Original Article

The diagnostic performance of the Mindray system in detecting CA125 and HE4 for patients with ovarian cancer

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Background: Cancer antigen 125 (CA125) and human epididymis protein 4 (HE4) are the most commonly used tumor biomarkers for ovarian cancer (OC) screening and diagnosis. The risk of ovarian malignancy algorithm (ROMA) score uses these markers, as detected by the Roche system, to predict the risk of OC. This study sought to assess the performance of the Mindray system in detecting CA125 and HE4 for ROMA score calculation in clinical settings.

Methods: Consecutive OC patients and patients with benign pelvic masses were screened and enrolled in this study. The CA125 and HE4 levels of these patients were measured using both the Mindray and Roche systems. The ROMA score for each patient was calculated. Diagnostic performance was evaluated using the area under the curve (AUC) of the receiver operating characteristic (ROC) curve.

Results: The HE4 and CA125 levels were significantly higher in the patients with OC than the patients with benign ovarian masses. Both detection systems showed high efficiency in detecting ovarian cancer. For the premenopausal OC patients, the AUC values for the ROMA score, HE4, and CA125 were 0.866, 0.852, and 0.879, respectively, using the Roche system, and 0.911, 0.902, and 0.883, respectively, using the Mindray system. For the postmenopausal OC patients, the AUC values for the ROMA score, HE4, and CA125 were 0.962, 0.920, and 0.953, respectively, using Roche system, and 0.966, 0.924, and 0.959, respectively, using the Mindray system. The correlation analysis showed strong agreement between the two systems. Among the patients who experienced recurrence, we observed a significant increase in both HE4 and CA125 levels compared to baseline using the Mindray system.

Conclusions: The Mindray and Roche systems provide consistent results. The Mindray system can be used to detect HE4 and CA125 for ROMA score calculation.

Keywords: Ovarian cancer (OC); cancer antigen 125 (CA125); human epididymis protein 4 (HE4); Mindray; Roche

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Introduction

Ovarian cancer (OC) is the most lethal malignancy of the female reproductive system, representing 3.4% of all new cancer cases and 4.7% of all cancer-related deaths among women (1). Every year, over 300,000 women are diagnosed with OC, and approximately 152,000 lose their lives to this disease (1). The survival rate for early-stage OC patients is around 92% over 5 years, but it drops significantly to only 29% for late-stage (stage III–IV) patients (2). Unfortunately, due to its often asymptomatic early clinical course, OC often goes undetected until the late stages (3). Indeed, over 70% of OC patients are in advanced stages (stage III–IV) at the time of diagnosis (4). Thus, precursor lesion identification and early detection and diagnosis are crucial for improving the prognosis of OC patients (5-7).

The gold standard for diagnosing OC is tissue pathology examination. Due to the absence of specific symptoms in early-stage OC, advanced diagnostic techniques, including ultrasound imaging, blood biomarker detection, and artificial intelligence with machine-learning algorithms that leverage multi-omics and multi-dimensional data are being used to supplement traditional diagnostic methods for the early detection of OC (6,8). Still, there is no screening test with confirmed potential to reduce the risk of dying from ovarian cancer. Serum biomarkers offer a convenient, cost-effective, and non-invasive method for predicting malignant tumors. Thus, identifying more reliable early OC biomarker signatures for diagnostic purposes would be a major advance (9).

The current gold standard for ovarian cancer treatment is surgery with no residual tumor and chemotherapy based on platinum drugs, but some details are controversial. Benedetti Panici and colleagues' review indicates that lymphadenectomy for ovarian cancer does not improve overall survival and is associated with increased surgical morbidity, advocating for a judicious application of this procedure (10). Di Donato and team's research delves into the resection of hepatobiliary metastases in advanced epithelial ovarian cancer, demonstrating that achieving complete cytoreduction is not only feasible but also correlates with enhanced patient survival, even amidst the intricacies of the surgery and the risks of elevated morbidity (11). Poly (ADP-ribose) polymerase inhibitors, gaining clinical approval in China in 2018, have become integral to the treatment landscape of ovarian cancer, especially serving as a first-line and maintenance therapy for patients with breast cancer susceptibility gene, highlighting their role in personalized medicine (12).

