Article

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Correlation Between Low-Density Lipoprotein Cholesterol/High-Density Lipoprotein Cholesterol Ratio and Complete Blood Count and Coagulation Parameters, and Their Relationship With Severity and Prognosis of Early-Onset Coronary Artery Disease

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Background: This study aims to investigate the correlation between the low-density lipoprotein cholesterol (LDL-C)/high-density lipoprotein cholesterol (HDL-C) ratio, in combination with complete blood count and coagulation panel parameters, and both the severity of coronary artery lesions and prognosis in patients with early-onset coronary heart disease, and to provide novel, comprehensive clinical indicators for risk assessment and prognosis evaluation in this patient population.

Methods: A retrospective study was conducted on the clinical data of 159 patients diagnosed with early-onset coronary heart disease through initial coronary angiography between January 2023 and August 2025. Patients were categorized into three groups based on coronary lesion severity: a mild lesion group (n = 78), a moderate disease group (n = 59), and a severe disease group (n = 22). Lipid profiles [total cholesterol (TC), triglycerides (TG), LDL-C, HDL-C, LDL-C/HDL-C ratio], fasting blood glucose, uric acid, and coagulation parameters [prothrombin time (PT), prothrombin time ratio (PTR), activated partial thromboplastin time (APTT), thrombin time (TT), fibrinogen (FIB)], complete blood count [hemoglobin (HGB), red cell distribution width-coefficient of variation (RDW-CV), red cell distribution width-standard deviation (RDW-SD), mean platelet volume (MPV), platelet distribution width (PDW)] were detected, and the correlation between statistically significant indicators and the severity of coronary artery lesions was analyzed. Participants were divided into the MACE group and the non-MACE group based on the occurrence of major adverse cardiac events (MACE) within 100 days, and binary logistic regression analysis was applied to identify MACE risk factors.

Results: The severe group showed higher TC, LDL-C, LDL-C/HDL-C, fasting blood glucose, and uric acid levels than the moderate group, which in turn had higher levels than the mild group; TG was higher than in the moderate/mild groups; HDL-C was lower than in the moderate group but higher than in the mild group ($p < 0.05$). The severe group had higher PT, PTR, APTT, TT, and FIB than the moderate group, which in turn was higher than the mild group ($p < 0.05$). There were no statistically significant differences in HGB levels among the groups ($p > 0.05$); however, the severe group had higher RDW-CV, RDW-SD, MPV, and PDW than the moderate group, and the mild group had the lowest ($p < 0.05$). Kendall's correlation coefficients indicated that TC, TG, LDL-C, LDL-C/HDL-C, fasting blood glucose, uric acid, PT, PTR, APTT, TT, FIB, RDW-CV, RDW-SD, MPV, and PDW were positively correlated with the severity of coronary artery lesions (τ = 0.375, 0.372, 0.346, 0.448, 0.305, 0.239, 0.388, 0.310, 0.299, 0.447, 0.364, 0.476, 0.226, 0.401, 0.466, $p < 0.001$), HDL-C was negatively correlated with the severity of coronary artery lesions (τ = –0.410, $p < 0.001$). The incidence of MACE was highest in patients with severe early-onset coronary heart disease, followed by moderate and mild severity (χ^2 = 23.283, $p < 0.001$). Binary logistic regression analysis revealed that severity of coronary artery disease (severe), LDL-C/HDL-C ratio, fasting blood glucose, uric acid, PT, APTT, TT, FIB, RDW-SD, and PDW were all independent predictors of MACE in patients with early-onset coronary heart disease ($p < 0.05$).

Conclusion: In patients with early-onset coronary heart disease, LDL-C/HDL-C ratio, coagulation function indicators (PT, APTT, TT, FIB), and blood routine parameters (RDW-SD, PDW) show significant positive correlations with the anatomical severity of coronary artery lesions and are closely associated with increased short-term adverse prognosis risk.

