

Research Article

Diagnostic Reliability of the Risk of Malignancy Index for Ovarian Mass Evaluation: A Histopathological Study

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Abstract: **Objective:** To determine the Risk of Malignancy Index's (RMI) diagnostic accuracy in identifying malignant ovarian masses using histopathology results as the gold standard. **Material & Methods:** The Cross Sectional Study was conducted at Department of Radiography and Imaging Technology, Hussain College of Health Sciences affiliated Hospital, Lahore from November 2025 to March 2026 with Patients between the ages of 20 and 60 who had an ovarian mass on ultrasonography of any size (echo patterns such as papillary projections, solid component septation >3mm, free fluid, and metastatic deposits) for more than three months were included. Excluded were pregnant women, patients deemed unsuitable for major surgery, instances deemed inoperable by the surgical team, any intraoperative mass other than the ovarian tumor, and patients with a diagnosis confirmed by a biopsy. **Results:** Total of 141 women were included. The average age of the patients was 43.22±8.39 years, and the average length of illness was 6.55±1.48 weeks. The condition had been present for less than six months in 72 (51.06%) of the women. 91 women (64.54%) had lesions less than 3 cm. Of the women, 96 (68.01%) were multipara, and 78 (55.32%) came from rural regions. Five of the RMI-positive patients were determined to be false positive, while 74 were confirmed to be real positive. Of the 44 patients who tested negative for RMI, 52 were genuine negative and 10 were false negative (p=0.0001). RMI's overall sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were 88.10%, 91.23%, 93.67%, 83.87%, and 89.36%, respectively, for the diagnosis of malignant ovarian masses using histopathological results as gold standard. **Conclusion:** RMI was a useful diagnostic tool since it was very accurate in identifying cancerous ovarian tumors early on. It was simple to use and understand for the preoperative diagnosis of ovarian masses.

Keywords: Diagnostic Reliability, Ovarian Mass, Histopathology, Malignancy Index

INTRODUCTION

Ovarian masses represent one of the most frequent gynecological findings encountered in clinical practice, ranging from simple benign cysts to highly aggressive malignant tumors. Globally, nearly 2.5 million new cases of ovarian masses are reported each year, creating a significant diagnostic challenge for clinicians and radiologists. Among all gynecological malignancies, ovarian cancer is the fourth leading cause of cancer-related death in women. The high mortality rate is mainly due to late presentation, vague symptoms, and the absence of an effective screening method for early detection [1]. This problem is even more pronounced in developing and emerging countries, where limited

awareness and delayed access to diagnostic facilities contribute to advanced-stage presentation [2].

The exact etiology of ovarian cancer is still not fully understood, but several risk factors have been identified. Genetic predisposition, particularly mutations in BRCA1 and BRCA2 genes, plays a major role. Reproductive factors such as nulliparity, early menarche, late menopause, infertility, and prolonged ovulation cycles also increase the risk. In contrast, factors that suppress ovulation, such as pregnancy, breastfeeding, and oral contraceptive use, are considered protective. Environmental and lifestyle factors may further contribute to disease development [3,4]. When a woman presents with an adnexal or ovarian mass, the primary clinical challenge is to differentiate between benign and

malignant lesions before surgery. This distinction is crucial because benign masses can often be managed conservatively or with minimal surgery, while malignant masses require referral to specialized oncological centers for proper staging and management [5].

Various imaging modalities are used in the assessment of ovarian masses, including ultrasound, CT scan, MRI, and laboratory evaluation of tumor markers such as CA-125. Among these, ultrasound is considered the first-line and most important imaging tool because it is inexpensive, non-invasive, widely available, and highly sensitive for detecting adnexal pathology. Ultrasound provides valuable morphological details such as cyst wall thickness, septations, solid components, papillary projections, bilaterality, and the presence of ascites. However, despite its high sensitivity, ultrasound has relatively low specificity [6,7]. This means that while it can detect most masses, it cannot always reliably distinguish benign from malignant lesions, and approximately 20% of adnexal masses may be misinterpreted when ultrasound is used alone.

To overcome this limitation, the Risk of Malignancy Index (RMI) was introduced as a practical clinical tool. The RMI is a simple regression-based scoring system that combines three important parameters: the ultrasound score, the menopausal status of the patient, and the serum CA-125 level. Each of these components contributes to the overall probability that an ovarian mass is malignant. A cut-off value of 250 for the RMI is widely accepted as an indicator of high risk for malignancy. Patients with RMI values above this threshold are considered more likely to have malignant ovarian tumors and should be referred for oncological evaluation and surgical management. Several studies have evaluated the diagnostic performance of the RMI [8,9]. One such study reported a sensitivity of 77.8% and a specificity of 80.6%, indicating that the RMI is reasonably accurate in predicting malignancy. However, results across different studies and populations have been inconsistent due to variations in patient demographics, ultrasound expertise, CA-125 variability, and study design [10].

