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New Potential Biomarkers for the Differential Diagnosis of Pericarditis and Myopericarditis

Perikardit ve Miyoperikarditin Ayırıcı Tanısına Yönelik Yeni Potansiyel Biyobelirteçler

ABSTRACT

Objective

Myopericarditis is an inflammatory disease characterized by elevated cardiac biomarkers. In the absence of elevated cardiac biomarkers, myocardial involvement is subclinical or unclear in most cases of pericarditis. In order to differentiate between pericarditis and myopericarditis, this study sought to comprehensively evaluate the predictive value of inflammatory biomarkers.

Materials and Methods

After applying the exclusion criteria, this study included 193 out of 1220 patients enrolled in our hospital's database in 2022 who satisfied the diagnostic criteria for pericarditis and myopericarditis. Inflammatory scores were calculated from peripheral complete blood counts and analyzed using demographic and clinical data. Statistical significance was set at $p < 0.05$.

Results

A total of 193 patients (105 with pericarditis, 88 with myopericarditis) were included in the study. The pericarditis group had more female patients, whereas the myopericarditis group was predominantly male (p=0.014). The mean age was 38.39 ± 15.84 years. The inflammatory scores were significantly higher in patients with myopericarditis. In univariate and multivariate logistic regression, neutrophil-lymphocyte ratio (NLR), derived neutrophil-lymphocyte ratio (dNLR) and systemic inflammatory response index (SIRI) showed high specificity, sensitivity, and predictability for myopericarditis. Receiver operating characteristic (ROC) and area under the curve (AUC) analyses identified NLR, dNLR, and SIRI to have the highest AUC values (0.88, 0.85, and 0.85, respectively). With a cut-off of 2.45 ($p < 0.01$) the NLR had the highest sensitivity (84.1%) and specificity (81.9%). The dNLR (cut-off 1.85, $p < 0.01$) had 80.7% sensitivity and 81.9% specificity, while the SIRI (cut-off 1.64, $p < 0.01$) had 80.7% sensitivity and 82.9% specificity.

Conclusion

The NLR, dNLR, and SIRI scores could be potential biomarkers for predicting and differentiating myopericarditis. Further research is required to validate these findings and to adapt them to clinical practice.

Key Words

Pericarditis, Myopericarditis, Inflammatory Biomarkers, Diagnosis

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ÖZ

Amaç

Miyoperikardit, kardiyak biyobelirteçlerin yükselmesiyle karakterize edilen enflamatuvar bir hastalıktır. Kardiyak biyobelirteçlerin yükselmediği durumlarda, perikardit vakalarının genelinde miyokardiyal tutulum subklinik veya belirsizdir. Bu çalışmada, perikardit ve miyoperikardit vakalarının ayırıcı tanısında enflamatuvar biyobelirteçlerin öngördürücü değerlerinin belirlenmesi amaçlanmıştır.

Gereç ve Yöntemler

Dışlama kriterleri uygulandıktan sonra, 2022 yılında hastanemizin veri tabanına kaydedilen ve perikardit ile miyoperikardit için tanı kriterlerini karşılayan 1220 hasta arasından 193 hasta çalışmaya dahil edilmiştir. Periferik tam kan sayımlarından elde edilen enflamatuvar skorlar, demografik ve klinik veriler ile birlikte analiz edilmiştir. İstatistiksel anlamlılık sınırı $p < 0,05$ olarak kabul edilmiştir.

Bulgular

Çalışmaya toplamda 193 hasta (105 perikardit, 88 miyoperikardit) dahil edilmiştir. Perikardit grubunda kadın hasta oranı daha yüksek iken, miyoperikardit grubu ağırlıklı olarak erkeklerden oluşmaktaydı (p=0,014). Genel popülasyonda ortalama yaş 38,39±15,84 yıl olarak hesaplanmıştır. Miyoperikardit grubunda enflamatuvar skorların anlamlı derecede yüksek olduğu tespit edilmiştir. Tek değişkenli ve çok değişkenli lojistik regresyon analizlerinde nötrofil lenfosit oranı (NLR), derive nötrofil lenfosit oranı (dNLR) ve sistemik inflamatuar cevap indeksi (SIRI) skorlarının miyoperikardit için yüksek özgüllük, duyarlılık ve öngördürücülüğe sahip olduğu belirlenmiştir. Alıcı işletim karakteristiği ve eğrinin altında kalan alan (ROC ve AUC) analizlerine göre, NLR (0,88), dNLR (0,85) ve SIRI (0,85) miyoperikardit için en yüksek AUC değerlerine sahiptir. NLR için 2,45 kesim noktası kullanıldığında, en yüksek duyarlılık (%84,1) ve özgüllük (%81,9) sağlanmıştır ($p <0,01$). dNLR için 1,85 kesim noktası kullanıldığında duyarlılık %80,7, özgüllük %81,9 iken; SIRI için 1,64 kesim noktası ile duyarlılık %80,7, özgüllük %82,9 olarak belirlenmiştir ($p <0,01$).

