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ORIGINAL ARTICLE

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Evaluation of new scoring system to diferntiate between benign and malignant adnexal mass

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OBJECTIVE(S) : To study the role of color doppler in differentiation of benign from malignant adnexal mass and to evaluate usefulness of this new scoring system evolved by Alcazar for the same.

METHOD(S) : A prospective cohort study, was done from August 2003 to July 2004 on 38 patients admitted with adnexal mass. All of them were subjected to preoperative ultrasonography and color doppler study. The data were used for calculation of score for probability of malignancy using new scoring system developed by Alcazar. The efficacy of scoring system was evaluated by histopathological examination of the mass or by fine needle aspiration cytology of the mass or by ascitic fluid cytology as a gold standard.

RESULTS : Alcazar's scoring system was able to identify 17 out of 18 malignant adnexal masses and 19 out 20 benign adnexal masses as diagnosed by histopathology. The sensitivity and specificity of Alcazar's scoring system was 94.44% and 95% respectively.

CONCLUSION(S) : The new scoring system of Alcazar using both ultrasonographic and colour doppler studies is useful in differentiating a benign from a malignant adnexal mass and gives better results than DePriest's and Sassone's scoring systems.

Key words: adnexal mass, benign ovarian tumor, malignant ovarian tumor, color doppler

Introduction

The adnexal mass represents a common problem in clinical practice. The differential diagnosis of an adnexal mass varies from functional cysts to benign tumors to malignant tumors of various abdominal and pelvic organs [1]. Surgery is often required solely to exclude the possibility of malignancy and about 1/3rd of tumors operated upon for suspected ovarian cancer turn out to be benign [2].

Ultrasonography is the most practical modality for assessment of ovarian tumors because it is readily available, noninvasive, and has a high negative predictive value [3]. The sensitivity and specificity of vaginal sonography in identifying benign and malignant tumor is 82% and 92% respectively [4]. Ultrasonography correlates morphologic images with macroscopic pathologic features of tumors [5]such as nonfatty solid tissue, thick septations, and papillary projections [3].

High operator dependence and extreme variability of macroscopic characteristics of ovarian tumor make a precise diagnosis difficult by sonography alone. To overcome these limitations, use of a sonographic scoring system has been advocated [6]. These scoring systems are based on the use of different sonographic parameters, each with different scores, according to determined features and with a cut off value to categorize tumors as benign or malignant [4]. The introduction of color doppler scanning allows the assessment of tumor vascularity and increases the specificity of diagnosis.[7, 8]

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In 2003, Alcazar et al [7]. designed a scoring system with high diagnostic value. The present study was conducted utilizing ultrasonography and color doppler in patients with adnexal mass. The objective was to evaluate the role of color doppler and the new scoring system of Alcazar [7] in differentiation of benign from malignant adnexal mass.

Methods

This study was conducted from August 2003 to July 2004. Thirty-eight patients with a adnexal mass were included in the study. At the time of registration, a detailed history was taken and complete examination done. All patients were subjected to transvaginal or transabdominal sonography and colour doppler study. They were then followed up till resolution of signs and symptoms with conservative management or surgical intervention. Results of color doppler and scoring system were not made available to the treating gynecologist to avoid any bias.

The gold standard for diagnosis was histopathological examination of specimen obtained from laparotomy or fine needle aspiration cytology of adnexal mass or cytology of ascitic fluid.

All cases were evaluated by the same radiologist by transvaginal or transabdominal sonography with the use of Toshiba SSA-370A Machine that was equipped with real time 5-7 MHz sector electronic assay endovaginal probes with 5.0 MHz pulsed and color doppler capabilities.

Table 1 shows the various parameters and scoring system proposed by Alcazar et al [7]. The ultrasonographic parameters used in this study were volume, inner wall structure, wall thickness, septations, papillary structures, solid area (absence or presence of any solid area $\geq$ 1 x 1 cm in the internal wall surface of the septum), and echogenicity (cystic, anechoic, homogenous content, heterogeneous content or purely solid) (Figure 1). Color doppler parameters used in this study were blood flow (present or absent), amount of blood flow (scant, moderate, abundant), blood flow location (central or peripheral), resistance index (RI), and peak systolic velocity (PSV) [8-10] (Figure 2).

Table 1. Scoring system proposed by Alcazar at al [7].

Score	Thick papillary projection	Solid areas or purely solid echogenicity	Blood flow location	Velocimetry
0	Absent	Absent	Absent or peripheral	Other
2	Present	–	–	High velocity/ low resistance
4	–	Present	Central	–

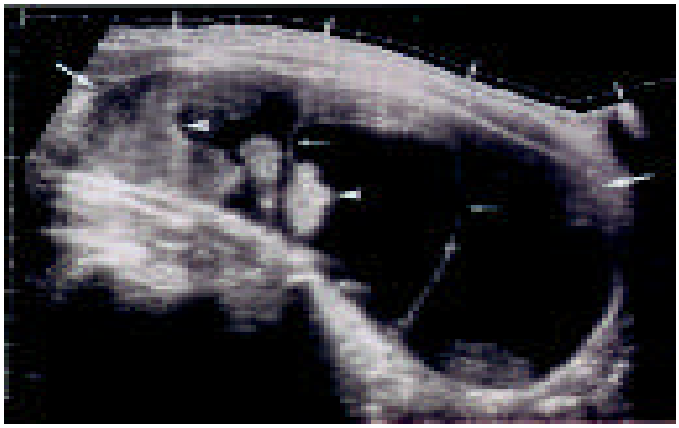

Figure 1. Ultrasonographic characteristics of a malignant adnexal mass.

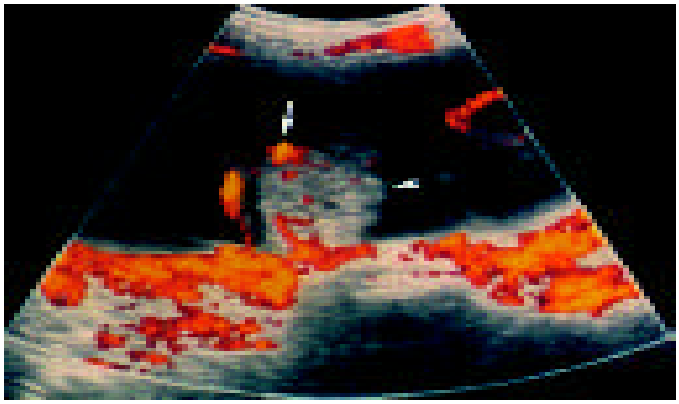

Figure 2. Doppler blood flow characteristics of a malignant adnexal mass.

Results

Out of 38 patients recruited in the study, 30 got operated. Out of the other eight patients, seven were managed conservatively by antitubercular drugs or neo-adjuvant chemotherapy based on ascitic fluid cytology. One patient had sonography guided cyst aspiration.

Table 2 shows distribution of 38 patients according to Alcazar scoring system and by cytology or histopathology proven final diagnosis. Out of the total 38 patients, 20 (52.3%) had a score between 0 and 5 and 19 out of these 20 (95%) were found to be benign on histopathology. Eighteen out of the 38 cases (i.e. 47.37%) were having a score between 6 and 12 and 17 of them (94.44%) were malignant on histopathology. This showed a good positive correlation of the score with the final diagnosis.

Table 3 shows diagnostic efficacy of the Alcazar scoring system as seen in our study. Table 4 shows significance of different variables as found on univariate analysis.

The mean age of malignant group (47.44±13.83 years)

was significantly higher (P=0.003) than that of benign group (34.65±9.01 years). Out of 14 adnexal masses in postmenopausal patients, 10 i.e. 71.43% were malignant (P=0.023).

Table 2. Comparison between Alcazar's scoring system and histopathology.

Score	Diagnosis on basis of histopathology		Total
	Malignant	Benign	
6-12 (Malignant)	17	1	18
0-5 (Benign)	1	19	20
Total	18	20	38

Table 3. Efficacy of Alcazar's scoring system for diagnosing malignant tumors.

Statistical parameter	Percent
Sensitivity	94.44
Specificity	95
Positive predictive value	94.44
Negative predictive value	95.24

Table 4. Univariate analysis of variables used in assessment of adnexal mass.

Variable	Malignancy criterion (cutoff)	Significance of univariate analysis (P value)
Age (≥40 years)	≥40 years	0.003
Menopausal status	Postmenopausal	0.023
Volume (mL)	>200 mL	0.804
Inner wall structure (smooth, irregular)	Irregular	0.001
Bilaterality	Bilateral	0.573[a]
Structure (anechoic, mixed, solid)	mixed, solid areas	0.028
Septa (present, absent)	Present	0.703[a]
Septal thickness (mm)	>3 mm	0.027
Papillary structures (Present, absent)	Present	0.048
Papillary thickness	≥3 mm	0.02
Blood flow (abundant, moderate, scant)	Abundant	<0.001
Central vascularization	Present	<0.001
Resistance index (RI)	<0.45	<0.001
Peak systolic velocity (PSV)	>10 m/s	<0.001
Velocimetry	High velocity / low resistance	<0.001
Score	≥6	<0.001
Wall thickness	≥3 mm	0.08

a Not significant

Velocimetric classification of tumors showed that adnexal mass falling in category of high velocity/low resistance group had greatest possibility of being malignant. Eighteen out of 38 cases (47.37%) showed high velocity with low resistance. Out of these 17 (94.44%) were malignant.

Wall thickness did not relate well with malignancy (P=0.08). Irregularity of the tumor wall had positive association with malignancy (P=0.001). Out of 18 malignant cases detected by histopathology, 13 i.e. 72.22% had irregular wall structure on ultrasonography whereas out of 20 benign cases only 4 i.e. 20% had irregular wall. Presence or absence of septa was statistically not significant (P=0.703). But if septa were present septal thickness (≥3 m) was significantly associated with malignancy (P=0.027). Papillary projection thickness (P=0.02), and presence of solid area or echogenicity were significantly (P=0.028) associated with malignancy. Volume of tumor and bilaterality were not significantly associated with malignancy on univariate analysis.

Table 5 gives comparative efficacy of the various known scoring systems in differentiating benign from malignant tumors as applied to our study. It shows that Alcazar scoring system is better than other scoring systems.

Table 5. Comparison of efficacy of Alcazar's scoring system with efficacy of earlier published scoring systems as applied to our study.

Scoring system [7]	Sassone scoring system [11]	DePriest scoring system [6]	Alcazar scoring system [7]
Sensitivity	89.1	88.9	94.4
Specificity	65	50.0	95
Positive predictive value	70	61.54	94.4
Negative predictive value	86.67	83.3	95

Discussion

Sassone et al [11] devised a scoring system using traditional gray scale transvaginal ultrasonography to characterize ovarian lesion. The scoring system was based on determining the wall thickness, inner wall structure, characteristics of septa and echogenicity of lesion. De Priest et al [6] developed a scoring system based on volume, cyst wall structure, and septal structure of adenexal mass assessed by sonography.

Color doppler parameters were not included in their scoring systems by Sassone et al [11] and De Priest et al [6]. After

introduction of color doppler, RI and PSV were not used as independent predictors of malignancy because considerable overlapping was found between benign and malignant tumors in spite of statistical difference [7]. To overcome this limitation, in the scoring system of Alcazar et al [7] tumors were classified in four velocimetric categories according to the best RI and PSV cut off values. Only those variables were used which were independent predictors of malignancy in multivariate logistic regression analysis. This scoring system may yield a total score of 0 to 12. Score of 6 or more was taken as malignant. The receiver operator characteristic (ROC) curve showed that the best cut off value was a score of $\geq$6 with a sensitivity of 94.4% and a false positive rate of 5.5% (Table 1) [7].

Using Alcazar scoring system and taking $\geq$ 6 as cut off value for malignancy, we found that out of 38 cases, 20 i.e. 53% had a score of $\leq$ 5 and out of these 20 cases, 19 i.e. 95% were benign on histopathology. Only 1 case with a score of 4 was malignant. In this patient tumor was cystic with no solid areas but had thick papillary projections with peripheral vascularization and high velocity/low resistance on velocimetry. Only one case with a score of more than 6 was benign. The scoring system by Alcazar gave better results because of the use of color doppler measurements [12]. The use of color doppler decreased false positive results.

The efficacy of a morphologic scoring system alone was hampered by overlap between malignant and benign appearing masses. In our study, wall thickness and tumor volume were not related with malignancy. They were used as independent variables in the scoring system of Sassone et al [11] and of DePriest et al [6].

The false positive results in the scoring systems of Sassone [11] and DePriest [6] are basically due to high scoring of benign lesions like teratoma, endometrioma, and ovarian fibroma. The false positive results in the scoring system of Alcazar et al [7] were because of benign lesions like ovarian cystadenofibroma and ovarian fibroma which were frequently encountered as unilocular cysts with solid areas and central flow. This scoring system could not differentiate well between primary and metastatic malignant ovarian tumors. Following points should be considered while using Alcazar scoring system. Utrasonographic and color doppler technic is highly operator dependent leading to high interobserver variation. Also the flow within the tumor varies greatly. So the whole mass should be adequately scanned by only an expert sonologist.

Conclusion

Of all the ultrasonographic parameters, thick papillary projections (P=0.020) and solid areas/echogenicity (P=0.028) are most consistently associated with malignancy. Presence of central vascularization (P<0.001) and high velocity/low resistance flow on color doppler are most consistently associated with malignancy. Addition of color doppler increases the specificity and diagnostic performance of Alcazar's scoring system.

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