Because of these inconsistent findings in the literature, there is a need to further evaluate the diagnostic reliability of the RMI in different clinical settings. Therefore, this study was conducted to determine the diagnostic accuracy of the Risk of Malignancy Index in differentiating malignant from benign ovarian masses, using histopathological examination of the surgical specimen as the gold standard for confirmation.

MATERIALS AND METHODS

This cross-sectional study was carried out from November 2025 to March 2026 in the Department of

Radiography and Imaging Technology; Hussain College of Health Sciences affiliated Hospital, Lahore. The Institution Review Board authorized the study, and the trial subjects gave their informed consent. All patients between the ages of 20 and 60 who had an ovarian mass on ultrasonography of any size (echo patterns such as papillary projections, solid component septation >3mm, free fluid, and metastatic deposits) for more than three months were included. Excluded were pregnant women, patients deemed unsuitable for major surgery, instances deemed inoperable by the surgical team, any intraoperative mass other than the ovarian tumor, and patients with a diagnosis confirmed by a biopsy. The computed sample size was 141 with a 95% confidence interval (CI) based on the prevalence of malignant ovarian masses of 54.76%, a 10% margin of error for sensitivity, a 1.8% margin of error for specificity, and a sensitivity of 72.5% and specificity of 98.2% of RMI in identifying malignant ovarian masses. The method of non-probability sequential sampling was employed. A thorough history and physical examination were collected for each subject. Age, the length of the lesion, the mass's size, and the resident's location (rural or urban) were all observed. For each patient, a risk of malignancy index was determined. Surgery was carried out in accordance with established protocols, and samples were sent for histology. They noticed the characteristics of cancer. The findings of histology and RMI were compared. The ultrasonography score $\times$ menopausal state $\times$ CA-125 level was used to assess the risk of cancer. Multiloculated cysts (an echoic, many loculi in the cysts), solid (hyperechoic) regions, signs of metastasis (involvement of the liver and lungs), ascites, and bilateral lesions were among the ultrasonography findings diagnostic of malignancy. Premenopausal women had a menopausal score of 1, while postmenopausal women received a score of 3. Malignancy was defined as a CA-125 level (A) cutoff of >200. Histopathology revealed the presence of cancerous cells. Data was gathered using a pre-made form and imported into SPSS version 25.0. The mean and standard deviation were used to display the size of the lesion and the duration of ovarian mass. Frequency and percentages were shown for parity, residence, malignant ovarian mass on RMI, and histology. A 2x2 contingency table was used to calculate the diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value. Age, parity, location of residence, length of ovarian mass, and lesion size were all stratified. The diagnostic accuracy was then computed. The p-value (<0.05 as significant) was determined using the chi square test.

RESULTS

The average age of the patients was 43.22 ± 8.39 years, and the average length of disease was 6.55 ± 1.48 weeks. The condition had been present for less than six months in 72 (51.06%) of the women. 91 women (64.54%) had lesions less than 3 cm. Of the women, 96 (68.01%) were multipara, and 78 (55.32%) came from rural regions. Five of the RMI-positive patients were determined to be false positive, while 74 were confirmed to be real positive. Of the 44 patients who tested negative for RMI, 52 were genuine negative and 10 were false negative ($p=0.0001$). This is provided in Table I. RMI's overall sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were 88.10%, 91.23%, 93.67%, 83.87%, and 89.36%, respectively, for the diagnosis of malignant ovarian masses using histopathological results as the gold standard.

Table 1: Assessment of Diagnostic Accuracy of the Risk of Malignancy Index in Ovarian Masses with Histopathology

Variable	Positive results on Histopathology	Negative results on Histopathology	p-Value
Positive on RMI	74 (TP)	05 (FP)	0.0001
Negative on RMI	10 (FN)	52 (TN)	

Diagnostic accuracy with respect to age group showed that 35 patients were true positives, five were false negatives, three were false positives, and 25 were genuine negatives ($p=0.001$). Sensitivity was 87.50%, specificity was 89.29%, positive predictive value was 92.11%, negative predictive value was 83.33%, and diagnostic accuracy was 88.24%. 39 women were true positive, five were false negative, two were false positive, and 27 were true negative ($p=0.001$) when the diagnostic accuracy was stratified according to the age range 41–60 years ($n=73$). The corresponding values for sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were 88.64%, 93.01, 95.12%, 84.38%, and 90.41%.

