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# Unifying Inflammatory and Lipid Pathways: Prognostic Relevance of CRP/HDL-C Ratio in Acute Ischemic Stroke After Mechanical Thrombectomy

## Enflamatuar ve Lipid Yolaklarının Birleştirilmesi: Mekanik Trombektomi Sonrası Akut İskemik İnmede CRP/HDL-C Oranının Prognostik Önemi

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**ABSTRACT**

**Background:** To investigate the prognostic value of the C-reactive protein to high-density lipoprotein cholesterol (CRP/HDL-C) ratio, a composite marker reflecting both inflammation and lipid metabolism, in acute ischemic stroke (AIS) patients treated with mechanical thrombectomy (MT).

**Methods:** In this retrospective study, 206 consecutive AIS patients with large vessel occlusion who underwent MT between February 2023 and June 2025 were analyzed. Data including demographic, clinical, imaging, procedural, and laboratory parameters were obtained from medical records. Functional outcome was assessed at 90 days using the modified Rankin Scale (mRS), with mRS >2 defined as poor outcome. Univariate comparisons were made, and independent predictors were identified through multivariate logistic regression analysis.

**Results:** The study population comprised 104 (50.5%) patients with good outcome (mRS ≤2) and 102 (49.5%) with poor outcome (mRS >2). The poor outcome group had significantly higher age, baseline NIHSS scores, longer puncture-to-recanalization times, lower ASPECTS, lower rates of successful recanalization (TICI 3), and required a higher number of passes. Laboratory analysis revealed that the poor outcome group had significantly elevated CRP levels (P=.02) and CRP/HDL-C ratios (P=.001). Multivariate analysis identified low ASPECTS (OR=0.26, 95% CI 0.09–0.72, P=.01) and high CRP/HDL-C ratio (OR=2.05, 95% CI 1.11–3.77, P=.02) as independent predictors of poor outcome.

**Conclusion:** The CRP/HDL-C ratio is an independent predictor of 90-day functional outcome in AIS patients following MT. This simple and readily available biomarker may serve as a useful tool for risk stratification and clinical management.

**Keywords:** Ischemic stroke, thrombectomy, c-reactive protein, high-density lipoprotein cholesterol

**ÖZ**

**Amaç:** Bu çalışmada, mekanik trombektomi (MT) uygulanan akut iskemik inme (Aİİ) hastalarında inflamasyon ve lipit metabolizmasını birlikte yansıtan C-reaktif protein / yüksek yoğunluklu lipoprotein kolesterol (CRP/HDL-C) oranının prognostik değerinin araştırılması amaçlanmıştır.

**Yöntemler:** Şubat 2023 – Haziran 2025 tarihleri arasında büyük damar tıkanıklığı nedeniyle MT uygulanan 206 ardışık Aİİ hastası retrospektif olarak incelendi. Demografik, klinik, görüntüleme, işlemsel ve laboratuvar verileri hasta kayıtlarından elde edildi. Fonksiyonel sonuç, 90. günde modifiye Rankin Skalası (mRS) ile değerlendirildi ve mRS >2 kötü prognoz olarak tanımlandı. Gruplar arası karşılaştırmalar yapıldı ve bağımsız prognostik faktörler çok değişkenli lojistik regresyon analizi ile belirlendi.

**Bulgular:** Hastaların 104'ü (%50.5) iyi prognoz (mRS ≤2), 102'si (%49.5) ise kötü prognoz (mRS >2) grubundaydı. Kötü prognoz grubu, daha ileri yaş, daha yüksek başlangıç NIHSS skoru, daha düşük ASPECT skoru, daha uzun ponksiyon-rekanalizasyon süresi, daha düşük tam rekanalizasyon (TICI 3) oranı ve daha yüksek pas sayısına sahipti. Laboratuvar bulgularında ise kötü prognoz grubunda CRP düzeyi (P=.02) ve CRP/HDL-C oranı (P=.001) anlamlı olarak daha yüksekti. Çok değişkenli analizde, düşük ASPECT skoru (OR=0.26, %95 GA 0.09–0.72, P=.01) ve yüksek CRP/HDL-C oranı (OR=2.05, %95 GA 1.11–3.77, P=.02) bağımsız kötü prognoz belirteçleri olarak saptandı.

