

ORIGINAL ARTICLES

The Risk of Malignancy Index for Ovarian Tumours in Northeast Scotland
– a Population Based Study

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Abstract**Background and Aims**

The Scottish Intercollegiate Guidelines Network (SIGN) recommends the use of the Risk of Malignancy Index (RMI) for ovarian tumours, a scoring system based on ultrasound findings, menopausal status and CA 125 level, in the pre-operative evaluation of pelvic masses. The aim of this study was to investigate the accuracy of this as a predictive method of discriminating benign from malignant disease.

Methods and Results

All women who underwent oophorectomy in 2004 at Aberdeen Royal Infirmary for suspected primary ovarian pathology were evaluated. The RMI was calculated and these results were compared with the final histopathology. The sensitivity of the RMI for diagnosing malignant ovarian disease was 94% (32/34) while the specificity was 70% (76/108).

Conclusions

Compared to previous studies, the RMI score was highly sensitive in detecting malignant disease, although not as specific in excluding benign lesions, particularly cystadenomas and endometriomas. This can be improved by the refinement of imaging techniques as well as the use of laparoscopy in particular cases. The RMI score may also be especially valuable in directing referrals to a specialised centre.

Key Words

Risk of malignancy index, pelvic mass, ovarian cancer, preoperative evaluation

by a gynaecological oncologist have an improved prognosis,^{1,2,3} and accurate preoperative evaluation is essential in ensuring an appropriate referral is made. Streamlining of referrals in oncology has always been a clinical challenge in attempting to create a satisfactory safety net. Algorithms and scores used in this respect are particularly relevant for referral centres responsible for a population that is spread across a large geographical area such as the gynaecological oncology centre at Aberdeen Royal Infirmary (ARI). The catchment area for this specialised centre covers the Northeast of Scotland including Highland, Shetland and Orkney Islands.

The Risk of Malignancy Index (RMI) is a scoring system initially devised by Jacobs et al⁴ that utilises the ultrasound findings, menopausal status and serum CA 125 levels in an attempt to predict whether or not an ovarian mass is likely to be malignant. This method has been validated by several studies^{5,6,7,8,9,10,11,12} and its use is recommended by the Scottish Intercollegiate Guidelines Network (SIGN) in the assessment of women with suspected ovarian cancer.

This scoring method appears to be attractive in its simplicity, lack of invasiveness and its potential for use in less specialised units. The aim of this study was to evaluate the accuracy of the RMI and determine its applicability in our setting.

Methods

All women who underwent oophorectomy at Aberdeen Royal Infirmary in 2004 for suspected primary ovarian pathology were evaluated by case note review. This included women with an ovarian mass on ultrasound scan. Data collected included menopausal status, ultrasound morphology and preoperative serum CA 125 levels. The RMI was calculated for each patient using the RMI 2 score as modified by Tingulstad et al.¹¹ The features of this score are shown in Table 1 and the equation used was:

RMI score = ultrasound score x menopausal status x CA 125 level in U/ml

Ultrasound scans were performed at both our radiology unit at ARI as well as peripheral units, using a transvaginal and abdominal approach. Postmenopausal status was defined as 1 year or more of amenorrhoea and CA 125 serum assays were all done centrally at the laboratory at ARI. The RMI cut-off level of 200 was used to indicate malignancy and the final histopathology was regarded as the true definite outcome.

Introduction

An ovarian mass is one of the most common clinical presentations in gynaecology but the ability to differentiate between benign and malignant disease remains a diagnostic dilemma. It is well known that women with ovarian cancer who have an operation performed in a specialised oncology centre

Table I: The RMI 2 Scoring System

Feature	RMI 2 score
Ultrasound features	0 = no abnormality
- multilocular cyst	1 = one abnormality
- solid elements	4 = two or more abnormalities
- bilateral lesions	
- ascites	
- intra-abdominal metastases	
Premenopausal	1
Postmenopausal	4
CA 125	U/ml

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 14.0. The RMI was evaluated for sensitivity, specificity and positive (PPV) and negative (NPV) predictive values with reference to the presence of malignant or benign disease. A p-value of <0.05 was considered statistically significant.

