RESEARCH COMMUNICATION

Subjective Sonographic Assessment for Differentiation between Malignant and Benign Adnexal Masses

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Abstract

Objective: To determine the accuracy of subjective sonographic assessment in distinguishing between benign and malignant adnexal masses. Study design: Cross-sectional descriptive study. Methods: The patients scheduled for elective surgery due to adnexal masses were recruited into the study. All patients were sonographically examined within 72 hours of surgery were subjectively evaluated by the experienced sonographer, who had no any information of the patients, to differentiate between benign and malignant adnexal masses based on sonographic morphology. The final diagnoses, used as gold standard, were based on either pathological or operative findings. Results: One hundred and fifty-eight patients with 174 adnexal masses, (benign; 108 and malignant; 66) were recruited into the study. The accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were of 89.7%, 84.9 % and 92.6 %, 87.5% and 90.9%, respectively. Conclusions: Subjective evaluation of sonographic morphology has high accuracy in differentiating between benign and malignant adnexal masses.

Key Words: Adnexal mass - subjective assessment - ultrasound

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Introduction

The differentiation of benign from malignant adnexal masses is of great value, because therapeutic approach is markedly different between the two entities. Benign ovarian masses, functional change or neoplasm, need more conservative approach, either closed observation or laparoscopic surgery, whereas the malignant tumors require urgent laparotomy in most cases with planned systematic consultation of available oncologists. Several attempts have been made to distinguish the both conditions, 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 accuracy for ovarian cancer and such a test needs to be sought for. Some western studies showed that sonographic features of the masses can effectively differentiate the benign from malignant tumors with various accuracy (Fleischer et al., 1978; Campbell et al., 1982; Moyle et al., 1983; Sassone et al., 1991). For example, Sassone and et al (1991) found that sonographic morphology scores (SMS) system was effective in the differentiation with sensitivity of 100% and specificity of 83%. Likewise, Timmerman et al (1999), Valentine (1999a; 1999b) reported that subjective sonographic evaluation with experienced examiner also had high accuracy of 90%. Nevertheless, despite the availability of scoring systems, most sonographers base their diagnosis on a subjective assessment of adnexal masses by using ultrasonography and the available information, including a medical history. In our country, although ultrasound is widely available and subjective sonographic evaluation of adnexal masses is commonly used in general practice, the effectiveness of this assessment has never been evaluated. Therefore, we conducted this study to determine the accuracy, sensitivity and specificity of subjective sonographic evaluation in distinguishing between benign and malignant ovarian tumors.

Materials and Methods

All patients scheduled for elective surgery due to clinical diagnosis of ovarian tumor at Maharaj Nakorn Chiang Mai Hospital between November, 2003 and September, 2004 were recruited into the study. All underwent ultrasound examination by the same sonographer who had no any clinical information of the patients. with transabdominal approach first using curvilinear transabdominal probe of frequency 3.5 MHz. If the morphology of mass could not be seen clearly then transvaginal approach was done using curvilinear transvaginal probe of frequency 5-7 MHz. The machines used in this study were either Aloka Prosound SSD 5000 (Tokyo, Japan) or Voluson 730 Pro (GE Medical Systems; Tokyo, Japan). During each scan, attention was given to

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the size, locularity, echogenicity, papillary structures and internal surface of the tumor. The assessment was totally based on sonographic morphology of adnexal masses and each mass was subjectively classified as malignant or benign. Subjective sonographic evaluation in differentiation between benign and malignant adnexal masses was based on the morphologic characteristics of the masses.

Results

One hundred and fifty-eight patients, including 174 adnexal masses, were examined by ultrasound and underwent laparotomy or laparoscopic surgery between July, 2003 and October, 2004. The patient's age ranged from 14 to 82 years with a mean of 46.91 years. Of 174 adnexal masses, 108 (62.0%) was proven to be benign and 66 (37.9%) were pathological diagnosis of malignancy. The final diagnoses of all masses are shown in Table 1.

