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Original Research Article

Association of preoperative inflammatory and nutritional serum markers with post-surgical outcomes in advanced epithelial ovarian cancer patients undergoing primary cytoreductive surgery

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ABSTRACT

Background: Advanced epithelial ovarian cancer typically presents at later stages, contributing to high morbidity and mortality. Simple, inexpensive biomarkers such as neutrophil-to-lymphocyte ratio (NLR) and serum albumin may help predict postoperative outcomes, particularly in low-resource settings. This study aimed to evaluate the association of preoperative inflammatory and nutritional serum markers with postoperative outcomes among women undergoing primary cytoreductive surgery for advanced epithelial ovarian cancer.
Methods: A descriptive observational study was conducted at Dhaka Medical College Hospital from July 2021 to June 2022, including 50 women with advanced epithelial ovarian cancer undergoing primary cytoreductive surgery. Preoperative NLR and serum albumin were measured and categorized (NLR <3.4 vs ≥3.4; albumin ≥3.5 g/dL vs <3.5 g/dL). Postoperative complications within 30 days and the length of hospital stay were recorded. Statistical analyses included Chi-square tests and t-tests, with $p<0.05$ considered significant.
Results: Elevated NLR (≥3.4) was significantly associated with higher rates of wound infection requiring secondary suturing and increased postoperative blood transfusion. Similarly, hypoalbuminemia (<3.5 g/dL) was strongly associated with postoperative wound complications and higher transfusion needs. Both elevated NLR and low albumin were significantly correlated with prolonged hospital stay.
Conclusions: Preoperative NLR and serum albumin are valuable predictors of postoperative morbidity and recovery after primary cytoreductive surgery for advanced epithelial ovarian cancer. These readily accessible biomarkers can enhance preoperative risk stratification and guide optimization strategies to improve surgical outcomes.

Keywords: Epithelial ovarian cancer, Neutrophil-to-lymphocyte ratio, Serum albumin, Cytoreductive surgery

INTRODUCTION

Epithelial ovarian cancer remains the most lethal gynecologic malignancy worldwide, largely because most women present at an advanced stage when curative treatment becomes challenging. Approximately 95% of ovarian cancers arise from epithelial cells and more than half are diagnosed at an advanced stage due to asymptomatic early progression and the absence of reliable screening strategies.[1,2] Globally, an estimated 313,959 new ovarian cancer cases and 207,252 deaths were reported in 2020, underscoring its significant contribution to cancer morbidity and mortality.[3] Although less prevalent than breast cancer, ovarian cancer is

substantially more lethal and projections suggest further growth in mortality by 2040.[4] In Bangladesh, the burden is similarly notable, with 3,122 new cases and 2,096 deaths reported in 2020.[5]

Primary cytoreductive surgery followed by platinum-based chemotherapy remains the cornerstone of treatment for advanced epithelial ovarian cancer.[6] However, surgical morbidity—particularly in medically or nutritionally compromised patients—may significantly affect perioperative outcomes, delaying chemotherapy, increasing length of hospital stay and ultimately affecting overall survival.[7,8] Traditional predictors of postoperative complications—such as age, performance status, comorbidities, or FIGO stage—provide only partial explanatory value for postoperative risks. Consequently, there is increasing interest in biochemical markers that reflect systemic inflammation and nutritional status as low-cost, accessible prognostic indicators.

Inflammatory and nutritional markers, including C-reactive protein, interleukin-6, neutrophil-to-lymphocyte ratio (NLR), serum albumin and composite scores such as the Glasgow Prognostic Score, have demonstrated prognostic importance across a range of malignancies.[9,10] Immune function is tightly interlinked with nutritional state and inflammatory responses and disturbances in these pathways may predispose patients to postoperative complications.[11] NLR reflects the balance between circulating neutrophils, which promote tumor progression and inflammatory cytokine release and lymphocytes, which mediate antitumor immunity.[12] Elevated NLR has consistently been correlated with worse survival and more advanced disease in ovarian cancer.[13,14]

Serum albumin, one of the most widely used biochemical indicators of nutritional status, also reflects systemic inflammation. Hypoalbuminemia results from decreased synthesis due to inflammatory cytokines, altered vascular permeability and catabolic states.[15] Numerous studies have demonstrated its prognostic significance in surgical oncology, including ovarian cancer, where hypoalbuminemia has been associated with higher postoperative complication rates and poorer overall survival.[10,16]

Preoperative hypoalbuminemia and elevated NLR can predict increase risk of post-operative complications and long hospital stay. Pre-operative immunonutrition improves nutritional status, stimulate immune response by increasing T lymphocytes and modulate control of inflammatory response, thereby improving post-surgical outcomes. Given the simplicity, affordability and universal availability of NLR and serum albumin measurements, these markers represent practical tools for preoperative risk assessment in low-resource settings. Understanding their predictive value is particularly relevant in Bangladesh, where patients undergoing major gynecologic oncology surgery often have limited nutritional reserves and delayed presentation.

