

GYNAECOLOGY

Sonographic Morphology Scores (SMS) for differentiation between benign and malignant adnexal masses

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ABSTRACT

Objective To determine the sensitivity and specificity of scoring system in distinguishing between benign and malignant adnexal mass. To detect threshold score for prediction of malignant adnexal tumor.

Study design Cross-sectional diagnostic test.

Settings Department of Obstetrics and Gynecology, Faculty of Medicine, Chiang Mai University.

Subjects A total 158 patients scheduled for elective surgery due to ovarian tumor at Maharaj Nakorn Chiang Mai Hospital between June 16, 2002 and August 8, 2003 were recruited into the study.

Methods All patients were sonographically examined within 72 hours of surgery by the same sonographer to evaluate the morphology including wall structure, shadowing, septum, echogenicity and score the tumors. The final diagnosis was based on either pathological or operative findings.

Main outcome measure Sensitivity and specificity of the best cut-off score.

Results The score of 5 from receiver operating characteristic curve was the best cut-off score, giving the sensitivity and specificity of 85% and 70% respectively.

Conclusion The sonographic morphology scores are probably useful in distinguishing adnexal malignancy from benign adnexal masses in some selected cases. The cut-off point score was 5, giving the sensitivity and specificity of 85% and 70%.

Key words: ultrasonography, sonographic morphology scores, adnexal masses

From International Agency for Research on Cancer (IARC) report, ovarian cancer is the second common gynecologic cancer in Thailand with overall incidence of 4.5:100,000 per year⁽¹⁾ and it is the most common cause of death in women with gynecologic cancer. The incidence of ovarian cancer in Maharaj Nakorn Chiang Mai Hospital between 1987-1994 was

9.6%⁽²⁾, consisting of stage I in only 51.3%.⁽³⁾

Until currently, there has been no effective screening method for ovarian cancer and because they are usually asymptomatic until they have metastasized, patient have advanced disease at diagnosis in more than two-third of the cases and advanced-stage disease, the prognosis is poor.

Several attempts have been made to distinguish the benign from malignant condition leading to early detection of ovarian cancer, especially the use of pelvic ultrasound based on either morphological appearance or Doppler waveforms. However, there has been no an ideal screening test with very high sensitivity and specificity for ovarian cancer and such a test needs to be sought for. Some studies⁽⁴⁻⁶⁾ showed that sonographic features of the masses can effectively differentiate the benign from malignant tumors with various accuracy. At present, Lerner and Trimor-Tritsch sonographic scoring system⁽⁴⁾ has been shown to be effective and simple in discriminating between benign and malignant adnexal mass. The purpose of this study was to determine sensitivity, specificity and to detect threshold sonographic score for prediction of malignant adnexal mass based on Lerner and Trimor-Tritsch scoring system.⁽⁴⁾

Material and methods

One hundred and fifty-eight patients (185 adnexal masses) scheduled for elective surgery due to ovarian tumor at Maharaj Nakorn Chiang Mai

Hospital between June 16, 2002 and August 8, 2003 were recruited into the study. Exclusion criteria were as follows :

- 1) patients with ovarian malignancy who were scheduled for second look operation
- 2) patients undergoing operation after 72 hours of ultrasound examination.

All of these women were counseled and invited to join the study with informed consent.

Transabdominal sonography was done by the same sonographer using curvilinear transabdominal probe, Aloka model 5000, frequency 3.5 MHz, scan 90 degree. If the morphology of mass could not be seen clearly by transabdominal sonography then transvaginal approach was done using curvilinear transvaginal probe, Aloka model 5000, frequency 5 MHz, scan 120 degree.

Sonographic morphology scores based on Lerner and Trimor-Tritsch scoring system⁽⁴⁾ was consisted of 4 parameters including wall structure, shadowing, septa and echogenicity which weight the values to each variable then sum of scores with range of possible scores is 0-8 points as shown in Table 1.

Table 1. The sonographic scoring system

Parameter	Score = 0	Score = 1	Score = 2	Score = 3
Wall structure	Smooth or small irregularities < 3 mm	-	Solid or nonapplicable	Papillarities ≥ 3 mm
Shadowing	Yes	No	-	-
Septa	None or thin (<3 mm)	Thick (\geq or $= 3$ mm)	-	-
Echogenicity	Sonolucent or low-level echo or echogenic core	-	-	Mixed or high

The score was assigned to each ovarian or adnexal mass, not to each patient. The final diagnosis for gold standard of was pathologically confirmed in all cases which specimen were obtained. However, the cases with no specimen, few cases of benign condition such as follicular cyst, the diagnosis was

based on intraoperative or laparoscopic findings. We included borderline ovarian tumor into malignant group, so all of ovarian tumor and adnexal masses were divided in 2 groups as benign and malignant adnexal masses.