True positive, false negative, false positive, and true negative were found to be 31, 03, 04, and 34, respectively, in the stratification of diagnostic accuracy with respect to the duration of disease < 6 months ($n=72$) ($p=0.001$). For sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy, the corresponding results were 91.18%, 89.47%, 88.57%, 91.89%, and 90.285. When the diagnostic accuracy was stratified according to the length of the disease ($n = 69$), 43 of the results were true positives, 7 were false negatives, 1 was a false positive, and 18 were genuine negatives ($p=0.001$). Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were found to be 86.0%, 94.74%, 97.73%, 72%, and 88.41%, respectively. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were found to be 87.27%, 97.22%, 97.22%, 83.33%, 91.21%, and 48 true positives, seven false negatives, one false positive, and 35 true negatives ($p=0.001$) in the stratification of diagnostic accuracy with respect to lesion size < 3 cm ($n=91$). The stratification of diagnostic accuracy according to lesion size < 3 cm ($n = 50$) revealed 26 true positives, 3 false negatives, 4 false positives, and 17 true negatives ($p = 0.001$) with 89.66% sensitivity, 80.96% specificity, 86.67% positive predictive value, 85.00% negative predictive value, and 86.00% diagnostic accuracy of RMI..

Stratification of diagnostic accuracy with regard to primipara ($n=45$) revealed 17 true positives, 5 false negatives, 1 false positive, and 22 true negatives ($p=0.001$). The results were 77.27% for sensitivity, 95.65% for specificity, 94.44% for positive predictive value, 81.48% for negative predictive value, and 86.67% for RMI diagnostic accuracy. 57 were true positives, 5 were false negatives, 4 were false positives, and 30 were genuine negatives ($p=0.001$) when the diagnostic accuracy of multiparous women ($n=96$) was stratified. The corresponding values for sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were 91.94%, 88.24%, 93.44%, 85.71%, and 90.63%. Stratification of diagnostic accuracy with respect to rural area ($n=78$) showed true positive were 40, false negative three, false positive two, and true negative 33 ($p=0.001$). Data revealed 93.02% sensitivity, 94.29% specificity, 95.24% positive predictive value, 91.67% negative predictive value, and 93.59% diagnostic accuracy of RMI. Stratification of diagnostic accuracy with respect to urban area ($n=63$) showed 34 true positive, seven false negative, three false positive, 19 true negatives ($p=0.001$). The results showed 82.93% sensitivity, 86.36% specificity, 91.89% positive predictive value, 73.08% negative predictive value and 84.13% diagnostic accuracy of RMI.

DISCUSSION

Our investigation showed that RMI has a strong diagnostic capacity with 88.1% sensitivity and 91.23% specificity. Before undergoing surgery, a trustworthy diagnostic examination is necessary to determine if the ovarian tumors are benign or malignant due to the increased occurrence of gynecological cancers. Early

diagnosis and treatment will improve the patient's prognosis and survival. Over the past ten years, RMI has become a crucial diagnostic tool for distinguishing between benign and malignant ovarian tumors [13]. The same findings were found in our investigation. On the other hand, varied findings are described in the literature. RMI had a sensitivity of 72.5% and specificity of 98.2%

in a research where malignant ovarian mass was detected in 54.76% of cases [9]. According to Raya et al., the sensitivity and specificity of RMI in identifying malignant ovarian masses are 77.8% and 80.6%, respectively, which is lower than what our investigation found [10]. According to another research, RMI showed 92.20% diagnostic accuracy, 85.71% sensitivity, 94.64% specificity, 94.64% negative predictive value, and 85.71% positive predictive value [11]. Another research indicated that RMI's sensitivity, specificity, and diagnostic accuracy for ovarian cancer were 100%, 96.3%, and 96.6%, respectively [12]. RMI has 91.3% sensitivity, 76.9% specificity, 87.5% positive predictive value, and 83.3% negative predictive value when used to diagnose ovarian cancer, according to a research conducted in Pakistan. [14] A few more trials showed outcomes that were almost identical [15–16]. According to the statistics, RMI is a simple method for generating a preliminary diagnosis prior to initiating a specific course of therapy. As a result, it aids in the early identification of ovarian malignancies.

CONCLUSION

RMI was a useful diagnostic tool since it was very accurate in identifying cancerous ovarian tumors early on. It was simple to use and understand for the preoperative diagnosis of ovarian masses.