For the past three decades, cancer antigen 125 (CA125) has been the most widely used biomarker for OC despite some limitations (13,14). In recent years, serum human epididymis protein 4 (HE4) has emerged as a promising biomarker for ovarian malignancy. HE4 exhibits similar sensitivity relative to CA125 in detecting late-stage OC but demonstrates higher specificity in distinguishing malignant from benign tumors (15). However, like CA125, elevated serum HE4 levels are not unique to ovarian tumor patients and can also be observed in gynecological and pulmonary tumor patients (15). To address these limitations, Moore *et al.* (16) developed a risk of ovarian malignancy algorithm (ROMA) in 2009. The ROMA combines serum CA125 and HE4 levels, along with menopausal status, and uses a logistic regression analysis to conduct a preoperative evaluation of pathological pelvic masses. The Food and Drug Administration approved the use of the ROMA for diagnosing OC in 2010, as it was shown to have better predictive value than using CA125

Highlight box

Key findings

- The Mindray and Roche systems consistently yield reliable results. The Mindray system is capable of detecting human epididymis protein 4 (HE4) and cancer antigen 125 (CA125) for calculating the risk of ovarian malignancy algorithm (ROMA) score.

What is known, and what is new?

- Roche diagnostics offers diagnostic kits for the identification of CA125 and HE4, along with analytical software designed to compute the ROMA score.
- The Mindray system has the capability to detect HE4 and CA125 biomarkers to calculate the ROMA score for the evaluation of a patient's susceptibility to malignant ovarian neoplasms.

What is the implication, and what should change now?

- Early detection of ovarian cancer is critical but challenging due to the lack of a broadly accepted screening test. Diagnosis requires surgery confirmation, making false positives a serious concern. Hence, international guidelines do not recommend population-wide ovarian cancer screening. However, there are Food and Drug Administration-approved tests to estimate ovarian cancer risk in women with an adnexal mass planned for surgery. This study, based on Chinese patients with benign pelvic mass or ovarian cancer, evaluated CA125 and HE4 using the Mindray system. Results were comparable or slightly superior to those obtained using the ROMA score in Roche system. The Mindray system could be implemented in healthcare systems in China and elsewhere. Accessible and affordable diagnostic technology could reduce healthcare costs, improve resource allocation, and support the development of a broadly applicable ovarian cancer screening test, potentially having a major positive impact on survival rates.

or HE4 alone (17,18). Nevertheless, in most countries apart from the US, the test has not been implemented, and screening for ovarian cancer outside of clinical trials is not generally recommended by guidelines.

The Mindray chemiluminescent analyzer was developed in China and showed excellent performance in the coronavirus disease 2019 (COVID-19) pandemic. However, the ability of the Mindray chemiluminescent analyzer to detect CA125 and HE4 remains unclear, especially when compared with the world's leading analyzer made by Roche. In this prospective cohort study, the CA125 and HE4 concentrations of OC patients and ovarian benign tumor patients were detected using both the Mindray and Roche chemiluminescent analyzers. The study established the preliminary critical value of the ROMA using the Mindray chemiluminescent immunoassay and then evaluated the consistency of the results obtained from the two detection systems. The study further provided information on the predictive power of the combination of CA125 and HE4 biomarker for ovarian cancer screening in Chinese patients with benign pelvic masses or early-stage ovarian malignancy. We present this article in accordance with the STARD reporting checklist (available at https://tcr.amegroups.com/article/view/10.21037/tcr-24-1107/rc).

Methods

Study population

Between September 2022 and April 2023, consecutive female patients diagnosed with OC or benign pelvic masses at the Nanfang Hospital of Southern Medical University were prospectively screened and enrolled in this study. To be eligible for inclusion in this study, the patients had to meet the following inclusion criteria: (I) aged over 18 years; (II) being newly diagnosed with OC or benign pelvic masses; and (III) had not been treated with surgery, chemotherapy, radiotherapy, targeted therapy, or other therapy for OC before sample collection. Patients were excluded from the study if they met any of the following exclusion criteria: with other tumors, or rheumatic disease, or organ failure, or on dialysis. In the follow-up study, we included first-line chemotherapy patients who had undergone at least six cycles of chemotherapy at our hospital (the Nanfang Hospital of Southern Medical University). With a 1-year follow-up endpoint, patients were categorized into recurrence and non-recurrence groups based on imaging findings. The CA125 and HE4 levels of the follow-up patients were tested using Mindray instruments. The study aimed to evaluate the consistency between the trends in CA125 and HE4 levels and the progression of the disease. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Medical Ethics Committee of the Nanfang Hospital of Southern Medical University (No. NFEC-2022-364). Informed consent was taken from all the patients.

Tumor diagnosis

OC was diagnosed by histopathological examination. Patients with benign ovarian diseases were diagnosed with cysts or benign tumors by pathological examination or medical imaging.