**Sonuç:** CRP/HDL-C oranı, MT uygulanan hastalarda 90. gün fonksiyonel sonucun bağımsız bir belirleyicisidir. Bu bulgu, basit ve erişilebilir bu biyobelirtecin, risk sınıflandırması ve hasta yönetiminde yararlı bir araç olabileceğini düşündürmektedir.

**Anahtar Kelimeler:** İskemik inme, trombektomi, c-reaktif protein, yüksek dansiteli lipoprotein kolesterol

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## INTRODUCTION

Acute ischemic stroke (AIS) is a leading cause of disability and mortality worldwide, accounting for approximately 80% of all strokes and primarily caused by arterial thrombosis or embolism.[1] A significant proportion of AIS cases involve large vessel occlusions (LVO), which are associated with more severe neurological deficits, higher early mortality, and increased long-term functional dependency.[2] Since 2015, randomized controlled trials have established mechanical thrombectomy (MT) as the standard of care for AIS-LVO, demonstrating its efficacy in achieving reperfusion and improving functional outcomes.[3] Despite high rates of successful recanalization, approximately half of the patients still experience poor long-term functional outcomes.[4] Therefore, identifying reliable prognostic biomarkers is crucial for refining risk stratification and optimizing treatment strategies.

Inflammation and lipid metabolism are intricately linked and play a fundamental role in the pathophysiology of stroke.[5,6] Systemic inflammation significantly contributes to stroke risk by promoting atherosclerosis, endothelial dysfunction, and thrombogenesis.[7,8] C-reactive protein (CRP), a key acute-phase reactant, has emerged as a prominent biomarker due to its association with both stroke risk and post-stroke outcomes, as well as its clinical accessibility.[9,10] Conversely, high-density lipoprotein cholesterol (HDL-C) plays a vital role in maintaining vascular homeostasis through reverse cholesterol transport and by exerting anti-inflammatory, antioxidant, and antithrombotic effects.[11,12] Low levels of HDL-C have been consistently associated with an increased risk of stroke.[13,14]

The dynamic interplay between these two pathways has spurred interest in composite biomarkers that may offer a more comprehensive risk assessment than either parameter alone. The CRP/HDL-C ratio serves as a practical tool to evaluate this interaction, integrating low-grade systemic inflammation and lipid imbalance into a single metric.[15] Its advantages include ease of measurement, low cost, and high standardization, enhancing its clinical applicability. Indeed, the CRP/HDL-C ratio has been shown to be significantly associated with the risk of cardiovascular diseases and ischemic stroke.[16] However, the prognostic value of this composite marker for predicting 90-day functional outcomes in AIS patients specifically treated with mechanical thrombectomy remains insufficiently investigated.

### MAIN POINTS

- The CRP/HDL-C ratio is an independent predictor of poor functional outcome at 90 days after mechanical thrombectomy.
- Low baseline ASPECTS is associated with poor clinical prognosis.
- The CRP/HDL-C ratio showed a stronger association with poor outcome than CRP or HDL-C alone in the study cohort.

The primary aim of this retrospective study was to investigate whether the CRP/HDL-C ratio independently predicts poor 90-day functional outcome (mRS>2) in AIS patients undergoing MT. We hypothesize that this readily available biomarker will aid in early risk stratification, facilitate individualized treatment approaches, and improve post-procedural management strategies.

## MATERIAL AND METHODS

### Study Design and Patient Selection

This single-center, retrospective, observational cohort study included consecutive patients with AIS who underwent MT for LVO between February 2023 and June 2025. All patients were evaluated at a comprehensive stroke center by an experienced stroke team in accordance with current national and international guidelines. Inclusion criteria were: (i) age ≥18 years, (ii) presence of LVO, (iii) MT performed within 24 hours of symptom onset, and (iv) availability of complete clinical and laboratory data. The exclusion criterion was incomplete follow-up data after MT.

