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Original Research

Association of naples score with syntax score in patients with non-ST-segment elevation myocardial infarction

Naples score and syntax score

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Abstract

Aim: This retrospective observational study aimed to investigate the relationship between the Naples prognostic score (NS) and SYNTAX score (SS) in patients diagnosed with non-ST segment elevation myocardial infarction (NSTEMI), focusing on their implications for coronary artery disease (CAD) severity.

Material and Methods: Data were collected from 300 consecutive NSTEMI patients who underwent coronary angiography between January 2024 and May 2024. NS, calculated from serum albumin, total cholesterol, neutrophil/lymphocyte ratio (NLR), and lymphocyte/monocyte ratio (LMR), was assessed alongside SS, which quantifies CAD complexity based on angiographic findings.

Results: NS was significantly higher in patients with more extensive CAD, as indicated by higher SS ($p < 0.05$). This association underscores NS as a potential marker for predicting CAD severity in NSTEMI patients. Age was also noted to correlate significantly with higher NS, consistent with literature linking age to poorer nutritional status and cardiovascular outcomes.

Discussion: The findings of this study underscore the potential clinical relevance of the NS in patients with NSTEMI. NS, which integrates serum albumin levels, serum cholesterol levels, NLR, and LMR, emerged as significantly associated with the SS, a marker of CAD complexity. The study revealed that higher NS correlated with increased SS, suggesting that patients with poorer nutritional and inflammatory profiles may exhibit more extensive CAD. This association implies that NS could serve as a useful tool in risk stratification and management decisions for NSTEMI patients undergoing coronary angiography.

Moreover, the study highlighted age and lipid profiles (triglycerides and LDL) as independent predictors of NS, further emphasizing the multifactorial nature of cardiovascular risk assessment in these patients.

Keywords

Naples Prognostic Score, Syntax Score, Coronary Artery Disease Severity

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Introduction

Acute coronary syndrome (ACS) is a major cause of mortality and morbidity. The spectrum of ACS includes ST-segment elevation myocardial infarction (STEMI), non-ST segment elevation myocardial infarction (NSTEMI), and unstable angina [1]. NSTEMI ACS, one of the types of ACS, is the result of partial occlusion of a coronary artery after rupture or erosion of a vulnerable atherosclerotic plaque [2].

The Naples prognostic score (NS) is a multidimensional, comprehensive prognostic assessment system based on serum albumin levels, serum cholesterol levels, neutrophil/lymphocyte ratio (NLR), and lymphocyte/monocyte ratio (LMR). This score can assess both the inflammatory and nutritional status of patients [3]. While neutrophils contribute significantly to atherosclerotic plaque destabilization, neutrophil count can be influenced by variables such as blood volume [4]. Lymphocytes and monocytes are key immune cells with important roles in the development of inflammation and atherosclerosis and influence prognosis in cases of myocardial infarction. Serum albumin is a negative acute phase reactant and its synthesis decreases and catabolism increases in response to inflammation [5, 6] .

The SYNTAX score (SS) is an angiographic scoring system that assesses the complexity of coronary artery disease (CAD) [7]. SS is recognized as a vital tool to guide decision-making between coronary artery bypass grafting (CABG) and PCI [8]. SS has been shown to aid revascularization decision-making and predict mortality and morbidity in patients with CAD [9].

In this study, we aimed to investigate the relationship between NS and SS in patients with NSTEMI in light of all these literature data.

Material and Methods

For this retrospective observational analysis, we collected data from 300 consecutive non-STEMI patients who underwent coronary angiography (CAG) between January 2024 and May 2024. Patients with active cancer, active autoimmune disease, active infections, and chronic kidney disease requiring hemodialysis and peritoneal dialysis were excluded.

ACS, unstable angina, NSTEMI and STEMI were defined as recommended in the latest universal myocardial infarction definition guideline [10]. Demographic and clinical parameters were recorded from the hospital database. Biochemical analyses including complete blood count, serum creatinine, serum albumin, total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), triglyceride (TG) and serum electrolyte levels were evaluated. Blood samples were collected at the time of admission to the emergency department.

Hypertension was defined as taking antihypertensive medication or having systolic blood pressure >140 mmHg and/or diastolic blood pressure >90 mmHg. Diabetes mellitus (DM) was defined as fasting glucose level ≥126 mg/dl or receiving antidiabetic treatment.

Coronary angiography via femoral or radial access was performed for each patient. Two independent, experienced cardiologists individually evaluated the coronary angiographic images to calculate SS. Coronary arteries were assessed as 16 individual segments, and segments with 50% or greater luminal narrowing and ≥1.5 mm diameter were scored separately and combined to give a total score using the SS algorithm.

