Transvaginal Ultrasonographic Characteristics **of** Adnexal Masses to Predict Malignancy*

MALİGN ADNEKSAL KİTLELERDE TRANSVAGINAL ULTRASONOGRAFİK ÖZELLİKLER

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SUMMARY

Objective: The aim of the study was to differentiate adnexal manses as benign and malignant with the use of transvaginal ultrasonografphy.

Materials and Methods: Transvaginal ultrasonographic images of 130 patients were investigated who were operated for adnexal masses between January 1992 and April 1994. These sonographic images were analyzed by using morphologic scoring system as described previously by Sassone etal. in 1991.

Results: This histopathologic findings of the masses were 114 benign lesions, 15 malignant lesions and 1 tumor of low malignant potential. The mean point value obtained was 7.93 for the benign masses, 12 for the tumor of low malignant potential, and 12.6 for the malignant tumors (p<0.0001). At cutoff point >0 The sensitivity was 93% and the specificity 59% at cut off point >9. The positive and negative predictive values were 23% and 98%, respectively.

Conclusion: Although this diagnostic procedure is not a gold standard in the evaluation of adnexal masses, but it is gettig acceptance as because of being a noninvasive, aplicable and cost effective technique. In our study 47 of 115 benign masses scored <9 points leading to a high false positive rate. It is clear that additional parameters are needed to identify of these high false positive results to avoid unnecessary surgery.

Key Words: Transvaginal ultrasonography, ovarian carcinoma, morphology.

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ÖZET

Amaç: Transvaginal ultrasonografi ile adneksiyal ve ovaiyen benign ve malign kitlelerin ayırdedilmesi.

Çalışmanın yapıldığı yer: Zeynep Kamil Kadın ve Çocuk Hastalıkları Hastanesi: Kadın Hastalıkları ve Doğum Klin.

Materyal ve Metod: Ocak 1992 ve Nisan 1994 tarihleri arasında adneksiyal kitle tanısı ile öpere edilen 130 hastaya transvaginal ultrasonografik inceleme yapıldı. Sonografi bulguları Sassone ve arkadaşları (1991) tarafından tarif edilen morfolojik skorlama sistemine göre değerlendirildi.

Bulgular: Histopatolojik inceleme sonucu 114'ü benign lezyon, J57 malign lezyon ve 17 düşük malignité potansiyeli gösteren tumor olarak saptandı. Olguların ortalama sonografik skoru benign kitleler için 7.93; düşük malignité pc'ansiyeli gösteren tümör için 12 ve malign kitleler için 12.6 olarak tespit edildi (p<0.0001). Skor için eşik değeri 9 olarak alındığında sensitivite %93, spesisite %59, pozitif prediktif değer %23 ve negatif prediktif değer %98 olarak saptandı.

Sonuç: Adneksiyal kitlelerin malignité potansiyellerinin değerlendirilmesinde kolay uygulanması, invazif olmaması ve maliyetinin ucuz olması nedeniyle transvaginal ultrasonografik skorlama günümüzde önemini arttırmaktadır. Bizim çalışmamızda 115 benign kitlenin eşik değer olan >9 olması, yüksek yanlış pozitifliğe neden olmuştur. Gereksiz operasyonların engellenmesi için yüksek yanlış pozitifliğini azaltmak amacıyla ek parametrelere ihtiyaç vardır.

Anahtar Kelimeler: Transvaginal ultrasonografi, över karsinomu, morfoloji.

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INTRODUCTION

The purpose of the present study was to assess the accuracy of transvaginal ultrasonography in confirming or excluding the presence of ovarian cancer and to determine whether sonographic patterns of ovarian cancers correlate with histologic features and with the stage of the tumor.

MATERIALS AND METHODS

The study population consisted of all cases of laparotomy performed for indications of adnexal masses in Zeynep Kamil Women and Children's Hospital between January 1992 and April 1994. Age, menopausal status, reason for referral to sonography, symptomatology, and previous pelvic surgery were noted. Women

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Table 1. Scorring system for evaluation of pelvic masses
Tablo 1. Pelvik kitleieri degerlendirmedeki skorlama sistemi.