### Clinical and Imaging Data Collection

Demographic data, medical history (hypertension, diabetes mellitus, atrial fibrillation, coronary artery disease, hyperlipidemia, smoking, alcohol use, and previous stroke), baseline clinical parameters (National Institutes of Health Stroke Scale [NIHSS], Alberta Stroke Program Early CT Score [ASPECTS]), and procedural variables (symptom-to-puncture time, puncture-to-recanalization time, thrombectomy technique, number of passes, and Thrombolysis in Cerebral Infarction [TICI] score) were retrospectively obtained from electronic medical records. ASPECTS was calculated using standard methodology, and recanalization success was graded according to the TICI scale.

### Laboratory Measurements

Routine biochemical and hematological parameters were assessed in all patients, including glucose, urea, creatinine, liver function tests (aspartate aminotransferase [AST], alanine aminotransferase [ALT]), total bilirubin, serum albumin, total cholesterol, low-density lipoprotein cholesterol (LDL-C), HDL-C, hemoglobin, hematocrit, activated partial thromboplastin time (aPTT), international normalized ratio (INR), and CRP levels. A composite marker reflecting the interplay between inflammation and lipid metabolism was calculated as the CRP/HDL-C ratio. All laboratory analyses were performed in an accredited biochemistry laboratory using validated autoanalyzers in compliance with international quality standards.

### Outcome Measures

The primary outcome was poor functional outcome, defined as a modified Rankin Scale (mRS) score >2 at 90 days. Functional assessments were conducted by stroke neurologists through in-person evaluation or structured telephone interviews.

### Statistical Analysis

All analyses were performed using IBM SPSS Statistics software version 26.0; (IBM Corp., Armonk, NY, USA). The Shapiro–Wilk test was applied to assess the normality of continuous variables. Normally distributed data were expressed as mean ± standard deviation, and non-normally distributed data as median (minimum–maximum). Categorical variables were presented as counts and percentages.

Between-group comparisons were made using the independent samples t-test for parametric data, the Mann–Whitney U test for nonparametric data, and the chi-square or Fisher's exact test for categorical variables. Variables that were statistically significant in univariate analyses were entered into a multivariable logistic regression model to identify independent predictors of poor outcome. A two-tailed P value <.05 was considered statistically significant.

## RESULTS

As summarized in Table 1, a total of 206 patients were evaluated; 104 were classified into the good outcome group and 102 into the poor outcome group. At 3-month follow-up, patients with good outcomes were significantly younger than those with poor outcomes (72 [37–91] vs. 79 [40–101] years, P=.001). Although the proportion of females was higher in the poor outcome group (66.7% vs. 51.9%), the difference was not statistically significant (P=.16). There were no significant intergroup differences regarding medical history variables such as hypertension, diabetes mellitus, atrial fibrillation, coronary artery disease, heart failure, hyperlipidemia, malignancy, previous stroke, alcohol, or smoking status (all P>.05). Regarding clinical parameters, baseline NIHSS scores were higher (18 [8–38] vs. 14 [6–35], P=.001), and ASPECTS were lower (7 [6–10] vs. 10 [6–10], P=.001) in the poor outcome group. For procedural variables, puncture-to-recanalization time was significantly longer in the poor outcome group (50 [15–260] vs. 30 [15–140] minutes, P=.001). The rate of complete recanalization (TICI 3) was lower (33.3% vs. 65.4%), while partial recanalization (TICI 2b–2c) was more frequent in this group (P=.002). Similarly, the number of thrombectomy passes was significantly higher in the poor outcome group (2 [1–8] vs. 1 [1–4], P=.001). There was no significant difference in the distribution of occlusion sites between the groups (P=.12); however, middle cerebral artery (MCA) M2 occlusions were more frequent in the good outcome group (21.2% vs. 7.8%), while internal carotid artery (ICA) T/L occlusions predominated in the poor outcome group (23.5% vs. 9.6%). The rate of intravenous thrombolysis (IV tPA) administration was higher in the good outcome group (23.1% vs. 11.8%), but the difference did not reach statistical significance (P=.19).

As presented in Table 2, serum glucose (P=.04) and urea (P=.001) levels were significantly higher in the poor outcome group. Hemoglobin levels showed a trend toward lower values (P=.057), whereas hematocrit levels were significantly reduced (P=.03). No significant differences were observed between groups for other routine biochemical parameters, including creatinine, liver function tests, bilirubin, coagulation parameters, total cholesterol, and LDL-C (all P>.05). Although HDL-C levels were lower in the poor outcome group, this difference was not statistically significant (P=.12). In contrast, CRP levels (P=.02) and particularly the CRP/HDL-C ratio (P=.001) were significantly associated with poor outcome.