This study therefore, aims to evaluate the association between preoperative inflammatory and nutritional serum markers—specifically NLR and serum albumin—and postoperative outcomes in women with advanced epithelial ovarian cancer undergoing primary cytoreductive surgery.

METHODS

This descriptive observational study was conducted in the Gynaecological Oncology Unit of the Department of Obstetrics and Gynecology, Dhaka Medical College Hospital, Dhaka. The study period extended from July 2021 to June 2022. A total of 50 women diagnosed with advanced epithelial ovarian cancer who were scheduled to undergo primary cytoreductive surgery during this period are included in this study. Patients were grouped based on preoperative NLR (<3.4 vs ≥3.4) and serum albumin level (≥3.5 g/dl vs <3.5 g/dl).

Selection criteria

Inclusion criteria

Women with advanced epithelial ovarian cancer scheduled for primary cytoreductive surgery; patients admitted to Dhaka Medical College Hospital within the study period were included.

Exclusion criteria

Non-epithelial ovarian malignancy; candidates for interval cytoreductive surgery; significant concomitant illnesses, including chronic heart failure, renal failure, or chronic liver disease; patients are unable to comprehend written or verbal study information were excluded.

Data collection procedure

Patients with a provisional diagnosis of advanced epithelial ovarian cancer were identified through clinical evaluation, CA-125 testing, ultrasonography and CT imaging. Preoperative serum albumin was measured using the Bromocresol Green (BCG) method. The neutrophil-to-lymphocyte ratio was calculated by dividing the absolute neutrophil count by the lymphocyte count. All patients underwent primary cytoreductive surgery with FIGO staging and postoperative complications within 30 days were recorded. Length of hospital stay was counted from the first postoperative day until discharge. Data were collected using a structured questionnaire and verified through clinical and laboratory records.

Ethical considerations

Ethical approval was obtained in accordance with the regulations of the Dhaka Medical College Ethical Review Committee, following the Declaration of Helsinki (1964). Participation was voluntary and informed consent was obtained from all participants after explanation of the

study aims in the local language. Patients were assured of confidentiality, anonymity and the freedom to withdraw at any stage without affecting their care. Personal data were protected and used solely for research purposes.

Statistical analysis

Data were analyzed using SPSS version 26.0 for Windows. Continuous variables were summarized as mean±standard deviation and categorical variables as frequencies and percentages. The Chi-square test was applied to assess the association between categorical variables and postoperative complications. Independent sample t-tests were used to compare mean hospital stay across NLR and albumin groups. A p value <0.05 was considered statistically significant.

RESULTS

Table 1 shows that the mean age was 51.9±12.2 years. All were multiparous. The majority of 32 (64.0%) patients had normal BMI <25 kg/m^2 and 23 (46.0%) patients had ascites. 13 (26.0%) patients had hypertension and 5 (10.0%) had diabetes mellitus. 29 (58.0%) patients had serous, 9 (18.0%) had adenocarcinoma, 8 (16.0%) had endometrioid, 2 (4.0%) had mucinous and 2 (4.0%) had clear cell. Premenopausal was found in 16 (32.0%) and postmenopausal was 34 (68.0%). Mean baseline NLR ratio was 3.36±0.81 and mean serum albumin was 3.57±0.39 gm/dl.

Figure 1 shows that two-thirds (66.0%) of patients had NLR <3.4 and 17(34.0%) had NLR ≥3.4.

Table 1: Baseline characteristics of the study population (n=50).

Variable		Frequency (N)	Percentage (%)
Age (years)		51.9±12.2	
Multiparous		50	100
BMI	<25 kg/m²	32	64
	≥25 kg/m²	18	36
Comorbidities	Hypertension	13	26
	Diabetes mellitus	5	10
Histological type	Serous	29	58
	Endometrioid	8	16
	Adenocarcinoma	9	18
	Mucinous	2	4
	Clear cell	2	4
Menopausal status	Premenopausal	16	32.0
	Postmenopausal	34	68.0
Ascites present		23	46
Baseline NLR (mean)	Mean±SD	3.36±0.81	
Serum albumin (mean)	Mean±SD	3.57±0.39	

Table 2: Association between postoperative complications with NLR (n=50).