Conflict of Interest: None

REFERENCES

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2019. *CA: a cancer journal for clinicians*. 2019 Jan;69(1):7-34.
2. Yelikar KA, Deshpande SS, Nanaware SS, Pagare SB. Evaluation of the validity of risk malignancy index in clinically diagnosed ovarian masses and to compare it with the validity of individual constituent parameter of risk malignancy index. *Int J Reprod Contracept Obstet Gynecol*. 2016 Feb 1;5(2):460-.
3. Suh-Burgmann E, Kinney W. The value of ultrasound monitoring of adnexal masses for early detection of ovarian cancer. *Frontiers in Oncology*. 2016 Feb 10;6:25.
4. Raza MA, Habib S, Khan BA, Altuf L, Arshad S, Mussarat I, Ghazanfar S. Diagnostic Accuracy of Color and Spectral Doppler in Identifying Endometrial Cancer in Post-Menopausal Menometrorrhagial Patients with Histopathology as Gold Standard. *Journal of Health and Rehabilitation Research*. 2024 May 24;4(2):910-5.
5. Jacobs IJ, Menon U, Ryan A, Gentry-Maharaj A, Burnell M, Kalsi JK, Amso NN, Apostolidou S, Benjamin E, Cruickshank D, Crump DN. Ovarian cancer screening and mortality in the UK Collaborative Trial of Ovarian Cancer Screening (UKCTOCS): a randomised controlled trial. *The Lancet*. 2016 Mar 5;387(10022):945-56.
6. Meys EM, Kaijser J, Kruitwagen RF, Slangen BF, Van Calster B, Aertgeerts B, Verbakel JY, Timmerman D, Van Gorp T. Subjective assessment versus ultrasound models to diagnose ovarian cancer: A systematic review and meta-analysis. *European Journal of Cancer*. 2016 May 1;58:17-29.
7. Jabbar F, Talib I, Umair A, Raza MA, Hussain N, Bibi R, Rehman S, Abrar R. CORRELATION OF OVARIAN ARTERY DOPPLER INDICES WITH ULTRASOUND FINDINGS IN PATIENTS WITH POLYCYSTIC OVARIAN SYNDROME.
8. Moore RG, Blackman A, Miller MC, Robison K, DiSilvestro PA, Eklund EE, Strongin R, Messerlian G. Multiple biomarker algorithms to predict epithelial ovarian cancer in women with a pelvic mass: Can additional makers improve performance?. *Gynecologic oncology*. 2019 Jul 1;154(1):150-5.
9. Dora SK, Dandapat AB, Pande B, Hota JP. A prospective study to evaluate the risk malignancy index and its diagnostic implication in patients with suspected ovarian mass. *Journal of ovarian research*. 2017 Aug 14;10(1):55.
10. Ray A, Divya S, Guru BK, Ramaswamy AS, Kumar B. Diagnostic accuracy of the risk of malignancy index 1 compared to more recent IOTA ADNEX model in discriminating benign from malignant adnexal masses: a multicentre study. *Int J Reprod Contracept Obstet Gynecol*. 2019 Mar 1;8:1001-.
11. Jenitha B, Subbiah M. Diagnostic value of risk malignancy index (RMI) for detection of malignancies in clinically diagnosed ovarian masses and to evaluate the validity of individual constituent parameter of risk malignancy index. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 2019 Apr 1;8(4):1558-63.
12. Mushtaq Q, Zafar M, Navid S. Accuracy of risk of malignancy index in preoperative evaluation of adnexal masses. *Pakistan Armed Forces Medical Journal*. 2014 Dec 1(4):528.
13. Du Bois A, Herrstedt J, Hardy-Bessard AC, Müller HH, Harter P, Kristensen G, Joly F, Huober J, Åvall-Lundqvist E, Weber B, Kurzeder C. Phase III trial of carboplatin plus paclitaxel with or without gemcitabine in first-line treatment of epithelial ovarian cancer. *Journal of Clinical Oncology*. 2010 Sep 20;28(27):4162-9.
14. Irshad F, Irshad M, Naz M, Asim Ikram M. Accuracy of “risk of malignancy index” in the preoperative diagnosis of Zovarian malignancy in post menopausal women. *Rawal Med. J*. 2013 Jul;38:266-70.
15. Bailey J, Tailor A, Naik R, Lopes A, Godfrey K, Hatem HM, Monaghan J. Risk of malignancy index for referral of ovarian cancer cases to a tertiary center: does it identify the correct cases?. *International Journal of Gynecological Cancer*. 2006 Feb;16(S1):30-4.
16. Hemeda HM, Ali KK, Onsil KA. The role of risk of malignancy index in the preoperative assessment of

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patients with adnexal masses. *Life Sci J*.
2014;11(1):241-6.