As shown in Table 3, multivariable logistic regression analysis revealed that higher ASPECTS (odds ratio [OR]= 0.26, 95% confidence interval [CI]: 0.09–0.72, P=.01) was an independent protective factor against poor outcome. In contrast, age, baseline NIHSS score, procedure time, TICI grade, number of passes, glucose, urea, and hematocrit were not identified as independent predictors (all P>.05). Most notably, an elevated CRP/HDL-C ratio independently and significantly predicted poor functional outcome (OR=2.05, 95% CI 1.11–3.77, P=.02)

**Table 1.** Baseline demographic, clinical, and procedural characteristics of patients with good and poor 90-day outcomes

| Variable | Good Outcome (N=104) | Poor Outcome (N=102) | P value |
|---|---|---|---|
| Age | 72 (37–91) | 79 (40–101) | .001 |
| **Gender, n (%)** | | | |
| Female | 54 (51.9%) | 68 (66.7%) | .16 |
| Male | 50 (48.1%) | 34 (33.3%) | |
| **Medical history, n (%)** | | | |
| Hypertension | 86 (82.7%) | 82 (80.4%) | .96 |
| Diabetes mellitus | 30 (28.8%) | 42 (41.2%) | .26 |
| Coronary artery disease | 50 (48.1%) | 52 (51.0%) | .92 |
| Heart failure | 24 (23.1%) | 28 (27.5%) | .56 |
| Atrial fibrillation | 58 (55.8%) | 68 (66.7%) | .42 |
| Hyperlipidemia | 42 (40.4%) | 36 (35.3%) | .70 |
| Malignancy | 4 (3.8%) | 4 (3.9%) | .90 |
| Previous Stroke | 16 (15.4%) | 26 (25.5%) | .28 |
| Alcohol use | 6 (5.8%) | 8 (7.8%) | .97 |
| Smoking | 34 (32.7%) | 30 (29.4%) | .88 |
| **Clinical Features** | | | |
| NIHSS | 14 (6–35) | 18 (8–38) | .001 |
| ASPECTS | 9 (6–10) | 7 (6–10) | .001 |
| Dense MCA sign, n (%) | 46 (44.2%) | 52 (51.0%) | .55 |
| IV Tpa given, n (%) | 24 (23.1%) | 12 (11.8%) | .19 |
| Symptom-to-Puncture time (min) | 247.9 ± 109.3 | 283.8 ± 125.9 | .22 |
| Puncture-to-Recanalization time (min) | 30 (15–140) | 50 (15–260) | .001 |
| **Stroke Subtype, n (%)** | | | |
| Cardioembolism | 58 (55.8%) | 56 (54.9%) | .67 |
| Large artery atherosclerosis | 22 (21.2%) | 28 (27.5%) | |
| Other | 24 (23.1%) | 18 (17.6%) | |
| **Vascular occlusion site, n (%)** | | | |
| MCA M1 | 46 (44.2%) | 50 (49.0%) | .12 |
| MCA M2 | 22 (21.2%) | 8 (7.8%) | |
| ICA terminus | 10 (9.6%) | 24 (23.5%) | |
| Basilar artery | 14 (13.5%) | 10 (9.8%) | |
| Tandem lesion | 12 (11.5%) | 10 (9.8%) | |
| TICI Score, n (%) | | | |
| 2b | 10 (9.6%) | 34 (33.3%) | .002 |
| 2c | 26 (25.0%) | 34 (33.3%) | |
| 3 | 68 (65.4%) | 34 (33.3%) | |
| **Thrombectomy Technique, n (%)** | | | |
| Solumbra | 82 (78.8%) | 86 (84.3%) | .67 |
| Adapt | 8 (7.7%) | 4 (3.9%) | |
| Solumbra+Adapt | 14 (13.5%) | 12 (11.8%) | |
| Number of Passes | 1 (1–4) | 2 (1–8) | .001 |

**Abbreviations:** NIHSS, National Institutes of Health Stroke Scale; ASPECTS, Alberta Stroke Program Early CT Score; MCA, Middle cerebral artery; IV tPA, intravenous tissue plasminogen activator; TICI, Thrombolysis in Cerebral Infarction; ICA, Internal carotid artery.

