

Original Research

Evaluation of Preoperative Serum CA-125 as a Predictor of Cancer Severity

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Abstract

Introduction: Ovarian cancer remains a significant global health challenge, with its prognosis closely tied to the stage at diagnosis. Serum CA-125 has been widely recognized as a potential biomarker for ovarian cancer, but its efficacy in predicting cancer severity, particularly in diverse populations, requires further exploration.

Aim of the study: The aim of the study was

Methods: This retrospective observational study was conducted at the Department of Gynecological Oncology, BSMMU, Dhaka, analyzing hospital records of 150 patients diagnosed with ovarian cancer from September 2019 to August 2020. Data were collected using a structured questionnaire, with clinical examinations and relevant investigations recorded. Statistical analysis was performed using SPSS 22, considering a p -value < 0.05 as statistically significant.

Result: The study population predominantly consisted of patients aged between 41-50 years (28%), with the majority being housewives (68%). The most common histopathological type was serous tumors (70%), and the majority of patients were diagnosed at advanced stages (Stage III: 44%, Stage IV: 10.67%). A significant correlation was found between preoperative serum CA-125 levels and the stage of cancer, with the highest mean CA-125 levels observed in stage IV (1484.00 ± 101.34 , $p < 0.001$).

Conclusion: The study underscores the potential of preoperative serum CA-125 levels as a significant predictor of ovarian cancer severity. Elevated CA-125 levels were associated with advanced stages of cancer, suggesting its utility in clinical practice for prognosis and guiding treatment strategies. These findings highlight the need for early detection and intervention in ovarian cancer management.

Introduction

Cancer diagnosis and prognosis represent pivotal aspects of modern healthcare, addressing a disease that stands as a formidable global health challenge. Cancer's impact is profound and widespread, with its prevalence and mortality rates presenting a significant burden worldwide. Globally, cancer is a leading cause of death, and its incidence continues to rise, necessitating urgent and effective interventions^{1,2}. The prevalence and mortality of specific cancer types, such as ovarian cancer, are particularly alarming. Ovarian cancer, often diagnosed at a late stage due to its subtle

symptomatology, has a high mortality rate, underscoring the critical importance of early detection and accurate prognosis in cancer treatment^{3,4}. Early detection and prognosis in cancer treatment are not just clinical imperatives but are also crucial for improving patient outcomes and survival rates. The earlier cancer is detected, the higher the chances of successful treatment and the better the prognosis for the patient. This is particularly true for ovarian cancer, where early-stage detection significantly improves survival rates^{5,6}. In this context, biomarkers play a crucial

role, and one such biomarker that has garnered attention is the preoperative serum Cancer Antigen 125 (CA-125). CA-125, a glycoprotein, has been extensively studied for its role in predicting cancer severity, especially in ovarian cancer. Elevated levels of CA-125 have been associated with poor prognosis and advanced disease stages in ovarian cancer patients⁷. The importance of evaluating CA-125 as a predictor lies in its potential to guide clinical decisions, impacting clinical practices and patient outcomes significantly. For instance, high CA-125 levels can indicate the need for more aggressive treatment strategies or closer monitoring⁸. A review of existing literature reveals that CA-125 is widely used in clinical settings, primarily for monitoring the treatment response and recurrence in ovarian cancer patients. Studies have shown that changes in CA-125 levels can be indicative of treatment efficacy or disease progression, thus aiding in clinical decision-making⁹. However, the utility of CA-125 extends beyond ovarian cancer. Elevated CA-125 levels have been observed in other malignancies, including endometrial, lung, and breast cancers, albeit with less specificity than in ovarian cancer⁸. Despite its widespread use, research on CA-125 as a cancer biomarker has revealed gaps and inconsistencies. For instance, while CA-125 is a useful marker for ovarian cancer, its elevation can also occur in benign conditions, leading to false positives. This lack of specificity can complicate the interpretation of CA-125 levels, especially in the early stages of disease¹⁰. Moreover, the types of cancers most commonly associated with CA-125, beyond ovarian cancer, are not fully understood, and there is a need for further research to delineate its role in other malignancies. The existing literature, while extensive, reveals a gap in understanding the full potential of CA-125 across different cancer types and stages. There is a need for more comprehensive studies with larger sample sizes and robust methodological approaches to explore the utility of CA-125 in various cancer types. Additionally, research should focus on improving the specificity and sensitivity of CA-125, potentially in combination with other biomarkers, to enhance its predictive accuracy and clinical utility. In conclusion, while CA-125 remains a valuable tool in the oncological arsenal, particularly for ovarian cancer, there is a clear need for further research to optimize its use and

expand its applicability. Addressing these gaps will not only enhance our understanding of CA-125 as a biomarker but also significantly contribute to improving cancer diagnosis, treatment, and prognosis.

