Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

Diagnostic accuracy of the risk of malignancy index for adnexal masses in women over 35 years: a prospective cross-sectional study at a tertiary care centre in Punjab, India.

Dr. Harpreet Kaur[1], Dr. Pardeep Garg[2], Dr. Harkiratjit Singh Bhullar[3*], Dr. Sarita Nibhoria[4]
[1]Department of Obstetrics and Gynaecology, [2]Department of Radiation Oncology, [3]Department of Pharmacology and [4]Department of Pathology, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab, India (Baba Farid University of Health Sciences). HK and PG are Heads of their respective departments.

Abstract

Background:

The risk of malignancy index (RMI) is widely used to decide which adnexal masses should be referred to a gynaecological oncologist, but few Indian studies report which tumours the index misses. This study estimated the accuracy of RMI at the conventional cut-off of 200 against histopathology, compared it with its individual components, and examined misclassified cases by histological type and menopausal status.

Methodology:

This prospective cross-sectional study enrolled 80 consecutive women aged over 35 years with an adnexal mass scheduled for surgery at a tertiary care teaching hospital in Punjab, India, from 23 April 2021 to 22 October 2022. RMI was calculated as U × M × CA-125, with the ultrasound score (U) and menopausal score (M) each 1 or 3. Histopathology was the reference standard.

Results:

Forty-seven of 80 masses (58.8%) were malignant. At a cut-off of 200, RMI had a sensitivity of 87.2% (95% CI 74.3–95.2), specificity of 87.9% (71.8–96.6), positive likelihood ratio 7.2 and negative likelihood ratio 0.15. The area under the ROC curve was 0.94 (0.88–0.99), higher than for CA-125 (0.84; P = .002), ultrasound score (0.85; P = .043) or menopausal status (0.83; P = .008) alone. Five of six false negatives were mucinous carcinomas: RMI detected 2 of 7 mucinous carcinomas against 39 of 40 other malignancies (P < .001). Specificity in postmenopausal women was 4 of 7.

Conclusion:

RMI at 200 performed as reported in other populations. A lower in-sample optimum near 160 rested on three mucinous carcinomas and is too unstable to replace 200. A low RMI should not overrule a malignant-appearing ultrasound, particularly when a mucinous tumour is possible.

Recommendation:

Multicentre studies that include women managed without surgery, document blinding, and compare RMI with International Ovarian Tumor Analysis (IOTA) models in the same patients are needed.

Keywords. *Adnexal mass; CA-125 antigen; ovarian neoplasms; risk of malignancy index; sensitivity and specificity.*
Submitted: *July 09, 2026* ***Accepted:*** *August 17, 2026* ***Published:*** *September 30, 2026*
Corresponding author: *Dr Harkiratjit Singh Bhullar*
Email: *drharkirat0@gmail.com*
Department of Pharmacology and 4Department of Pathology, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab, India (Baba Farid University of Health Sciences)

Introduction

Ovarian cancer caused an estimated 207,000 deaths worldwide in 2020, and most women still present with advanced disease[1]. Outcomes depend on complete staging and cytoreduction, so for a woman with an adnexal mass the preoperative question is less "what is it?" than "who should operate on it?". A benign cyst can be removed by a general gynaecologist, often laparoscopically; a probable cancer should go to a gynaecological oncology team.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

The risk of malignancy index (RMI), introduced by Jacobs et al. in 1990, answers that triage question with three inputs available in almost any hospital: an ultrasound score, menopausal status and serum CA-125[2]. Later versions changed the weights given to ultrasound and menopause (RMI II and RMI III)[3,4], without consistent gains[5]. Systematic reviews put the pooled sensitivity of RMI at a cut-off of 200 between 72% and 78%, with specificity between 87% and 92%[6,7]. Ultrasound-based models from the International Ovarian Tumor Analysis (IOTA) group perform better in expert hands[8,9] and are recommended where trained examiners are available[10]. In much of India, ultrasound is performed by general radiologists or sonologists without IOTA training, and RMI remains the practical referral tool.

Indian studies of RMI have mostly come from single centres in northern and western India[11,12]. They report pooled accuracy but seldom ask which tumours the index misclassifies, which is what a clinician needs to know when an RMI result seems to contradict the scan. This study therefore estimated the accuracy of RMI at the conventional cut-off of 200 against histopathology in women over 35 years undergoing surgery for an adnexal mass, compared it with its individual components, and examined the misclassified cases by histological type and menopausal status.