Sonuç

NLR, dNLR ve SIRI biyobelirteçleri, miyoperikarditi öngörmede ve ayırt etmede potansiyel biyobelirteçler olabilir. Bu bulguların doğrulanması ve klinik uygulamalara uyarlanması için daha fazla araştırmaya ihtiyaç duyulmaktadır.

Anahtar Kelimeler

Perikardit, Miyoperikardit, Enflamatuvar Biyobelirteçler, Ayırıcı Tanı

INTRODUCTION

The heart is surrounded by the pericardial cavity, which contains 15–50 mL of plasma ultrafiltrate, and the pericardium, which is made up of the visceral and parietal layers. Pericarditis is an inflammation of the pericardium that is typically benign and self-limiting, and may occur independently or in association with other systemic diseases (1).

The most typical clinical signs of pericarditis include a pericardial friction rub, which is a superficial, scratchy, or squeaking sound that is best detected with the stethoscope's diaphragm over the left sternal border, new widespread ST elevation and PR depression on the electrocardiography (ECG), and sharp, pleuritic chest pain that gets better when sitting up and leaning forward. Although pericardial effusion is often present in pericarditis cases, it is not a prerequisite for diagnosis (2).

Approximately one-third of idiopathic pericarditis cases develop myocarditis, which manifests as increased troponin levels and other markers of cardiac damage (1). In addition to pericarditis, the clinical manifestations of myocarditis may include typical symptoms (chest pain, dyspnea, fatigue, and palpitations), laboratory findings (ECG changes, widespread ST elevation or T inversion, elevated troponin T/I, and fever of 38.0°C), functional and structural abnormalities on echocardiography (anomalies of regional wall motion, anomalies of left ventricular [LV] and right ventricular [RV] function, or global systolic or diastolic dysfunction), cardiovascular magnetic resonance (CMR) findings with tissue characterization, and myocardial biopsy findings (3).

Immune-mediated factors in myocarditis and pericarditis include systemic inflammatory diseases, vaccination-related conditions, and infections primarily caused by cardiotropic viruses. A range of myopericardial syndromes are observed in clinical practice, from pure myocarditis to varied degrees of myocardial involvement (myopericarditis and perimyocarditis). Myopericarditis refers to a pericarditic disease with myocardial involvement, whereas perimyocarditis is primarily associated with pure myocarditis. Myopericarditis is diagnosed when signs of myocardial involvement, such as elevated cardiac biomarkers and normal myocardial wall motion on imaging, are accompanied by primary pericarditis symptoms. Perimyocarditis is characterized by localized wall motion abnormalities and reduced ventricular function (4, 5).

Complete blood count analyses are simple, fast, and cost-effective tests that can aid in the diagnosis of several diseases. By calculating inflammatory biomarkers, such as the neutrophil-lymphocyte ratio (NLR), derived neutrophil-lymphocyte ratio (dNLR), monocyte-lymphocyte ratio (MLR), and platelet-lymphocyte ratio (PLR), recent clinical studies have investigated the use of routine tests for diagnosis and prognosis. These studies have focused on activated neutrophils, monocytes, and platelets, which are components of systemic inflammation, and indicators of increased mortality and poor prognosis in cardiovascular diseases. The systemic immune-inflammation index (SII) and systemic inflammatory

response index (SIRI) are biomarkers that may predict prognosis and reflect the immune and inflammatory status. They have shown promise in predicting outcomes and assessing disease severity in cancer, cardiovascular disease, and inflammatory disorders. The SII, calculated using platelet, neutrophil, and lymphocyte counts, has been useful for evaluating the prognosis of patients with solid tumors. SIRI, which incorporates neutrophil, monocyte, and lymphocyte counts, has demonstrated potential for predicting survival and treatment response in cancer patients (6, 7).

This study was designed to determine the diagnostic and predictive value of inflammatory biomarkers NLR, MLR, PLR, dNLR, SII, and SIRI, which have gained increasing attention in recent years, for pericarditis and myopericarditis, conditions frequently conflated in the literature. This study sought to comprehensively analyze these biomarkers and elucidate the distinctions between pericarditis and myopericarditis concerning inflammatory biomarkers.