Continuous variables are presented as median (min–max) for non-normally distributed data and as mean±standard deviation (SD) for normally distributed data. Categorical variables are expressed as number (percentage, %). Group comparisons were performed using the Mann–Whitney U test or independent samples t-test for continuous variables, and the Chi-square test for categorical variables. A P value <.05 was considered statistically significant.

**Table 2.** Comparison of laboratory parameters between patients with good and poor outcomes at 90 days

| Variable | Good Outcome (N=104) | Poor Outcome (N=102) | P value |
|---|---|---|---|
| Glucose (mg/dL) | 127.0 (71.0–323.0) | 153.0 (94.0–517.0) | .04 |
| Urea (mg/dL) | 35.0 (13.0–113.0) | 48.0 (19.0–228.0) | .001 |
| Creatinine (mg/dL) | 0.8 (0.5–7.7) | 0.8 (0.4–2.8) | .53 |
| AST (U/L) | 21.0 (11.0–57.0) | 23.0 (8.0–94.0) | .56 |
| ALT (U/L) | 15.0 (6.0–69.0) | 15.0 (4.0–88.0) | .65 |
| Total Bilirubin (mg/dL) | 0.7 (0.2–1.8) | 0.7 (0.2–2.7) | .69 |
| Serum Albumin (g/L) | 37.5 (24.0–45.0) | 36.0 (18.0–45.0) | .11 |
| aPTT (s) | 27.5 (18.8–47.1) | 28.2 (18.4–297.0) | .88 |
| INR | 1.1 (0.9–3.4) | 1.2 (1.0–2.6) | .19 |
| Total Cholesterol (mg/dL) | 170.58 ± 35.60 | 159.96 ± 38.09 | .14 |
| LDL Cholesterol (mg/dL) | 108.12 ± 30.02 | 98.22 ± 31.36 | .10 |
| Lymphocytes ($\times 10^9$/L) | 1.6 (0.5–11.6) | 1.3 (0.2–5.8) | .13 |
| Hemoglobin (g/dL) | 13.8 (7.5–17.9) | 13.0 (6.7–16.2) | .057 |
| Hematocrit (%) | 41.8 (26.8–47.4) | 39.6 (20.3–49.3) | .03 |
| HDL Cholesterol (mg/dL) | 44.0 (30.0–62.0) | 39.0 (26.0–58.0) | .12 |
| CRP (mg/L) | 7.2 (2.1–24.0) | 13.6 (4.0–42.0) | .02 |
| CRP/HDL-C ratio | 0.14 (0.04–0.48) | 0.42 (0.15–1.10) | .001 |

**Abbreviations:** CRP, C-reactive protein; HDL, high-density lipoprotein; LDL, low-density lipoprotein; AST, aspartate aminotransferase; ALT, alanine aminotransferase; aPTT, activated partial thromboplastin time; INR, international normalized ratio.

Continuous variables are presented as median (min–max) for non-normally distributed data and as mean±SD for normally distributed data. Comparisons between groups were performed using the Mann–Whitney U test or independent samples t-test for continuous variables and the Chi-square test for categorical variables. A P value <.05 was considered statistically significant.

**Table 3.** Multivariate logistic regression analysis of factors associated with poor outcome at 90 days

| Variable | OR (95% CI) | P value |
|---|---|---|
| Age | 1.22 (0.89–1.69) | .21 |
| NIHSS | 1.31 (0.90–1.93) | .15 |
| ASPECTS | 0.26 (0.09–0.72) | .01 |
| Puncture-to-Recanalization time (min) | 0.88 (0.60–1.29) | .50 |
| TICI Score | 0.64 (0.24–1.73) | .38 |
| Number of Passes | 0.83 (0.57–1.22) | .34 |
| Glucose (mg/dL) | 1.29 (0.93–1.78) | .12 |
| Urea (mg/dL) | 1.15 (0.84–1.58) | .38 |
| Hematocrit (%) | 0.78 (0.48–1.27) | .32 |
| CRP/HDL-C ratio | 2.05 (1.11–3.77) | .02 |

**Abbreviations:** NIHSS, National Institutes of Health Stroke Scale; ASPECTS, Alberta Stroke Program Early CT Score; TICI, Thrombolysis in Cerebral Infarction; CRP, C-reactive protein; HDL, high-density lipoprotein.