HE4 and CA125 assays

All the study subjects were asked to provide 3 mL of fasting venous blood collected in the morning. After centrifugation at 3,000 rpm for 10 minutes in a centrifuge, the serum was stored at –80 ℃. At the end of this study, quantitative measurements of serum CA125 and HE4 levels in all samples were performed using the Mindray (Shenzhen, China) CL-6000i fully automated chemiluminescent immunoassay analyzer (3-month mean coefficient of variation: CA125, 4.52%; HE4, 4.59%) and the Roche (Basel, Switzerland) Cobas e601 fully automated electrochemiluminescence immunoassay analyzer (3-month mean coefficient of variation: CA125, 4.72%; HE4, 4.46%) on the same day under the same laboratory conditions. All the measurements were performed in strict accordance with the manufacturers' instructions. All the results were recorded in an Excel sheet without any specific indication as to whether the Mindray or Roche system had been used to ensure blinding to the investigators who conducted the statistical analysis.

Calculation of the ROMA score

The ROMA score was calculated using the natural log (LN) of the HE4 and the LN of the CA125 values with different coefficients based on menopausal status. The predictive index (PI) was calculated as follows: premenopausal: PI = –12.0 + 2.38 × LN (HE4) + 0.0626 × LN (CA125); and postmenopausal: PI = –8.09 + 1.04 × LN (HE4) + 0.732 × LN (CA125). The calculated PI was then substituted into the following formula: ROMA (%) = exp (PI)/[1 + exp (PI)]

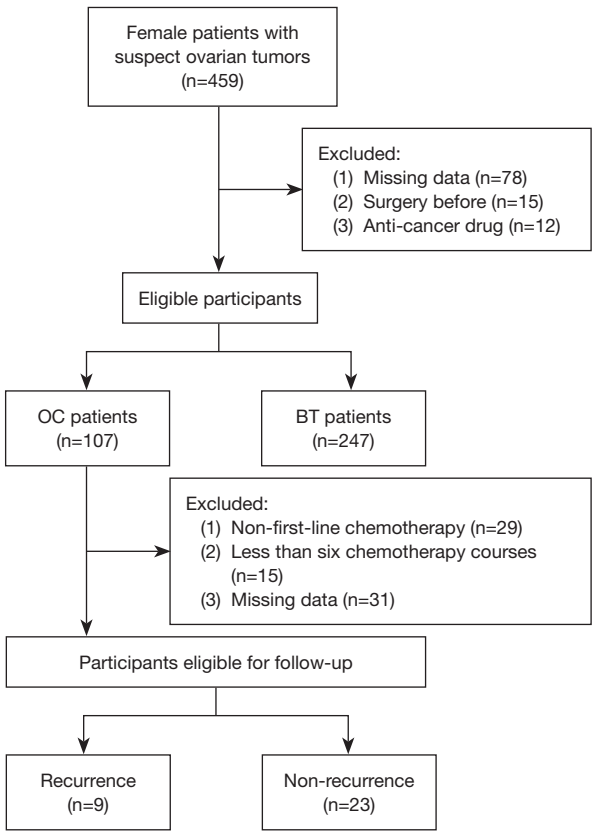

Figure 1 Patient enrollment flowchart. OC, ovarian cancer; BT, benign tumor.

× 100. The ROMA cut-off values recommended by the manufacturers' instructions were as follows: >11.4% for premenopausal ROMA, and >29.9% for postmenopausal ROMA.

Statistical analysis

The data analysis was conducted using SPSS statistical software (version 22.0, IBM, Armonk, NY, USA) and MedCalc Statistical Software (version 20.0.4, MedCalc Software, Ostend, Belgium). The continuous variables with non-normal distributions were expressed as the median and interquartile range [M (P25, P75)], and were analyzed using non-parametric Mann-Whitney *U* and Kruskal-Wallis *H* tests. A linear regression analysis was conducted to compare the results of the two detection systems (i.e., Mindray and Roche), and a bias analysis was conducted using the Bland-Altman method. The diagnostic performance of CA125, HE4, and the ROMA score was evaluated using the receiver operating characteristic (ROC) curves. Statistical significance was set at the conventional alpha level of 0.05. The areas under the ROC curves of the Mindray and Roche systems were compared using the Delong test.

Results

Baseline characteristics

Based on the inclusion and exclusion criteria, 107 female patients [aged 21–84 years, 52.0 (46.0, 58.0) years] diagnosed with OC and 247 female patients [aged 13–85 years, 32.0 (26.0, 43.0) years] diagnosed with benign pelvic masses were consecutively enrolled in the study and included in the final analysis. Out of 107 ovarian cancer patients, 32 cases met the criteria of receiving first-line chemotherapy, completing at least six cycles of chemotherapy at our hospital, and having follow-up results with Mindray. Among these, nine cases experienced recurrence within 1 year (*Figure 1*). The baseline characteristics of the patients are shown in *Table 1*.