Methods

Design, setting and ethics

This prospective cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Guru Gobind Singh Medical College and Hospital, Faridkot, Punjab, over 18 months, from 23 April 2021 to 22 October 2022. The hospital is a government tertiary care teaching hospital affiliated to Baba Farid University of Health Sciences and serves the Malwa region of Punjab and neighbouring districts. Its Department of Obstetrics and Gynaecology provides antenatal, gynaecological and gynaecological oncology surgical services, supported by in-house departments of Radiodiagnosis, Pathology and Radiation Oncology. It is reported according to the STARD 2015 guideline[13]. The Institutional Ethics Committee of Guru Gobind Singh Medical College and Hospital approved the study on 13 April 2021, and the study plan was approved by the Faculty of Medical Sciences, Baba Farid University of Health Sciences, on 29 October 2021 (letter no. BFUHS/2K21-TH/34179). Every participant gave written informed consent.

Participants

Women aged over 35 years with ultrasound evidence of an ovarian mass who were admitted for surgery were enrolled consecutively until 80 participants had been recruited. Women already receiving chemotherapy for diagnosed ovarian cancer, and those with masses of non-ovarian origin, genital tuberculosis or pelvic inflammatory disease, were excluded, as were women who declined to participate. Participant flow from enrolment is shown in Figure 1 in the Results.

Index test

Transabdominal and/or transvaginal ultrasonography was performed at the first visit in the Department of Radiodiagnosis of the institution, as part of routine preoperative work-up. Five features were recorded as present or absent: multilocularity, solid areas, bilateral lesions, ascites and evidence of extra-ovarian spread. The ultrasound score (U) was 1 when none or one feature was present and 3 when two or more were present. Women were classed as postmenopausal (M=3) if they had more than one year of amenorrhoea, or were older than 50 years after hysterectomy; all others were premenopausal (M=1). Serum CA-125 was measured at the same visit in the hospital laboratory and recorded in U/mL. RMI was calculated as U × M × CA-125, and a value above 200 was prespecified as positive.

This scoring of U (1 or 3) is the weighting described by Tingulstad et al. for RMI III[4]; the original index of Jacobs et al. scores U as 0, 1 or 3[2]. The two differ only for masses with no suspicious ultrasound feature, and the effect of the original weighting is reported as a sensitivity analysis.

Reference standard

All women underwent laparotomy with oophorectomy, hysterectomy, omentectomy or cytoreductive surgery as clinically indicated. Specimens were examined in the Department of Pathology of the same institution and classified according to the WHO classification of female genital tumours. Borderline tumours were to be analysed with malignant tumours; none occurred.

Data handling

RMI was calculated from the recorded components for every participant. In three case records the hand-calculated RMI did not equal U × M × CA-125; these arithmetic errors were corrected to the product of the recorded components. Accuracy based on the uncorrected values is reported as a sensitivity analysis.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

Bias

Selection bias was reduced by enrolling all eligible women consecutively during the study period. Every participant received the reference standard, so partial verification within the cohort did not occur. RMI was calculated from tests done at the first visit, before surgery, so the histopathology result could not influence it. The cut-off of 200 was fixed before analysis, avoiding the optimism of choosing a threshold from the same data; alternative cut-offs are reported as exploratory. Bias that could not be controlled is discussed under Limitations.

Statistical analysis

Continuous variables were compared between benign and malignant groups with the unpaired t-test or the Mann–Whitney U test according to distribution, and categorical variables with Fisher's exact test. Sensitivity, specificity, predictive values and accuracy were calculated with exact (Clopper–Pearson) 95% confidence intervals (CI), together with positive and negative likelihood ratios. The area under the receiver operating characteristic curve (AUC) was estimated for RMI and for each component, and paired AUCs were compared using the DeLong method[14]. Performance was tabulated across cut-offs with the Youden index, and the stability of the Youden-optimal cut-off was examined with 2,000 bootstrap resamples. Performance by histological type and by menopausal status was compared with Fisher's exact test; these subgroup analyses were exploratory. Predictive values at lower prevalences of malignancy were derived from the observed sensitivity and specificity. No formal sample size calculation for diagnostic accuracy was made; the precision achieved is shown by the confidence intervals[15]. Analyses were performed in Python 3 using SciPy and scikit-learn, and a two-sided p value below 0.05 was considered significant.