All data were analyzed by using Stata program.

Results

One hundred and fifty-eight patients (185 adnexal masses) with a suspected ovarian tumor were examined by sonography and underwent laparotomy or laparoscopic surgery during June 16, 2002 to August 8, 2003. The patient's age ranged from 13 to 79 with a mean of 44.84 years. According to histologic diagnosis or intraoperative findings, 120 of adnexal masses were benign and 65 masses were malignant, including 58 cancer masses and 7 borderline tumor masses. The mean age in benign

group and malignant group were 41.2 and 51.57 years, respectively.

In premenopausal patients, there were benign tumors 78.99%, borderline tumors 3.36% and 17.65% for cancer. Postmenopausal patients, 36.39%, 4.55%, 56.06% were benign, borderline tumors and cancer, respectively.

The mean score of the malignant group was significantly higher than that of the benign group, 2.59 and 5.75, as shown in Table 2, respectively.

Table 2. Mean sonographic scores of the benign and malignant group

Pathological report	Number	Mean	SMS Standard deviation	Range
Benign	120	2.59	2.33	0-8
Malignant	65	5.75	1.77	0-8
- Borderline	7	6.43	1.51	4-8
- Cancer	58	5.67	1.79	0-8
Total	185	3.70	2.63	0-8

The sensitivity and specificity for each score were plotted to create a receiver operating characteristic curve (ROC). Construction of this curve showed that 5 was the score that best distinguished malignant from benign adnexal masses, giving a sensitivity and

specificity of 85 and 70 per cent, respectively, positive predictive value (PPV) 60 % and negative predictive value (NPV) is 89 %. As shown in Fig.1. The mean and range of scores for each type of adnexal masses and adnexal masses that $SMS \geq 5$ were shown in Table.3.

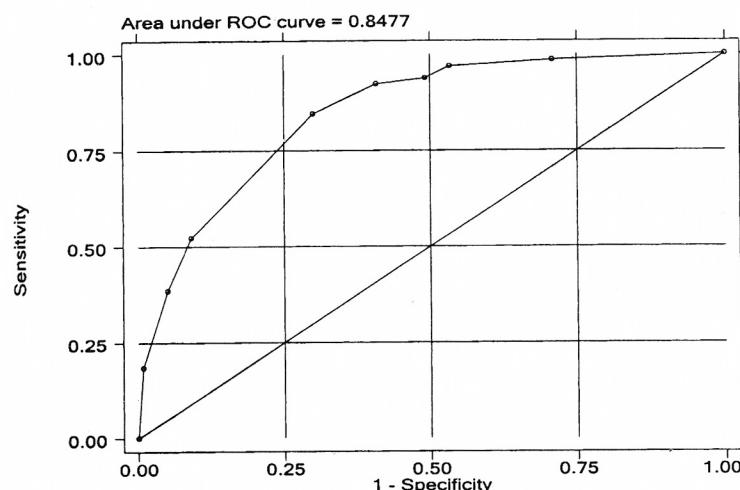


Fig. 1. Reciever operating characteristic (ROC) curve of the scoring system.

Table 3. The sonographic score for each type of the final diagnosis and type of adnexal masses with SMS ≥ 5

Final Diagnosis	Number	SMS		SMS > 5 Number (percent)
		Mean	Range	
Malignant				
Mucinous tumor of LMP	7	6.43	4-8	6 (85)
Serous adenocarcinoma	17	5.47	3-8	15 (88)
Mucinous adenocarcinoma	4	5.5	2-7	3 (75)
Endometrioid carcinoma	7	6.42	4-8	6 (85)
Germ cell tumor	3	6.00	5-7	3 (100)
Metastatic carcinoma	10	5.80	0-8	7 (70)
Clear cell carcinoma	3	5.67	5-7	3 (100)
Sexcord stromal tumor	2	4.00	1-7	1 (50)
Others	12	5.67	2-8	11 (91)
Benign				
simple cyst	10	1.50	0-5	1 (10)
Serous cystadenoma	7	0.86	0-3	0 (0)
Mucinous cystadenoma	12	1.75	0-5	1 (8)
Endometriosis	42	1.55	0.7	6 (14)
Mature cystic teratoma	23	4.35	0-7	16 (69)
Tubo-ovarian abscess	2	4.00	4-4	0 (0)
Uterine leiomyoma	6	4.83	0-8	4 (66)
Others	18	3.72	0-6	8 (44)
Total	185	3.70	0-8	91 (49)