Comparison of serum CA125 and HE4 concentrations between the two groups

The results showed that both the serum CA125, HE4, ROMA score levels of the OC group were significantly higher than those of the ovarian benign tumor group (P<0.05) (*Figure 2* and *Table 2*). Moreover, statistically significant differences (P<0.05) were found between both the Mindray and Roche detection systems in terms of the CA125 and HE4 concentrations between the OC and ovarian benign tumor groups both before and after menopause (*Figure 2* and *Table 2*).

Calculation of the ROMA score and establishment of its reference value

Using the CA125 and HE4 values, different coefficients were applied based on menopausal status to calculate the ROMA score. For the Mindray detection system, the median of ROMA scores of the OC group were 53.75% for premenopausal women and 92.90% for postmenopausal women, while the benign ovarian tumor group were 7.30% for premenopausal women and 13.80% for postmenopausal women. For the Roche detection system, the median of ROMA scores of the OC group were 52.10% for premenopausal women and 91.90% for postmenopausal women, while the benign ovarian tumor group were 7.80%

Table 1 Baseline characteristics of patients with OC and patients with BT

Characteristics	OC (n=107)			BT (n=247)	P value
	Recurrent patients in the follow-up queue (n=9)	Non-recurrent patients in the follow-up queue (n=23)	All		
Age (years)	49.0 (45.0, 55.0)	49.0 (43.5, 61.0)	51.0 (46.0, 58.0)	37.0 (27.0, 50.0)	<0.001
Menopause	6 (66.6)	9 (39.1)	61 (57.0)	61 (24.7)	<0.001
Tumor					–
Benign teratoma	–	–	–	38 (15.4)	
BOT	–	1 (4.3)	3 (2.8)	–	
CC	–	–	–	57 (23.1)	
EOC	8 (88.9)	22 (95.7)	100 (93.5)	–	
OB	–	–	–	2 (0.8)	
OOC	–	–	1 (0.9)	–	
OCT	–	–	–	150 (60.7)	
OGCC	1 (11.1)	–	3 (2.8)	–	
Clinical stage					–
I	1 (11.1)	1 (4.3)	10 (9.3)	–	
II	–	1 (4.3)	7 (6.5)	–	
III	4 (44.4)	5 (21.7)	33 (30.8)	–	
IV	4 (44.4)	10 (43.5)	37 (34.6)	–	
Unknown	–	6 (26.1)	20 (18.7)	–	

Data are presented as median (P25, P75) or n (%). The P value is used to compare between OC and BT. OC, ovarian cancer; BT, benign tumor; BOT, borderline ovarian tumor; CC, chocolate cyst; EOC, epithelial ovarian cancer; OB, other benign; OOC, other ovarian cancer; OCT, ovarian cyst (excluding chocolate cysts); OGCC, ovarian germ cell cancer.

for premenopausal women and 16.00% for postmenopausal women. In both detection systems, the ROMA score of the OC group was higher than that of the benign ovarian tumor group (P<0.001 for both) both before and after menopause (*Table 2*).

As *Table 3* shows, the ROMA cut-off value of the Mindray detection system for differentiating between premenopausal ovarian benign tumors and OC was 10.30%, with a specificity of 75.27% [95% confidence interval (CI): 68.31–81.16%] and a sensitivity of 80.43% (95% CI: 65.62–90.14%); while the ROMA cut-off value for differentiating between postmenopausal ovarian benign tumors and OC was 29.20%, with a specificity of 75.41% (95% CI: 62.44–85.15%) and a sensitivity of 93.44% (95% CI: 83.25–97.88%). The Mindray ROMA reference values were deemed positive when >10.30% for premenopausal and >29.20% for postmenopausal women. The Roche ROMA reference values were considered positive when >11.40% for premenopausal and >29.90% for postmenopausal women (according to the instructions of the kit).

Evaluation of the diagnostic efficacy of CA125, HE4, and the ROMA score

The results showed that CA125 had higher sensitivity than HE4 and the ROMA score, while HE4 had higher specificity than CA125 and the ROMA score. The ROMA score had higher sensitivity than HE4, higher specificity than CA125, better positive predictive value than CA125, and better negative predictive value than HE4 (Table S1).