MATERIAL and METHODS

Ethics and Design

Our hospital's local ethics council granted ethical approval for this study on March 10, 2025 (Approval Number: 2025/41). The requirement for informed consent was waived dueto the retrospective design of the study. This study was conducted in accordance with the ethical standards of the 2013 Declaration of Helsinki. The funders had no control over the study's design, data collection and analysis, publication decisions, or manuscript preparation.

Patient Selection

This study included 193 patients who met the diagnostic criteria for pericarditis and myopericarditis after applying the exclusion criteria among 1220 patients registered in our hospital database between 2021 and 2022 with a prediagnosis of pericarditis and myocarditis according to the International Classification of Diseases (ICD-10) codes. The hospital database was filtered using ICD-10 diagnosis codes I30-32 and I40-41 for pericarditis and myocarditis, respectively. The patients were retrospectively and consecutively enrolled in the study (Figure 1).

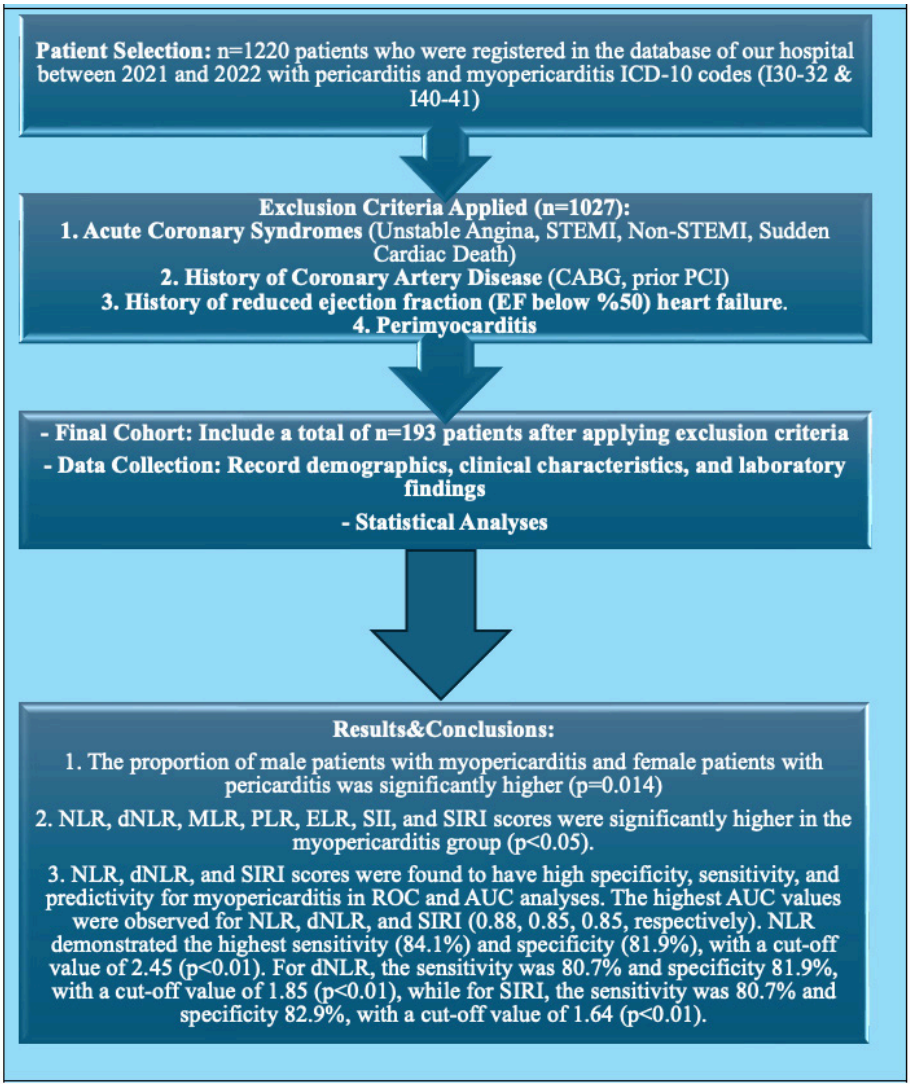

Figure 1 (Central Figure): New Potential Biomarker For The Differential Diagnosis Of Pericarditis And Myopericarditis

Exclusion Criteria

The exclusion criteria were acute coronary syndrome (such as unstable angina, ST-elevation myocardial infarction [STEMI], and non-ST-elevation myocardial infarction [NSTEMI]), history of percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG), history of heart failure with low ejection fraction (EF <50%), and echocardiographic LV wall motion defects (presumed perimyocarditis).