Results

One hundred and forty two women, aged 32 to 85, underwent oophorectomy for suspected primary ovarian pathology in 2004 at ARI. According to the histopathological examination of the specimens, 108 (76%) had benign disease, and 34 (24%) had malignant disease.

The results obtained following calculation of the RMI 2 score are displayed in Table II.

Table II: Results of Evaluation by RMI 2

RMI 2	Benign	Malignant
< 200	76	2
> 200	32	32

The sensitivity of the RMI for diagnosing malignant lesions was 94% (32/34) while the specificity was 70% (76/108). The PPV was 50% (32/64) and the NPV was 97% (76/78). The false negatives cases as well as the false positives, ten of which were premenopausal, are listed in Table III. There was no significant difference between the RMI calculated for the false positives and the true positive cases ($p > 0.05$).

Table III: False Positive and False Negative Cases

False-positive cases	n (%)
Cystadenoma	18 (56%)
Endometrioma	6 (19%)
Fibroma	4 (13%)
Adenofibroma	2 (6%)
Dermoid cyst	2 (6%)
False-negative cases	
Epithelial ovarian carcinoma (stage 1)	1 (50%)
Thecoma	1 (50%)

Discussion

In this study, we evaluated the RMI 2 in our population and found that at a cut-off value of 200 was able to correctly identify 94% of women with ovarian cancer prior to their operation. This high sensitivity of the RMI 2 score is greater than that noted in similar studies,^{6,8,13} but our specificity and PPV were comparably lower at 70% and 50% respectively. Although our findings confirm the usefulness of RMI 2 in selecting the patients at most risk of having ovarian cancer, a lower specificity is of concern as this would imply that an unacceptably high number of benign cases would be referred to a specialised oncology centre, thereby increasing workload and cost.

Similar to findings of Anderson et al,⁶ 56% of the false-positive cases were due to ovarian cystadenomas, and 19% due to endometriomas. It has recently been suggested that false positive rates, in the case of endometriomas, may be improved by further using ultrasonography to identify an ovarian crescent sign (OCS), a rim of visible healthy ovarian tissue in the affected ovary.¹⁴ Yazbek et al compared the use of the RMI score versus OCS to assist in the pre-operative detection of ovarian cancer, taking the absence of OCS to be suggestive of malignancy. Interestingly, they found that seven patients with endometriomas, all of whom had an RMI >200, and therefore false positives, were all accurately detected by the presence of the OCS, and did not have ovarian cancer.¹⁴ The use of colour Doppler has similarly been shown to increase the diagnostic accuracy of ultrasonography in the assessment of adnexal malignancies with a high specificity.¹⁵

Also of note, one third of the 32 false-positives cases was premenopausal and included all six patients with endometriomas. In these circumstances, we suggest that a laparoscopic evaluation may be undertaken to exclude ovarian malignancy, which would substantially obviate the need for a laparotomy. Laparoscopy has been shown to be useful in identifying ovarian cancer¹⁶ and it may be worthwhile to offer this to premenopausal women who have an RMI score of more than 200.

In any scoring system designed to exclude malignancy, a worrying concern is the false-negative rate as this should ideally be zero or close to zero. In our study, two of the 34 women (6%) with malignant ovarian disease had an RMI score of less than 200. One patient was found to have a malignant thecoma with a normal CA 125 level which may be attributed to the non-secretory behaviour of these non-epithelial stromal tumours. Of greater concern is the other false negative case, a stage 1 ovarian serous cystadenocarcinoma. Previous studies have similarly demonstrated a reduced sensitivity of the RMI score in early stage disease.⁵ There also appears to be limitations in the RMI score in not only detecting patients with borderline tumours⁶ and larger studies are needed to fully understand this relationship.

Conclusion

The RMI score in our setting appears to be a simple and applicable method that can be utilised in the preoperative evaluation of women with ovarian masses. Our study reconfirms its accuracy in detecting malignant disease, but however highlights its limitations in excluding benign masses. We support the development of improved imaging techniques that would aid in this discrimination, as well as judicious use of diagnostic laparoscopy.

Especially in regions of a wide geographical area but low density population such as ours, the RMI score has a particularly valuable role in directing referral to a single regional centre which is usually of considerable distance from many women. This can be extended to similar areas worldwide, and we advocate the use of RMI to ensure appropriate streamlining of referral patterns to a gynaecological oncology centre.

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