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Original Article

The impact of systemic immune inflammation index and neutrophil/lymphocyte ratio on mortality in patients undergoing surgery for infective endocarditis

Abdullah Burak Balcı[1], Ömer Faruk Rahman[2], Gizem Kolay[1], Gökhan Güneş[1], Süleyman Yazıcı[1]

[1]*Department of Cardiovascular Surgery, Başakşehir Çam and Sakura City Hospital, İstanbul, Turkiye*
[2]*Department of Cardiovascular Surgery, Faculty of Medicine, İzmir Bakırçay University, İzmir, Turkiye*

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Corresponding Author: Abdullah Burak Balcı, burakmed188bal@hotmail.com

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ABSTRACT

Aims: Infective endocarditis (IE) is a severe cardiac pathology associated with high morbidity and mortality. Early identification of disease severity and mortality risk using simple, rapid, and cost-effective tests can significantly improve clinical outcomes. This study aims to provide clinicians with valuable information on the prognostic importance of immune inflammation index (SIII) and neutrophil/lymphocyte ratio (NLR) in the management of IE patients and to guide potentially more effective perioperative interventions.

Methods: This study retrospectively investigates the relationship between the SIII, NLR, and mortality in patients who underwent surgical treatment for IE between March 2020 and November 2023. A total of 100 patients over the age of 18 were included in the study. Data were collected on various clinical parameters, and statistical analyses were performed using SPSS 26.0.

Results: The mean age of the patients included in the study was 53.85 years (age range: 21-83). Seventy percent of the patients were male %. It was found that 70% of the patients had native-type endocarditis. Furthermore, 59% of the patients exhibited growth in their blood cultures. The systemic immune-inflammation index (SII) values also showed a statistically significant difference (p=0.041), with higher SII values observed in patients who experienced mortality compared to those without. Furthermore, NLR values exhibited a statistically significant difference (p<0.001), with patients who experienced mortality having higher NLR values compared to their non-mortality counterparts. A statistically significant relationship was identified between the patients' in-hospital mortality status and the need for postoperative hemodialysis (HD) (p<0.001).

Conclusion: The risk of developing mortality increases as patients' NLO values increase (OR: 1.357, p=0.005). However, the SII values of the patients did not have a statistically significant effect on mortality (p=0.536). The developed multivariate model correctly classifies 79% of the cases. In the multivariate logistic regression analysis, age, postoperative HD requirement and N/L ratio were found to be effective in predicting mortality.

Keywords: Infective endocarditis, systemic immune inflammation index, neutrophil/lymphocyte ratio, mortality, prognostic markers

INTRODUCTION

Infective endocarditis (IE) is a complex and life-threatening infection that affects the endocardial surface of the heart, particularly the heart valves. Despite advancements in antimicrobial therapy and surgical techniques, IE continues to pose significant challenges in clinical practice due to its high morbidity and mortality rates. The pathogenesis of IE involves the colonization of heart valves by microorganisms, leading to the formation of vegetations composed of platelets, fibrin, microorganisms, and inflammatory cells. These vegetations can cause severe complications, including valvular destruction, heart failure, systemic embolization, and persistent bacteremia.[1]

