ORIGINAL RESEARCH ARTICLE

Ultrasound Evaluation of Adnexal Masses and its Correlation with Ultrasound Scoring, CA-125 and Histopathological Findings

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ABSTRACT

Introduction: Adnexal masses are commonly encountered in pre and post-menopausal women. Routine ultrasound evaluation of the pelvis is paramount for predicting malignant lesions and for preoperative planning. Techniques based on multiple USG characteristics allow for more accurate evaluation. Study objectives were to assess the common morphological characteristics of malignant lesions and the accuracy of ultrasound for the same and to validate the precision of existing scoring systems to predict malignancy.

Material and Methods: The prospective study involved 51 patients diagnosed with adnexal mass on USG at M.S Ramaiah Hospitals, Bangalore between November 2016 and June 2018. USG characteristics of these masses were assessed and correlated with final diagnosis and with USG scoring systems (Risk of Malignancy Index, Sassone score). Results were calculated with respect to sensitivity, specificity, positive and negative predictive values.

Results: Out of the 51 patients, ultrasound was able to diagnose malignancy in 83.3% of the cases and with greater accuracy (P=0.000). Menopausal status (P=0.0391), echogenicity (P=0.0167), inner wall structure (P=0.0092), intramural nodule or solid areas (P=0.0001), vascularity (P=0.0072), and presence of ascites (P=0.0264) were found to be significant in discriminating benign and malignant masses. CA-125, RMI and Sassone score showed statistical significance in predicting malignancy and the corresponding sensitivities and specificities noted were 71.4% and 56.8%, 71.4% and 78.4%, and 85.7% and 56.8% (P < 0.05).

Conclusion: USG can be recommended as a reliable imaging modality for the characterization of adnexal masses. The existing scoring systems such as RMI and Sassone score are also sensitive in predicting the malignancies.

Keywords: Ultrasound, Ovarian Mass, RMI, Sassone Score

INTRODUCTION

According to International Ovarian Tumour Analysis (IOTA), an adnexal lesion is defined as 'the part of an ovary or an adnexal mass that is judged from an assessment of ultrasound images to be inconsistent with normal physiologic function'.[1] Adnexal mass, which may range from simple cyst to benign or malignant ovarian mass, is one of the most common pathological conditions noted in gynecologic practice and it can occur in women of all ages. The causes of adnexal masses noted in premenopausal females include ovarian cysts, tumors, polycystic ovaries, abscesses, and ectopic pregnancy. Whereas in menopausal women, the probable causes include fibroid and malignant tumors, and fibromas.[2] The overall incidence of malignant neoplasms noted in adnexal masses is around 1-8%. Ovarian cancer has been identified as the fifth most common cause of cancer death in females.[3] The incidence of adnexal masses is estimated to be around 1 in 81 to 1 in 8000 pregnancies.[4] The occurrence of adnexal mass during gestation could be complicated by pain due to rupture, torsion, labor obstruction or bleeding/infection.[4]

According to the 2008 American College of Obstetricians and Gynecologists (ACOG), females with adnexal masses possess 5-10% risk of need for surgery and the risk of being diagnosed with ovarian cancer in subjects who undergo surgery is around 13–21%.The guidelines have also highlighted the limited potential of pelvic examinations in identifying adnexal masses, especially in subjects with BMI >30 kg/m^2.[5] In the recent years, USG has emerged as a quick, cost -effective and reliable technique for the initial assessment of abdominal masses, especially pelvic masses, owing to its established role in characterizing such lesions. The imaging modalities that are used to further evaluate the lesions are computed tomography and magnetic resonance

imaging. The most fool-proof method of confirming the malignant nature of an adnexal lesion is a histopathological diagnosis and about 30% of all adnexal masses operated for suspected malignancy turn out to be benign.[6]

The present study was intended to assess the morphological characteristics of various adnexal masses on USG (transabdominal and/or transvaginal) and color Doppler. The study corroborated the accuracy of USG in differentiating benign and malignant masses by comparing with histopathological diagnosis. It also validated the precision of existing ultrasound scoring systems in the prediction of malignancy.

