Original Study

Comparison of 4 Risk-of-Malignancy Indexes in the Preoperative Evaluation of Patients With Pelvic Masses: A Prospective Study

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Abstract

The aim of this study was to evaluate the ability of 4 risk-of-malignancy indexes (RMIs) to discriminate benign from malignant pelvic masses. The RMI methods were calculated for 296 patients together with the sensitivity, specificity, positive predictive value, and negative predictive value. The RMI method is a valuable and applicable method in diagnosing pelvic masses with high risk of malignancy.

Background: The aim of this study was to validate the risk-of-malignancy index (RMI) incorporating menopausal status, serum CA 125 levels, and imaging findings for discriminating benign from malignant pelvic masses and to evaluate the ability of 4 different RMIs. **Patients and Methods:** This is a prospective study of 296 women admitted to the Department of Obstetrics and Gynecology of Kochi Health Sciences Center, between September 2011 and April 2014, for surgical exploration of pelvic masses. The RMI 1, 2, 3, and 4 methods were calculated for all patients together with the sensitivity, specificity, positive predictive value, and negative predictive value. **Results:** The sensitivity of RMIs 1, 2, 3, and 4 was 73.0%, 81.1%, 73.0%, and 77.0%, respectively, and the specificity was 93.7%, 89.6%, 93.7%, and 92.3%, respectively. The RMI 2 was significantly better at predicting malignancy than RMIs 1 3; however, there was no statistically significant difference in performance of RMIs 2 4. **Conclusion:** The RMI method is a valuable and applicable method in diagnosing pelvic masses with high risk of malignancy and a simple technique that can be used in gynecology clinics and less-specialized centers.

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Introduction

A pelvic mass is one of the most frequent indications for referral to gynecology specialists. Often, these pelvic masses are malignant and require surgical treatment. Up to 24% of ovarian tumors in premenopausal women are malignant and up to 60% are malignant in postmenopausal women.[1-3]

The preoperative determination of whether a mass is malignant cannot always be made with current diagnostic modalities. Surgery can be optimally planned if it is known in advance whether an ovarian neoplasm is benign or malignant. The type of surgical procedure and the experience of the surgeon are important factors for the prognosis of ovarian cancer. An improved method for preoperative discrimination of pelvic mass would result in more women receiving first-line therapy from appropriately trained and experienced personnel.[4,5] For such referrals to be efficient, improved specific and sensitive methods for diagnosing ovarian cancer are needed.

Used alone, the diagnostic accuracy of demographics, ultrasound (US), and biochemical variables is inadequate for clinical application. Various combined methods for evaluating the risk of ovarian cancer have been proposed. The risk-of-malignancy index (RMI) is a simple scoring method based on menopausal status, US findings, and the serum CA 125 level. This method has given significantly better results than the use of a single parameter.[6-8] The RMI can be applied in less-specialized centers. The RMI is the product of the imaging

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scores (U), the menopausal score (M), and the absolute value of the serum CA 125:

$$\text{RMI} = \text{U} \times \text{M} \times \text{CA 125}$$

In 1990, Jacobs et al[6] originally developed the RMI, which we have termed "RMI 1." Tingulstad et al[7] developed their version of the RMI in 1996, and it is known as RMI 2. In1999, Tingulstad et al[8] modified the RMI, which we have termed "RMI 3." In 2009, Yamamoto et al[9] added the parameter of the tumor size score (S) to the RMI and have termed it the RMI 4:

$$\text{RMI 4} = \text{U} \times \text{M} \times \text{S} \times \text{CA 125}$$

The aim of this study was to evaluate the ability of 4 RMI to discriminate a benign from a malignant pelvic mass and to evaluate the performances of 4 RMI.

Patients and Methods

This is a prospective study. The clinical data were obtained from 296 women with a pelvic mass scheduled for laparotomy and laparoscopy at the Department of Obstetrics and Gynecology of Kochi Health Sciences Center between September 1, 2011, and April 30, 2014. Preoperative serum CA 125 levels, imaging findings, and menopausal status were noted. All patients were required to have a pelvic US, computed tomography (CT), magnetic resonance imaging (MRI), or any combination of imaging modalities for documentation of an ovarian tumor or a pelvic mass. An RMI imaging score was assigned for the following features suggestive of malignancy: the presence of a multilocular cystic lesion; solid areas; bilateral lesions; ascites; and intra-abdominal metastases. One point was given for each feature. A total imaging score (U) was calculated for each patient, and the tumor size (S) was measured by US, CT, and/or MRI for each patient. Postmenopausal status was defined as more than 1 year of amenorrhea or age greater than 50 years in women who had undergone hysterectomy. All other women were considered premenopausal. Preoperative serum CA 125 levels were measured in the hospital's biochemistry laboratory by ECLusys CA125 II assay (Roche Diagnostics, Tokyo, Japan).

On the basis of the data obtained, the RMI 1, 2, 3, and 4 methods were calculated for all patients together with the sensitivity, specificity, positive predictive value, and negative predictive value of the 4 methods:

(1) RMI 1 (Jacobs et al[6]) = $U \times M \times$ CA 125; a total US score of 0 yielded $U = 0$, a score of 1 yielded $U = 1$, and a score of ≧ 2 yielded $U = 3$. Premenopausal status yielded $M = 1$ and postmenopausal status yielded $M = 3$. The

Table 1 Distribution of Diagnosis and Stages in 296 Patients Presenting With a Pelvic Mass

Diagnosis	Premenopausal Patients	Postmenopausal Patients	Total, Patients (%)
Ovarian cancer			
Stage I	6 I, 9 B	10 I, 7 B	16 I (5.4), 16 B (5.4)
Stage II	1 I, 2 B	3	4 I (1.4), 2 B (0.7)
Stage III	4 I, 1 B	15	19 I (6.4), 1 B (0.3)
Stage IV	1	3	4 (1.4)
Tubal cancer			
Stage II	0	1	1 (0.3)
Stage III	0	2	2 (0.7)
Stage IV	0	1	1 (0.3)
Metastatic cancer	3	5	8 (2.7)
Total malignant cases	27	47	74 (25.0)
Endometriosis	68	3	71 (24.0)
Dermoid cyst	54	7	61 (20.6)
Serous cystadenoma	14	18	32 (10.8)
Mucinous cystadenoma	17	15	22 (7.4)
Parovian cyst	2	4	6 (2.0)
Fibroma/thecoma	1	8	9 (3.0)
Hydrosalpinx	3	0	3 (1.0)
Tubo-ovarian abscess	1	2	3 (1.0)
Leiomyoma	6	0	6 (2.0)
Other	7	2	9 (3.0)
Total benign cases	166[a]	56[b]	222[c] (75.0)

Abbreviations: B = borderline; I = invasive.
[a]Including 2 cases of endometriosis + dermoid cyst and endometriosis + serous cystadenoma, serous + mucinous cystadenoma, dermoid cyst + serous cystadenoma, and dermoid cyst + mucinous cystadenoma.
[b]Including endometriosis + serous cystadenoma, serous + mucinous cystadenoma, and serous cystadenoma + fibroma.
[c]Including 3 cases of endometriosis + serous cystadenoma, 2 cases of dermoid cyst + endometriosis and serous + mucinous cystadenoma, dermoid cyst + serous cystadenoma, dermoid cyst + mucinous cystadenoma, and serous cystadenoma + fibroma.

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