Results

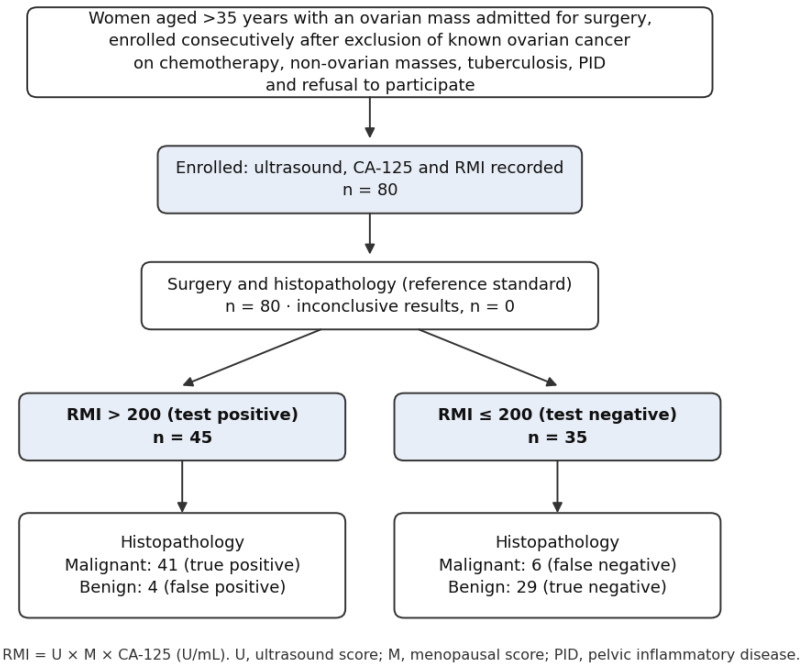


Figure 1. STARD flow diagram of participants. *RMI, risk of malignancy index.*

Participants

Eighty women aged 36 to 73 years (mean 52.7, SD 12.4) were included; 48 (60.0%) were postmenopausal. Histopathology showed 33 benign (41.2%) and 47 malignant (58.8%) masses, with no inconclusive results (Figure 1). Women with malignant masses were older and

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

more often postmenopausal, and had higher CA-125 and RMI values (Table 1). The malignant tumours were low-grade serous carcinoma (20), high-grade serous carcinoma (12), papillary serous carcinoma not further graded (7), mucinous carcinoma (7) and immature teratoma (1). The benign masses were serous cystadenoma (12), mucinous cystadenoma (10), mature cystic teratoma (4), endometrioma (3), corpus luteum cyst (2) and simple serous cyst (2).

Table 1 *Characteristics of participants by final histology*

Characteristic	Benign (n=33)	Malignant (n=47)	p value
Age, years, mean (SD)	43.8 (9.8)	58.9 (10.0)	<0.001
Postmenopausal (M=3), n (%)	7 (21.2)	41 (87.2)	<0.001
Nulliparous, n (%)	3 (9.1)	6 (12.8)	0.73
Ultrasound score 3, n (%)	7 (21.2)	43 (91.5)	<0.001
CA-125, U/mL, median (IQR)	33.9 (22.0–52.0)	223.0 (105.7–657.9)	<0.001
RMI, median (IQR)	50.2 (32.0–104.7)	1755 (690–5157)	<0.001

Note. SD, standard deviation; IQR, interquartile range; RMI, risk of malignancy index. Age compared by unpaired t-test, CA-125 and RMI by Mann–Whitney U test, proportions by Fisher's exact test.

Diagnostic accuracy

At a cut-off of 200, RMI classified 70 of 80 women correctly (87.5%), with 41 true positives, 6 false negatives, 4 false positives and 29 true negatives (Table 2). Sensitivity was 87.2% (95% CI 74.3–95.2) and specificity 87.9% (71.8–96.6); the positive likelihood ratio was 7.2 and the negative likelihood ratio 0.15. The AUC for RMI was 0.94 (0.88–0.99) (Figure 2). RMI discriminated better than CA-125 alone (AUC 0.84; difference 0.10, 95% CI 0.04–0.16; p=0.002), the ultrasound score alone (0.85; p=0.043) and menopausal status alone (0.83; p=0.008). Its advantage over age (0.85; p=0.064) was not statistically significant.