MATERIAL AND METHODS

The prospective study involved patients admitted in a super specialty hospital based in Bangalore, India between November 2016 and June 2018. The inclusion criterion considered was those who were diagnosed with adnexal mass on USG at the department of radiodiagnosis. The study excluded patients who did not undergo histopathological examination of the detected mass. All the recruited subjects were interviewed to collect the relevant clinical data. USG was used to diagnose the following conditions: the presence of a solid component, thick walled cysts, papillary nodules, septa >3 mm thickness, irregular thick septations, presence of ascites, peritoneal deposits and lymphadenopathy.[7] RMI and Sassone scores were calculated for all the patients who had undergone USG.[8, 9] The patients were evaluated either via transabdominal and/or transvaginal scan (TAS or TVS) along with Doppler using Voluson 730 Pro GE. Imaging characteristics were observed as present or absent, and the lesions were subcategorized based on the feature and frequency of occurrence of those characteristics.

Risk of malignancy score was calculated with a simplified regression equation obtained from the product of menopausal status score (M), ultrasonographic score (U), and absolute value of serum CA-125.[10-12] RMI score >200 was considered for suspected malignancy. Descriptive statistics of the characterization of adnexal masses was carried out and the results were summarized in terms of percentage. Sensitivity, specificity and positive predictive value (PPV) were used for validation of the effectiveness of ultrasound in predicting the