Post operative complications	NLR		P value
	<3.4 (n=33)	≥3.4 (n=17)	
Superficial wound infection	9 (27.3)	6 (35.3)	0.557
Wound infection needs secondary suturing	2 (6.1)	6 (35.3)	0.007
Blood transfusions for anaemia	8 (24.2)	10 (58.8)	0.015
Urinary tract infection	4 (12.1)	4 (23.5)	0.297
Pneumonia	2 (6.1)	1 (5.9)	0.997
Burst abdomen	0 (0.0)	1 (5.9)	0.159

Table 3: Association between postoperative complications with serum albumin (n=50).

Complications	Serum albumin (gm/dl)		P value
	<3.5 (n=14)	≥3.5 (n=36)	
Superficial wound infection	7 (50.0)	8 (22.2)	0.054
Wound infection needs secondary suturing	5 (35.7)	3 (8.3)	0.017
Blood transfusions for anaemia	9 (64.3)	9 (25.0)	0.009
Urinary tract infection	3 (21.4)	5 (13.9)	0.513
Pneumonia	2 (14.3)	1 (2.8)	0.123
Burst abdomen	0 (0.0)	1 (2.8)	0.528

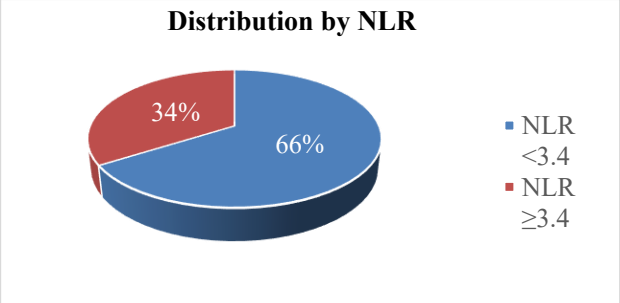

Figure 1: Distribution of the study patients by NLR (n=50).

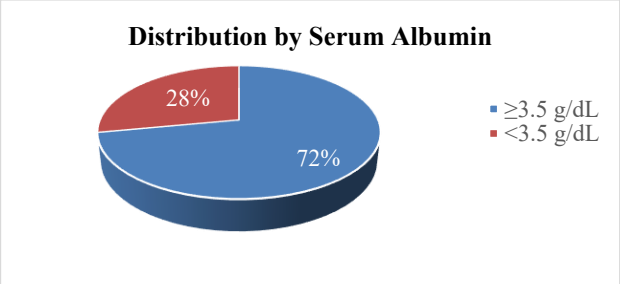

Figure 2: Distribution of the study patients by serum albumin (n=50).

More than two-thirds (72.0%) of patients had serum albumin (gm/dl) ≥3.5 and 14(28%) had <3.5.

Table 2 shows that wound infection needed secondary suturing (35.3% vs 6.1%) and blood transfusion for anemia (58.8% vs 24.2%) were significantly higher in NLR ≥3.4 than <3.4. Superficial wound infection, urinary tract infection, pneumonia and burst abdomen were not statistically significant compared with NLR.

Table 3 shows that wound infection needed secondary suturing (35.7% vs 8.3%) and blood transfusion for anemia (64.3% vs 25.0%) were significantly higher in hypoalbuminemia patients than in normal patients. Superficial wound infection, urinary tract infection, pneumonia and burst abdomen were not statistically significant compared with serum albumin level.

Table 4 shows that the mean hospital stay was higher in NLR ≥3.4 than <3.4 (23.35±5.64 vs 18.69±4.88) and also in hypoalbuminemia patients than in normal patients (23.07±6.00 vs 19.19±5.05). The difference was statistically significant ($p<0.05$) compared to hospital stay with NLR and albumin level.

Table 4: Association between hospital stay with NLR and serum albumin (n=50).