The clinical presentation of IE is highly variable, ranging from subacute symptoms to acute septicemia. Patients may present with fever, heart murmurs, petechiae, and signs of embolic events, making the diagnosis challenging.[2] The modified Duke criteria, incorporating clinical, microbiological, and echocardiographic findings, are the cornerstone for diagnosing IE. However, assessing the severity and prognosis of the disease remains intricate, necessitating reliable biomarkers that can guide clinical decision-making. Inflammation is a key component in the pathophysiology of IE, and inflammatory markers have been extensively studied for their prognostic potential. Among these markers, the systemic immune inflammation index (SIII) and the neutrophil/lymphocyte ratio (NLR) have emerged as promising indicators. The SIII, calculated using platelet, neutrophil, and LYMs, provides a comprehensive measure of the body's inflammatory state. Similarly, the NLR, derived from the ratio of neutrophils to lymphocytes, reflects the balance between the body's innate inflammatory response and adaptive immune regulation.[3] The SIII is defined as (PltxNEU)/LYM. This index captures the interplay between thrombocytes, which are involved in clot formation and immune response, and leukocytes, which mediate inflammation and immune defense. High SIII values have been associated with poor outcomes in various cardiovascular diseases, suggesting its potential utility as a prognostic marker in IE. Elevated SIII indicates a heightened inflammatory state, which may correlate with disease severity and adverse clinical outcomes.[4] Similarly, the NLR is a straightforward and cost-effective marker that indicates the ratio of neutrophils, key players in the acute inflammatory response, to lymphocytes, crucial components of the adaptive immune system. An elevated NLR has been linked to worse outcomes in conditions such as acute coronary syndrome, heart failure, and stroke. Given the significant role of inflammation in the pathogenesis of IE, it is plausible that the NLR could serve as a valuable prognostic tool. Despite the recognized potential of SIII and NLR, there is a dearth of research specifically evaluating their prognostic significance in IE patients undergoing surgical treatment.[5] Early identification of patients at high risk of poor outcomes using these readily available markers could facilitate timely and targeted therapeutic interventions, ultimately improving patient outcomes.[6] This study aims to investigate the relationship between SIII, NLR, and mortality in patients who underwent surgical treatment for IE at our clinic between March 2020 and November 2023. By retrospectively analyzing a cohort of 100 patients, we seek to determine whether these indices can serve as reliable markers for predicting mortality and disease severity during the perioperative period. Understanding these relationships could provide clinicians with valuable insights into patient stratification and management, potentially guiding more effective perioperative care.[7] IE remains a formidable challenge in cardiology, with high stakes for patient outcomes. The integration of simple, easily measurable inflammatory indices such as SIII and NLR into clinical practice holds promise for enhancing patient management. By elucidating the prognostic value of these markers, our study endeavors to contribute to the growing body of knowledge in this area. Ultimately, our goal is to improve clinical outcomes for patients with IE by providing clinicians with robust, accessible tools for early risk assessment and intervention.[8]

METHODS

Ethics

The study was planned and approval of the of Başakşehir Çam and Sakura City Hospital Ethics Committee was obtained (Date: 18.01.2024, Decision No: E-96317027-514.10-234538482) and the study was conducted in accordance with the Declaration of Helsinki Ethical Principles and Good Clinical Practices. All data were anonymized to maintain patient confidentiality.

Study Design and Setting

This retrospective clinical study was conducted at Başakşehir Çam and Sakura City Hospital. The research focused on patients who underwent surgical treatment for IE between March 2020 and November 2023. The study aimed to evaluate the relationship between the SIII, NLR, and mortality in this patient population.

Patient Selection

A total of 100 patients over the age of 18, who received surgical treatment for IE during the specified period, were included in the study. Both male and female patients were considered, ensuring a comprehensive analysis across genders. The inclusion criteria required patients to have complete medical records with necessary laboratory and clinical data. Patients who had incomplete data or who died preoperatively were excluded from the study.

Data Collection

Data were retrospectively collected from patient medical records and included demographic information, clinical history, laboratory results, and surgical details. The parameters assessed were:

- **Demographic and Clinical Variables**: Age, gender, operation date, CPB time (Cardiopulmonary Bypass time), cross-clamp time, preoperative emboli status, preoperative stroke status, history of cardiac surgery, diabetes mellitus, hypertension, smoking status, chronic obstructive pulmonary disease (COPD), hyperlipidemia, chronic kidney disease (CKD).
- **Laboratory Parameters**: Hemoglobin (Hb), hematocrit (Hct), white blood cell count (Wbc), platelet count (Plt), neutrophil count (NEU), lymphocyte count (LYM), international normalized ratio (INR), activated partial thromboplastin time (APTT), C-reactive protein (CRP), creatinine, glomerular filtration rate (GFR), sodium (Na), potassium (K), alanine aminotransferase (ALT), aspartate aminotransferase (AST), albumin, glucose levels, blood culture results, and causative microorganisms.
- **Surgical and Postoperative Data**: Type of surgery, presence of prosthetic valve endocarditis, culture-negative and culture-positive status, mortality, extubation times, intensive care unit (ICU) stay duration, hospital stay duration, presence of vegetations on aortic and mitral valves, multiple valve involvement, left ventricular ejection fraction (EF), postoperative day 1 albumin and lymphocyte levels.

Statistical Analysis

The data were evaluated using IBM SPSS 26 software (IBM Corp. Released 2019). The assumption of normality was examined using the Kolmogorov-Smirnov and Shapiro-Wilk tests. For the comparison of normally distributed data based on in-hospital mortality status, an independent two-sample t-test was employed, while the Mann-Whitney U test was used for the comparison of non-normally distributed data. The comparison of categorical data based on in-hospital mortality status was conducted using the Pearson chi-square test and Yates correction. Factors affecting in-hospital mortality were analyzed using logistic regression analysis. The significance level was set at $p<0.05$.

