Sonographic Morphological Pattern in the Pre-operative Prediction of Ovarian Masses

MONGKOL BENJAPIBAL, MD*,
CHAYAWAT PHATIHATTAKORN, MD*,
WIWAT IAMURAIRAT, MD*
PRASERT SUNSANEEVITAYAKUL, MD*,
ISSARACHA SUPHANIT, BSc*,

Abstract

The study was undertaken to evaluate the accuracy of sonographic morphological pattern in the detection of ovarian malignancy. A total of 123 patients with a suspicion of ovarian pathology, who were scheduled for elective surgery at the Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital, Mahidol University were included in the study. All patients underwent sonographic examination prior to surgery by the same physician. The sonographic morphological pattern of each patient was compared to the histological diagnosis of the ovarian tumors. Of the 120 patients with an ovarian lesion, the sonographic morphological pattern of 10 had a sensitivity of 88.6 per cent and a specificity of 89.4 per cent in detection of malignant ovarian tumors. The positive predictive value, negative predictive value, and the accuracy rate were 77.5, 95.0, and 89.2 per cent, respectively. In the present study, a score of 9 would be the best discriminator between benign and malignant ovarian masses, giving a sensitivity of 97.1 per cent and specificity of 82.4 per cent. As stand alone, the present results confirm that ultrasonography is still a useful diagnostic tool in the differentiation of benign from malignant ovarian masses.

Key word : Ovarian Tumor, Ultrasonography, Morphological Pattern

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* Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

Ovarian cancer accounts for approximately 25 per cent of all gynecological malignancies. Because it is a silent disease, the overall 5-year survival rate remains low. It is the major lethal gynecological malignancy in Western countries[1,2]. In Thailand, it comprises about 16 per cent of all gynecological cancers and is the second most common cancer of the female genital tract after cervical cancer[3]. An accurate pre-operative diagnosis provides better pre-operative and intra-operative management, and the morbidity and even the mortality of these patients may be reduced.

Ultrasonography, especially transvaginal sonography, is widely used to differentiate benign from malignant ovarian tumors by the morphological patterns of the tumors. The reason is that it is easy to use in connection with a gynecological examination, it is easily handled, and the image is rather easily interpreted after some training. The diagnosis is based on morphological criteria, summarized as scores or sonographic patterns. Different morphological criteria and scores have been suggested to distinguish between benign and malignant ovarian masses[4-8]. Wanapirak et al[9], in 2001, reported a sensitivity of 93.1 per cent and specificity of 75.6 per cent using the sonographic morphological score proposed by Sassone et al[6] in distinguishing benign from ovarian cancer. Reles et al[10] demonstrated that a sonographic score modified from that of Vera et al[11] and Kawai et al[12] allowed an easy and reliable evaluation of ovarian masses, giving a sensitivity of 91 per cent and specificity of 84 per cent. This sonographic criteria is explicit and easily reproducible in the general gynecological practice. The aim of this study was to evaluate the accuracy of the sonographic morphological pattern in differentiating a benign ovarian tumor from ovarian cancer.

MATERIAL AND METHOD

All patients with a suspected ovarian tumor, who were admitted for elective surgery at the Department of Obstetrics and Gynecology Siriraj Hospital between July 2001 and June 2002, were evaluated. The equipment used was a Toshiba (Eccocee) SSA-340A unit. Each patient was evaluated by vaginal sonography the day before surgery. All these examinations were performed by the same physician (P.S.). Transvaginal ultrasound was done with PVF-621 VT, 5-MHz transducer. In patients who could not be evaluated vaginally or in whom the tumor occupied more or less the whole lower pelvis and vaginal scanning could not image the whole tumor, abdominal scanning was performed to obtain a sonographic image of the tumor. For the abdominal scan a PVF-375 MT, 3.75-MHz transducer was used. The morphology of the obtained sonographic image was evaluated with the help of a sonographic score modified from that of Vera et al[11] and Kawai et al[12] as shown in Fig. 1. According to the sonographic morphological pattern, a tumor was classified as either benign (a score of 1-9) or suspected of being malignant (a score of 10-14) before surgery. The pathological diagnosis was made according to the criteria set by the World Health Organization[13]. The authors excluded those patients with previous bilateral salpingo-oophorectomy, surgery for ovarian cancer, a metastatic tumor to the ovary, and tumors of nonovarian origin.

The sonographic morphological pattern was related to the benign or malignant nature of the ovarian tumor by contingency table methods and evaluated for significance by Chi-square analysis.

RESULTS

One hundred and twenty-three patients with a suspected ovarian tumor were examined by sonography and underwent laparotomy. Of these patients, 114 (92.7%) had sonography performed vaginally and 9 (7.3%) were scanned transabdominally. Three patients were excluded due to subsequent histological diagnosis of tumors of nonovarian origin including leiomyoma and parovarian cyst. The remaining 120 patients were available for analysis.

