Diagnostic accuracy of risk of ovarian malignancy algorithm (ROMA) experienced in the clinical practice at a single hospital

Jiyoung Kim, Haeil Park, Jae Eun Shin, Dae Woo Lee, Min Jeong Kim, Hae Nam Lee

1Department of Obstetrics and Gynecology, Daejeon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Republic of Korea

2Department of Laboratory Medicine, Bucheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Republic of Korea

3Department of Obstetrics and Gynecology, Bucheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Republic of Korea

Background

The risk of ovarian malignancy algorithm (ROMA) is used for assessing epithelial ovarian cancer (EOC) risk in women with a pelvic mass. The reported diagnostic accuracy of ROMA is variable. We investigated whether the clinically acceptable minimal sensitivity of >0.800 could be obtained with the suggested cutoff of 7.4%/25.3% for pre-/postmenopausal women, and with different cutoffs set to a specificity of ≥0.750, in a hospital with a lower EOC prevalence than has been reported.

Methods

ROMA scores were calculated from measurements of HE4 and CA125 in blood samples drawn from 443 patients with a pelvic mass. The ROMA sensitivity and specificity for predicting EOC were calculated for the suggested and adjusted cutoff values.

Fig. 1. Flow chart of participants.

Results

When EOC prevalence was 0.041, the sensitivity and specificity at the suggested cutoff were 0.778 and 0.894, respectively. Meanwhile, the sensitivity was 0.889 at the 4.78%/14.35% cutoff set to a specificity of 0.750.

Table 1 Clinical characteristics of the patients for whom biopsy was performed (N = 309)

		Premenopausal		Postmenopausal		Total	
		N	(%)	N	(%)	N	(%)
Benign disease		212	(68.6)	60	(19.4)	272	(88.0)
Age (Mean±SD)		35.2±10.3		59.7±9.0		40.6±14.3	
Histological type	Endometriotic cyst	68	(22.0)	3	(1.0)	71	(23.0)
	Endometriotic cyst + fibroma	1	(0.3)	1	(0.3)	2	(0.6)
	Endometriotic cyst + tubo-ovarian abscess	1	(0.3)			1	(0.3)
	Dermoid cyst	45	(14.6)	5	(1.6)	50	(16.2)
	Mucinous cystadenoma	20	(6.5)	17	(5.5)	37	(12.0)
	Serous cystadenoma	8	(2.6)	8	(2.6)	16	(5.2)
	Seromucinous cystadenoma	5	(1.6)	2	(0.6)	7	(2.3)
	Serous cystadenofibroma			3	(1.0)	3	(1.0)
	Endometriosis	14	(4.5)			14	(4.5)
	Luteal cyst	12	(3.9)			12	(3.9)
	Paratubal cyst	10	(3.2)	2	(0.6)	12	(3.9)
	Fibroma	3	(1.0)	5	(1.6)	8	(2.6)
	Hemorrhagic cyst	6	(1.9)	2	(0.6)	8	(2.6)
	Parovarian cyst	1	(0.3)	5	(1.6)	6	(1.9)
	Tubo-ovarian abscess	6	(1.9)			6	(1.9)
	Benign struma ovarii	4	(1.3)			4	(1.3)
	Leiomyoma	3	(1.0)	1	(0.3)	4	(1.3)
	Hydrosalpinx	2	(0.6)	1	(0.3)	3	(1.0)
	Benign Brenner tumor			2	(0.6)	2	(0.6)
	Chronic granulomatous inflammation, Mycobacterial infection	1	(0.3)			1	(0.3)
	Follicular cyst			1	(0.3)	1	(0.3)
	Mucinous cystadenofibroma			1	(0.3)	1	(0.3)
	Paramesonephric (mullerian) cyst pseudocyst	1	(0.3)			1	(0.3)
	Tubal pregnancy	1	(0.3)			1	(0.3)
BOT		8	(2.6)	7	(2.3)	15	(4.9)
Age (Mean±SD)		39.1±10.2		57.7±7.5		47.8±12.9	
Histological type	Serous borderline tumor	3	(1.0)	2	(0.6)	5	(1.6)
	Mucinous borderline tumor	1	(0.3)	4	(1.3)	5	(1.6)
	Seromucinous borderline tumor	4	(1.3)	1	(0.3)	5	(1.6)
FIGO Stage	I	7		7		14	
	II	1		0		1	
EOC		6	(1.9)	12	(3.9)	18	(5.8)
Age (Mean±SD)		45.8±2.9		55.5±4.5		52.3±6.1	
Histological type	High-grade serous carcinoma	5	(1.6)	7	(2.3)	12	(3.9)
	Clear cell carcinoma			2	(0.6)	2	(0.6)

Abbreviations: BOT, borderline ovarian tumor; EOC, epithelial ovarian cancer; Non-EOC, non-epithelial ovarian cancer; DPAM, disseminated peritoneal adenomucinosis.