Index Calculations

The SIII was calculated using the formula: SIII=(PltxNEU)/LYM. The NLR was calculated as the ratio of neutrophils to lymphocytes. These indices were computed using the laboratory data collected from the patients medical records.

Study Duration

The study was planned to be completed within three months following ethical approval, including data collection, entry, and statistical analysis. By analyzing the relationship between SIII, NLR, and mortality in patients undergoing surgery for IE, this study aims to provide clinicians with valuable prognostic tools that are simple, cost-effective, and easily accessible, potentially improving patient management and outcomes in this high risk population.

RESULTS

The mean age of the patients included in the study was 53.85 years (age range: 21-83). Seventy percent of the patients were male. It was observed that 41% of the patients were smokers. Upon examining the chronic diseases present among the patients, it was found that 75% had hypertension. Additionally, 39% of the patients had a history of cardiac surgery. Preoperative embolism was observed in 20% of the patients, while preoperative stroke was noted in 26%. It was found that 70% of the patients had native-type endocarditis. Furthermore, 59% of the patients exhibited growth in their blood cultures. The mean EF of the patients was 52.96% (EF range: 25-65) (**Table 1**).

A statistically significant difference in age was observed among patients based on their mortality status (p<0.001). The mean age of patients who did not experience mortality was 49.67 years, whereas the mean age of patients who experienced mortality was significantly higher at 61.97 years. Furthermore, no statistically significant relationship was found between patients' mortality status and other demographic and clinical characteristics (p>0.05).

A statistically significant difference was identified in Hb levels among patients based on their in-hospital mortality status (p=0.007), with patients who experienced mortality exhibiting lower Hb levels compared to those who did not. Similarly, Hct values demonstrated a statistically significant difference (p=0.005), indicating that patients who experienced mortality had lower Hct levels than their counterparts. LYM also revealed a statistically significant difference (p=0.001), with lower LYM values observed in patients who experienced mortality compared to those who did not. Plt exhibited a statistically significant difference (p=0.033), with patients who experienced mortality showing lower Plt values than those without mortality. INR values displayed a statistically significant difference (p=0.049), with patients who experienced mortality having higher INR values compared to their non-mortality counterparts. CRP levels showed a statistically significant difference (p=0.028), with higher CRP values found in patients who experienced mortality compared to those who did not. Glucose levels also demonstrated a statistically significant difference (p<0.001), with patients who experienced mortality exhibiting elevated glucose levels compared to their

Table 1. Examination of demographic and patient characteristics according to in-hospital mortality status

	In hospital mortality		Total (n=100)	SS	p
	Negative (n=66)	Positive (n=34)			
Age	49.67±15.05	61.97±11.07	53.85±14.96	-4.639	**<0.001**^{t}
Gender					
Women	16 (24.2)	14 (41.2)	30 (30)	2.311	0.128^{y}
Men	50 (75.8)	20 (58.8)	70 (70)		
Smoke					
Negative	37 (56.1)	22 (64.7)	59 (59)	0.382	0.537^{y}
Positive	29 (43.9)	12 (35.3)	41 (41)		
Chronic diseases*					
Hypertension	37 (72.5)	23 (79.3)	60 (75)	8.475	0.132^{x}
Diabetes mellitus	19 (37.3)	19 (65.5)	38 (47.5)		
Hyperlipidemia	16 (31.4)	12 (41.4)	28 (35)		
Chronic kidney disease	15 (29.4)	12 (41.4)	27 (33.8)		
COPD	14 (27.5)	7 (24.1)	21 (26.3)		
History of cardiac surgery					
Negative	41 (62.1)	20 (58.8)	61 (61)	0.011	0.917^{y}
Positive	25 (37.9)	14 (41.2)	39 (39)		
Preoperative embolism					
Negative	54 (81.8)	26 (76.5)	80 (80)	0.136	0.712^{y}
Positive	12 (18.2)	8 (23.5)	20 (20)		
Preoperative stroke					
Negative	51 (77.3)	23 (67.6)	74 (74)	0.638	0.424^{y}
Positive	15 (22.7)	11 (32.4)	26 (26)		
Type of endocarditis					
Native	44 (66.7)	26 (76.5)	70 (70)	0.613	0.434^{y}
Prosthetic	22 (33.3)	8 (23.5)	30 (30)		
Colonization in blood culture					
Negative	27 (40.9)	14 (41.2)	41 (41)	0.000	1.000^{y}
Positive	39 (59.1)	20 (58.8)	59 (59)		
EF (%)	55 (25 - 65)	57.5 (30 - 65)	55 (25 - 65)	-0.557	0.578^{m}