Table 2 *Diagnostic performance of RMI and its components against histopathology (n=80; 47 malignant)*

Test (positive if)	Sensitivity, % (95% CI)	Specificity, % (95% CI)	PPV, %	NPV, %	LR+	LR−	AUC (95% CI)
RMI > 200	**87.2 (74.3–95.2)**	**87.9 (71.8–96.6)**	**91.1**	**82.9**	**7.20**	**0.15**	**0.94 (0.88–0.99)**
CA-125 > 35 U/mL	85.1 (71.7–93.8)	57.6 (39.2–74.5)	74.1	73.1	2.01	0.26	0.84 (0.75–0.93)
Ultrasound score 3	91.5 (79.6–97.6)	78.8 (61.1–91.0)	86.0	86.7	4.31	0.11	0.85 (0.77–0.93)
Postmenopausal (M=3)	87.2 (74.3–95.2)	78.8 (61.1–91.0)	85.4	81.2	4.11	0.16	0.83 (0.74–0.92)

Note. PPV and NPV, positive and negative predictive values at the study prevalence (58.8%); LR, likelihood ratio; AUC, area under the ROC curve. Exact (Clopper–Pearson) CIs for proportions. Paired DeLong comparisons of RMI with CA-125, p=0.002; ultrasound score, p=0.043; menopausal status, p=0.008.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

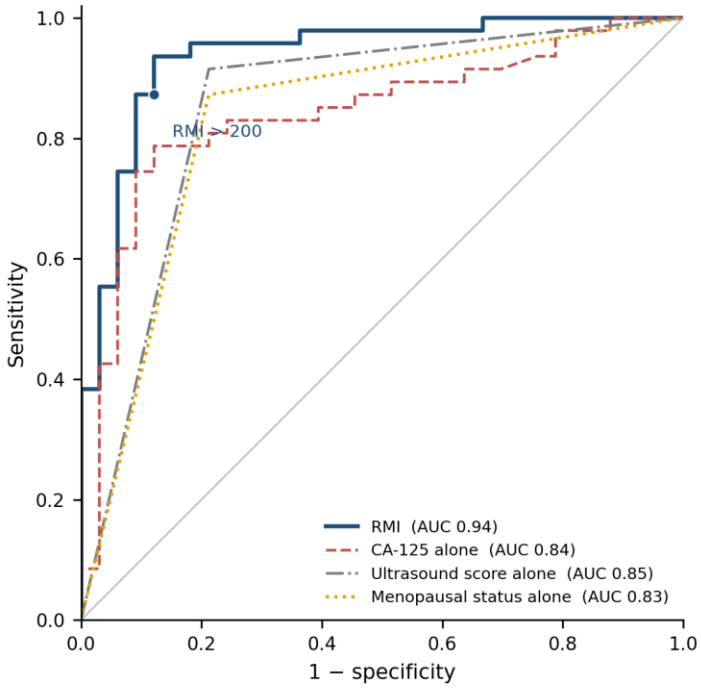


Figure 2. Receiver operating characteristic curves for RMI and its components in distinguishing malignant from benign adnexal masses (n=80).

The marked point is the conventional RMI cut-off of 200 (sensitivity 87.2%, specificity 87.9%).

Choice of cut-off

The Youden index was highest at an RMI of 162 or more (sensitivity 93.6%, specificity 87.9%; J=0.81), against 0.75 at 200 (Table 3). The gain came entirely from three mucinous carcinomas with RMI values between 162 and 198. Across 2,000 bootstrap resamples the optimal threshold ranged from 153 to 333 (2.5th–97.5th percentiles), an interval that includes 200. No participant had an RMI between 198 and 201.6, so every threshold in that range classified patients identically.