Table 2 Frequency distribution of ROMA risk groups according to disease status (N = 443)

Menopausal status	Cutoff	ROMA risk group	Non-ovarian tumor	Benign disease	BO T	EO C	Non-EOC	Total
Premenopausal	7.4	Low	0	281	4	0	1	286
		High	1	28	4	6	0	39
		Total	1	309	8	6	1	325
Postmenopausal	25.3	Low	1	88	4	4	1	98
		High	0	9	3	8	0	20
		Total	1	97	7	12	1	118
Total	7.4/25.3	Low	1	369	8	4	2	384
		High	1	37	7	14	0	59
		Total	2	406	15	18	2	443

Table 3 Diagnostic accuracy of ROMA with the suggested cutoff and adjusted cutoffs set at different specificity and sensitivity values (N = 443; target condition: EOC (N=18) vs others (N=425))

	Suggested cutoff	Adjusted cutoff		Set to specificity of		Set to sensitivity of
		0.750	0.800	0.900	0.950	0.950
Premenopausal						
AUC (95% CI)	0.978 (0.952, 1.003)	0.978 (0.952, 1.003)	0.978 (0.952, 1.003)	0.978 (0.952, 1.003)	0.978 (0.952, 1.003)	0.978 (0.952, 1.003)
Cutoff value	7.40	4.78	5.48	7.52	11.54	9.74
ROMA high risk	0.120 (39/325)	0.265 (86/325)	0.215 (70/325)	0.117 (38/325)	0.065 (21/325)	0.089 (29/325)
Prevalence	0.018 (6/325)					
Sensitivity (95% CI)	1.000 (0.541, 1.000)	1.000 (0.541, 1.000)	1.000 (0.541, 1.000)	1.000 (0.541, 1.000)	0.833 (0.359, 0.996)	1.000 (0.541, 1.000)
Specificity (95% CI)	0.897 (0.858, 0.928)	0.749 (0.698, 0.796)	0.799 (0.751, 0.842)	0.900 (0.861, 0.930)	0.950 (0.920, 0.971)	0.928 (0.894, 0.954)
PPV (95% CI)	0.154 (0.112, NaN*)	0.070 (0.055, NaN*)	0.086 (0.066, NaN*)	0.158 (0.115, NaN*)	0.238 (0.159, 0.937)	0.207 (0.146, NaN*)
NPV (95% CI)	1.000 (0.982, 1.000)	1.000 (0.979, 1.000)	1.000 (0.980, 1.000)	1.000 (0.983, 1.000)	0.997 (0.971, 0.998)	1.000 (0.983, 1.000)
Postmenopausal						
AUC (95% CI)	0.816 (0.627, 1.005)	0.816 (0.627, 1.005)	0.816 (0.627, 1.005)	0.816 (0.627, 1.005)	0.816 (0.627, 1.005)	0.816 (0.627, 1.005)
Cutoff value	25.30	14.35	15.59	29.91	42.16	4.71
ROMA high risk	0.169 (20/118)	0.314 (37/118)	0.263 (31/118)	0.161 (19/118)	0.110 (13/118)	0.847 (100/118)
Prevalence	0.102 (12/118)					
Sensitivity (95% CI)	0.667 (0.349, 0.901)	0.833 (0.516, 0.979)	0.833 (0.516, 0.979)	0.667 (0.349, 0.901)	0.667 (0.349, 0.901)	0.917 (0.615, 0.998)
Specificity (95% CI)	0.887 (0.811, 0.940)	0.745 (0.651, 0.825)	0.802 (0.713, 0.873)	0.896 (0.822, 0.947)	0.953 (0.893, 0.985)	0.160 (0.096, 0.244)
PPV (95% CI)	0.400 (0.267, 0.752)	0.270 (0.191, 0.777)	0.323 (0.226, 0.817)	0.421 (0.280, 0.767)	0.615 (0.399, 0.879)	0.110 (0.064, 0.842)
NPV (95% CI)	0.959 (0.863, 0.979)	0.975 (0.894, 0.985)	0.977 (0.901, 0.986)	0.960 (0.864, 0.980)	0.962 (0.871, 0.988)	0.944 (0.712, 0.966)
Total						
AUC (95% CI)	0.836 (0.736, 0.936)	0.819 (0.741, 0.896)	0.844 (0.767, 0.922)	0.838 (0.738, 0.938)	0.836 (0.729, 0.943)	0.84 (0.782, 0.899)
Cutoff value (pre-/post-menopausal)	7.40/25.30	4.78/14.35	5.48/15.59	7.52/29.91	11.54/42.16	9.74/4.71
ROMA high risk	0.133 (59/443)	0.278 (123/443)	0.228 (101/443)	0.129 (57/443)	0.077 (34/443)	0.291 (129/443)
Prevalence	0.041 (18/443)					
Sensitivity (95% CI)	0.778 (0.524, 0.936)	0.889 (0.653, 0.986)	0.889 (0.653, 0.986)	0.778 (0.524, 0.936)	0.722 (0.465, 0.903)	0.944 (0.727, 0.999)
Specificity (95% CI)	0.894 (0.861, 0.922)	0.748 (0.704, 0.789)	0.800 (0.759, 0.837)	0.899 (0.866, 0.926)	0.951 (0.925, 0.969)	0.736 (0.692, 0.778)
PPV (95% CI)	0.237 (0.186, 0.565)	0.130 (0.107, 0.573)	0.158 (0.129, 0.628)	0.246 (0.192, 0.576)	0.382 (0.285, 0.689)	0.132 (0.109, 0.864)

*The upper limit of the confidence interval that could not be computed in situations where the numerator or the difference between the denominator and the numerator was equal to zero [29].
Abbreviations: EOC, epithelial ovarian cancer; AUC, area under the curve; CI, confidence interval; PPV, positive predictive value; NaN, Not a Number; NPV, negative predictive value.

Conclusions

In a hospital serving a patient population with a low EOC prevalence, the sensitivity of ROMA in clinical practice could be less than expected when using the suggested cutoff.