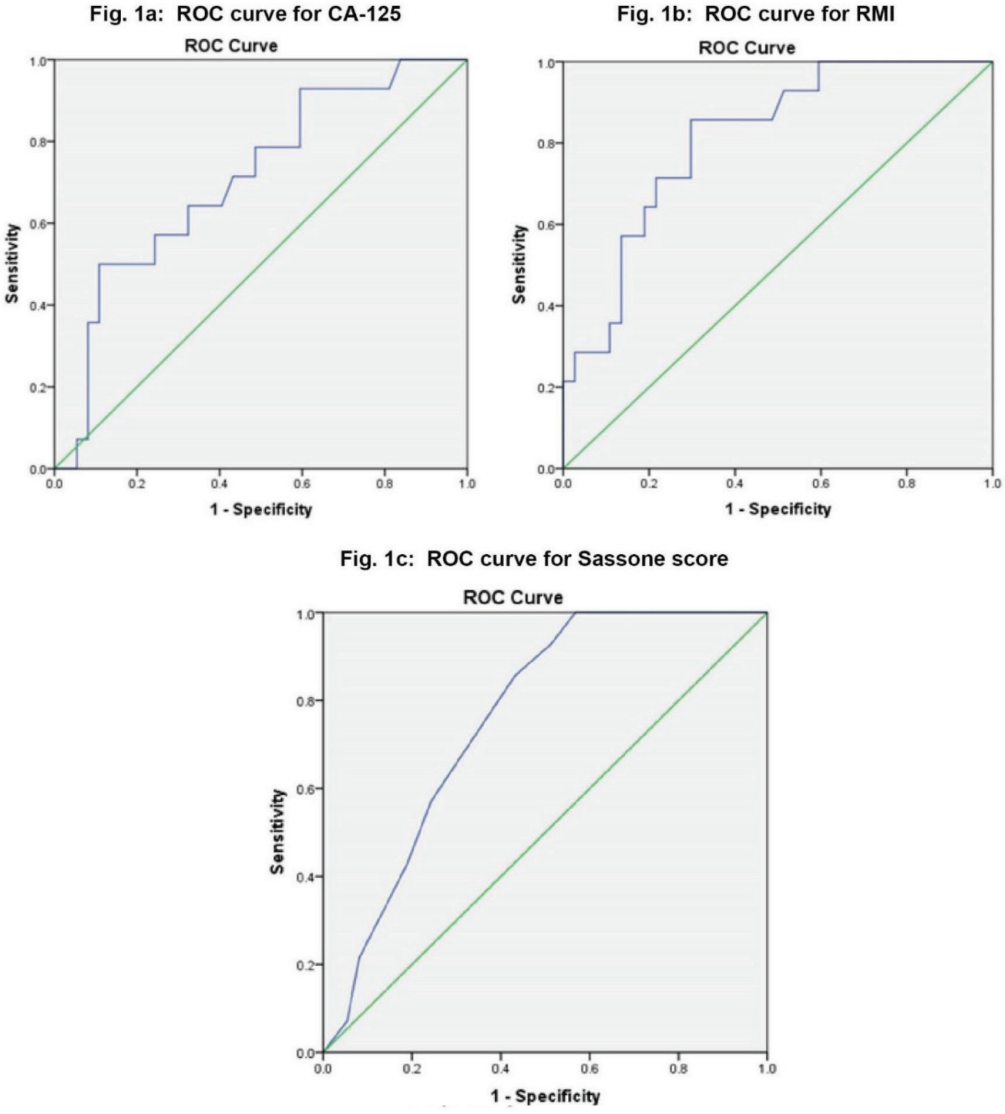

Figure-1: ROC curves showing the association between specificity and sensitivity for CA-125, RMI and Sassone score in diagnosing malignant lesions

malignancy. Each variable considered for the study was cross tabulated with the final diagnosis to validate its potential to predict the malignancy.

RESULTS

The study considered 51 patients detected with adnexal masses on USG. Among these subjects, 30 were premenopausal and 21 were postmenopausal. Comparison of menopausal status with the final diagnosis demonstrated that 83% of the pre-menopausal subjects had benign lesions, whereas it was only 57% in post-menopausal patients. With regard to various echogenic characteristics, nearly 45% lesions had mixed echogenicity. Smooth inner wall lesions were found to be benign in 92% of the cases. Whereas, irregular inner walls were malignant in 45% of the cases. Nearly 50% of the Nearly 50% of the were benign in 71-76% of the cases. Comparison of intramural nodule or solid areas with the final diagnosis demonstrated that around 96% of the lesions without solid components were benign and 52% with a solid component were malignant (Table 1).

With respect to vascularity, nearly 57% of the lesions with internal vasclarity were found to be malgnant; whereas 94% of the avascular lesions were noted to be benign. Benign lesions were noted in 81% of the subjects who did not show the presence of ascites. With regard to the accracy of USG in diagnosing adnexal masses, nearly 90% of the benign and 83% of the malignant lesions were correctly diagnosed through USG (Table 1). Menopausal status (P= 0.0391), echogenicity (P=0.0167), inner wall structure (P=0.0092), intramural nodule or solid areas (P=0.0001), vascularity (P=0.0072), and presence of ascites (P=0.0264) were found to be significant in differentiating benign and malignant lesions. In addition, the use of USG was found to be highly significant in differentiating benign and malignant lesions (P=0.000) (Table 1).

Comparison of the size of the adnexal masses between benign and malignant lesions demonstrated that benign masses ranged between 21 to 221, while malignant masses between