Multivariate logistic regression analysis was performed including clinically relevant variables and those with P<.10 in univariate analyses. Continuous variables were standardized per 1-SD increase. A P value <.05 was considered statistically significant.

## DISCUSSION

This study demonstrated that the CRP/HDL-C ratio, a composite marker reflecting both inflammatory response and lipid metabolism, is an independent predictor of 90-day functional outcomes in patients with acute ischemic stroke treated with mechanical thrombectomy. Our findings revealed that while CRP levels were significantly higher and HDL-C levels were lower in the poor outcome group, the difference in HDL-C alone did not reach statistical significance. In contrast, the CRP/HDL-C ratio showed a strong association with poor functional outcome. Additionally, low ASPECTS was identified as an independent indicator of poor functional outcome. These data suggest that the interaction between inflammation and lipid metabolism may play a significant role in clinical recovery following mechanical thrombectomy.

The pivotal role of systemic inflammation in the pathophysiology of acute ischemic stroke and its impact on treatment response has long been recognized. Elevated CRP levels are associated not only with stroke development but also with early neurological deterioration, larger infarct volumes, and unfavorable functional outcomes.[17,18] CRP promotes microcirculatory impairment by inducing endothelial dysfunction, enhances procoagulant activity, and amplifies the post-reperfusion inflammatory response.[19] Specifically, in patients treated with MT, high CRP levels have been reported to correlate with lower rates of successful recanalization, a higher incidence of symptomatic intracranial hemorrhage, and poor functional outcomes.[20,21] These findings indicate that inflammatory burden holds prognostic value not only in stroke occurrence but also in the recovery process after MT. Conversely, HDL-C plays a critical role in maintaining

neurovascular integrity through its antioxidant, anti-inflammatory, and antithrombotic properties.[22,23] HDL-C facilitates vasodilation by supporting endothelial nitric oxide synthesis and limits oxidative stress–induced vascular injury. Recent studies have reported that low HDL-C levels are associated with increased mortality, larger infarct volume, and poor functional recovery in MT patients, potentially due to impaired anti-inflammatory capacity.[24,25] The CRP/HDL-C ratio, which simultaneously assesses the interaction between these two biological pathways, provides a more comprehensive systemic risk indicator by integrating inflammatory activity and lipid imbalance. Previous clinical studies have shown this ratio to be strongly associated with cardiovascular events and ischemic stroke.[16,26] Furthermore, several reports have indicated that higher CRP/HDL-C ratios are significantly correlated with poor functional recovery in AIS patients.[27,28] The present study extends these findings to the MT population, placing this study among the first to demonstrate that a high CRP/HDL-C ratio independently predicts poor outcome after MT. These results support the notion that combined assessment of inflammation and lipid metabolism may provide additional prognostic value in early post-thrombectomy risk stratification.

The relationship between elevated CRP/HDL-C ratio and poor functional outcome can be explained by the pathophysiological interaction between inflammatory response and lipid metabolism. Systemic inflammation in AIS disrupts vascular endothelial integrity, reduces nitric oxide synthesis, increases endothelial adhesion molecule expression, and ultimately leads to microcirculatory impairment. This process underlies the no-reflow phenomenon and reperfusion injury frequently observed after MT.[29,30] CRP stimulates monocyte and neutrophil activation, increases proinflammatory cytokine release, and accelerates neuronal apoptosis via oxidative stress.[31] In contrast, HDL-C under normal conditions reduces lipid peroxidation through antioxidant enzymes, maintains nitric oxide bioavailability, and inhibits inflammatory cell adhesion.[32] However, the intensified inflammatory state alters HDL-C composition, rendering it dysfunctional and diminishing its antioxidant and anti-inflammatory properties.[33] This dual deterioration—increased inflammatory burden and HDL-C dysfunction—may lead to inadequate microvascular reperfusion and limited neuronal recovery after thrombectomy. Therefore, the CRP/HDL-C ratio can be regarded as a composite biochemical indicator that reflects both the degree of inflammation and the biochemical manifestation of HDL-C dysfunction. These mechanisms provide biological plausibility for the association between elevated CRP/HDL-C ratio and poor prognosis observed in our study.