Methods

This retrospective observational study was conducted at the Department of Gynecological Oncology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. The study encompassed a comprehensive review of hospital records for 150 patients who were admitted and histopathologically diagnosed with various forms of cancer. These patients had undergone surgical procedures within the timeframe of September 2019 to August 2020. The data collection process was meticulously carried out using a preformed and pretested structured questionnaire, designed to capture a wide array of relevant patient information. This included, but was not limited to, demographic details, clinical history, and the specifics of the cancer diagnosis and treatment received. The clinical examination findings and results from necessary investigations were also systematically documented for each patient. To ensure the accuracy and reliability of the data, the questionnaire was subjected to rigorous pretesting before being employed in the study. This pretesting phase was crucial in identifying and rectifying any potential issues with the questionnaire, thereby enhancing the validity of the data collected. The data analysis was performed using the Statistical Package for the Social Sciences (SPSS) software, version 22. This advanced statistical tool facilitated a comprehensive analysis of the data, allowing for the identification of significant patterns and correlations. The statistical significance was set at a p-value of less than 0.05. This threshold was chosen to ensure that the findings of the study were robust and reliable, minimizing the likelihood of false-positive results.

Results

The age distribution of the participants indicated a relatively wide range, with the majority being under 50 years of age. Specifically, 34.00% (n=51) of the participants were aged 30 years or younger, 24.00% (n=36) fell into the 31-40 years age group,

28.00% (n=42) were between 41 and 50 years, and the remaining 14.00% (n=21) were over 50 years of age. The mean age of the participants was 45.7 years, with a standard deviation of ± 15.2 years. Body Mass Index (BMI), a key indicator of health, had a mean value of 23.3 with a standard deviation of ± 3.0 , suggesting a generally healthy weight range among the study population. Education levels varied among the participants. Half of them (50.00%, n=75) had primary education, while 26.00% (n=39) had completed secondary education. Those with higher secondary education comprised 19.33% (n=29) of the study population, and a minority of 4.67% (n=7) were graduates. Occupationally, the majority of the participants were housewives, accounting for 68.00% (n=102) of the study population. Teachers represented 17.33% (n=26), service holders were 8.00% (n=12), students made up 4.00% (n=6), and tailors were 3.33% (n=5) of the participants.

Table 1: Distribution of baseline characteristics among the participants (N=150)

Variables	Frequency	Percentage
Age		
≤30	51	34.00%
31-40	36	24.00%
41- 50	42	28.00%
>50	21	14.00%
Mean Age	45.7± 15.2	
Mean BMI	23.3± 3.0	
Education		
Primary	75	50.00%
Secondary	39	26.00%
Higher Secondary	29	19.33%
Graduate	7	4.67%
Occupation		
Housewife	102	68.00%
Teacher	26	17.33%
Service holder	12	8.00%
Student	6	4.00%
Tailor	5	3.33%

Regarding the histopathological types of ovarian cancer, the study found that serous tumors were the most prevalent, accounting for 70.00% of cases. This was a significant finding, as serous tumors are known for their aggressive nature and poor prognosis. Mucinous tumors were present in 11.33% of the cases, followed by endometrioid

adenocarcinoma (8.00%), clear cell tumors (4.00%), malignant teratoma (5.33%), and Brenner tumors (0.67%). The presence of dysgerminoma was noted in 0.67% of the cases.

Table 2: Distribution of histopathological type of ovarian cancer among participants (N=150)

Type of Tumor	Frequency	Percentage
Epithelial		
Mucinous tumors	17	11.33%
Serous tumor	105	70.00%
Clear cell tumors	6	4.00%
Endometrioid adenocarcinoma	12	8.00%
Brenner	1	0.67%
Germ cell		
Dysgerminoma	1	0.67%
Malignant teratoma	8	5.33%

Table 3: Distribution of surgical stages of ovarian cancer among participants (N=150)

Stages	Frequency	Percentage
I	32	21.33%
II	36	24.00%
III	66	44.00%
IV	16	10.67%

The distribution of surgical stages of ovarian cancer indicated that the majority of the cases were in the advanced stages. Stage III was the most common, comprising 44% of the cases, followed by stage II (24%), stage I (21.33%), and stage IV (10.67%).