Keywords: coronary heart disease; early onset; low-density lipoprotein cholesterol/high-density lipoprotein cholesterol ratio; coagulation function; complete blood count; severity of coronary artery disease; major adverse cardiac events

Introduction

Early-onset coronary heart disease refers to coronary atherosclerotic heart disease diagnosed in men ≤55 years of age and women ≤65 years of age [1]. Compared with late-onset coronary heart disease, patients with early-onset coronary heart disease have a stronger genetic background, more active metabolic disorders, and a rapid progression of coronary artery lesions. The risk of major adverse cardiac events (MACE) is significantly increased, which imposes a heavy burden on individuals, families and society [2,3]. Therefore, it is crucial to explore biomarkers that can accurately assess the severity and poor prognosis of early-onset coronary artery lesions for early and precise intervention and to improve the clinical outcomes of patients. The ratio of low-density lipoprotein cholesterol (LDL-C) to high-density lipoprotein cholesterol (HDL-C) is an indicator that comprehensively reflects the pattern of dyslipidemia. It is superior to single lipid components in predicting the risk of atherosclerosis. It can simultaneously quantify atherosclerotic and protective factors, and more sensitively reflect the overall state of lipid metabolism disorder and net damage to blood vessels [4]. Blood routine indicators can reflect various physiological and pathological states of the body, such as inflammation and immunity, and are closely related to the occurrence and development of diseases [5]. Moreover, recent research has confirmed that the occurrence and development of coronary heart disease is the result of the combined action of multiple pathophysiological mechanisms such as chronic inflammation, endothelial dysfunction, hypercoagulable state and enhanced platelet activity. Among them, coagulation function plays a core role in coronary thrombotic events [6]. However, no studies have yet combined the LDL-C/HDL-C ratio, complete blood count, and coagulation function indicators to explore their relationship with the anatomical severity of coronary artery lesions and short-term clinical prognosis in patients with early-onset coronary artery disease. This retrospective study aims to evaluate the value of the combined application of these indicators, providing a reference for risk assessment and stratified management of high-risk groups for early-onset coronary artery disease.

Methods

General Information

A retrospective study was conducted on the clinical data of 159 patients who were first diagnosed with early-onset coronary heart disease by coronary angiography from January 2023 to August 2025. The patients aged from 31 to 65 years, with an average age of (52.86 ± 7.32) years, consisted of 73 males and 86 females. Inclusion criteria: ① Coronary angiography showed that at least one major epicardial coronary artery (including the left main coronary artery, left anterior descending artery, circumflex artery or right coronary artery) had a luminal diameter stenosis of ≥50% [7]; ② The age met the definition of early-onset coronary heart disease: males ≤55 years and females ≤65 years; ③ The clinical data and follow-up data were complete. Exclusion criteria: ① Patients with a history of coronary intervention or coronary artery bypass grafting; ② Patients presenting for non-coronary artery disease reasons such as severe valvular heart disease, cardiomyopathy, or congenital heart disease; ③ Patients with end-stage organ failure or severe chronic diseases that may significantly affect the study indicators: [Severe renal insufficiency: estimated glomerular filtration rate <30 mL/min/1.73 m^2 (chronic kidney disease stage 4–5), or currently receiving maintenance renal replacement therapy; severe hepatic insufficiency: diagnosed with cirrhosis (Child-Pugh B or C), or serum albumin <28 g/L and total bilirubin >51 μmol/L (twice the upper limit), or a history of hepatic encephalopathy or portal hypertension bleeding; other severe chronic liver diseases: such as decompensated cirrhosis, primary biliary cholangitis, primary sclerosing cholangitis, active autoimmune hepatitis, hereditary hemochromatosis, Wilson's disease]; ④ Patients with active infections or hematological disorders; ⑤ Patients with malignant tumors or autoimmune diseases; ⑥ Patients who have recently (<3 months) experienced major trauma, surgery, or bleeding events. Patients were divided into three groups based on the severity of coronary artery lesions: mild lesion group (n = 78), moderate lesion group (n = 59), and severe lesion group (n = 22). This study protocol has been approved by the ethics committee (Ethical batch number: 20250926).

Research Methods

(1) Severity of coronary artery disease [8]: ① Mild disease group: Single vessel disease: Only one of the left anterior descending artery, circumflex artery or right coronary artery has a lesion with a diameter stenosis ≥50%. Left main coronary artery disease is excluded. ② Moderate disease group: Involvement of two-vessel disease is defined as stenosis ≥50% in any two of the above three coronary arteries. Alternatively, single-vessel disease involving only the proximal segment of the left anterior descending artery is classified as moderate, since the left anterior descending artery supplies a large area, and severe lesions in its proximal segment are usually considered high-risk. ③ Severe disease group: Three-vessel disease is defined as diameter stenosis ≥50% in the left anterior descending artery, circumflex artery and right coronary artery. Left main coronary artery disease: A diameter ≥50% in the left main coronary artery, regardless of the presence of other vessel diseases, is directly classified as severe disease. All coronary angiography images and reports were independently reviewed and evaluated by two interventional cardiologists who were blind to the study and not involved in the clinical management. If there was a discrepancy between the two physicians' evaluation results, the final grouping was de-

Table 1. Comparison of blood lipid levels among groups.