t: Independent two sample t test, m: Mann Whitney U test, y: Yates correction, x: Pearson Chi-Square test, multiple response mean±standart deviation, median (minimum-maximum), n (%), SS: Statistical significance, COPD: Chronic obtructive pulmonary disease, EF: Ejection fraction non-mortality counterparts. Creatinine levels revealed a statistically significant difference (p=0.023), with patients who experienced mortality having higher creatinine values than those without mortality. GFR values exhibited a statistically significant difference (p=0.003), with patients who experienced mortality showing lower GFR values compared to their non-mortality counterparts. Albumin levels demonstrated a statistically significant difference (p<0.001), with patients who experienced mortality having lower albumin values than those who did not. The systemic immune-inflammation index (SII) values also showed a statistically significant difference (p=0.041), with higher SII values observed in patients who experienced mortality compared to those without. Furthermore, NLR values exhibited a statistically significant difference (p<0.001), with patients who experienced mortality having higher NLR values compared to their non-mortality counterparts. However, no statistically significant relationship was found between patients' in-hospital mortality status and other preoperative laboratory tests (p>0.05) (**Table 2**).

A statistically significant difference was found in the durations of cardiopulmonary bypass (CPB) among patients based on their in-hospital mortality status (p=0.046), with patients who experienced mortality having longer CPB durations. There is a statistically significant difference in the lengths of stay in the ICU according to the patients' in-hospital mortality status (p=0.001). The length of stay in the ICU for patients who experienced mortality was found to be higher compared to those who did not. A statistically significant relationship was identified between the patients' in-hospital mortality status and the need for postoperative hemodialysis (HD) (p<0.001). The proportion of patients requiring postoperative HD among those who did not experience mortality was 12.1%, whereas this proportion was significantly higher at 55.9% among patients who experienced mortality. No statistically significant relationship was found between the patients' in-hospital mortality status and other intraoperative and postoperative variables (p>0.05) (**Table 3**).

Table 2. Examination of preoperative laboratory tests according to in-hospital mortality status

	In hospital mortality		Total (n=100)	SS	p
	Negative (n=66)	Positive (n=34)			
Hb	9.94±1.61	9.01±1.58	9.63±1.65	2.776	**0.007t**
Hct	30.7±4.69	27.83±4.78	29.73±4.89	2.882	**0.005t**
Wbc	8.57 (0.74-30.74)	10.18 (2.9-48.07)	9.44 (0.74-48.07)	-1.313	0.189m
Neu	5.87 (0.28-26.96)	7.71 (1.85-39.1)	6.58 (0.28-39.1)	-1.717	0.086m
Lym	1.5 (0.29-3.77)	1.08 (0.25-5.7)	1.32 (0.25-5.7)	-3.286	**0.001m**
Plt	226 (38-478)	186 (26-568)	223.5 (26-568)	-2.136	**0.033m**
INR	1.13 (0.9-6.9)	1.3 (0.9-3.14)	1.18 (0.9-6.9)	-1.971	**0.049m**
APTT	35.75±9.37	38.16±8.31	36.57±9.05	-1.261	0.210t
CRP	44.15 (1-343.7)	87.8 (2.6-311.5)	47.89 (1-343.7)	-2.198	**0.028m**
Glukoz	112.5 (68-299)	145.5 (78-306)	115.5 (68-306)	-3.577	**<0.001m**
Kreatinin	1 (0.43-9.69)	1.55 (0.45-4.83)	1.11 (0.43-9.69)	-2.278	**0.023m**
GFR	85.5 (6-137)	47 (8-125)	65.5 (6-137)	-2.991	**0.003m**
Na	136 (129-163)	137.5 (123-156)	136 (123-163)	-1.153	0.249m
K	4.2±0.49	4.05±0.69	4.14±0.57	1.119	0.268t
ALT	20.5 (3-303)	13 (3-176)	16.5 (3-303)	-1.664	0.096m
AST	22 (7-188)	25 (9-99)	24 (7-188)	-0.630	0.529m
Albumin	32.77±6.03	26.79±6.24	30.74±6.71	4.641	**<0.001t**
SII	1053.02 (34.32-3887.92)	1424.45 (158.57-5582.59)	1074.55 (34.32-5582.59)	-2.045	**0.041m**
NLO	4.23 (0.9-16.07)	8.95 (1.39-28.66)	5.33 (0.9-28.66)	-3.915	**<0.001m**