For the Mindray detection system, the ROMA score had a higher area under the curve (AUC) (0.911) than HE4 (0.902) and CA125 (0.883) in discriminating between premenopausal OC and benign tumors. Additionally,

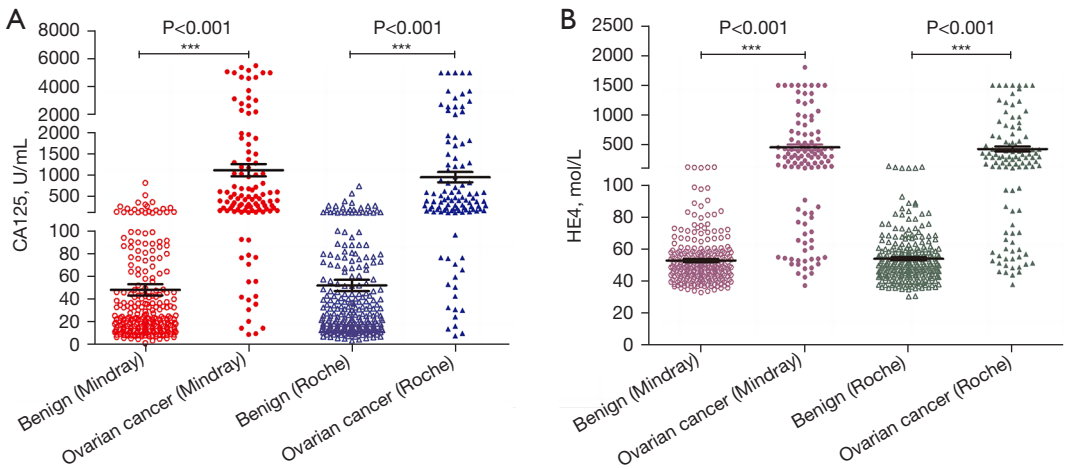

Figure 2 Serum (A) CA125 and (B) HE4 concentrations in the OC group and ovarian benign tumor group. CA125, cancer antigen 125; HE4, human epididymis protein 4; OC, ovarian cancer.

Table 2 Comparison of serum CA125, HE4 and ROMA scores between the two groups

Systems	Ovarian cancer		Ovarian benign tumor	
	Premenopausal (n=46)	Postmenopausal (n=61)	Premenopausal (n=186)	Postmenopausal (n=61)
Mindray				
CA125 (U/mL)	329.90 (110.00, 1,010.00)	487.30 (215.70, 1,804.00)	24.95 (15.98, 50.70)*	18.20 (9.35, 42.25)*
HE4 (pmol/L)	143.00 (60.75, 435.20)	342.90 (123.00, 702.90)	48.90 (43.08, 57.13)*	51.00 (43.65, 66.90)*
ROMA, %	53.75 (12.93, 94.73)	92.90 (71.60, 98.30)	7.30 (5.38, 10.33)*	13.80 (8.75, 29.20)*
Roche				
CA125 (U/mL)	319.20 (100.20, 778.80)	415.60 (174.00, 1,625.00)	28.45 (16.75, 64.85)*	22.70 (12.10, 47.20)*
HE4 (pmol/L)	136.30 (58.80, 393.90)	293.40 (123.50, 664.00)	50.15 (44.18, 58.25)*	52.60 (42.85, 66.60)*
ROMA, %	52.10 (11.45, 93.27)	91.90 (68.00, 98.15)	7.80 (5.88, 11.40)*	16.00 (9.80, 29.80)*

Data are presented as median (P25, P75). *, compared with ovarian cancer, all P<0.001. CA125, cancer antigen 125; HE4, human epididymis protein 4; ROMA, risk of ovarian malignancy algorithm.

the ROMA score had an AUC of 0.966 in discriminating between postmenopausal OC and benign tumors, which was higher than the AUCs of HE4 (0.924) and CA125 (0.959). For the Roche detection system, the AUCs of the ROMA score, HE4, and CA125 in distinguishing between premenopausal OC and benign tumors were 0.866, 0.852, and 0.879, respectively. Additionally, in distinguishing between postmenopausal OC and benign tumors, the AUCs for the ROMA score, HE4, and CA125 were 0.962, 0.920, and 0.953, respectively (*Figure 3*).

These results generally suggested that the Mindray and Roche detection systems had good consistency in terms of diagnostic performance, and the diagnostic performance of the three diagnostic indicators in the Mindray detection system was slightly higher than that of the Roche detection system (see *Figure 3A-3F* and Table S1 for details).