NS, serum albumin and serum TC levels were calculated using NLR and LMR ratios as described in Table 1.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Scientific and Social Sciences (IBM SPSS Statistics for Windows; IBM Corp., Armonk, New York, USA) software. Pearson chi-square test was used for categorical variables. The conformity of numerical variables to normal distribution was analyzed by statistical methods including the Kolmogorov-Smirnov test. Mann-Whitney U test was applied for non-normally distributed variables and Student's t test was applied for normally distributed variables. Data are expressed as 'mean ± standard deviation' for normally distributed and 'median (minimum and maximum)' for non-normally distributed; categorical variables are expressed as 'n (%)'. Univariate and multivariate logistic regression analyses were performed for independent predictors of Naples prognostic score. P < 0.05 was considered significant.

Ethical Approval

This study was approved by the Ethics Committee of Republic of Turkey Ministry of Health Bursa City Hospital (Date: 2024-05-29, No: 2024-9/7)

Results

The mean age of the 300 patients included in the study sample, of whom 31,3% were female, was 63 ± 10 years. 62.6% (n:188) of the patients had a Naples score of 0, 1, or 2 (group 1). The distribution of the demographic, clinical and angiographic characteristics of patients by groups is shown in Table 2.

In Group 2, compared to Group 1, age was significantly higher, while the smoking rate and EF were significantly lower (Table 1) (p <0.05). In patients with a high Naples score (Group 2), the SYNTAX score was significantly higher compared to Group 1 [9 (1.0-26.5)- 12 (2.0-37.0); p<0.001] (Table 2).

The distribution of the laboratory test results by the groups is shown in Table 2. In Group 2, the levels of neutrophils and NLR were significantly higher compared to Group 1, while the levels of, lymphocytes, LMR, triglycerides, total cholesterol, HDL, LDL, and albumin were significantly lower (p <0.05). There was no significant difference between the groups in other blood parameters (Table 2).

Univariable logistic regression analysis revealed that age, tobacco, EF, SYNTAX score, hemoglobin, triglyceride, HDL,LDL,

Table 1. Naples Score

Variable	Cut-off	Points	NS Group
Albumin (g/dl)	≥4	0	Group 1: 0,1 or 2 points
	<4	1	
Total Cholesterol (g/dl)	>180	0	Group 2: 3 or 4 points
	≤180	1	
NLR	≤2.96	0	
	>2.96	1	
LMR	>4.44	0	
	≤4.44	1	

Calculation of Naples Score. LMR, lymphocyte to monocyte ratio; NLR, neutrophil to lymphocyte ratio; NS, Naples Score

BUN and creatinine were significantly associated with Naples score (Table 3). Further analysis of these variables with multivariable logistic regression analyses indicated that both age, SYNTAX score, triglycerides and LDL were independent predictors of Naples score ($p < 0.05$) (Table 3).

Discussion

This study revealed that NS was significantly higher in NSTEMI patients who underwent CAG and had more extensive coronary artery disease. NS was positively correlated with SS.

Being older age was also found to be significantly higher

Table 2. Demographic, Clinical Characteristics and Laboratory Findings of Patients

Variables	Group 1 (n=188)	Group 2 (n=112)	p
Age, years	61.0 ± 10.0	66.0 ± 10.0	<0.001
Females, n (%)	53 (28.2)	41 (36.6)	0.129
Tobacco, n (%)	100 (53.2)	46 (41.1)	0.042
Hyperlipidemia, n (%)	87 (46.3)	47 (42.0)	0.467
Diabetes mellitus, n (%)	67 (35.6)	51 (45.5)	0.090
Hypertension, n (%)	93 (49.5)	62 (55.4)	0.324
Post-PCI TIMI, n (%)			0.347
Grade 0-2	20 (10.6)	16 (14.3)	
Grade 3	168 (89.4)	96 (85.7)	
Family history of CAD, n (%)	41 (21.8)	21 (18.8)	0.527
Ejection fraction, %	55.0 (25.0-60.0)	50.0 (20.0-60.0)	0.003
SYNTAX score	9.0 (1.0-26.5)	12.0 (2.0-37.0)	<0.001
≤ 22	186 (98.9)	99 (88.4)	
> 22	2 (1.1)	13 (11.6)	
Hemoglobin, g/dL	14.3 ± 1.6	14.2 ± 1.7	0.096
White blood cell count, x10³/mm³	9.2 (3.0-21.9)	9.1 (4.4-20.1)	0.737
Platelet count, x10³/mm³	233.0 (98.0-447.0)	227.0 (29.0-685.0)	0.460
Lymphocyte count,x10³/mm³	2.2 (0.5-6.4)	1.5 (0.4-3.7)	<0.001
Monocyte count, x10³/mm³	0.6 (0.1-5.3)	0.6 (0.0-7.0)	0.271
Neutrophil count, x10³/mm³	5.6 (1.9-19.6)	6.5 (2.4-17.1)	0.001
LMR	4.0 (0.1-11.7)	2.5 (0.2-8.7)	<0.001
NLR	2.1 (0.6-19.2)	4.2 (0.9-21.8)	<0.001
Triglycerides, mg/dL	129.0 (29.0-1000.0)	89.5 (33.0-637.0)	<0.001
Total cholesterol, mg/dL	205.0 (101.0-498.0)	165.5 (80.0-341.0)	<0.001
HDL-C, mg/dL	40.7 (21.0-142.0)	37.8 (23.8-67.4)	0.003
LDL-C, mg/dL	137.0 (32.0-404.0)	108.5 (36.0-193.0)	<0.001
C-reactive protein, mg/L	0.5 (0.1-7.5)	0.6 (0.1-10.4)	0.123
Albumin, g/L	4.1 ± 0.2	3.9 ± 0.3	<0.001