Variables		Total number	Hospital stays (days), mean±SD	P value
NLR	<3.4	33	18.69±4.88	0.004
	≥3.4	17	23.35±5.64	
Serum albumin (gm/dl)	<3.5	14	23.07 ±6.00	0.025
	≥3.5	36	19.19 ±5.05	

DISCUSSION

This study found that the mean age of participants was 51.9±12.2 years and all were multiparous. Approximately one-third were premenopausal (32.0%), whereas 68.0% were postmenopausal. Previous work by Demir et al reported that nearly half of patients diagnosed with ovarian cancer are older than 65 years and overall survival tends to decline with advancing age.[17] Similarly, Kumar et al reported a higher mean age of 68.8±11.7 years.[16]

Regarding nutritional status, most participants (64.0%) had a normal BMI of 25 kg/m². This aligns partially with Zhang et al, who found that 13.1% of patients had a BMI <18.5 kg/m² and 86.9% had a BMI ≥18.5 kg/m².[18] In contrast, Kumar et al observed a higher prevalence of obesity, with 34.0% of patients having a BMI ≥30 kg/m².[16]

The mean neutrophil-to-lymphocyte ratio (NLR) in this study was 3.36±0.81 and the mean serum albumin level was 3.57±0.39 g/dl. Demir et al reported a median NLR of 3.7 (range 0.42–17.5), while Kumar et al noted a mean serum albumin level of 3.7±0.7 g/dl.[16,17] Zhou et al similarly documented a mean NLR of 3.37, a value used as reference in the current study.[19]

With respect to histopathology, serous carcinoma constituted the largest proportion (58.0%), followed by adenocarcinoma (18.0%), endometrioid (16.0%) and mucinous and clear-cell types (4.0% each). Comparable distributions were reported by Demir et al, who observed serous carcinoma as the predominant subtype (87%).[17] Zhang et al documented serous histology in 51.9% of cases.[18] Findings from Kumar et al and Ataseven et al also reinforce the predominance of serous pathology among ovarian cancer patients.[16,20]

This study identified that two-thirds (66.0%) of patients had an NLR <3.4, while 34.0% had an NLR ≥3.4. John-Olabode et al reported a similar pattern, with 59.1% of patients having an NLR <2.23.[21] Zhou et al also showed that across multiple studies, NLR <3.4 was observed in 43.8% and ≥3.4 in 56.3%.[19]

Serum albumin levels ≥3.5 g/dl were present in 72.0% of participants, while 28.0% had levels <3.5 g/dl. Kumar et al found hypoalbuminemia (≤3.0 g/dl) in 19.0% of patients and Ataseven et al noted a preoperative hypoalbuminemia rate of 16.4%.[16-20] Another study by Kumar et al reported low serum albumin (<3.5 g/dl) in 14.2% of cases.[22]

Postoperative outcomes showed that patients with NLR ≥3.4 had significantly higher rates of wound infection requiring secondary suturing (35.3% vs 6.1%) and blood transfusion for anemia (58.8% vs 24.2%). Other postoperative complications—including superficial wound infection, urinary tract infection, pneumonia and burst abdomen—did not differ significantly. Zhang et al demonstrated that elevated NLR is associated with poorer overall survival (OS).[23] These findings are consistent with previous meta-analyses evaluating NLR as a prognostic marker in various malignancies.[24]

Hypoalbuminemia was also associated with higher rates of complications. Patients with albumin <3.5 g/dl showed significantly more wound infections requiring secondary suturing (35.7% vs 8.3%) and a higher need for blood transfusion (64.3% vs 25.0%). Other postoperative complications were not significantly associated with albumin levels. Ataseven et al found that hypoalbuminemic patients were at markedly increased risk of severe complications and 30-day postoperative mortality.[20] Similar associations were reported in ovarian cancer cohorts by Aletti et al and Obermair et al, the latter noting significantly higher rates of wound complications, septicemia and anastomotic leakage in hypoalbuminemic patients undergoing extensive cytoreductive procedures.[25,26]

Finally, the mean hospital stay was significantly longer among hypoalbuminemic patients compared with those with normal albumin levels (23.07±6.00 vs 19.19±5.05 days). Kumar et al also observed prolonged hospitalization in patients with albumin ≤3 g/dl, although the difference was not statistically significant.[16] In contrast, Kim et al reported a significantly longer postoperative stay among patients with hypoalbuminemia.[27]

CONCLUSION

Preoperative inflammatory and nutritional markers, particularly NLR and serum albumin, are significantly associated with postoperative complications and length of hospital stay in women undergoing primary cytoreductive surgery for advanced epithelial ovarian cancer. Elevated NLR and hypoalbuminemia were strong predictors of wound infection, increased transfusion requirements and prolonged hospitalization. These findings emphasize the importance of incorporating simple, cost-effective biochemical markers into preoperative assessment to optimize surgical planning and improve postoperative recovery. Integrating these markers into routine evaluation may be especially valuable in low-resource settings, where early identification of high-risk patients can inform targeted perioperative interventions.

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