Group	*n*	TC (mmol/L)	TG (mmol/L)	HDL-C (mmol/L)	LDL-C (mmol/L)	LDL-C/HDL-C ratio	Fasting blood glucose (mmol/L)	Uric acid (umol/L)
Mild group	78	4.50 (3.65, 4.91)	1.12 (0.84, 1.60)	1.26 (1.10, 1.53)	2.33 (2.02, 2.81)	1.83 (1.46, 2.29)	5.81 ± 1.82	268.18 ± 73.98
Moderate group	59	5.05 (4.15, 5.80) ^{a}	1.75 (1.32, 2.66) ^{a}	1.05 (0.95, 1.29) ^{a}	2.66 (2.32, 3.33) ^{a}	2.40 (1.89, 3.36) ^{a}	6.61 ± 1.61 ^{a}	301.85 ± 92.61 ^{a}
Severe group	22	5.62 (5.16, 6.76) ^{ab}	1.93 (1.39, 5.55) ^{a}	0.87 (0.79, 1.00) ^{ab}	3.53 (3.00, 4.14) ^{ab}	4.10 (3.15, 5.22) ^{ab}	7.62 ± 3.05 ^{ab}	368.30 ± 112.76 ^{ab}
Z/F value		37.313	34.698	42.507	34.408	51.538	8.096	11.645
p-value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Note: Compared with the mild group, ^{a} $p < 0.05$; compared with the moderate group, ^{b} $p < 0.05$. TC, total cholesterol; TG, triglycerides; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol.

Table 2. Comparison of coagulation parameters among groups.

Group	*n*	PT (S)	PTR (S)	APTT (S)	TT (S)	FIB (g/L)
Mild group	78	10.35 ± 0.52	0.92 ± 0.06	24.04 ± 2.44	17.40 ± 1.17	2.65 ± 0.64
Moderate group	59	10.86 ± 0.61 ^{a}	0.94 ± 0.07 ^{a}	25.59 ± 2.02 ^{a}	18.56 ± 1.99 ^{a}	3.13 ± 0.55 ^{a}
Severe group	22	11.25 ± 0.86 ^{ab}	0.98 ± 0.04 ^{ab}	28.07 ± 6.22 ^{ab}	19.73 ± 1.45 ^{ab}	3.63 ± 1.00 ^{ab}
F value		23.644	9.233	15.213	22.274	21.351
p-value		<0.001	<0.001	<0.001	<0.001	<0.001

Note: Compared with the mild group, ^{a} $p < 0.05$; compared with the moderate group, ^{b} $p < 0.05$. PT, prothrombin time; PTR, prothrombin time ratio; APTT, activated partial thromboplastin time; TT, thrombin time; FIB, fibrinogen.

termined by a third senior interventional physician through arbitration.

(2) Data Collection: Two researchers who received standardized training independently collected data, which mainly included the following dimensions: Demographic and Baseline Data: Gender, age, lipid indicators [total cholesterol (TC), triglycerides (TG), LDL-C, HDL-C, LDL-C/HDL-C ratio], fasting blood glucose (FBG), uric acid (UA), coagulation indicators [prothrombin time (PT), prothrombin time ratio (PTR), activated partial thromboplastin time (APTT), thrombin time (TT), fibrinogen (FIB)], complete blood count [hemoglobin (HGB), red cell distribution width - standard deviation (RDW-SD)] were retrieved from the electronic medical record system. red cell distribution width - coefficient of variation (RDW-CV), mean platelet volume (MPV), platelet distribution width (PDW), and the occurrence of MACE over 100 days were collected.

Statistical Analysis

SPSS 22.0 (IBM Corp., Armonk, NY, USA) was used for data analysis. Gender was expressed as (n, %) for count data, and a χ^2 test was performed. For continuous data, the Shapiro-Wilk test was used to assess the normality of the data; a p-value > 0.05 was considered a normal distribution, and the data were expressed as mean ± standard deviation ($\bar{x} \pm s$). Independent samples t-tests were used for comparisons between two groups, and one-way ANOVA was used for comparisons among multiple groups. If the ANOVA results are statistically significant, a Bonferroni correction is applied to perform post-hoc pairwise comparisons. For non-normally distributed continuous data, the median (interquartile range) [M(Q1, Q3)] was compared between two groups using the Mann-Whitney U test, and the Kruskal-Wallis H test was used for comparisons among multiple groups. Kendall correlation coefficients were used for correlation analysis. Binary logistic regression analysis was used to analyze influencing factors. A p-value < 0.05 was considered statistically significant.