Parameter	Score				
	1	2	3	4	5
Inner wail structure	Smooth	Irregular ities< 3 mm	Papillaris > 3 mm	Not applicable, mostly solid	
Wall thickness (mm)	Thin < 3 mm	Thick > 3 mm	Not applicable, mostly solid		
Septa (mm	No septa	Thin < 3 mm	Thick > 3 mm		
Echogenicity	Sonolucent	Lo* echogenicity	Low echogenicity with echogenic core	Mixed echogenicity	High echogenicity

Table 2. Benign masses
Tablo 2. Benign kitleler

Type of mass	No(%)	Mean score (Range)	SD	No. of scores >9
Benign cystic	15(13.1%)	10.0	2.37	11
Endometrioma	16(14,0%)	7.88	2.47	4
Serous cystadenoma	32(28 1%)	5.90	1.97	4
Rbroma-thecoma	4 (3.5%)	11.50	1.66	4
Corpus luteum cyst	9 (7.9%)	7.00	2.54	2
Tuboovarian abscess	19(16.6%)	11.89	1.97	17
Paraovarian cyst	2 (1.7%)	5.0	1,0	-
Simple cyst	7(6.1%)	4.86	0.64	-
Mucinous cystadenoma	7(6.1%)	8.0	2.0	3
Cyst hydatidiform	1 (0.9%)	7	-	-
Mesonephric cyst	1 (0.9%)	9	-	1
Cystic lenfangion':	1 (0.9%)	11	-	1
TOTAL	114(100%)	7.93	3.15	47

with previous hysterectomy and/or unilateral salpingo-oophorectomy were included; however, those with previous bilateral salpingo-oophorectomy or previously treated carcinoma were excluded. Malignancies were staged according to the International Federation of Gynecology and Obstetrics (F1GO).

All of the examinations were performed by gynecologists. The adnexa! masses were scanned transvaginal^ with Combison 410 and Hitachi EUB 315 ultrasonography machines using a 5 or 7.5 MHz transvaginal transducer, depending on the required depth of penetration.

The scoring system used was that by Sassone et al. using the traditional gray scale, real time transvaginal ultrasonography. Table 1 illustrates the scoring system for evaluation of the ovaries. The same scoring system was also applied to extrauterine masses of unclear origin. The four variables were looked for and the individual values were added to represent the final

Table 3. Malignant masses and tumor of low malignant potential
Tablo 3. Düşük malign potansiyelli tümörier ve malign tümörler.

Type of mass	No (%)	Mean score (Range)	SD	No. of scores >9
Serous cystadenocarcinoma	11 (68.8%)	13.55	1.92	11
Mucinous cystadenocarcinoma	2(12.5%)	10.5	0.5	2
Granulosa cell tumor	1 (6.3%)	7	-	.
Sertoli-Leydig cell tumor	1.63%)	12	.	1
Serous tumor of low malignant potential	1 (6.3%)	12	-	1
TOTAL	16(100%)	12.6	2.47	1

Table 4. Malignant versus nonmalignant findings
Tablo 4. Malign ve nonmaiign tumorlerde buigular.

Finding	No.	Mean score	SD
Nonmalignant	114	7.93	3.15
Malignant	16	12.6	2.47

Table 5. Score versus diagnosis
Tablo S. Teşhiste skorlama durumu.

Score	Benign	Malignant
>9	14	47
<9	1	68
TOTAL	15	115

Sensitivity: 93%, specificity: 59%, positive predictive value 23%, and negative predictive value 98%.

Table 6. Sonographic size and malignancy of ovaries
Tablo 6. Over malignitesi ve sonografik ölçümler.

Size (cm)	No.	Benign	Malignant
>10	31 (23.8%)	19(16.6%)	12(75%)
5-10	93(71.5%)	89(%78.1)	4 (25%)
<5	6 (4.6%)	6 (5.3%)	-
TOTAL	130(100%)	114	16

score for any given lesion. The score was assigned not to each woman, but to each ovary or mass. Normal ovaries were not included in this study. The maximum diameters of the imaged ovaries and extrauterine masses were also measured. The patients were operated within a week after sonography.

Statistical analysis was performed using the chi-square test (Mann-Whitney U) and multiple regression analysis.