Table 4: Comparison of preoperative Mean \pm SD Serum CA-125 between different stages of cancer (N=150)

Stage	Mean \pm SD	p-value
I	247.18 \pm 149.28	<0.001
II	449.26 \pm 79.33	
III	505.97 \pm 481.40	
IV	1484.00 \pm 101.34	

A significant finding of the study was the comparison of preoperative mean serum CA-125 levels across different stages of cancer. There was a notable increase in CA-125 levels with the advancement of cancer stages. Stage I had a mean CA-125 level of 247.18 \pm 149.28, stage II had 449.26 \pm 79.33, stage III had 505.97 \pm 481.40, and stage IV showed a significantly higher level of 1484.00 \pm 101.34. The p-value for these

differences was <0.001 , indicating a statistically significant association between the serum CA-125 levels and the stages of ovarian cancer.

Discussion

The age distribution of the participants indicated a higher prevalence of ovarian cancer in the age groups of 31-50 years, aligning with findings from similar studies^{11,12}. The mean age of 45.7 ± 15.2 years among the study participants is consistent with global trends, where ovarian cancer predominantly affects middle-aged women¹³. The mean BMI of 23.3 ± 3.0 in our study population is noteworthy, as it suggests that ovarian cancer risk is not necessarily confined to higher BMI categories, contrasting with some previous reports¹⁴. Educational background and occupation of the participants varied, with a significant proportion being housewives (68%). This demographic distribution is reflective of the societal structure in the region and highlights the need for targeted awareness and educational programs in ovarian cancer detection and treatment, especially among populations with limited access to higher education and healthcare information. Histopathologically, serous tumors were the most common type of ovarian cancer in our study (70%), which is in line with global statistics where serous carcinoma is reported as the most prevalent subtype¹⁵. The presence of other subtypes like mucinous tumors, clear cell tumors, and endometrioid adenocarcinoma in our study further emphasizes the histological diversity of ovarian cancer, necessitating varied therapeutic approaches. The distribution of surgical stages showed a higher frequency of advanced stages (III and IV) at 54.67%, underscoring the challenge of early detection in ovarian cancer. This is a critical finding as it aligns with global data indicating that a significant number of ovarian cancer patients are diagnosed at an advanced stage, contributing to poorer prognoses^{16,17}. The analysis of preoperative serum CA-125 levels across different stages of ovarian cancer revealed a significant increase in levels with advancing stage. Stage IV patients exhibited markedly higher CA-125 levels (mean 1484.00 ± 101.34) compared to Stage I (mean 247.18 ± 149.28), with a statistically significant p-value of <0.001 . This finding corroborates with previous studies suggesting that

higher CA-125 levels are associated with advanced disease and could be indicative of a higher tumor burden⁸. Our study's observation that CA-125 levels rise with advancing cancer stage is consistent with the literature, reinforcing the biomarker's role in indicating disease severity⁸. However, it is crucial to note that while CA-125 is a valuable tool in monitoring disease progression, it is not exclusively specific to ovarian cancer and can be elevated in other conditions¹⁰. This necessitates cautious interpretation of CA-125 levels and underscores the importance of comprehensive diagnostic approaches. In conclusion, our study contributes valuable data to the existing literature on ovarian cancer in the context of a South Asian population. The findings highlight the predominance of serous tumors, the challenge of late-stage diagnosis, and the potential role of CA-125 as a marker of disease severity. Future research should focus on early detection strategies and exploring the utility of CA-125 in conjunction with other biomarkers for a more accurate and early diagnosis of ovarian cancer.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community. The retrospective manner of the study further limited the capabilities of the current study.

Conclusion

In conclusion, this retrospective observational study conducted at the Department of Gynecological Oncology, BSMMU, Dhaka, offers significant insights into the role of preoperative serum CA-125 levels in predicting the severity of ovarian cancer. Our analysis of 150 patients, who underwent surgery for ovarian cancer, reveals a clear correlation between elevated CA-125 levels and advanced stages of the disease. Notably, the highest mean CA-125 levels were observed in stage IV patients, significantly differing from those in the early stages, which underscores the potential of CA-125 as a reliable biomarker for assessing cancer severity. The study also highlights the predominance of serous tumors among the histopathological types of ovarian cancer in our patient cohort. Furthermore, the distribution of surgical stages indicates a higher frequency of advanced-stage diagnoses,

emphasizing the critical need for early detection and intervention in ovarian cancer management. These findings reinforce the importance of CA-125 in clinical practice, not only as a diagnostic tool but also as a prognostic indicator, aiding in the stratification of patients for appropriate therapeutic strategies. However, it is imperative to acknowledge the limitations inherent in a single-center study and the need for larger, multicentric studies to validate these findings further. The potential of CA-125 in improving patient outcomes through tailored treatment approaches remains a promising avenue for future research and clinical application.

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