Diagnose

By reviewing their medical records, the study included patients with clinical signs and symptoms of pericarditis, including pericardial frictional sound and/or pericardial effusion, new diffuse concave ST elevation and PR depression, and sharp and pleuritic chest pain that is usually relieved by sitting and bending forward (2). The presence of at least two of the physical examinations and laboratory findings, along with typical chest pain defined as for pericarditis, was considered diagnostic.

Patients with a prediagnosis of pericarditis and elevated biomarkers of cardiac injury (Hs-Troponin T, Creatine Kinase-MB fraction) were diagnosed with myopericarditis. Perimyocarditis was excluded from this study due to difficulties in distinguishing it from acute coronary syndrome (ACS), given the associated low EF and wall motion abnormalities (3).

The patients were categorized into two cohorts: those with pericarditis (n=105) and those with myopericarditis (n=88). The demographic and clinical data obtained from the hospital database were recorded using a statistical program. Complete blood count data were obtained from blood samples taken within the first 24 h after admission to the hospital. Echocardiographies were performed using the GE Healthcare Vivid S6 Echocardiography device.

Calculation of Inflammatory Ratios and Indices (Each cell count is given in x10^3/µL)

The ratios and indices calculated according to the absolute inflammatory cell counts obtained from the complete blood count are as follows (6):

- NLR: Neutrophils (Neu) / Lymphocytes (Lym),
- MLR: Monocytes (Mono) / Lymphocytes (Lym),
- PLR: Platelets (Plt) / Lymphocytes (Lym),
- dNLR: Neutrophils (Neu) / [WBC (Leucocytes) - Neutrophils (Neu)]
- SII: Neutrophils (Neu) x Platelets (Plt) / Lymphocytes (Lym),
- SIRI: Neutrophils (Neu) x Monocytes (Mono) / Lymphocytes (Lym)

Statistical Analysis

Mean ± standard deviation and minimum and maximum values were used to present the data; frequencies (n) and percentages (%) were used to describe the categorical variables; the Kolmogorov-Smirnov test was used to determine whether the data was normal; Fisher's exact test and Pearson's chi-square were used to analyze the categorical variables; the independent samples t-test or Mann-Whitney U test were used for continuous variables, depending on whether the data was skew or not; the Mann-Whitney U test was used for two independent group comparisons when the numerical variables did not exhibit a normal distribution.

The factors linked to certain clinical outcomes were determined using univariate and multivariate logistic regression analyses. Comparative study of the median NLR, MLR, PLR, ELR, SII, SIRI, and dNLR scores revealed statistically significant differences. Inflammatory scores were examined and independently corrected for several variables associated with the clinical condition under investigation, including age, gender, smoking, Hb, BUN, Cre, CRP, and Eos, in the multiple logistic regression model. Multicollinearity was prevented by applying each inflammatory score independently to the multiple logistic regression model. Odds ratios (OR), 95% confidence intervals (CI), and p-values were determined. A thorough summary and tabulation of the findings of the logistic regression analysis were provided. Additionally, the cut-off values for inflammatory scores were included in a separate table that presents the findings of the ROC analysis.

The IBM SPSS Statistics for Windows (Computer software, Version 27.0, IBM Corp. 2020, Armonk, NY) was used to perform the statistical analyses. A significance level of $p < 0.05$ was used for all statistical analyses.

RESULTS

A total of 193 patients with pericarditis (n=105) and myopericarditis (n=88) were included in this study. The population as a whole was 38.39±15.84 years old, the pericarditis group was 39.08±13.38 years old, and the myopericarditis group was 37.58±18.40 years old. The population as a whole consisted of 94 (48.7%) females and 99 (51.3%) males; the pericarditis group included 60 (57.2%) females and 45 (42.8%) males; and the myopericarditis group had 34 (38.6%) females and 54 (61.4%) males. Age differences between the groups were not statistically significant (p =0,117), while the number of females in the pericarditis group was substantially higher than that in the myopericarditis group (p =0.014) (Table I).

In terms of comorbidities, 75 (38.9%) patients were smokers: 37 (19.2%) in the pericarditis group and 38 (19.7%) in the myopericarditis group. Of the 17 (8.9%) hypertensive patients in the whole population, 11 (5.7%) were in the pericarditis group and 6 (3.2%) were in the myopericarditis group. Diabetes mellitus was found in 5 (2.6%) individuals in the pericarditis group and 3 (1.6%) in the myopericarditis group. Smoking, hypertension, and diabetes mellitus did not differ significantly between the patient groups with pericarditis and myopericarditis (Table I).