RESULTS

Transvaginal ultrasonographic images and histopathologic findings of **130** patients who were operated for adnexal masses were obtained. At surgery, **114** benign masses, **15** malignant masses, and **1** tumor of low malignant potential were encountered. The patients ages ranged from **17** to **75** years, with a mean age of **35.8** years. The mean age of the patients with benign lesions was **34.2** for those with malignant masses it was **49.5,** and for the tumor of low malignant potential it was **32.** Eighty-six percent of the patients evaluated overall were premenopausal. The menopausal status significantly differed in the groups: **7.9%** of the patients with benign lesions and **64.3%** of the patients with malignant diagnosis were premenopausal., The patient with low malignant potential diagnosis was premenopausal, pathologic diagnosis are summarized in Tables **2** and **3.**

The mean point value obtained was **7.93 (±3.15** SD) for benign masses, **12** for the low malignant potential tumor, and **12.6 (±2.47** SD) for the malignant masses (p**<0.0001).** Within each histologic type the scores were noted and means and SDs were calculated (Tables **2** to **4).** With a cutoff of **>9** used as a discriminator between benign and malignant masses, the sensitivity and sepcifity of the weighted scoring system were **93%** and **59%,** respectively. The positive and negative predictive values obtained were **23%** and **98%,** respectively (Table: **5).** False-positive sonographic diagnosis of malignancy included benign cystic teratoma **(N-11),** Tubo ovarian abscess **(N-17),** fibro-thecoma **(N-4),** endometrioma **(N-4)** and serous cystadenoma **(N-4).**

Table 7. The four variables' scores for benign and malign lesions
Tablo 7. Benign ve malign lezyon skarlanmasinda 4 değişken.

Variables	Benign	Malignant	P
Inner wall structure	2.40±1.02	3.38±1.05	<0.001
Wall thickness	1.86+0.73	2.50+0.79	<0.001
Septa	1.59+0.81	2.13±0.99	<0.05
Echogenicity	2.27±1.14	3.81±1.29	<0.0001
Total score	7.93±3.15	12.6±2.47	<0.0001

For malignant lesions, ovaries larger than 10 cm on transvaginal sonography were 75% nd for benign lesions, it was 16.6% (Table 6).

To identify the scoring threshold that best distinguished the malignant ovaries from the others, the sensitivity and specificity for each score from 5-13 were calculated and plotted to create a receiver operating characteristic curve (Fig. 1).

Examination of the detailed structural variables compared in Table 7. According to the results of multiple regression analysis, echogenecity was the most significant variable (p-0.0013)

DISCUSSION

The approach to ovarian diseases has undergone basic changes in recent years. Previously, vaginal examination under anesthesia, followed by laparotomy was necessary to exclude ovarian cancer in a patient with adnexal mass. This lead to numerous surgical procedures for benign lesions, with potential late sequelae of the laparotomy, such as adhesions with chronic lower abdominal pain or sterility. In recent years, the decision as to whether the appropriate surgical approach to an ovarian mass involves the use of laparoscopy or laparotomy is determined almost exclusively by the malignant potential of the ovarian mass.

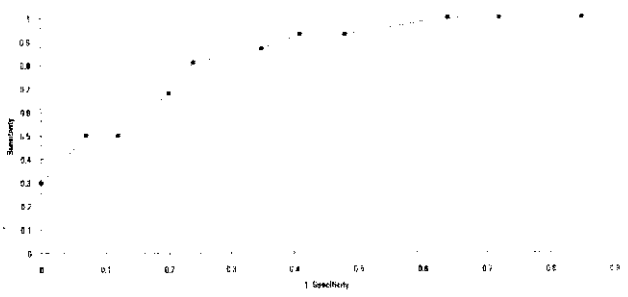

Figure **1**: Receiver operating characteristic curve
Şekil **1**: Öpere olanların karakteristik eğrisi

The first studies attempting to defferentiate benign from malignant ovarian masses used transabdominal ultrasonography, but the superior resolution obtained with transvaginal ultrasonography soon made transabdominal characterization of the ovaries absolete. Locating the ultrasound transducer in the vagina allows close examination of the cervix, uterus, fetus, ovaries, and fallopian tubes. These portions of pelvic anatomy are within about 10 cm of the transducer when inserted vaginally. Shortening this distance with the transvaginal approach and the improved resolution of higher-frequency vaginal probes invites the possibility of early detection of ovarian cancer, the leading cause of death from gynecologic malignancy and the fourth leading cause of death among all cancers in women. When an ovarian mass in encountered on transvaginal ultrasonography, the structural details within the mass provide information regarding the possibility of its malignancy. Factors associated with a greater risk of malignancy include a complex or solid apperance and persistence over time. The great accuracy in depicting these structural features transvaginal^ prompted several investigators to attempt classification of ovarian masses on the basis of the presence or absence of several ultrasonographic components. Abnormal structures include markedly hypoor hyperechogenic areas, i.e., purely-cystic (specify the wall thickness), cystic with low echogenic material (blood, mucin or pus), cystic with thin or thick (>5 mm) septations, predominantly cystic with solid elements (e.g., papillae), predominantly solid, and completely solid. To achieve a less subjective assessment of pelvic masses, researchers have evaluated various scorring systems.