The patients' ages ranged from 12 to 81 with a mean of 41.5 $\pm$ 14.1 years. Nearly half of the patients (46.7%) were nulliparous and one-fourth were postmenopausal. Ninety-one per cent of the patients had gynecological symptoms that made them contact their physicians. The rest of the tumors (8.3%) were diagnosed at a routine gynecological checkup. Of the 120 patients, 35 (29.2%) were found to have a malignant ovarian tumor.

Tumors were evaluated pre-operatively as either benign or suspicious of being malignant according to the sonographic classification shown in Fig. 1. With a cutoff of 10 as the discriminator between benign and malignant ovarian masses, the sensitivity and specificity were 88.6 per cent (95% CI, 72.3-96.3) and 89.4 per cent (95% CI, 80.4-94.7), respectively. The positive predictive value was 77.5 per cent (95% CI, 61.1-88.6) and the negative predictive value was 95.0 per cent (95% CI, 87.0-98.4) with a false positive and negative rate of 10.6 and 11.4 per cent,

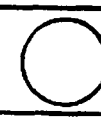
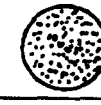
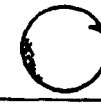
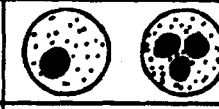
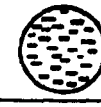
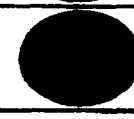
Benign Pattern	1.	Simple cyst without internal echo	
	2.	Two or more cysts without internal echo	
	3.	Simple cyst with scattered echoes	
	4.	Simple cyst with vague boundary echoes	
	5.	Cyst with sessile or polypoid smooth mural echo	
	6.	Cystic structure with central dense round echoes	
	7.	Cystic structure with multiple linear echoes	
	8.	Cystic structure with irregular shaped internal echoes	
	9.	Complex polycystic pattern with smooth thin septae	
Malignant pattern	10.	Complex cystic pattern with irregularly thick septae	
	11.	Cystic or polycystic pattern with papillary or indented mural part	
	12.	Polycystic pattern with irregularly thick septae and solid part < 50%	
	13.	Solid pattern (solid part > 50%) with irregular cystic part	
	14.	Completely solid homogeneous or inhomogeneous pattern	

Fig. 1. Sonographic pattern of ovarian tumors (modified from the sonographic classification of Vera et al 1986[11] and Kawai et al 1992[12]).

Table 1. Contingency table arranged to show the prediction of malignant ovarian tumor by sonographic pattern.*

Sonographic pattern (SP)	Histopathology		Total
	Malignant	Benign	
SP = 10-14 (positive)	31	9	40
SP = 1-9 (negative)	4	76	80
Total	35	85	120

* sensitivity = 88.6% (31/35), specificity = 89.4% (76/85), positive predictive value = 77.5% (31/40), negative predictive value = 95.0% (76/80).

Table 2. Sensitivity and specificity of varying cut-off points.

Cut-off point	Sensitivity %	Specificity %
1	100	0
2	100	18.8
3	100	32.9
4	100	60.0
5	100	62.4
6	100	67.1
7	100	72.9
8	100	78.8
9	97.1	82.4
10	88.6	89.4
11	82.9	89.4
12	65.7	92.9
13	37.1	96.4
14	11.4	100

respectively. The accuracy rate of sonographic morphological pattern was 89.2 per cent (Table 1).

To identify the scoring threshold that best distinguished the malignant from benign ovarian lesions in the present study, the authors calculated sensitivity and specificity for each score (Table 2). The sensitivity and specificity for each score were plotted to create a receiver operating characteristic curve. Construction of this curve showed that 9 was the score that best distinguished malignant from benign ovarian tumors, giving a sensitivity and specificity of 97.1 and 82.4 per cent, respectively.

DISCUSSION

Sonography of the pelvis has become an important part of the evaluation of pelvic organs, particularly ovaries. Pre-operative prediction of the histological diagnosis of ovarian masses has remained a challenge for the physician since many ovarian lesions have nonspecific sonographic appearance. Accurate differentiation of benign and malignant disease would reduce unnecessary anxiety and improve the triage of appropriate ovarian tumors to a gynecologic oncologist. The superior resolution that is available with high frequency transvaginal sonography has allowed the authors to develop a scoring system based on the morphology pattern of the ovarian lesion. Several investigators have established various criteria for the sonographic diagnosis of ovarian masses; they include amounts of echogenicity or solid material within the mass, size and thickness of the septae, and consistency and definition of borders of the mass. The sensitivity of sonography in predicting a malignant ovarian tumor has been shown to range from 82-100 per cent, with a specificity of 76-92 per cent[4-10].