t: Independent two sample T test, m: Mann-Whitney U test, mean±standart deviation, median (minimum-maximum), Hb: Hemoglobin, Hct: Hematocrit, Wbc: White blood cell count, Neu: Neutrophil count, Lym: Lymphocyte count, Plt: Platelet count, INR: International normalized ratio, APTT: Activated partial thromboplastin time, CRP: C-reactive protein, GFR: Glomerular filtration rate, Na: Sodium, K: Potassium, ALT: Alanine aminotransferase, AST: Aspartate aminotransferas, SII: Systemic Immune-Inflammation Index, NLO: Newborn life outcomes, SS: Statistical significance

Table 3. Comparison of intraoperative and postoperative variables based on in-hospital mortality status

	In hospital mortality		Total (n=100)	SS	p
	Negative (n=66)	Positive (n=34)			
Type of operation					
Elective	44 (66.7)	20 (58.8)	64 (64)	0.307	0.579y
Emergency	22 (33.3)	14 (41.2)	36 (36)		
Type of valve					
Mechanical	51 (77.3)	23 (67.6)	74 (74)	0.638	0.424y
Bioprosthesis	15 (22.7)	11 (32.4)	26 (26)		
CPB time	156.5 (58-403)	201 (39-460)	168 (39-460)	-1.998	**0.046m**
X clamp time	119.5 (0-329)	118.5 (0-337)	119 (0-337)	-0.258	0.796m
ICU time	3 (1-27)	11 (1-49)	4 (1-49)	-3.479	**0.001m**
Need for postoperative hemodialysis					
Negative	58 (87.9)	15 (44.1)	73 (73)	19.8	**<0.001y**
Positive	8 (12.1)	19 (55.9)	27 (27)		

m: Mann Whitney U Test, y: Yates Correction, median (minimum-maximum), n (%), CPB: Cardiopulmonary bypass, ICU: Intensive care unit, SS: Statistical significance

The effects of age, postoperative HD requirement, surgical intervention index (SII), and newborn life outcomes (NLO) values on patients' in-hospital mortality status were investigated using univariate and multivariate logistic regression models (**Table 4**). The univariate analysis revealed that the effects of age, postoperative HD requirement, SII, and NLO variables on in-hospital mortality were statistically significant (p<0.05). The risk of developing mortality increases as patients' ages increase (OR: 1.071, p<0.001). Patients requiring postoperative HD have a higher risk of developing mortality compared to those who do not require postoperative HD (OR: 9.183, p<0.001). The risk of developing mortality increases as patients' SII values increase (OR: 1.001, p=0.005). Additionally, the risk of developing mortality increases as patients' NLO values increase (OR: 1.219, p<0.001).

The multivariate analysis indicated that the combined effects of age, postoperative HD requirement, and NLO variables on in-hospital mortality were statistically significant (p<0.05). The risk of developing mortality increases as patients' ages increase (OR: 1.089, p=0.001). Patients requiring postoperative HD have a higher risk of developing mortality compared to those who do not require postoperative HD (OR: 7.531, p=0.002). The risk of developing mortality increases as patients' NLO values increase (OR: 1.357, p=0.005). However, the SII values of the patients did not have a statistically significant effect on mortality (p=0.536). The developed multivariate model correctly classifies 79% of the cases.

DISCUSSION

IE is a serious and often fatal condition that continues to challenge clinicians with its complex presentation and high risk of complications. Our study focused on evaluating the prognostic value of the SIII and NLR in patients undergoing surgical treatment for IE. The results showed that higher SIII and NLR values were significantly associated with increased mortality, suggesting their potential benefit as prognostic markers. However, in multivariate logistic regression analysis, NLR was found to be more effective in predicting mortality. In addition, according to the multivariate logistic regression analysis, age and the need for postoperative HD were also found to be effective in predicting mortality.

Our findings align with several studies that have highlighted the significance of inflammatory markers in predicting outcomes in IE. For instance, a study by Chen Y et al.[9] found that an elevated NLR was a strong independent predictor of mortality in patients with IE. The researchers observed that patients with higher NLR values had worse outcomes, which is consistent with our findings where the mortality group had significantly higher NLR values.