The median values of the hematological and biochemical parameters of the patients included in the study are shown in (Table I). The GLU, BUN, AST, Hs-Troponin T, CK-MB, CRP, WBC, NEU, MONO, EOS, NLR, dNLR, MLR, PLR, ELR, SII, and SIRI values were considerably higher in the myopericarditis group than in the pericarditis group ($p<0.05$).

Table I. Comparison of Demographic, Hematologic, and Biochemical Parameters

		Diagnosis				
		Pericarditis (n=105)		**Myopericarditis** (n=88)		**p-value**
Gender	Female	60 (57,2)		34 (38,6)		0,014
	Male	45 (42,8)		54 (61,4)		
Smoking		37 (19,2)		38 (19,7)		0,3
Hypertension		11 (5,7)		6 (3,2)		0,45
Diabetes		5 (2.6)		3 (1,6)		0,73
		Min-Max.	**Mean±SD**	**Min-Max.**	**Mean±SD**	**p-value**
Age, years		18-68	39,08±13,38	18-82	37,58±18,40	0,117
GLU, mg/dL		70-353	104,43±44,05	67-329	112,15±36,29	**0,001***
BUN, mg/dL		5-28	12,59±4,51	4-33	14,58±5,71	**0,004***
CRE, mg/dL		0,42-1,40	0,78±0,19	0,30-1,67	0,85±0,23	**0,012***
AST, mg/dL		10-48	19,97±7,62	9-217	31,16±31,40	**0,003***
ALT, mg/dL		5-56	20,58±11,11	5-182	25,93±26,90	0,443
TSH, mU/L		0,42-13	2,08±1,61	0,56-17,40	1,90±1,90	0,157
HsTropT, ng/L		0,10-8,71	1,13±2,07	14,07-2002	189,65±325,77	**0,001***
CK-MB, µg/L		1-4	1,15±0,52	0,3-96	13,20±18,79	**0,001***
CRP, mg/L		0,13-22,42	3,06±3,83	0,18-286,60	33,68±55,08	**0,001***
WBCx10^3/µL		3,28-12,50	7,70±1,91	6,39-28,69	11,66±3,36	**0,001***
HB, g/dL		9,90-17,70	13,87±1,81	10-17,70	13,87±1,99	0,961
NEUx10^3/µL		1,51-9,40	4,44±1,54	2,33-27,60	8,61±3,39	**0,001***
LYMx10^3/µL		0,59-5,39	2,50±0,82	0,43-5,09	2,10±0,93	**0,004***
PLTx10^3/µL		4,97-569	269,58±77,09	98-652	272,44±92,91	0,648
MPV, fL		8,50-13,20	10,41±0,93	8,10-13,20	10,27±0,86	0,319
MONOx10^3/µL		0,29-1,47	0,579±0,19	0,08-1,85	0,79±0,34	**0,001***
EOSx10^3/µL		0,01-0,60	0,15±0,11	0,01-1,60	0,12±0,19	**0,001***

*Significant at p<0.05 level, Mann-Whitney U test; SD: Standard Deviation
**Significant at p<0.05 level, Pearson Chi-Square or Fisher's Exact Test
Abbreviations in table contents (continuous variables with their normal ranges): HT: Hypertension, DM: Diabetes Mellitus, HL: Hyperlipidemia, Glucose (GLU: 70-110 mg/dL), Creatinin (CRE: 0.7-1.2 mg/dL), Aspartate Aminotransferase (AST: 0-40 U/L), Alanine Aminotransferase (ALT: 0-41 U/L), Thyroid Stimulating Hormone (TSH: 0.27-4.2 mU/L), High Sensitive (Hs) – TroponinT (HsTropT: 0-14 ng/L), Creatine Kinase - MB (CK-MB: 0-6.22 µg/L), C Reactive Protein (CRP: 0-5 mg/L), White Blood Count (WBC: 4.5-10 x10^3/µL), Hemoglobin (HB: 13-17 g/dL), Neutrophil (NEU: 1.8-7.5 x10^3/µL), Lymphocyte (LYM: 0.8-3.2 x10^3/µL), Platelet (PLT: 150-450 x10^3/µL), Monocyte (MONO: 0.2-0.9 x10^3/µL), Eosinophil (EOS: 0-0.5 x10^3/µL), Mean Platelet Volume (MPV: 9-12 fL).