Methodological comparison of the two detection systems

Using the results of the Roche detection system as the comparator (X) and the results of the Mindray detection system as the comparator (Y), a correlation analysis was performed of CA125, HE4, and the ROMA score in the OC patients. As *Figure 4A-4C* show, the linear regression equations for premenopausal CA125, HE4, and the ROMA score were y=1.206x–15.567 (R^2=0.954), y=1.099x–6.389

Table 3 Patients divided into low- and high-risk groups: ovarian benign tumors versus ovarian cancer

Menopausal status	Disease	Low risk (N)	High risk (N)	Total (N)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Combined	Benign	186	61	247	87.85	75.30	60.65	93.47
	Cancer	13	94	107				
	Total	199	155	354				
Premenopausal	Benign	140	46	186	80.43	75.27	44.05	93.96
	Cancer	9	37	46				
	Total	149	83	232				
Postmenopausal	Benign	46	15	61	93.44	75.41	79.17	92.00
	Cancer	4	57	61				
	Total	50	72	122				

PPV, positive predictive value; NPV, negative predictive value.

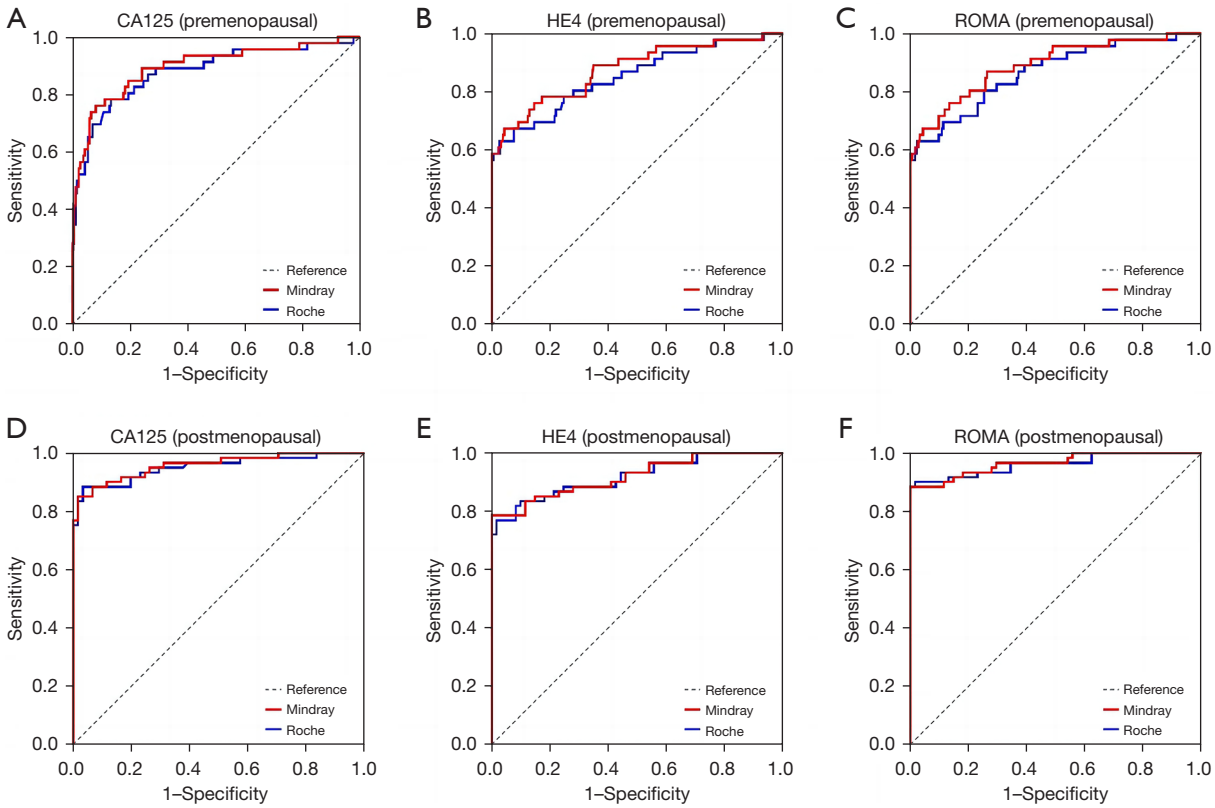

Figure 3 ROC curves of serum CA125, HE4, and the ROMA score in the diagnosis of ovarian malignant tumors. (A-F) The P values for the performance comparison differences of the two ROC curves are 0.02, 0.12, 0.07, 0.10, 0.77, 0.38. CA125, cancer antigen 125; HE4, human epididymis protein 4; ROMA, risk of ovarian malignancy algorithm; ROC, receiver operating characteristic.