Variables	Final diagnosis		P Value
	Benign, no. of subjects (%)	Malignant, no. of subject (%)	
Menopausal status			0.0391
Pre-menopausal	25 (83)	5 (17)	
Post-menopausal	12 (57)	9 (43)	
Echogenicity			0.0167
Sonolucent	18 (95)	1 (5)	
High	2 (100)	0	
Low	1 (100)	0	
Mixed	16 (55)	13 (45)	
Inner wall structure			0.0092
Smooth	23 (92)	2 (8)	
Irregular	11 (55)	9 (45)	
Mostly solid	3 (50)	3 (50)	
Wall thickness			0.3358
Mostly solid	3 (50)	3 (50)	
Thick	6 (67)	3 (33)	
Thin	28 (78)	8 (22)	
Septations			0.7062
Thick	1	1	
Thin	19	6	
No	17	7	
Intramural nodule or solid areas			0.0001
Present	12 (48)	13 (52)	
Absent	25 (96)	1 (4)	
Vascularity			0.0072
Present	6 (42)	8 (57)	
Minimal	4 (57)	3 (43)	
Peripheral	10 (83)	2 (16)	
Absent	17 (94)	1 (6)	
Ascites			0.0264
Present	7 (50)	7 (50)	
Absent	7 (19)	30 (81)	
USG accuracy			0.0000
Benign	35 (90)	4 (10)	
Malignant	2 (17)	10 (83)	

Table-1: Comparison of different variables with the final diagnosis

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Variables	Benign	Malignant
No. of subjects	37	14
Maximum	221	172
Minimum	21	39
Std. deviation	56.23	41.55
Median	85	100.50
Mean	101.68	100.57

Table -2: Comparison of the average size of the lesions benign vs. malignant

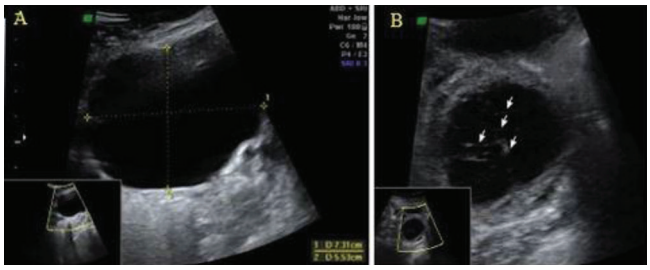

Figure-2: Right papillary cystadenoma and left hemorrhagic cyst: TAS showing a large cystic lesion in the right ovary and a cystic lesion with lace-like internal septations in the left ovary

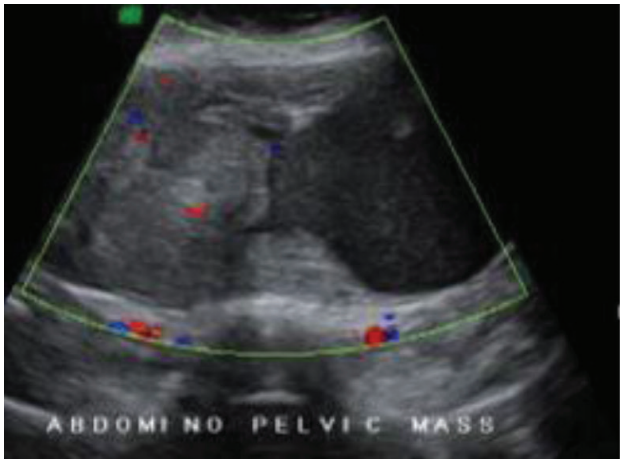

Figure-3: Low grade papillary serous carcinoma: Solid component with vascularity (Malignant adnexal mass)

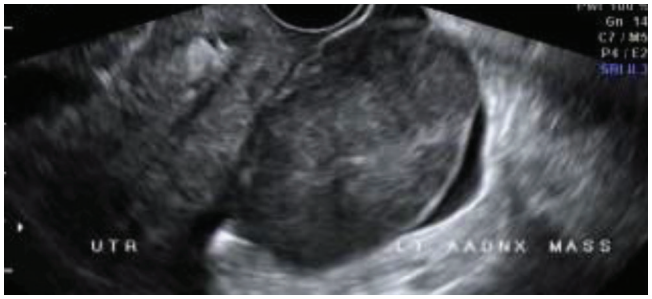

Figure-4: Fibrothecoma: Solid ovarian lesion seen on TVS

39 to 172 (Table 2). The cut-off value determined for ROC curve for CA-125 was ≥ 21 (Table 3). The correspoding sensitvity and specificty noted were 71.4% and 56.8% with area under the curve of 70.8% (P=0.023, signifcant). The values ranged from 0.5 to 830 for benign cases (mediian= 18.8) and 8 to 627 for malignant lesions (median= 78.7)