Table 3 *Performance of RMI across cut-off values*

RMI cut-off	TP / FN / FP / TN	Sensitivity, %	Specificity, %	Youden J	LR+	LR−
> 100	45 / 2 / 10 / 23	95.7	69.7	0.65	3.16	0.06
> 150	45 / 2 / 6 / 27	95.7	81.8	0.78	5.27	0.05
≥ 162 (in-sample optimum)	44 / 3 / 4 / 29	93.6	87.9	0.81	7.72	0.07
> 200 (conventional)	**41 / 6 / 4 / 29**	**87.2**	**87.9**	**0.75**	**7.20**	**0.15**
> 250	40 / 7 / 3 / 30	85.1	90.9	0.76	9.36	0.16
> 450	37 / 10 / 3 / 30	78.7	90.9	0.70	8.66	0.23

Note. TP, true positive; FN, false negative; FP, false positive; TN, true negative. Bootstrap 95% range of the Youden-optimal cut-off (2,000 resamples): 153–333.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

Misclassified cases

Five of the six false negatives were mucinous carcinomas, with CA-125 values between 17 and 57 U/mL; four of these five had an ultrasound score of 3. The sixth was a low-grade serous carcinoma in a premenopausal woman with a CA-125 of 11.25 U/mL. RMI detected 2 of 7 mucinous carcinomas (28.6%; 95% CI 3.7–71.0) against 39 of 40 other malignancies (97.5%; 86.8–99.9; p<0.001) (Table 4). The ultrasound score was 3 in five of the seven mucinous carcinomas, whereas CA-125 exceeded 35 U/mL in only two. Excluding mucinous carcinomas, the AUC was 0.95. The four false positives were two mucinous cystadenomas, one serous cystadenoma, and one endometrioma with a CA-125 of 1,573 U/mL.

In premenopausal women (n=32, 6 malignant), sensitivity was 4 of 6 and specificity 25 of 26 (96.2%). In postmenopausal women (n=48, 41 malignant), sensitivity was 37 of 41 (90.2%), but specificity was only 4 of 7 (57.1%; p=0.023 for the difference in specificity), and the negative predictive value was 4 of 8.

Table 4 *Performance of RMI > 200 by histological type and menopausal status*

Group	n	RMI > 200, n	Estimate, % (95% CI)
Sensitivity by malignant histology			
High-grade serous carcinoma	12	12	100 (73.5–100)
Papillary serous carcinoma, not graded	7	7	100 (59.0–100)
Low-grade serous carcinoma	20	19	95.0 (75.1–99.9)
Mucinous carcinoma	7	2	28.6 (3.7–71.0)
Immature teratoma	1	1	—
False positives by benign histology			
Mucinous cystadenoma	10	2	—
Serous cystadenoma	12	1	—
Endometrioma	3	1	—
Other benign masses	8	0	—
By menopausal status			
Premenopausal, sensitivity	6	4	66.7 (22.3–95.7)
Premenopausal, specificity	26	1	96.2 (80.4–99.9)
Postmenopausal, sensitivity	41	37	90.2 (76.9–97.3)
Postmenopausal, specificity	7	3	57.1 (18.4–90.1)

Note. Mucinous carcinoma vs all other malignancies, sensitivity 2/7 vs 39/40: Fisher's exact p<0.001. Specificity, premenopausal vs postmenopausal: p=0.023. Other benign masses: mature cystic teratoma (4), corpus luteum cyst (2), simple serous cyst (2). Subgroup analyses are exploratory.

Sensitivity analyses and predictive values

Using the uncorrected hand-calculated values, sensitivity was 85.1% (40/47) with unchanged specificity. With the original Jacobs ultrasound weighting, three malignant masses with no suspicious ultrasound feature would have scored U=0 and been classified negative, lowering sensitivity to 80.9% (38/47) with unchanged specificity. Because 58.8% of this surgical cohort had cancer, the predictive values do not transfer to settings with fewer cancers: at a prevalence of 20%, the positive predictive value of RMI above 200 would be about 64% and the negative predictive value about 96%.

Discussion

Interpretation

In women over 35 years having surgery for an adnexal mass, RMI above 200 identified 87% of cancers while correctly classifying 88% of benign masses, and it discriminated better than any of its components alone. Most of its failures were in one tumour type: mucinous carcinoma accounted for five of six missed cancers.