Endometriotic cyst was the most common benign masses, accounting for 25% of all masses, followed by teratoma (18.5%) and simple epithelial cyst (18.5%). Among the malignant group, surface epithelial tumor was the most common, (65.2%), as shown in Table 1.

The accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were of 89.7%, 84.9 % and 92.6 %, 87.5% and 90.9%, respectively, as shown in Table 2.

Table 1. Pathological Diagnosis of the Adnexal Masses

Pathological diagnosis	
Benign masses	108 (100%)
- endometriotic cyst	27 (25.0%)
- teratoma	20 (18.5%)
- simple cyst,epithelial cyst, hemorrhagic cyst	20 (18.5%)
- mucinous cystadenoma	14 (13.0%)
- serous cystadenoma	12 (11.1%)
- myoma,adenomyosis	8 (7.4%)
- hydrosalpinx	3 (2.8%)
- thecoma	1 (0.9%)
- benign brenner	1 (0.9%)
- tubo-ovarian abscess	1 (0.9%)
- endosalpingiosis	1 (0.9%)
Malignant masses	66 (100%)
- surface epithelial- stromal tumor	43 (65.2%)
- metastatic adenocarcinoma	14 (21.2%)
- sex cord stromal tumor	5 (7.6%)
- metastatic squamous carcinoma	2 (3.0%)
- dysgerminoma	1 (1.5%)
- liposarcoma	1 (1.5%)

Table 2. Diagnostic Indices of the Subjective Assessment in Differentiating Adnexal Masses

Sonographic subjective assessment	Final diagnosis Malignant	Benign	Total
Malignant masses	56 (32.2)*	8 (4.6)	64 (36.8)
Benign masses	10 (5.7)	100 (57.5)	110 (62.2)
Total	66 (37.9)	108 (62.1)	174 (100)

*Number (%)

Sensitivity	84.9% [95% CI; 79.6-90.2 %]
Specificity	92.6% [95% CI; 88.7-96.5 %]
Positive predictive value	87.5% [95% CI; 82.6-92.4 %]
Negative predictive value	90.9% [95% CI; 86.6-95.2 %]
Accuracy	89.7% [95% CI; 85.2-94.2 %]

Discussion

Ultrasound examination plays an important role when deciding how to treat adnexal masses that cause symptoms. The knowledge of the tumor nature can lead to more proper management. For example, consultation of the oncologist and pathologist in advance or patient counseling regarding the extent of operation can provide the better management. Several techniques have been used for this purpose such as CA 125 tumor marker (Kudlacek et al., 1989), clinical course (MacFarlane et al., 1955), and various types of imaging technology. Currently, most attention has been paid to ultrasound. Several attempts have been made in order to objectively define the sonographic criteria in predicting malignancy and benignity (Fleischer et al., 1978; Campbell et al., 1982; Moyle et al., 1983; Sassone et al., 1991). However, subjective sonographic evaluation of the mass morphology was also shown to be effective (Timmerman et al., 1999; Valentin, 1999a; 1999b). An experienced ultrasound examiner can very confidently discriminate between benign and malignant pelvic tumors in the adnexal region using subjective assessment. Pattern recognition has been shown to be superior to all other ultrasound methods (e.g. simple classification systems, scoring systems, mathematical models for calculating the risk of malignancy) for discrimination between benign and malignant extrauterine pelvic masses (Valentin, 1999a; Valentin et al., 2001). Adding Doppler ultrasound examination to subjective evaluation of the gray-scale ultrasound image does not seem to yield much improvement in diagnostic precision but it may increase the confidence with which a correct diagnosis of benignity or malignancy is made (Jain, 1994; Valentin, 1999a). The accuracy of subjective assessment in this study is consistent with most western studies, in which the reported sensitivity of pattern recognition is varied between 88 and 100% and the reported specificity between 62 and 96% (Jain, 1994; Guerriero et al., 1998; Valentin, 1999a; Valentin et al., 2001).