(R^2=0.990), and y=0.989x+1.350 (R^2=0.990), respectively. As *Figure 4D-4F* show, the linear regression equations for postmenopausal CA125, HE4, and the ROMA score were y=1.118x+54.884 (R^2=0.950), y=1.035x+15.300 (R^2=0.990), and y=1.011x–0.0002 (R^2=0.988), respectively. These results suggested that both detection systems had a good linear

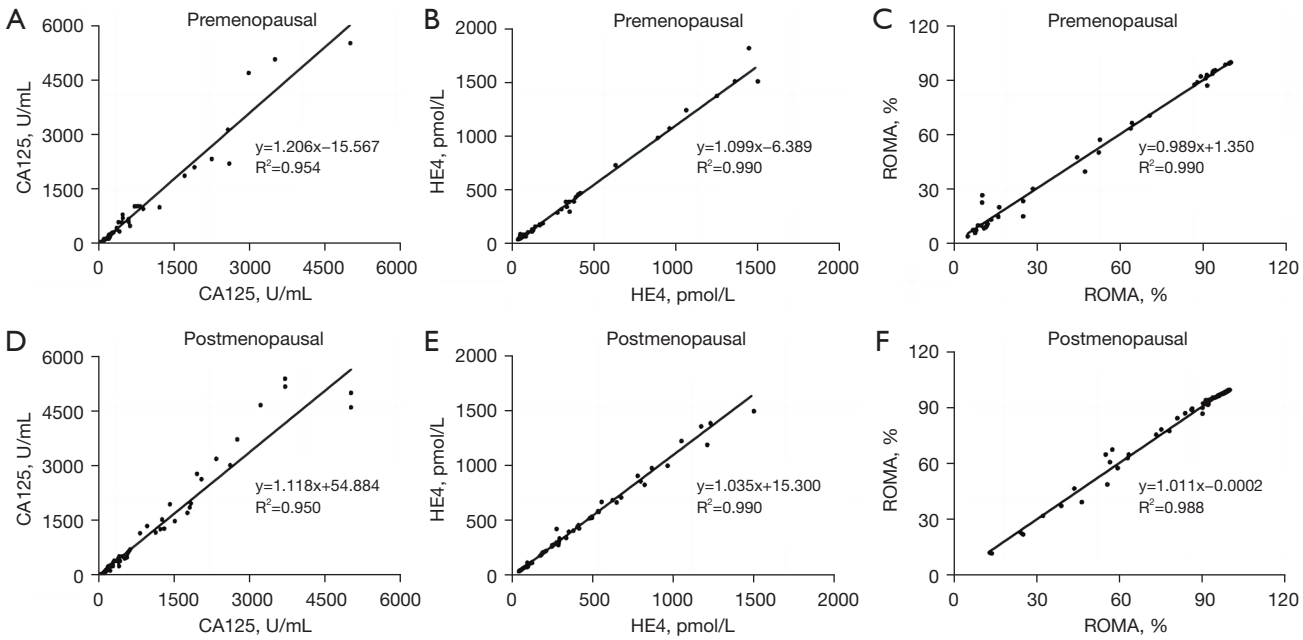

Figure 4 Correlation analysis of (A-F) CA125, HE4 and the ROMA score of the two detection systems. CA125, cancer antigen 125; HE4, human epididymis protein 4; ROMA, risk of ovarian malignancy algorithm.

correlation with CA125, HE4, and the ROMA score in both the premenopausal and postmenopausal OC patients (*Figure 4*).

A Bland-Altman analysis was conducted to assess the consistency of the two measurement results. The differences in the CA125, HE4, and the ROMA values between the two detection systems for the premenopausal and postmenopausal patients are shown in Figure S1A-S1F and Table S2. The results indicated that both detection systems showed good agreement in detecting CA125, HE4, and the ROMA score in the OC patients.

The value of Mindray CA125 and HE4 in follow-up of ovarian cancer

We tracked 32 ovarian cancer patients undergoing first-line chemotherapy, collecting and testing baseline values, values after three cycles of chemotherapy, values after six cycles of chemotherapy, and values before and after recurrence (see Table S3). For patients who did not experience recurrence within one year, the median HE4 baseline values, values after three cycles of chemotherapy, and values after six cycles of chemotherapy were all lower than those of the patients who experienced recurrence. Similarly, for CA125, the baseline values and values after six cycles of chemotherapy also showed the same trend. Among the patients who experienced recurrence, we observed a significant increase in both HE4 and CA125 values. The median HE4 value at the time of recurrence was 136, which was significantly higher than the baseline median value of 62.9 prior to recurrence (P=0.01). Similarly, the median CA125 value at the time of recurrence was 45.8, significantly higher than the baseline median value of 15.2 prior to recurrence (P=0.05).