Tables I and II show that the pericarditis group had a substantially greater LYM than the myopericarditis group (p = 0.004). Inflammatory rates and indices were significantly higher in the myopericarditis group. These findings suggest that increasing inflammatory status significantly increases the risk of myopericarditis.

Table III shows the imaging methods applied to the pericarditis and myopericarditis groups, and their results. Consequently, there was no discernible difference in the echocardiographic EF values between the two groups. However, the group with myopericarditis showed a considerably higher prevalence of pericardial effusion (p = 0.02). The myopericarditis group underwent significantly more coronary angiography (CAG) (p < 0.01). This finding was attributed to the fact that CAG was performed more frequently in the myopericarditis group to exclude ACS and to confirm the diagnosis.

After observing significant differences in favor of the myopericarditis group for inflammatory ratios and indices, these scores were confirmed using univariate and multivariate logistic regression analyses. Accordingly, significant statistical differences were found in favor of myopericarditis for NLR, dNLR, MLR, SII, and SIRI scores. PLR showed significant

Table II. Comparison of inflammatory biomarkers in pericarditis and myopericarditis patient groups

	Diagnosis				
	Pericarditis (n=105)		**Myopericarditis** (n=88)		
	Min-Max.	**Mean±SD**	**Min-Max.**	**Mean±SD**	**p-value**
NLR	0.55-12.10	2.03±1.484	0.59-55.20	5.81±6.730	**0,001***
MLR	0.13-0.72	0.25±0.088	0.05-1.58	0.48±0.340	**0,001***
PLR	1.39-444.07	120.99±64.953	54.21-596	165.30±116.026	**0,006***
ELR	0.004-0.43	0.06±0.056	0.003-0.55	0.06±0.073	**0,035***
dNLR	0.44-8.02	1.50±0.955	0.47-25.32	3.44±2.985	**0,001***
SII	1.21-5373.97	316.28±632.247	32.56-32899.2	1517.81±3831.075	**0,001***
SIRI	0.27-5.80	1.15±0.788	0.32-28.15	4.46±4.705	**0,001***

*Significant at p<0.05 level, Mann-Whitney U test; SD: Standard Deviation
Abbreviations in table contents: Neutrophil to Lymphocyte Ratio (NLR), Monocyte to Lymphocyte Ratio (MLR), Platelet to Lymphocyte Ratio (PLR), Eosinophile to Lymphocyte Ratio (ELR), derivated Neutrophil to Lymphocyte Ratio (dNLR), Systemic Immune-Inflammation Index (SII), systemic inflammatory response index (SIRI).

Tablo III. Comparison of Cardiac Imaging and Findings in Pericarditis and Myopericarditis Groups

	Diagnosis					
	Pericarditis (n=105)			**Myopericarditis** (n=88)		
	n		**%**	**N**	**%**	**p-value**
ECO	EF >60%	98	93,3	77	56,8	0,22
	EF 50-59%	7	6,7	11	43,2	
CAG	Done	9	8,6	50	56,8	**0.001***
	Not done	96	91,4	38	43,2	
CAG R.	Medical	102	97,1	86	97,7	1
	PCI	3	2,9	2	2,3	
P. EFFUSION	No	85	81	53	60,2	**0,002***
	Yes	20	19	35	39,8	

*Significant at p<0.05 level, Pearson Chi-Square or Fisher's Exact test
Abbreviations in table contents: Echocardiography (ECO), Coronary Angiography (CAG), Coronary Angiography Results (CAG R.), Pericardial Effusion (P. EFFUSION)

statistical differences in the univariate logistic regression model, whereas ELR did not show significant differences in either the univariate or multivariate logistic regression models. ROC and AUC analyses were performed for NLR, dNLR, MLR, PLR, PLR, SII, and SIRI scores. The NLR, dNLR, and SIRI scores were found to have high specificity, sensitivity, and predictability for myopericarditis in ROC and AUC analyses (Figure 2). NLR, dNLR, and SIRI had the highest AUC values (0.88, 0.85, and 0.85, respectively). With a cut-off value of 2.45 (p<0.01), NLR showed the highest sensitivity (84.1%) and specificity (81.9%). Using a cut-off value of 1.85 (p<0.01), the dNLR's sensitivity and specificity were 80.7% and 81.9%, respectively, whereas the SIRI's sensitivity and specificity were 80.7% and 82.9%, respectively, with a cut-off value of 1.64 (p<0.01). In Tables IV and V, the outcomes of these studies are displayed in comparison with the cutoff values.