These estimates sit close to those of the original description, in which Jacobs et al. reported a sensitivity of 85.4% and a specificity of 96.9% at the same cut-off[2], and within the range of pooled estimates from systematic reviews[6,7]. Specificity in this study was lower than in the original

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

report, largely because of the postmenopausal group, in which three of seven benign masses scored above 200. The menopausal multiplier triples CA-125 in every postmenopausal woman, so a modest benign rise is enough to cross the threshold, as it did for a serous cystadenoma with a CA-125 of 72.5 U/mL.

Several series have proposed a locally "optimal" cut-off different from 200[16,17]. The in-sample optimum near 160 in this study shows why such proposals are fragile: it rested on three mucinous carcinomas lying just below 200, and the bootstrap interval for the optimum included 200. In this cohort, a threshold of 150 would have detected four more cancers at the cost of two more benign referrals (Table 3). Whether that trade is worth making depends on oncology capacity, and it needs confirmation in a larger sample before any change to practice.

The concentration of false negatives in mucinous carcinoma has a straightforward explanation. CA-125 is often normal or only mildly raised in mucinous tumours[18], and because RMI is a product, a low CA-125 cancels a suspicious ultrasound: four of the five missed mucinous carcinomas had two or more malignant ultrasound features. A multiloculated or solid cyst should therefore not be reassigned to low risk on the strength of RMI alone, and measuring carcinoembryonic antigen may help when a mucinous tumour is suspected[18]. Some of these tumours may also have been metastases from the gastrointestinal tract, which commonly present as mucinous ovarian masses[19]; the primary site was not confirmed with immunohistochemistry or endoscopy.

Generalizability

The findings apply most directly to women over 35 years who are referred to a tertiary centre and selected for surgery, a group in which malignancy is common. In primary or secondary care, where fewer masses are malignant, the negative predictive value of RMI would be higher and the positive predictive value lower (about 64% at a prevalence of 20%), so a positive result in those settings should prompt referral rather than be read as a diagnosis. The case mix, with few mucinous and no borderline tumours, also limits transfer to populations in which these tumours are more frequent.

Recommendation

For hospitals without IOTA-trained sonologists, RMI with the conventional threshold of 200 remains a reasonable referral tool, provided clinicians remember that it underperforms in mucinous tumours and over-calls benign masses in postmenopausal women. The next step should be a multicentre study that includes women managed without surgery, documents blinding, and compares RMI with IOTA models in the same patients.

Conclusions

RMI above 200 had a sensitivity of 87% and a specificity of 88% for ovarian malignancy in this population, consistent with published data. A low RMI should not override a suspicious ultrasound, particularly when a mucinous tumour is possible.

Limitations

Most limitations of this study would make RMI look better than it would in general use. All women were operated on at a tertiary centre, so women with masses managed conservatively were not verified by histology; this partial verification tends to inflate sensitivity. The high prevalence of malignancy (58.8%) reflects referral of advanced disease, which is easier to detect, and inflates the positive predictive value[20]. Ultrasound, CA-125 and histopathology were part of routine care, and blinding of sonologists to CA-125 and of pathologists to the RMI was not documented; unblinded assessment would bias accuracy upwards. The number of women screened but not enrolled was not available, so selection at entry cannot be described. Confidence intervals are wide, and the subgroup findings rest on 7 mucinous carcinomas and 7 benign postmenopausal masses, so they are hypothesis-generating. Low-grade serous carcinoma made up a larger share of serous cancers than is usual, which may reflect local grading practice and limits comparison by subtype. Finally, RMI was not compared with the IOTA Simple Rules or ADNEX model, which would be the more useful comparison where trained examiners are available.

Acknowledgements. The authors thank Dr Anchal Nandrajog, who recruited the participants and collected the data for her MS (Obstetrics and Gynaecology) thesis, Dr Nishi Garg, Associate Professor of Obstetrics and Gynaecology, who co-supervised that thesis, the Department of Radiodiagnosis, Guru Gobind Singh Medical College & Hospital, Faridkot, and the women who took part in the study. The authors received no writing, editing, or statistical assistance from anyone outside the author group. Claude (Anthropic), a large language model, was used to help draft analysis code, prepare figures, and edit the language of the manuscript; the authors checked all code, results, and text and take full responsibility for the content.

Author contributions.