Discussion

Preoperative prediction of the histological diagnosis of adnexal masses especially ovarian masses was important for planning of treatment and there has currently been no effective method for screening adnexal malignancy. Many investigators attempted to determine the sonographic morphology scoring system that used to differentiate benign from malignant neoplasms as reported by Sassone (1991)⁽⁶⁾, Lerner (1994)⁽⁴⁾, Weber (1999)⁽⁷⁾, and Merz (1998)⁽⁸⁾ etc. The sensitivity and specificity of these sonography systems in predicting a malignant ovarian tumor were varied from 83 to 96.8% and 77 to 100%, respectively.

According to one of the well-known scoring system originally reported by Sassone⁽⁶⁾ and later reported from our institution⁽⁵⁾, Sassone scoring system has rather high sensitivity and specificity, but it has high false positive rate in some benign tumor

especially mature teratoma, endometrioma and mucinous cystadenoma.

In 1994, Lerner⁽⁴⁾ attempted to improve discriminatory ability in evaluation of adnexal masses and to simplify the scoring system by excluding the parameter of wall thickness from Sassone scoring system⁽⁶⁾ and added another important parameter especially shadowing in order to discriminate cystic teratoma from malignant adnexal masses and to improve positive predictive value. The Lerner scoring system⁽⁴⁾ using cut-off point at score 3 was reported to have 96.8% sensitivity, 77% specificity and 29.4, 99.6% positive predictive value and negative predictive value respectively.

For practical purpose, we used the variables based on SMS system proposed by Lerner et al⁽⁴⁾ because it is simple and easy to learn and can widely be applied without Doppler equipment. The variables

including inner wall structure, shadowing, septa, and echogenicity, can be clearly visualized in most cases.

Based on receiver operating characteristic (ROC) curve, the best cut-off score to discriminate malignant from benign adnexal masses is 5 with sensitivity 85%, specificity 70%, PPV 60% and NPV 89%. It was found that the sensitivity and specificity in this study was lower than that of the original study of Lerner et al⁽⁴⁾ who found sensitivity and specificity of 96.8% and 77% respectively.

Interestingly, we found that despite including shadowing into this new scoring system to improve discriminatory ability in dermoid cyst, the false positive rate remains high (36 from 91 masses). These results indicate that false positive rate was high in case of mature teratoma, myoma, and tubo-ovarian abscess or complex. These tumors were benign but had high scores because of their high echogenicity. This finding was consistent with that observed by Sassone et al⁽⁶⁾.

Our results did not show the superiority of the Lerner scoring system.⁽⁴⁾ However, in practical use this pitfall may be overcome by other characteristics of these tumors which are not included in the SMS system, such as fried egg appearance or hair speckles of mature teratoma, highly homogeneous echogenicity of endometrioma, multiple edged-shadow of myoma and some advanced stage ovarian malignancy with its frank peritoneal seeding or omental cake or ascites. In reality, experienced sonographer can diagnose mature teratoma or endometrioma without difficulty. The characteristic sonographic features of some type of adnexal mass alone can predict the histology without using any scoring system at all. Therefore if we had excluded these tumors from the study, the discriminatory ability of scoring system might improve.

As previously described, these scoring system may probably be useful in some selected cases, especially in adnexal masses without typical sonographic characteristics of a certain disorder and difficult to predict subjectively whether benign or malignant masses. In such situation, the scoring system may be helpful in decision making. If the Dop-

pler study of the adnexal masses was added the accuracy of prediction may improve.

The reliability of this study is based on the fact that ultrasound examinations were done by only one experienced examiner who had no any clinical information of the patient resulting in no interobserver variability, the examinations was done with the same high quality equipment, and finally the sample size was adequate.

In summary, even though the sensitivity and specificity of Lerner scoring system in this study was not as high as in previous original study of Lerner, but it may probably be useful in clinical practice for some selected cases. However, false positive rate was relatively high in mature teratoma, endometrioma and myoma due to their high echogenicity, therefore, extreme precaution should be taken in these conditions.

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