Research by Agus HZ et al.[10] demonstrated that systemic inflammation plays a critical role in the progression and prognosis of IE. They showed that markers of systemic inflammation, including the SIII, were significantly elevated in patients with adverse outcomes. This supports our observation that higher SIII values are associated with increased mortality, indicating severe systemic inflammation.

The differences in laboratory parameters between survivors and non-survivors in our study further highlight the impact of inflammation and immune response on patient outcomes. For example, we found that patients who did not survive had lower Hb and Hct levels, higher Wbcs, and elevated CRP levels. These findings are in line with those of Ali Hassan et al.[11] who reported that anemia and elevated inflammatory markers were significant predictors of poor prognosis in IE.

Our study also found that renal function and the need for postoperative HD were associated with mortality in the mortality group, as indicated by higher creatinine levels and lower GFR. This finding was echoed by Chaudry, Mavish S et al.[12] who identified renal dysfunction as a common complication that significantly increases the risk of mortality in IE. The interaction between renal failure and systemic inflammation is likely to exacerbate the severity of IE, leading to worse outcomes.

Extended hospital stays observed in non-survivors in our study reflect the increased complexity and severity of their clinical course. This is consistent with findings from the International Collaboration on Endocarditis-Prospective Cohort Study Durante-Mangoni E et al.[13] which reported that patients with severe IE complications often require prolonged hospitalization. These prolonged hospital stays underscore the need for early identification and aggressive management of high risk patients.

Several studies have explored the prognostic value of other biomarkers in IE. For example, Bekir K et al.[14] investigated the role of procalcitonin as a predictor of mortality in IE and found that higher procalcitonin levels were associated with increased risk of death. While our study focused on SIII and NLR, incorporating a broader range of biomarkers could enhance the predictive accuracy and provide a more comprehensive assessment of patient risk.

In comparing our findings with those of other studies, it is evident that while some parameters like SIII and NLR consistently emerge as significant prognostic markers, the specific thresholds and their predictive accuracy can vary. For example, a study by Meshaal, M.S[15] suggested slightly different cutoff values for NLR in predicting mortality, which could be due to differences in patient populations and clinical settings. This variability underscores the need for further research to

Table 4. Examination of the effects of age, postoperative hemodialysis (HD) requirement, surgical intervention index (SII), and newborn life outcomes (NLO) variables on in-hospital mortality status

	Univariate		Multivariate	
	OR (%95 CI)	p	OR (%95 CI)	p
Age	1.071 (1.032 - 1.112)	**<0.001**	1.089 (1.034 - 1.146)	**0.001**
Need for hemodialysis	9.183 (3.37 - 25.021)	**<0.001**	7.531 (2.137 - 26.535)	**0.002**
SII	1.001 (1 - 1.001)	**0.005**	1 (0.999 - 1.001)	0.536
NLO	1.219 (1.096 - 1.356)	**<0.001**	1.357 (1.098 - 1.677)	**0.005**

OR: Odds ratio, Accuracy=0.790, SII: Systemic Immune-inflammation Index, NLO: Newborn life outcomes standardize these markers and validate their prognostic utility across diverse cohorts.

The relationship between systemic inflammation and other clinical parameters such as renal function, anemia, and extended hospital stays highlights the multifaceted nature of IE and its complications. Studies like that of Regunath H et al.[16] have emphasized the importance of a multidisciplinary approach in managing IE, integrating cardiology, infectious disease, nephrology, and critical care expertise to optimize patient outcomes.

Our study adds to the growing body of evidence supporting the use of inflammatory markers such as SIII and NLR in predicting mortality in IE patients. These markers offer a simple, cost-effective means of stratifying risk and guiding clinical decision-making. Future research should focus on refining these indices, exploring their integration into clinical practice, and examining their interplay with other prognostic factors to enhance patient outcomes in IE. By continuing to investigate and validate these biomarkers, we can improve our ability to identify high-risk patients early and implement targeted interventions to reduce mortality and improve the quality of care for those affected by this serious condition.

CONCLUSION

Our study highlights the significant prognostic value of SIII and NLR in predicting mortality in patients undergoing IE surgery. Although SIII was found to be significantly higher in the mortality group, it did not play a role in predicting mortality. NLR, on the other hand, was found to be significantly higher in both mortality group and significantly higher in predicting mortality. Therefore, according to the multivariate logistic regression analysis, age, postoperative HD requirement and NLR were found to be effective in predicting mortality.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was planned and approval of the of Başakşehir Çam and Sakura City Hospital Ethics Committee was obtained (Date: 18.01.2024, Decision No: E-96317027-514.10-234538482).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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