HK conceived and supervised the study, oversaw clinical data collection and critically revised the manuscript. PG supervised the study and critically revised the manuscript.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

HSB re-analysed the data, prepared the tables and figures, and drafted the manuscript. SN supervised the histopathological examination and critically revised the manuscript. All authors approved the final version. HK is the guarantor.

Ethics approval and consent.

Approved by the Institutional Ethics Committee, Guru Gobind Singh Medical College and Hospital, Faridkot, on 13 April 2021; study plan approved by the Faculty of Medical Sciences, Baba Farid University of Health Sciences, on 29 October 2021 (letter no. BFUHS/2K21-TH/34179). Written informed consent was obtained from all participants.

Funding.

This study did not receive any funding from public, commercial, or not-for-profit agencies.

Competing interests.

The authors declare no competing interests.

Conflict of interest.

The authors declare no conflict of interest.

Data and code.

De-identified participant-level data and the analysis code (Python; SciPy, scikit-learn) are available from the corresponding author on reasonable request.

Origin.

This article is derived from the MS (Obstetrics and Gynaecology) thesis of Dr Anchal Nandrajog, submitted to Baba Farid University of Health Sciences, Faridkot, and is published with her consent.

List of abbreviations.

ADNEX, Assessment of Different NEoplasias in the adneXa; AUC, area under the receiver operating characteristic curve; CA-125, cancer antigen 125; CI, confidence interval; FN, false negative; FP, false positive; IOTA, International Ovarian Tumor Analysis; IQR, interquartile range; LR, likelihood ratio; M, menopausal score; NPV, negative predictive value; PID, pelvic inflammatory disease; PPV, positive predictive value; RMI, risk of malignancy index; ROC, receiver operating characteristic; SD, standard deviation; STARD, Standards for Reporting of Diagnostic Accuracy Studies; TN, true negative; TP, true positive; U, ultrasound score; WHO, World Health Organization.

Author biographies.

Dr Harpreet Kaur, MBBS, MS, is Professor and Head of the Department of Obstetrics and Gynaecology, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab.

Dr Pardeep Garg, MBBS, MD, is Professor and Head of the Department of Radiation Oncology, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab.

Dr Harkiratjit Singh Bhullar is working as a PG Resident in the Department of Pharmacology, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab. His work centres on pharmacovigilance and clinical research methods.

Dr Sarita Nibhoria, MBBS, MD, is a Professor in the Department of Pathology, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab.

References

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2021;71(3):209-49. https://doi.org/10.3322/caac.21660
2. Jacobs I, Oram D, Fairbanks J, Turner J, Frost C, Grudzinskas JG. A risk of malignancy index incorporating CA 125, ultrasound and menopausal status for the accurate preoperative diagnosis of ovarian cancer. Br J Obstet Gynaecol. 1990;97(10):922-9. https://doi.org/10.1111/j.1471-0528.1990.tb02448.x
3. Tingulstad S, Hagen B, Skjeldestad FE, Onsrud M, Kiserud T, Halvorsen T, et al. Evaluation of a risk of malignancy index based on serum CA125, ultrasound findings and menopausal status in the pre-operative diagnosis of pelvic masses. Br J Obstet Gynaecol. 1996;103(8):826-31. https://doi.org/10.1111/j.1471-0528.1996.tb09882.x
4. Tingulstad S, Hagen B, Skjeldestad FE, Halvorsen T, Nustad K, Onsrud M. The risk-of-malignancy index to evaluate potential ovarian cancers in local hospitals. Obstet Gynecol. 1999;93(3):448-52. https://doi.org/10.1097/00006250-199903000-00028
5. Yamamoto Y, Yamada R, Oguri H, Maeda N, Fukaya T. Comparison of four malignancy risk indices in the preoperative evaluation of patients

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

with pelvic masses. Eur J Obstet Gynecol Reprod Biol. 2009;144(2):163-7. https://doi.org/10.1016/j.ejogrb.2009.02.048