Subjective evaluation of the gray-scale ultrasound image, i.e. pattern recognition, for discrimination between benign and malignant tumors can almost certainly be learnt by anyone performing gynecological ultrasound examinations on a regular basis, but diagnostic accuracy increases with increasing experience (Timmerman et al., 1995).

Subjective assessment in general practice, as well as in this study, is based on the pattern recognition, which may be summarized as follows (Valentin, 2004): 1) benign tumor: absence of solid components and no irregularity; 2) malignant tumor: presence of solid components and irregularity; 3) dermoid cyst: white ball within a cyst, echogenic lines and prominent echogenic dots in fluid, shadowing; 4) endometrioma: ground glass appearance of cyst contents, wall nodularities; 5) hemorrhagic corpus luteum cyst: spider-web-like contents, bizarre blood clots; 6) hydro-pyo-hematosalpinx: fluid-filled sausage-shaped

cystic structure, incomplete septa, cog-wheel appearance, beads-on-a-string appearance; 7) paraovarian cyst: cyst clearly separate from a normal ovary; 8) peritoneal pseudocyst: cystic mass following the contours of the pelvis and with an ovary, often deformed, suspended among adhesions centrally or peripherally in the cyst; 9) fibroma, fibrothecoma: echo pattern similar to that of leiomyoma, i.e. solid, round, lobular or oval tumor with a smooth outline and a regular stripy echogenicity; 10) tubo-ovarian abscess; unilocular cystic structure, or complex multicystic structure with thick walls and thick septae, filled with homogeneously echogenic material (ground-glass appearance)

Notably, several cases of false positive (benign mass sonographic interpreted for malignant), and false negative rate, (malignant tumor with sonographic impression for benign) were found in cases of borderline tumors. These are due to the fact that cystadenomas versus borderline tumors and cystadenocarcinoma versus borderline tumors usually have overlapping ultrasound morphology.

Additionally, most cases of false positive result were associated with benign solid mass without typical findings of particular tumors. In such a condition, the mass should always evoke suspicion of malignancy. Benign solid tumors often mistaken for malignancy included ovarian fibroma, thecoma, fibrothecoma, thecofibroma, pedunculated uterine leiomyoma, and dense tubo-ovarian abscess. Furthermore, papillary projections considered a strong sign of malignancy are more common in borderline tumours than in invasive cancers but may also be seen in benign tumours, for example, in adenofibromas. They explain some false-positive ultrasound diagnoses of malignancy.

The reliability of this study is based on the fact that ultrasound features were interpreted by only one examiner who had no any clinical information of the patient resulting in no interobserver variability, the examinations was done with the high quality equipment, and finally the sample size was adequate. However, a limitation must be stressed. The high accuracy in this study represents that subjectively assessed by an extensively experienced sonographer, therefore, it may probably not be reproducible in general practice. However, this should encourage all sonographers to pay attention to the pattern recognition. Pattern recognition can almost certainly be learnt by anyone performing gynecological ultrasound examinations on a regular basis, but diagnostic accuracy increases with increasing experience. Using pattern recognition a fairly confident specific diagnosis can be made of a dermoid cyst, endometrioma, hemorrhagic corpus luteum cyst, hydrosalpinx, paraovarian cyst and peritoneal pseudocyst. However, it is sometime difficult to discriminate confidently between a solid benign ovarian tumor and a pedunculated uterine leiomyoma, or between an ovarian fibroma, fibrothecoma, thecofibroma and thecoma.

In conclusion, the subjective evaluation of an ovarian mass by an experienced ultrasonographer is a highly accurate method for discriminating between benign and malignant ovarian masses. This data suggest that training should focus on recognizing the constituent morphological features of a mass, rather than on any particular scoring system. This aim may be achieved by using examples of complex ultrasonographic video of different adnexal masses so that trainees may establish their own database of experience. Exposure to stored images, or video clips could be formally implemented into relevant training programs.

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