Results

Comparison of Blood Lipid Indicators Among Groups

In the severe group, TC, LDL-C, LDL-C/HDL-C ratio, fasting blood glucose, and uric acid were higher than in the moderate group, which in turn were higher than in the mild group; TG was higher in the severe /moderate group than in the mild group; HDL-C was lower in the moderate group than in the mild group ($p < 0.05$). See Table 1.

Comparison of Coagulation Parameters Among Groups

The severe group showed the highest values in PT, PTR, APTT, TT, and FIB, followed by the moderate group, and the mild group had the lowest ($p < 0.05$). See Table 2.

Table 3. Comparison of blood routine indicators among groups.

Group	*n*	HGB (g/L)	RDW-CV (%)	RDW-SD (fL)	MPV (fL)	PDW (fL)
Mild group	78	137.54 ± 14.74	12.60 ± 0.59	39.34 ± 2.50	8.90 ± 1.10	15.96 ± 0.40
Moderate group	59	138.10 ± 15.86	13.01 ± 0.46 ^{a}	40.34 ± 2.49 ^{a}	9.65 ± 1.15 ^{a}	16.28 ± 0.37 ^{a}
Severe group	22	140.86 ± 16.82	13.80 ± 0.73 ^{ab}	41.90 ± 3.32 ^{ab}	10.91 ± 1.21 ^{ab}	16.59 ± 0.16 ^{ab}
F value		0.399	39.524	8.688	28.242	29.616
p-value		0.671	<0.001	<0.001	<0.001	<0.001

Note: Compared with the mild group, ^{a} $p < 0.05$; compared with the moderate group, ^{b} $p < 0.05$. HGB, hemoglobin; RDW-CV, red cell distribution width-coefficient of variation; RDW-SD, red cell distribution width-standard deviation; MPV, mean platelet volume; PDW, platelet distribution width.

Table 4. Correlation between blood lipid levels, coagulation parameters, routine blood tests, and the severity of coronary artery disease.

Kendall	τ	*p*
TC	0.375	<0.001
TG	0.372	<0.001
HDL-C	–0.410	<0.001
LDL-C	0.346	<0.001
LDL-C/HDL-C ratio	0.448	<0.001
Fasting blood glucose	0.305	<0.001
Uric acid	0.239	<0.001
PT	0.388	<0.001
PTR	0.310	<0.001
APTT	0.299	<0.001
TT	0.447	<0.001
FIB	0.364	<0.001
RDW-CV	0.476	<0.001
RDW-SD	0.226	<0.001
MPV	0.401	<0.001
PDW	0.466	<0.001

Comparison of Blood Routine Indicators Among Groups

There were no statistically significant differences in HGB indicator among the groups ($p > 0.05$); however, the severe group had the highest values in RDW-CV, RDW-SD, MPV, PDW, followed by the moderate group, and the mild group had the lowest ($p < 0.05$). See Table 3.

Correlation Analysis of Blood Lipid Levels, Coagulation Parameters, Routine Blood Tests and the Severity of Coronary Artery Disease

Kendall's correlation coefficient showed that TC, TG, LDL-C, LDL-C/HDL-C, fasting blood glucose, uric acid, PT, PTR, APTT, TT, FIB, RDW-CV, RDW-SD, MPV, and PDW were all positively correlated with the severity of coronary artery lesions (τ = 0.375, 0.372, 0.346, 0.448, 0.305, 0.239, 0.388, 0.310, 0.299, 0.447, 0.364, 0.476, 0.226, 0.401, 0.466, $p < 0.001$), while HDL-C was negatively correlated with the severity of coronary artery lesions (τ = –0.410, $p < 0.001$). See Table 4.

Analysis of the Incidence and Influencing Factors of MACE in Patients With Early-onset Coronary Heart Disease

The incidence of MACE was highest in patients with severe premature coronary heart disease (54.55%, 12/22), followed by those with moderate premature coronary heart disease, and lowest in those with mild premature coronary heart disease (8.97%, 7/78) ($\chi^2 = 23.283$, $p < 0.001$).