Data are shown as mean±standard deviation, n (%) or median (minimum, maximum).
CAD, Coronary artery disease; HDL-C, High-density lipoprotein cholesterol; LDL-C, Low-density lipoprotein cholesterol; LMR, lymphocyte monocyte ratio; NLR, neutrophil lymphocyte ratio; Post-PCI TIMI, Post- percutaneous coronary intervention thrombolysis in myocardial infarction; $p < 0.05$ shows statistical significance

Table 3. Logistic Regression Analysis for Independent Predictors of Naples Prognostic Score

Variables	Univariate analysis			Multivariate analysis		
	OR	95% CI	p	OR	95% CI	p
Age	1.061	1.034-1.089	<0.001	1.046	1.007-1.086	0.019
Tobacco	0.613	0.382-0.984	0.043	1.019	0.497-2.089	0.960
EF	0.947	0.916-0.978	0.001	0.976	0.939-1.015	0.221
Syntax	12.212	2.702-55.200	0.001	10.288	1.997-53.002	0.005
Hemoglobin	0.819	0.708-0.946	0.007	0.938	0.770-1.142	0.524
Triglycerides	0.994	0.991-0.997	0.001	0.995	0.991-0.999	0.011
HDL-C	0.962	0.935-0.990	0.009	0.973	0.939-1.008	0.134
LDL-C	0.977	0.969-0.985	<0.001	0.980	0.971-0.989	<0.001
BUN	1.025	1.008-1.043	0.004	1.005	0.984-1.026	0.673
Creatinine	4.494	1.553-13.004	0.006	2.054	0.537-7.857	0.293

EF, Ejection fraction; HDL-C, High-density lipoprotein cholesterol; LDL-C, Low-density lipoprotein cholesterol; BUN, Blood urea nitrogen; OR, Odds ratio; CI, Confidence interval; $p < 0.05$ shows statistical significance

in group 2 patients. In the literature, age was found to be significantly associated with poor nutritional status, which is consistent with our study [11].

Hypoalbuminemia may be a risk factor for cardiovascular disease due to its detrimental pleiotropic effects on the cardiovascular system and the body [12]. Studies show that serum albumin levels are a reliable predictor of cardiovascular disease and are inversely associated with ischemic heart disease [13]. In another study, it was found that patients with low preoperative albumin levels had worse long-term survival after coronary artery bypass graft surgery compared to patients with normal albumin levels. The underlying cause may be related to the patient's preoperative nutritional status, immune status or both [14].

Malnutrition has been investigated with increasing interest in recent years and is one of the hallmarks of frailty. Initially, malnutrition was thought to be predictive of poor clinical outcomes in cancer patients and various scores were developed to identify this condition, but in recent years, malnutrition has also been associated with mortality, morbidity and disease severity in cardiovascular diseases [15].

Previous studies have shown that NS can independently predict in-hospital mortality in STEMI [16]. Patients with high NS who underwent successful percutaneous intervention for NSTEMI had a higher composite major adverse cardiac event (MACE) of non-fatal recurrent myocardial infarction, cerebrovascular event and all-cause death at one-year follow-up, and high NS was found to be a predictor of MACE [17]. However, the association between NS and CAD severity in patients with NSTEMI has not been clearly established.

Naples prognostic score is calculated using serum albumin and serum TC levels, NLR and LMR ratios [18]. Neutrophils can secrete prooxidant and prothrombotic substances that can lead to endothelial damage and platelet aggregation leading to acute coronary syndromes. Low lymphocyte count has been associated with poor prognosis in patients with CAD and unstable angina [19]. NLR has been found to be used to differentiate patients at high risk of CVD events and more severe CAD [20]. Monocytes actively bind to platelets to form thrombotic monocyte-platelet aggregates, which are increased in STEMI [21]. Low lymphocyte count and high monocyte count have been associated with adverse cardiovascular endpoints in CAD patients [22]. Gong et al. found LMR to be an independent predictor of severe coronary atherosclerosis [23]. LMR has also been reported to be an effective predictor in patients with carotid artery stenosis and coronary atherosclerosis [24]. In another study, LMR was found to be an independent predictor of CAD severity in patients with stable CAD undergoing CAG [25]. Our findings reveal an association between NLR and LMR levels and severe CAD.

Conclusion

In conclusion, our study demonstrates a significant correlation between the NS and SS in patients with NSTEMI. The elevated NS in patients with more extensive coronary artery disease, as assessed by SS, highlights its potential as a valuable prognostic tool in NSTEMI management. Integrating NS alongside SS could enhance risk assessment and guide personalized treatment strategies for better patient outcomes. Further research is needed to validate these findings and explore the mechanistic links between NS and SS in cardiovascular disease.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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