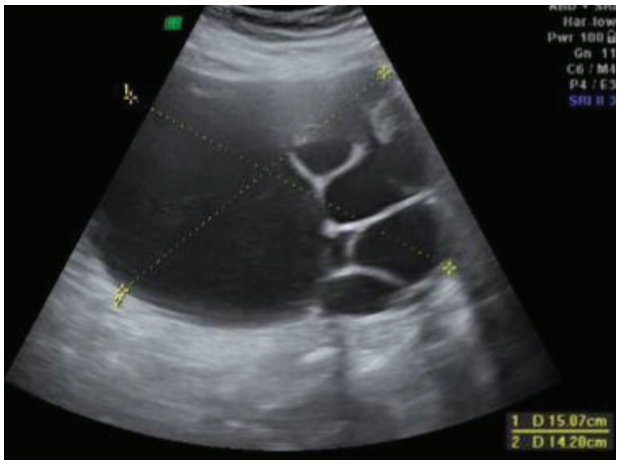

Figure-5: Serous cystadenoma : Multiloculated cystic lesion replacing the ovary on USG

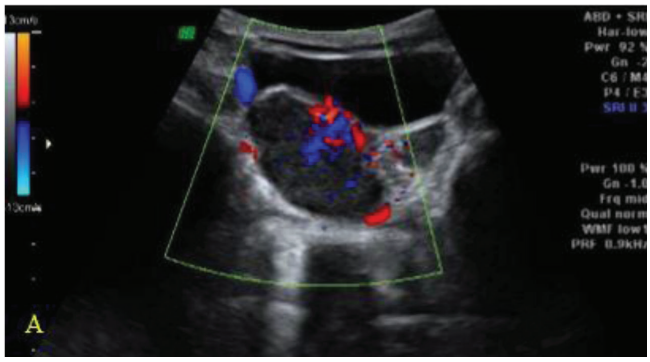

Figure-6: Small round blue cell tumour : A solid lesion appearing predominantly hypoechoic on USG with internal vascularity

(Fig.1a). The cut-off value determined for ROC curve for RMI was ≥120 (Table 3). The correspoding sensitvity and specificty noted were 71.4% and 78.4% with area under the curve 81.2% (P=0.01, signifcant) (Fig.1b). The cut-off value determined for ROC curve for Sassone score was ≥8 (Table 4). The correspoding sensitvity and specificty noted were 85.7% and 56.8% with area under the curve 76% (P=0.015, signifcant) (Fig.1c).

DISCUSSION

The present study considered all the features that are associated with decision making when malignancy of an adnexal mass is in question and the frequency of each finding was cross-tabulated with the final diagnosis. This gave abundant information about specific features that may predict malignancy in adnexal masses. The study has found that the factors such as menopausal status, echogenicity, inner wall structure, intramural nodule or solid areas, vascularity, and presence of ascites were significant in differentiating benign and malignant lesions. In concurrence with these findings, a review by Brown et al. has reported that it is necessary to consider the factors such as menopausal status, patient age, personal or family history of breast or ovarian cancer, and serum CA-125 level, apart from imaging findings. Similarly, the researchers have reported that the USG characteristics such as ascites, solid component, and thick septa assist in discriminating benign and malignant adnexal masses:.[13]