6. Geomini P, Kruitwagen R, Bremer GL, Cnossen J, Mol BW. The accuracy of risk scores in predicting ovarian malignancy: a systematic review. Obstet Gynecol. 2009;113(2 Pt 1):384-94. https://doi.org/10.1097/AOG.0b013e318195ad17
7. Kaijser J, Sayasneh A, Van Hoorde K, Ghaem-Maghami S, Bourne T, Timmerman D, et al. Pre-surgical diagnosis of adnexal tumours using mathematical models and scoring systems: a systematic review and meta-analysis. Hum Reprod Update. 2014;20(3):449-62. https://doi.org/10.1093/humupd/dmt059
8. Timmerman D, Van Calster B, Testa A, Savelli L, Fischerova D, Froyman W, et al. Predicting the risk of malignancy in adnexal masses based on the Simple Rules from the International Ovarian Tumor Analysis group. Am J Obstet Gynecol. 2016;214(4):424-37. https://doi.org/10.1016/j.ajog.2016.01.007
9. Van Calster B, Van Hoorde K, Valentin L, Testa AC, Fischerova D, Van Holsbeke C, et al. Evaluating the risk of ovarian cancer before surgery using the ADNEX model to differentiate between benign, borderline, early and advanced stage invasive, and secondary metastatic tumours: prospective multicentre diagnostic study. BMJ. 2014;349:g5920. https://doi.org/10.1136/bmj.g5920
10. Timmerman D, Planchamp F, Bourne T, Landolfo C, du Bois A, Chiva L, et al. ESGO/ISUOG/IOTA/ESGE consensus statement on preoperative diagnosis of ovarian tumors. Ultrasound Obstet Gynecol. 2021;58(1):148-68. https://doi.org/10.1002/uog.23635
11. Chopra S, Vaishya R, Kaur J. An evaluation of the applicability of the risk of malignancy index for adnexal masses to patients seen at a tertiary hospital in Chandigarh, India. J Obstet Gynaecol India. 2015;65(6):405-10. https://doi.org/10.1007/s13224-014-0583-7
12. Javdekar R, Maitra N. Risk of malignancy index (RMI) in evaluation of adnexal mass. J Obstet Gynaecol India. 2015;65(2):117-21. https://doi.org/10.1007/s13224-014-0609-1
13. Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig L, et al. STARD 2015: an updated list of essential items for reporting diagnostic accuracy studies. BMJ. 2015;351:h5527. https://doi.org/10.1136/bmj.h5527
14. DeLong ER, DeLong DM, Clarke-Pearson DL. Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach. Biometrics. 1988;44(3):837-45. https://doi.org/10.2307/2531595
15. Buderer NM. Statistical methodology: I. Incorporating the prevalence of disease into the sample size calculation for sensitivity and specificity. Acad Emerg Med. 1996;3(9):895-900. https://doi.org/10.1111/j.1553-2712.1996.tb03538.x
16. Enakpene CA, Omigbodun AO, Goecke TW, Odukogbe AT, Beckmann MW. Preoperative evaluation and triage of women with suspicious adnexal masses using risk of malignancy index. J Obstet Gynaecol Res. 2009;35(1):131-8. https://doi.org/10.1111/j.1447-0756.2008.00869.x
17. Bouzari Z, Yazdani S, Shirkhani Kelagar Z, Abbaszadeh N. Risk of malignancy index as an evaluation of preoperative pelvic mass. Caspian J Intern Med. 2011;2(4):331-5. https://doi.org/10.1186/1756-0500-4-206
18. Choi JH, Sohn GS, Chay DB, Cho HB, Kim JH. Preoperative serum levels of cancer antigen 125 and carcinoembryonic antigen ratio can improve differentiation between mucinous ovarian carcinoma and other epithelial ovarian carcinomas. Obstet Gynecol Sci. 2018;61(3):344-51. https://doi.org/10.5468/ogs.2018.61.3.344
19. Seidman JD, Kurman RJ, Ronnett BM. Primary and metastatic mucinous adenocarcinomas in the ovaries: incidence in routine practice with a new approach to improve intraoperative diagnosis. Am J Surg Pathol. 2003;27(7):985-93. https://doi.org/10.1097/00000478-200307000-00014
20. Leeflang MM, Bossuyt PM, Irwig L. Diagnostic test accuracy may vary with prevalence: implications for evidence-based diagnosis. J Clin Epidemiol. 2009;62(1):5-12. https://doi.org/10.1016/j.jclinepi.2008.04.007

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/qqn8qs93
Original Article

PUBLISHER DETAILS

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa