

Differentiation of benign and malignant adnexal masses: value of a morphologic scoring system

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Summary

Objective: The purpose of this study was to assess the value of conventional gray-scale ultrasonography, based on a morphologic scoring system, in the differential diagnosis of malignant and benign adnexal tumors.

Material and Methods: A total of 58 adnexal masses in 51 patients were classified prospectively as suggestive of malignant or benign, on the basis of gray-scale ultrasonographic morphology. The results were correlated with histopathological diagnosis.

Results: Histopathology of 42 masses was found to be benign and 16 masses were found to be malignant. On gray-scale analysis 15 of 16 malignant masses were classified as suggestive of malignant and 37 of 42 benign masses were classified as suggestive of benign. The sensitivity, specificity, positive predictive value and negative predictive value are calculated as 93%, 88%, 75%, and 97%, respectively.

Conclusion: Prediction of malignancy using gray scale ultrasonography based on a morphological scoring system was reliable (NPV = 97%, PPV = 93%). However further investigations about the assessment of adnexal masses with ultrasonography are needed

Key words: Adnexal masses; Gray-scale ultrasonography; Malignancy.

Introduction

Ovarian carcinoma is characterized by lack of symptoms in the early stages, which leads to a late diagnosis and consequently poor prognosis. Thus early detection is a major challenge to gynecologists. Ultrasonography has been advocated as a screening method for ovarian cancer because masses can be detected by this technique before they are clinically apparent [1, 2]. Since the introduction of transvaginal sonography, the diagnostic sensitivity and specificity of gray scale sonographic evaluation of adnexal masses have improved significantly [3, 4]. Differentiation of benign and malignant adnexal masses is essential to choose the proper therapeutic option. Although many studies about the differential diagnosis of adnexal masses have been published in the literature, the malignancy risk index published by Jacobs *et al.* in 1990 [5] and the morphological scoring system published by Sassone *et al.* in 1991 [6] are the most successful ones. Sassone's scoring system is based on the parameters of inner wall structure, wall thickness, septa and echogenicity. On the basis of these parameters characterization of adnexal masses is possible, and benign tumors can be separated from malignancies with reasonable accuracy. The purpose of this study was to define the diagnostic value of a morphologic scoring system and to diagnose the malignant cases earlier to avoid unnecessary major surgical operations in benign cases.

Material and Methods

Fifty-eight adnexal masses in 51 patients were examined. All patients included in this study underwent laparoscopic or laparotomic operations at Istanbul University Medical Faculty, Obstetrics and Gynecology Department, between December 2000 and September 2002 (42 patients laparotomy, 8 patients laparoscopy and one patient both laparoscopy and laparotomy). After informed consent was obtained, the patients were examined in the lithotomic position and transvaginal ultrasonographic images were obtained by the same clinician with 3.5 MHz transabdominal and 6.5 MHz transvaginal probes (logic RT-X 200 GE Medical System) within one month of the preoperative period. The patients who underwent hysterectomy and/or unilateral salpingo-oophorectomy were included but those who had previously undergone bilateral salpingo-oophorectomy or who had chemotherapy because of ovarian cancer were excluded from the study (n = 12). In premenopausal women transvaginal ultrasonography was scheduled in the proliferative phase of the menstrual cycle to avoid the diagnosis of corpora lutea. Age, reason for referral to the sonography, symptomatology, menopausal status and previous pelvic surgery were noted. The study was designed prospectively. The masses were evaluated according to the scoring system in Table 1, devised by Sassone *et al.* [6]. Masses with scores 9 or over were accepted as malignant. An overall morphologic impression was recorded as benign or malignant. The results were correlated with histopathological diagnosis. Statistical evaluation was performed with the Student's t-test, and $p < 0.05$ was regarded as significant.

Results

Patients' ages ranged from 14 to 83 years, with a mean of 41.3 and a median of 42. Twenty-eight patients were premenopausal (14-46 years), six patients were perimenopausal (42-47 years) and 17 patients were postmenopausal (43-83 years).

Table 1. — *Morphological scoring system.*

Points	Inner wall structure	Wall thickness	Septa	Echogenicity
1	Smooth	thin \leq 3 mm	No septa	sonolucent
2	Irregularities \leq 3 mm	thick $>$ 3 mm	thin \leq 3 mm	low echogenicity
3	Papillarities $>$ 3 mm	not applicable, mostly solid	thick $>$ 3mm	low echogenicity, with echogenic core
4	Not applicable, mostly solid			mixed echogenicity
5				high echogenicity

Fifty-eight masses in 51 patients were analyzed. Sixteen (27%) were malignant and 42 (73%) were benign on pathological examination. Fifteen of 16 (93%) malignant and 37 of 42 (88%) benign masses were correctly predicted. With these data the sensitivity, specificity, positive predictive value and negative predictive value were found to be 93%, 88%, 75% and 97%, respectively.

Forty-two masses in 39 patients were found to be benign (Table 2) and 37 (88%) were predicted as benign

Table 2. — *Benign masses (n = 42).*

Diagnosis	Score range	Mean score
Simple ovarian cysts (n = 8)	4-6	4.6
Abscesses (n = 4)	6-8	7.5
Endometriomas (n = 7)	6-8	6.6
Hemorrhagic cysts (n = 1)	7	7
Teratoma (n = 3)	6-13	10.3
Mucinous cystadenoma (n = 8)	6-11	7
Serous cystadenoma (n = 3)	7-8	7.3
Cystadenofibroma (n = 7)	7-11	8.3
Fibrothecoma (n = 1)	8	8

(*true negative*). Five cases were misclassified in the malignant group (*false positive*). Eight cases were simple ovarian cysts, which were easy to recognize. Four masses were reported as abscesses, of these one was tuberculosis and one patient had bilateral abscesses. All of the patients were sexually active. The scores of these abscesses ranged from 6-8. Seven endometriomas which were all recognized as endometrioma with their typical sonographic appearance, were predicted as benign masses. All scores of the seven imaged endometriomas were less than 9. There were three teratomas, among which two cases were predicted as malignant. Both masses, with 12 and 13 points were in postmenopausal patients and 8 cm in size. They had thick walls, a predominantly solid structure and mixed echogenicity and only differed from each other as having thin and thick septa. Another teratoma with 6 points, which was seen in a premenopausal patient, with thin walls and low echogenicity was excised laparoscopically. Eight cases were reported as mucinous cystadenomas, with scores ranging from 6-11. The size of the masses varied from 6 to 35 cm. One tumor which was mispredicted as malign with 11 points was 23 cm in size and had mixed echogenicity, papillary projections thicker than 3 mm, thin septa and thick walls. The pathologic diagnosis was borderline mucinous cystadenoma. There were seven cystadenofibromas with scores ranging from 7-11 (mean 8.3). Five masses were correctly pre-

dicted as benign but two masses in the same patient were misclassified in the malignant group with 11 points. They were reported as borderline cystadenofibromas. The last case of the benign group, reported as fibrothecoma, was correctly predicted as benign with 8 points.

There were 16 malignant cases in 12 patients (Table 3). All but one were correctly predicted as malignant. The largest population in the malignant group consisted of five mucinous cystadenocarcinomas with scores ranging from 8-14. Four cases had 13, 13, 14, 14 points and their sizes were more than 25 cm. The only false-negative member of the study was 6 x 8 cm in size, with thin walls, and thin septa, smooth inner wall structure and mixed echogenicity. It was predicted as an endometrioma with 8 points. Surgery began with laparoscopy. After the irregularities on the surface of the mass were noticed, frozen section biopsy was performed. When the histopathological result was reported as mucinous adenocarcinoma, laparotomy was performed. Four serous papillary adonocarcinomas with 10-13 points, three granulosa cell tumors with 11-14 points, two sarcomas with 12-14 points and two endodermal sinus tumors were correctly predicted as malignant.

Table 3. — *Malignant masses (n = 16).*

Diagnosis	Score range	Mean score
Mucinous adenocarcinoma (n = 5)	8-14	12
Serous papillary adenocarcinoma (n = 4)	10-13	11
Granulosa cell tumor (n = 3)	11-14	12
Sarcoma (n = 2)	12-14	13
Endodermal sinus tumor (n = 2)	9	9

Patient age, menopausal status, tumor size, and bilaterality of the masses were compared in the malignant and benign groups (Table 4). Malignant masses tend to be found more in patients with advanced ages (46 vs 40) and in postmenopausal patients (71% vs 25%) when compared with benign masses. While 7% of the benign cases were bilateral, 25% of the malignant masses were found to be bilateral. The average size of the benign tumors was 6 cm and malignant tumors 14 cm. The differences in all parameters were found to be statistically significant ($p < 0.05$).