Figure 2. Roc Curve Analysis Results of Inflammatory Ratios and Indices

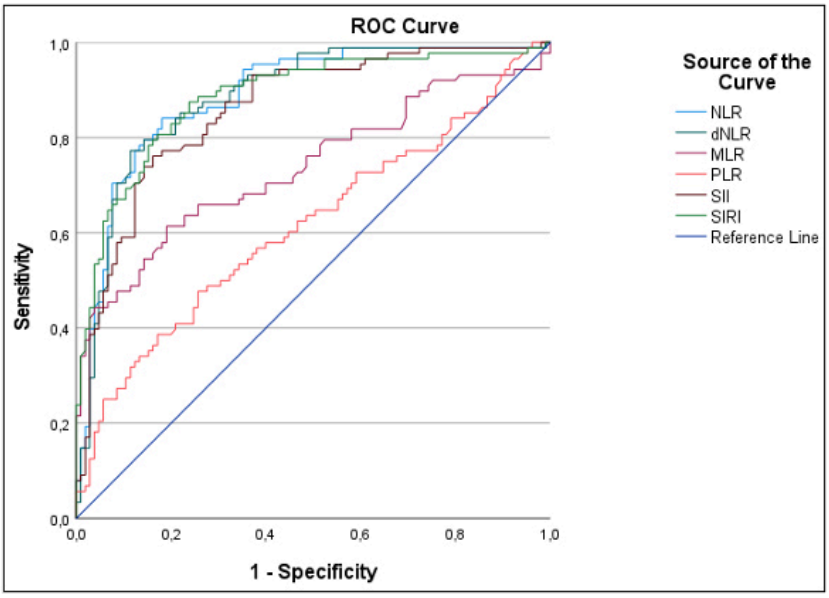

Table IV. Binary Logistic Regression Analysis Results For Inflammatory Biomarkers

	Logistic Regression (Univariate)			Logistic Regression (Multiple)*		
	Odds Ratio	**[95%CI]**	**p value**	**Odds Ratio**	**[95%CI]**	**p-value**
NLR	2,38	1,78 – 3,18	**0,001**	1,85	1,36 – 2,52	**0,001***
dNLR	3,99	2,56 – 6,22	**0,001**	2,85	1,71 - 4,75	**0,001***
MLR	654,6	48,1 - 8905	**0,001**	145,90	5,17 – 4115,5	**0,03***
PLR	1,001	1,00 – 1,01	**0.003**	1,00	0,99 – 1,01	0,25
ELR	0,2	0,002 – 21	0,5	1,62	0,00 – 93332	0,94
SII	1,00	1,00 – 1,00	**0,001**	1,00	1,00 – 1,00	**0,001***
SIRI	4,05	2,54 – 6,45	**0,001**	2,91	1,8 – 4,71	**0,001***

OR: Odds ratio, CI: Confidence interval
*Significant at p<0.05 level; Adjusted for Age, Gender, Smoking, Hb, BUN, Cre, CRP, Eos variables

Table V. ROC Analysis Results of Inflammatory Scores Inflammatory scores

Inflammatory scores	Cut-Off Value	Sensitivity (%)	Specificity (%)	AUC	Standard Error	p value*
NLR	2,45	84,1	81,9	0,888	0,024	**0,001***
dNLR	1,85	80,7	81,9	0,885	0,025	**0,001***
MLR	0,34	50	50	0,738	0,037	**0,001***
PLR	118,98	58,1	58,1	0,615	0,041	**0,006***
SII	986,59	50	50	0,859	0,027	**0,001***
SIRI	1,64	80,7	82,9	0,885	0,025	**0,001***

*Significant at 0.05 level; ROC Analysis

DISCUSSION

Important Findings and Highlights

In this study, we demonstrated that the inflammatory ratios and indices NLR, dNLR, and SIRI have a significant predictive value for myocardial involvement in patients with myopericarditis and pericarditis, which are frequently characterized in the literature as intertwined clinical conditions, in which cardiac biomarkers are either elevated to varying degrees or not elevated at all.

Myopericarditis is a relatively common condition typically caused by viral infections. The exact frequency and distribution of myopericarditis cases remains undetermined. In hospital settings, acute pericarditis accounts for 0.1% of hospital admissions. Currently, there is little information regarding the number of hospital admissions with a prediagnosis of pericarditis showing myocardial involvement (5). Nevertheless, Imazio et al. reported that myopericarditis is frequently observed at a young age and more frequently in males (4). The results of this study were partially similar to and comparable to those of our study. In this study, the patients were young adults, and pericarditis was more common in women, whereas myopericarditis was more common in men.

