≥3, 1/8 malignant masses were rightly identified but 22/62 benign masses were wrongly diagnosed as malignant. Using the cut off value of ≥4, 6/8 malignant masses were correctly identified while only 12/62 benign masses were considered malignant.

Table 3: Distribution of USG score in benign and malignant ovarian lesions.

Score value	No. of benign tumors (HPE)	No. of malignant tumors (HPE)
0	0	0
1	15	0
2	25	1
3	10	1
4	8	2
5	3	2
6	1	0
7	0	2
8	0	0
	62	8

Overall, malignant tumors demonstrated low resistance flow than benign tumors. Mean RI for malignant tumors was 0.42 with range of 0.28-0.72. mean RI for benign tumors was 0.67 with range of 0.2-1. Mean PI for malignant tumors was 0.67 with range 0.33-1.15. Mean PI for benign tumors was 1.2 with range of 0.4 to 1.8.

Table 4: Comparison of performance of score value >4OR >3IN predicting malignancy.

	>3	>4
Sensitivity	96.3	92.6
Specificity	66	77.27
Positive predictive value	63.4	71.4
Negative predictive value	96.7	94.44
False positive	34	22.7
False negative	3.7	7.4

Table 5: Doppler values of benign and malignant tumors.

Doppler values		Range	Mean
RI	Benign	0.2-1	0.67
	Malignant	0.28-0.72	0.42
PI	Benign	0.4-1.8	1.2
	Malignant	0.33-1.15	0.67

DISCUSSION

Statistical analysis of resistive index

Of 70 cases, the mean RI values[9,19] for benign tumor and malignant tumor was 0.67 and 0.42.A statistically significant P value <0.05 was obtained for RI value. Based on receiver operating characteristics curve(ROC) with area under curve of 95% confidence interval RI of 0.55 and 0.6 has optimal sensitivity and specificity and the best cut off for RI was 0.55 which gave a sensitivity of 96.29%, specificity 84.04%, positive predictive value 78.79% and negative predictive value 97.37% (Table 6). With a previously proposed RI value of 0.4, the sensitivity and

specificity of malignant tumors in our population were 20% and 95%.

Table 6: RI values of benign and malignant tumors.

RI value	Benign	Malignant	Total
<0.55	11	7	18
>0.55	51	1	52
	62	8	70

Statistical analysis of pulsatility index

Of 70 cases the mean PI value for benign tumor and malignant tumor was 1.2 and 0.67. The mean PI[16,18,24] in the benign and malignant group was significantly different. Based on receiver operating characteristics curve with area under curve of 95% confidence interval, the best cut off for PI was 0.8 which has a sensitivity of 96%, specificity of 81%,positive predictive value 76%,negative predictive value 97% and P value of <0.05 was obtained which was statistically significant. By using a previously proposed cut off value for PI of 1.0 with a value less than this considered indicative of malignancy, the sensitivity and specificity in our population was 96.3% and 77.27% (Table 7).

Table 7: PI values of benign and malignant tumors.

PI value	Benign	Malignant	Total
<0.8	21	7	28
>0.8	41	1	42
	62	8	70

Sonography often has a pivotal role in the evaluation of ovarian masses. While grey scale sonography is highly sensitive in identifying ovarian cancer, its diagnostic specificity has been poof. In an attempt to improve the specificity of ultrasound, the use of color Doppler sonography[2,11-13,19,22,25,27] in addition to grey scale imaging has been proposed. In present study, 70 patients were evaluated using morphologic scoring system[14,21,26,28,30] proposed by JP Lerner et al and colour flow directed Doppler measurements were taken. In my study the size of the tumour were not taken into account as it was not a significant factor in predicting malignancy. All patients who had bilateral tumours were diagnosed as malignant, while all the benign tumours were unilateral. The menopausal status was a significant factor as 65% of the patients with carcinoma were postmenopausal. The optimal cut off point for morphologic score in my study is 4 and for RI and PI it is 0.55 and 0.8 respectively.

CONCLUSION

In summary, the resistance to flow measurements obtained by Doppler had a higher sensitivity and specificity compared to the morphologic scoring system

in differentiating benign and malignant ovarian masses. The specificity of the scoring system was hampered by many benign masses that had high scores. If the above modalities are combined, malignancy can be ruled out in many masses that are benign by histopathology but nevertheless appear malignant on ultrasound and will guide the management protocols. The combination of morphological score and Doppler measurements improved the specificity and positive predictive value for differentiating benign and malignant ovarian masses.

1. The combination of ultrasound and Doppler values is better in differentiating benign from malignant ovarian masses.
2. The cut off point for ultrasound guided morphologic scoring system was 4 and Doppler velocimetry for benign and malignant ovarian masses was a RI of 0.55 and PI of 0.8.

ACKNOWLEDGEMENTS

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