Table 4. — *Comparison of malignant and benign masses.*

	Benign	Malignant	p
Age	40 (18-66)	46 (14-83)	< 0.05
Bilaterality	7%	25%	< 0.05
Post/premenopause	0.25	0.71	< 0.05
Tumor size (cm)	6 (4-23)	14 (6-41)	< 0.05

Table 5. — *Comparison of performance of different studies in the literature.*

Authors	No. of patients	PPV	NPV	Sensitivity	Specificity
Granberg <i>et al.</i> 1990 (4)	180	74	95	82	92
Sassone <i>et al.</i> 1991(6)	143	37	100	100	83
Lerner <i>et al.</i> 1993 (7)	350	29	99	97	77
Stein <i>et al.</i> 1995 (15)	70	50	99	98	62
Rehn <i>et al.</i> 1996 (16)	300	38	96	84	73
Roman <i>et al.</i> (17)	226	61	97	88	87
Topuz <i>et al.</i>	51	75	97	93	88

Discussion

The efficacy and importance of ultrasonography in the differential diagnosis of adnexal masses have increased with the superior resolution that is available with high frequency transvaginal scanners. If the morphologic scoring system is standardized, characterization of adnexal masses to some extent would be possible in the preoperative period. The Sassone morphological scoring system that we applied to 58 masses performed well in distinguishing benign from malignant masses. We searched the literature for previous reports dealing with the relation between a morphological scoring system and defining malignancy. Table 5 presents the comparison of our study with other studies reported in the literature.

Two of the five masses contributing to the false-positive group were teratomas with their overlapping scores. Although teratomas took part in the malignant group with high scores due to predominant solid components, calcification, and high echogenicity produced by fat tissue, they were predicted as benign because of their characteristic appearance. The hyperechogenicity relating to fat tissue in teratomas was regular, smooth, homogeneous and had lobulated contours, whereas the hyperechogenicity of the malignant masses tended to be irregular and heterogeneous. In addition, the calcifications belonging to the teeth with distal acoustic shadowing were differential signs of teratomas. Our results are consistent with the findings of Sassone *et al.* [6]. In their study the main source of the false-positive group was benign teratomas. They stated that although it was relatively easy to diagnose the teratomas, the strict application of the scoring system did not allow them to be specific enough. To eliminate the weak points of the system and to decrease the rate of false-positive cases Lerner *et al.* [7] devised a new weighted scoring system. In their weighted system the wall thickness, which was found to be non-significant, was excluded from the parameters and a new variable called shadowing was included.

The rest of the false-positive group were one borderline mucinous cystadenoma and two borderline cystadenofibromas. Although we regarded them morphologically in the benign group, pathologically their place was in the middle of malignant and benign masses. Thus, the overlapping can be explained with the concept of borderline.

The unique member of the false-negative group was a mucinous adenocarcinoma which was predicted as an endometrioma with 8 points. The surface irregularities detected in the operation could not be identified by ultrasonography. On the other hand the surface characteristics were not included in the scoring system which does not seem reasonable. The mass was 6 x 8 cm in size, indicating less probability of malignancy. Although tumor size was accepted as a risk factor for malignancy, the sensitivity and specificity based on the tumor size were unsatisfactory.

When we evaluated the parameters that were used to identify malignancy, we observed that in malignant masses the inner wall structure was never smooth, only

two masses had low echogenicity, six masses had no septa or thinner than 3 mm, and four masses had walls thinner than 3 mm. Based on these data, we suggest that inner wall structure (especially presence of papillary projections) and mixed echogenicity are more important in defining malignancy.

Efforts in distinguishing benign and malignant adnexal masses are not limited to a morphological scoring system. Transvaginal color Doppler sonography and spectral Doppler sonography have been the focus of several studies as possible methods of differentiating benign from malignant masses [8-10]. The pulsatility index (PI) and resistive index (RI) have been the most widely investigated parameters. Values below 1.0 for the pulsatility index and 0.4 for the resistive index have been proposed as suggestive of malignant tumor. In initial studies Kurjak *et al.* [11] (using a RI less than 0.4) and Fleischer *et al.* [12] (using a PI less than 1.0) reported both high sensitivity and specificity in differentiating malignant from benign ovarian masses. A later report by Fleischer *et al.* [8] described some overlap in the values, with several benign lesions having PI values less than 1.0. Brown *et al.* [13] found no discriminatory value for either PI or RI that had both high sensitivity and high specificity. Lately, Timmerman *et al.* [14] developed a new logistic regression model about comparison of methods for preoperative discrimination between malignant and benign adnexal masses.

Our data without Doppler studies can be regarded as successful with a sensitivity of 93%, specificity of 88%, PPV of 75%, and NPV of 97%. Consequently even though the morphological scoring system does not define the malignancy absolutely, this system can be a guide for clinicians in the differential diagnosis of adnexal masses in the preoperative period, when a Doppler facility is not available. However further investigations about the assessment of adnexal masses with ultrasonography are needed.

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