Discussion

For ovarian mass, the ROMA critical value for both premenopausal and postmenopausal women was set at a specificity of 75%. For the Mindray system, ROMA reference values >10.30% for premenopausal women and >29.20% for postmenopausal women indicated positive results. The comparison of the Mindray and Roche ROMA values showed consistent and correlated outcomes. In both systems, the ROMA values for OC were higher than those for benign tumors in both the premenopausal and postmenopausal women. The Mindray detection system showed AUC values close to those of the Roche system in distinguishing premenopausal ovarian cancer from benign tumors (AUC: 0.911 *vs.* 0.866) and postmenopausal ovarian cancer from benign tumors (AUC: 0.966 *vs.* 0.962). These

findings indicated good consistency between the Mindray and Roche detection systems, with a slightly superior diagnostic efficacy observed in the ROMA Mindray detection system. The correlation and Bland-Altman analyses also showed a high level of agreement between the two systems in measuring HE4, CA125, and the ROMA score, within an acceptable deviation range.

The most commonly used serum biomarker for OC diagnosis is CA125, a glycoprotein encoded by MUC16. However, CA125 has low sensitivity in early stage OC and is not expressed or is only minimally expressed in around 20% of cases (19). Elevated CA125 levels can also be found in patients with other conditions, such as menstruation, pregnancy, endometriosis, and peritoneal inflammatory diseases (20).

Another commonly used biomarker for OC is HE4, which has a specificity of 96% and a sensitivity of 67%. HE4 is less affected by benign gynecological diseases, does not increase in endometriosis, and is mainly elevated in patients with adenomyosis (17). The diagnostic efficacy of HE4 testing is higher in postmenopausal women than in premenopausal women, and HE4 levels increase with age, leading to a decrease in the specificity and sensitivity of HE4 in the elderly population (21).

Combining HE4 and CA125 provides the highest sensitivity and specificity for diagnosing OC, as suggested by Moore *et al.* (16). The ROMA score, which combines various diagnostic factors, including menopausal status and age, has shown better performance in preoperatively triaging ovarian tumors, particularly in postmenopausal women (22). Subsequent studies have confirmed the diagnostic efficacy of the ROMA for ovarian malignant tumors (23-26), but some controversy remains due to differences in detection tools, cut-off values, and disease spectrum.

In this study, the CA125 and HE4 serum levels of OC patients were higher than those of patients with ovarian benign diseases. Moreover, there were significant differences in the CA125 and HE4 concentrations between the two groups in both the premenopausal and postmenopausal women. CA125 had higher sensitivity than HE4 and the ROMA score, while HE4 had higher specificity than CA125 and the ROMA score. The sensitivity of the ROMA score was higher in postmenopausal women than in premenopausal women, but its specificity was lower in postmenopausal women than in premenopausal women. Compared with CA125, the ROMA score had a similar sensitivity but a higher specificity, especially in premenopausal women. Consistent with the results of Li *et al.* (23) and Chen *et al.* (24), the ROMA score had a lower specificity than HE4 but a superior specificity than CA125. In distinguishing between benign diseases and OC, the AUC of the ROMA score was superior to the AUCs of HE4 and CA125. This result is consistent with the ROC analysis results reported by Wang *et al.* (25) and Yanaranop *et al.* (26).

In this clinical study, we monitored the CA125 and HE4 levels in patients over a one-year follow-up period, distinguishing between those who experienced recurrence and those who did not. We identified the value of Mindray tumor markers HE4 and CA125 in the follow-up of ovarian cancer patients. The findings demonstrated that these tumor markers were closely related to treatment outcomes and tumor recurrence in ovarian cancer patients, establishing their role as key indicators for evaluating therapeutic efficacy.

This study had a small sample size and included patients from a single source, which might have led to selection bias. Additionally, the enrollment ratio of ovarian cancer samples at different stages was maintained to closely reflect the real-world incidence of ovarian cancer, resulting in a lower proportion of early-stage patients. Future studies with larger sample sizes that include more early-stage patients from multiple centers may provide more definitive data and conclusions.

Conclusions

In summary, neither HE4 nor CA125 alone can sufficiently improve the diagnostic efficacy of ovarian epithelial cancer. However, the combination of HE4 and CA125 detection using the ROMA score can significantly improve the sensitivity and diagnostic efficiency of OC diagnosis in patients with pelvic mass of unclear malignancy. The Mindray system and the Roche system have similar performance.

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Footnote

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