The median size of malignant masses was found to be slightly more in comparison to benign masses (100.5 mm vs. 85 mm). Size of adnexal mass has been suggested as a viable screening tool for discriminating malignancy. A study conducted by McDonald et al. in nonpregnant pre- and postmenopausal women has reported a significant association between tumor diameter >10 cm and diagnosis of malignancy. However, the results of multivariate analyses demonstrated that size alone cannot be considered as a major discriminator of malignancy.[14] A study by Granberg et al has examined 1017 ovarian tumors and correlated their gross appearance to the histological diagnosis and established a relationship between the macroscopic appearance and risk of malignancy.[15] The study demonstrated that unilocular cysts had a 0.3% chance of malignancy, whereas complex multiloculated masses were associated with a risk of malignancy of 36% and predominantly solid lesions with 39%. Valentin et al. have found that the sensitivity of pattern recognition while performing ultrasound for adnexal masses varied between 88% and 100%, whereas the specificity varied between 62% and 96%.[16]

The accuracy of USG in differentiating benign and malignant masses was found to be highly significant in the current study (P=0.000). The corresponding accuracy of USG noted in detecting malignancy and benignancy were 83.3% and 89.2%. An Indian study involving 100 patients suspected with adnexal masses has recommended the use of USG as a primary modality for assessing adnexal masses. The researchers have noted that the majority of benign ovarian tumors were serous cyst adenoma, whereas all malignant tumors were serous cyst adenocarcinoma and poorly differentiated adenocarcinoma.[17]

The current study found that scoring systems are statistically significant in detecting malignancy. For CA-125, a cut-off value of 21 was used to predict malignancy. The corresponding sensitivity, specificity, PPV, and NPV with 70.8% area under the curve (p = 0.023, significant) noted were 71.4% 56.8%, 38.5% and 84%. The corresponding values of variables noted in a 2012 cross-sectional study by Hartman et al. were 90%, 87%, 69% and 97%. In contrast, the researchers have noted that CA 125 alone has comparatively lesser potential than USG in differentiating malignant from benign adnexal tumors.[18]

With regard to RMI, the sensitivity, specificity, PPV and NPV noted when using a cut-off value of 120 with 81.2% area under the curve (P = 0.01, significant) were 71.4%, 78.4%, 52.2% and 92.8% respectively. The study by Javdekar and Maitra has concluded RMI as an effective tool in discriminating benign from malignant masses.[8] The corresponding sensitivity, specificity, PPV and NPV noted with RMI were 70.5% (95% CI 46.87–86.72), 87.8% (95% CI 74.46–94.68), 70.5%, and 87.8%.

The present study has also corroborated the efficacy of Sassone score. A cut-off value of 8 was calculated for the Sassone score and the corresponding sensitivity specificity, PPV and NPV noted in predicting malignancy with 76% area under the curve (p = 0.05, significant) were 85.7%, 56.8%, 42.8% and 91.3%. Shende et al. have recommended the use of Sassone scoring system using gray scale USG in routine practice to differentiate benign and malignant adnexal masses.[19] The researchers used a cut-off value of 9 and the corresponding specificity and sensitivity noted in predicting malignancy were 94% and 88%. Scoring systems were found to be statistically significant in detecting malignancy. Myers et al. have assessed the most frequently used scoring systems and found that the pooled sensitivity and specificity of detecting malignancy with these systems varied from 82% to 91% and 68% to 77% respectively, whereas in the current study they ranged between 80 to 85%.[20]

Though the required number of patients were achieved comfortably, the total number of patients included in this study was lesser when compared to the other studies with similar objectives. This limitation could be attributed to the restricted amount of time available to collect the information. Though the study considered many patients presented with adnexal masses during the study period, a good proportion of them were lost to follow-up. However, the present study holds greater clinical significance, as very few studies have explored the predictive potential of various USG features in distinguishing benign and malignant adnexal masses, especially in Indian population. However, further studies involving larger population are essential to corroborate the findings.

CONCLUSION

Ultrasound has a very high accuracy in classifying an adnexal mass as either benign or malignant. The use of distinguishing USG features such as echogenicity, inner wall structure, intramural nodule or solid areas, vascularity, and presence of ascites assists in making a reasonably confident diagnosis on benign and malignant masses. The use of CA-125 and USG scoring systems such as RMI and Sassone score is also useful in predicting malignancy in routine practice.

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