Granberg et. al. scanned endovaginally 230 women scheduled for elective surgery for adnexal masses the day before surgery. All tumors-were classified as unilocular cysts, unilocular-solid, multilocular, multilocular-solid, or solid and malignant and benign. The sensitivity to identify benign and malignant ovarian tumors was 90%, and the specificity was 87%. Seventy percent of the multilocular solid tumors were malignant and 0% were malignant for theunilocular cysts.

Five degrees of hemogeneity were differentiated in one study of 1,317 patients. The authors showed the following features increased likelihood of malignancy: I, clearly outlined solitary cysts (0,9% malignant); II, clearly outlined homogenous tumors (1.9% malignant); 111, poorly defined or slightly heterogenous tumors (1.9 % malignant); IV, marked heterogeneous tumors (58% malignant); V, completely heterogeneous tumors (75% malignant).

In this study, 47 of the 114 benign masses scored >9 points, leading to a high false-positive rate and a positive predictive vaiue only 23%. The relatively high false-positive diagnosis rate is mainly due to a significant overlap in the ultrasonic characteristics of tubo-ovarian abscesses, benign cystic teratomas, fibrothecoma and malignancies. For reducing the falsepositive results, Lerner et al reported that the variable called wall thickness was not significant and therefore deleted and "shadowing," defined as loss of acoustic echo behind a sound-absorbing structure, was included. In their study, 50 of 58 benign cystic teratomas (%86.2) exhibited shadowing behind the echogenic core. The dermoid may contain hair, which because of its high density, produces a typical acoustic shadow.

It is clear that an additional test is needed to identify as many of these false-positive results as possible to avoid unnecessary and inappropriate surgery. False-positive sonographic findings can be reduced further using additional methods, i.e., tumorscores, CA 125 assay, and transvaginal color Dopier. The combination of the scoring system with the resistance-to-flow indices is better able to discriminate between benign and malignant adnexal lesions. Timor-Tritsch et al reported that using this combination correctly identifid ovarian cancer in 14 of 18 cases and ruled out the disease in 87 of 67 cases. Ten benign masses (3 fibrothecoma, 3 benign teratoma, 1 tubo-ovarian abscess, 2 simple cyst and 1 serous cystadenoma) were identified correctly by flow but scored high.

One study (n-143) combined a risk malignancy index (RMI) composed of three criteria. Using an RMI (serum CA 125 level in U/ml x ultrasound scan result x menopausal status) cutoff level of 200, the sensitivity was 85%, and the specificity was 97%. This study clearly showed that supplementing sonographic results with the CA 125 assay value and menopausal status improved the specificity in excluding ovarian cancer.

Lerner et al. reported that when age of the patient was used as a constant variable, a score could be assigned that maintains reasonable sensitivity and specificity while improving positive predictive value results, in that study, the positive predictive value improved to 33.3% from 29.4% using this formuh. For our study, the formula used as follows: Age of the patient x 0.1+Inner wall structure score + Wall thickness score + Septa score + Echogenicity score. When a cutoff of >13.5 was used positive predictive value improved to %38.2.

An receiver operating characteristic (ROC) curve represents sensitivity (true-positive rate) plotted on the y-axis and 1 minus specificity (false-positive rate) plotted on the x-axis for the different cutoff points (Fig. 1). The choice of one particular cutoff point versus another on the ROC curve does not make the test better or worse. This choice should be based on the purpose for which the test is obtained. For example, in a screening test, a cutoff yielding a high sensitivity would be most appropriate. For a confirmatory diagnostic test, a high-specificity cutoff should be chosen. As Sassone's study, in our study all of the patients had a palpable pelvic mass. The differential diagnosis should be made for the management of the adnexal mass (e.g. expectant care with réévaluation in 1-2 months, puncture under sonographic visualization, operative laparoscopy or laparotomy; median versus Pfannenstiel). In our study, the ROC curve showed that >14 was the score that best distinguished malignant from benign ovaries (Specificity: %93. Sensitivity: %50, Positive predictive value: %50, and negative predictive value: %93).

The responsible surgeon will decide to undertake an intervention only after a comprehensive workup has been completed. False-positive sonographic findings can be reduced further using additional methods, i.e., tumor scores, morphology index. CA 125 assay, and transvaginal color Doppler.

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