As previously described, the sonographic images obtained were classified according to the sonographic pattern shown in Fig. 1 as being benign (a score of 1-9) or malignant (a score of 10-14). The sensitivity of 88.6 per cent and specificity of 89.4 per cent in the present study are within the range mentioned in the literature[4-10]. Using the sonographic score modified from that of Vera et al[11] and Kawai et al[12], the present results are comparable to those reported by Rele et al[10], however, the specificity and positive predictive value are somewhat higher (89.4% *vs* 84% and 77.5% *vs* 65%, respectively).

In the present series, 9 patients had false positive results (a benign lesion with a score of 10-14) and 4 had false negative results (a malignant lesion with a score of 1-9), giving the false positive and false negative rate of 10.6 and 11.4 per cent, respectively. The finding that endometriosis was the most common lesion in the false positive group (5/9 patients) is consistent with that observed by others[6,9]. For

the four patients whose malignancies were misread as benign by sonography, all had stage I ovarian cancer with a score of 9 (3 patients) and 8 (1 patient). Some investigators have shown that the false positve and negative rate can be reduced with the use of additional tests, such as serum CA125[14-18] and/or color Doppler study[17-22] of the ovarian tumor.

Using a score of 9 as threshold for a positive test would make the scoring system in the present study more sensitive with acceptable specificity (97.1 and 82.4%, respectively). The ability to manipulate test performance by varying the choice of the threshold is another advantage of a numerical scoring system.

Sonography is a useful noninvasive method for evaluating adnexal masses. The procedure can be performed easily without causing discomfort to the pateints. The present study confirms that the sonographic morphological score is reliable in distinguishing benign from malignant ovarian tumors. This scoring system should be applied in general gynecological practice since ultrasound equipment is available in many hospitals countrywide and the sonographic image can be easily interpreted after some training.

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การใช้คลื่นเสียงความถี่สูงในการทำนายเนื้องอกรังไข่ชนิดร้าย

มงคล เบญจาภิบาล, พบ, ประเสริฐ ศันสนีย์วิทยกุล, พบ*, ชยวัฒน์ ผาติหัตถกร, พบ*, อิสสระชา สู่พานิช, วทบ*, วิวัฒน์ เอี่ยมอุไรรัตน์, พบ**

ทำการวิจัยแบบตัดขวางเพื่อประเมินความถูกต้องของการใช้คะแนนจากภาพคลื่นเสียงความถี่สูงในการทำนายเนื้องอกรังไข่ ผู้ป่วยนรีเวชจำนวน 123 คนที่ได้รับการวินิจฉัยเบื้องต้นว่ามีพยาธิสภาพที่รังไข่ และได้รับการผ่าตัดแบบไม่ฉุกเฉินจะได้รับการตรวจด้วยคลื่นเสียงความถี่สูงที่ภาควิชาสูติศาสตร์-นรีเวชวิทยา คณะแพทยศาสตร์ศิริราชพยาบาล โรงพยาบาลศิริราช มหาวิทยาลัยมหิดล โดยแพทย์ผู้ตรวจเพียงท่านเดียว และให้คะแนนจากภาพคลื่นเสียงความถี่สูงที่ตรวจพบ หลังจากนั้นทำการเปรียบเทียบคะแนนจากภาพคลื่นเสียงความถี่สูงกับผลการตรวจเนื้องอกรังไข่ทางพยาธิวิทยา ผู้ป่วยจำนวน 120 คนที่มีพยาธิสภาพเกิดจากรังไข่ พบว่า เมื่อใช้คะแนนเท่ากับ 10 ในการทำนายเนื้องอกรังไข่ชนิดร้าย มีความไวร้อยละ 88.6, ความจำเพาะร้อยละ 89.4, ค่าทำนายผลบวกร้อยละ 77.5, ค่าทำนายผลลบร้อยละ 95, และความถูกต้องร้อยละ 89.2 จากการวิจัยนี้ พบว่าคะแนนเท่ากับ 9 เหมาะสมที่สุดในการใช้แยกเนื้องอกรังไข่ชนิดธรรมดา และชนิดร้าย โดยให้ความไวร้อยละ 97.1 และความจำเพาะร้อยละ 82.4 สรุปว่าคลื่นเสียงความถี่สูงมีประโยชน์ในการทำนายเนื้องอกรังไข่ก่อนการผ่าตัด

คำสำคัญ : เนื้องอกรังไข่, คลื่นเสียงความถี่สูง

มงคล เบญจาภิบาล, ประเสริฐ ศันสนีย์วิทยกุล, ชยวัฒน์ ผาติหัตถกร, อิสสระชา สู่พานิช, วิวัฒน์ เอี่ยมอุไรรัตน์
จดหมายเหตุทางแพทย์ ฯ 2546; 86: 332-337

* ภาควิชาสูติศาสตร์-นรีเวชวิทยา, คณะแพทยศาสตร์ศิริราชพยาบาล, มหาวิทยาลัยมหิดล กรุงเทพ ฯ 10700