A major strength of this study is that it is among the first to investigate the prognostic value of the CRP/HDL-C ratio, a marker integrating inflammation and lipid metabolism, in AIS patients treated with MT. The study was conducted in a homogeneous cohort with a substantial patient population, and clinical, imaging, procedural, and laboratory data were comprehensively evaluated. Laboratory analyses were performed according to standardized protocols, ensuring data reliability. Furthermore, multivariable logistic regression analysis demonstrated the independent effect of the CRP/HDL-C ratio, apart from established prognostic factors such as age, NIHSS, ASPECTS, and TICI. In this regard, the study provides a novel contribution by highlighting the impact of the inflammation–lipid interaction on post-stroke functional recovery. Although other inflammatory or composite biomarkers such as the CRP/albumin ratio, neutrophil/platelet ratio, and neutrophil/lymphocyte ratio have been previously reported to predict outcomes in ischemic stroke, these parameters mainly reflect systemic inflammation and do not account for the lipid-mediated protective mechanisms involved in endothelial recovery.[34,35] The CRP/HDL-C ratio, in contrast, provides a more integrated reflection of both inflammatory activation and lipid dysfunction, thereby encompassing two complementary biological pathways relevant to post-thrombectomy recovery. Nevertheless, the lack of comparison with other biochemical ratios represents a limitation of our study, and future research directly comparing multiple inflammation- and lipid-based indices would further clarify their relative predictive utility.

However, several limitations should be acknowledged. First, the single-center, retrospective design carries a potential risk of selection bias. Laboratory parameters were measured only at admission, which does not reflect temporal changes in inflammatory response. Moreover, CRP and HDL-C levels can be influenced by acute systemic conditions such as infection, medication use, or chronic diseases; therefore, their potential confounding effects cannot be completely excluded. The relatively limited sample size may have also restricted statistical power. Hence, prospective multicenter studies with larger cohorts are warranted. In clinical practice, an elevated CRP/HDL-C ratio may serve as an easily obtainable biomarker for early risk stratification after mechanical thrombectomy. Patients with higher ratios may benefit from closer post-procedural monitoring and more intensive secondary prevention strategies, particularly targeting inflammation and lipid dysregulation. Future research should assess serial measurements of the CRP/HDL-C ratio to confirm its prognostic validity and to establish optimal cutoff values for clinical application.

## CONCLUSION

This study demonstrated that the CRP/HDL-C ratio is an independent prognostic marker of 90-day functional outcomes in patients with acute ischemic stroke treated with mechanical thrombectomy. Owing to its simplicity, low cost, and wide accessibility, this composite biomarker represents a promising tool for risk stratification in routine clinical practice. However, large-scale, prospective, multicenter studies are warranted to validate these findings and to determine optimal cutoff values for clinical implementation.

**Ethics Committee Approval:** The study was approved by the Non-Interventional Clinical Research Ethics Committee of Diyarbakır Gazi Yaşargil Training and Research Hospital (Date: July 25, 2025; Decision No: 580). The study was conducted in accordance with the principles of the Declaration of Helsinki.

**Informed Consent:** Written informed consent was not obtained from the patients due to the retrospective nature of the study.

**Authorship Contributions:** Concept – F.K.; Design – F.K.; Supervision – R.Y., Ö.Z.E.; Resources – F.K., R.Y.; Materials – F.K., R.Y., Ö.Z.E.; Data Collection and/or Processing – F.K., R.Y., Ö.Z.E.; Analysis and/or Interpretation – F.K., R.Y., Ö.Z.E.; Literature Search – F.K.; Writing Manuscript – F.K.; Critical Review – R.Y., Ö.Z.E.; Other – F.K., R.Y., Ö.Z.E.

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