Choi et al. demonstrated that pericardial fluids from pericarditis patients had more lymphocytes that mediated the release of IL-33 and that this release of IL-33 and eotaxin induced the transfer of cardiac fibroblasts and eosinophils to the heart (8). This study demonstrated a significant association between pericarditis and elevated lymphocyte and eosinophil counts. Pericardial effusion was more common in the myopericarditis group. Several studies have shown that myopericarditis-related pericardial effusion may range from minimal pericardial fluid increase to cardiac tamponade, depending on the underlying etiology and severity of the disease. While viral infections are often self-limiting, serious pericardial effusions may occur in etiologies such as tuberculosis, autoimmune diseases, and malignancies (9).

Erythrocyte sedimentation rate, C-reactive protein level, and leukocyte count are non-specific inflammatory blood biomarkers that are often elevated in pericarditis but do not help diagnose myopericarditis. Cardiac biomarkers of myocardial damage may not be elevated in most individuals with myopericarditis; however, if elevated, the diagnosis can be confirmed. In adults and children with acute myopericarditis, elevated serum levels of troponin I (TnI) and T (TnT) are more frequently observed than those of creatinine kinase (CK) or creatinine kinase MB (CK-MB). Adult patients with acute myopericarditis exhibit poorer outcomes when their troponin T (TnT) levels are elevated. This study indicated that TnT has a sensitivity of 71% and specificity of 83% for myopericarditis (10). In this study, while lymphocyte elevation was significant for pericarditis, NLR, dNLR, SIRI, Hs-troponin T, and CK-MB elevations were significant for myopericarditis. In the ROC analysis, the relationship between NLR and myopericarditis was shown, and NLR had a sensitivity of 84,1% and specificity of 81,9% for the differential diagnosis of myopericarditis.

In another study, Mirna M. et al. reported that NLR and MLR are better predictors of prolonged hospitalization than important inflammatory biomarkers such as leukocyte count, CRP, IL-6, procalcitonin, so using some inflammatory ratios and indices for risk stratification can be an extremely easy and cost-effective way (11). Several studies have shown that inflammatory ratios and indices are effective predictors of endpoints such as prognosis, mortality, and length of hospital stay in myopericarditis and that these biomarkers can be used to identify high-risk patients and provide a better treatment strategy. Yaradılmış RM et al. demonstrated the utility of the SII in this regard in the pediatric age group and Erbay I et al. in the young adult age group in two recent studies (12, 13).

Although multiple studies have shown the predictive value of NLR, dNLR, MLR, PLR, SII, and SIRI inflammatory scores for prognosis, mortality, length of hospitalization, and various diseases, no specific studies in the literature have shown the importance of these scores for myopericarditis and pericarditis from a large and comparative perspective (14-16). We believe that this study may be an important model for future studies to address the prognostic relationship between the inflammatory status and many clinical conditions.

Study Limitations

The major limitation of this study is its retrospective design. The concepts of pericarditis and myopericarditis remain intertwined and often remain clinical entities that are difficult to distinguish. Selection bias remains a limitation despite the selection of participants among consecutive patients. The calculation of inflammatory biomarkers is based on absolute leukocyte counts, whereas the role of immune mediators and biomolecules released from these cells into circulation is still unclear. Further research in this area may be instructive.

Conclusions

In conclusion, this study found that patients with pericarditis and myopericarditis were predominantly young adults, with females in the pericarditis group and males in the myopericarditis group. Inflammatory status has been shown to be closely related to and predictive of myocardial involvement, as demonstrated by the increased inflammatory ratios and indices. The NLR, dNLR, and SIRI scores could be potential biomarkers for predicting and differentiating myopericarditis. We suggest screening patients for these inflammatory scores to improve the treatment outcomes for pericarditis and myopericarditis. However, our findings require validation through prospective studies involving larger and more diverse patient populations.

Ethical Committee Approval: This research complies with all the relevant national regulations and institutional policies, is in accordance with the tenets of the Helsinki Declaration, and has been approved by the Sağlık Bilimleri Üniversitesi Tıp Fakültesi Konya Şehir Hastanesi Ethical Committee on March 10, 2025 (Approval Number: 2025/41).

Informed Consent: This study adhered to the principles of the Declaration of Helsinki. All participants' rights were protected, and the requirement for written informed consent was waived because of the retrospective nature of the study.

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