Univariate results showed no statistically significant differences in age, sex, or HGB between the two groups ($p > 0.05$). However, statistically significant differences were found in TC, TG, HDL-C, LDL-C, LDL-C/HDL-C ratio, fasting blood glucose, uric acid, PT, PTR, APTT, TT, FIB, RDW-CV, RDW-SD, MPV, and PDW between the two groups ($p < 0.001$). See Table 5.

Logistic Regression Analysis of Factors Influencing MACE Occurrence

Using "MACE occurrence" as the dependent variable (assignment: no = 0, yes = 1), and "TC (measured data, directly included), TG (measured data, directly included), HDL-C (measured data, directly included), LDL-C (measured data, directly included), LDL-C/HDL-C ratio (measured data, directly included), fasting blood glucose (measured data, directly included), uric acid (measured data, directly included), PT (measured data, directly included), PTR (measured data, directly included), APTT (measured data, directly included), TT (measured data, directly included), FIB (measured data, directly included), RDW-CV (measured data, directly included), RDW-SD (measured data, directly included), MPV (measured data, directly included), PDW (measured data, directly included)" as independent variables, a binary logistic regression analysis was conducted. Binary logistic regression analysis showed that the severity of coronary artery lesions (severe), LDL-C/HDL-C ratio, fasting blood glucose, uric acid, PT, APTT, TT, FIB, RDW-SD and PDW were the influencing factors of mace in patients with premature coronary heart disease ($p < 0.05$). See Table 6.

Table 5. Comparison of clinical indicators between the two groups.

Index	Classification	Non-MACE group (129)	MACE Group (30)	t/χ^2	p
Gender	Male	58 (44.96)	15 (50.00)	0.249	0.618
	Female	71 (55.04)	15 (50.00)		
Age (years)		52.85 ± 7.06	52.90 ± 8.47	0.032	0.975
TC (mmol/L)		4.52 ± 0.87	6.18 ± 1.03	9.041	<0.001
TG (mmol/L)		1.50 ± 0.83	4.94 ± 5.18	7.241	<0.001
HDL-C (mmol/L)		1.27 ± 0.31	0.87 ± 0.10	6.986	<0.001
LDL-C (mmol/L)		2.56 ± 0.71	3.67 ± 0.89	7.352	<0.001
LDL-C/HDL-C ratio		2.14 ± 0.84	4.32 ± 1.38	11.151	<0.001
Fasting blood glucose (mmol/L)		5.72 ± 0.99	9.08 ± 3.02	10.535	<0.001
Uric acid (umol/L)		269.65 ± 68.46	401.51 ± 108.26	8.408	<0.001
PT (S)		10.48 ± 0.53	11.47 ± 0.72	8.554	<0.001
PTR (S)		0.92 ± 0.05	1.00 ± 0.06	7.186	<0.001
APTT (S)		24.41 ± 2.12	28.49 ± 5.32	6.755	<0.001
TT (S)		17.84 ± 1.58	19.51 ± 1.88	5.037	<0.001
FIB (g/L)		2.75 ± 0.53	3.90 ± 0.83	9.557	<0.001
HGB (g/L)		137.75 ± 15.26	140.17 ± 16.11	0.773	0.441
RDW-CV (%)		12.79 ± 0.59	13.45 ± 0.84	5.005	<0.001
RDW-SD (fL)		39.33 ± 2.11	43.24 ± 2.95	8.444	<0.001
MPV (fL)		9.12 ± 1.12	10.91 ± 1.10	7.922	<0.001
PDW (fL)		16.05 ± 0.35	16.68 ± 0.34	8.866	<0.001

Discussion

The incidence of early-onset coronary heart disease (diagnosed in men ≤55 years old and women ≤65 years old) is on the rise, accounting for about 25% of the total incidence of coronary heart disease. About 73% of patients with early-onset coronary heart disease have at least two cardiovascular risk factors, and 43% of patients have three or more risk factors [9,10]. Its clinical significance is particularly pronounced, not only because the disease progresses rapidly with marked vascular remodeling, significantly increasing the risk of serious cardiovascular events such as acute myocardial infarction, but also because its early onset imposes long-term impact on patients' work ability and quality of life, while placing a heavy medical and economic burden on families and society [11]. Exploring its risk factors and prognosis association is of great practical significance for achieving prompt and precise intervention, improving patients' clinical outcomes, and reducing the social burden.

The LDL-C/HDL-C ratio is derived from the traditional lipid assessment system and can comprehensively reflect the relative proportion of pro-atherosclerotic and protective lipoproteins. In patients with early-onset coronary heart disease, this ratio is closely related to the pathophysiological process of the disease. Increased LDL-C promotes lipid deposition and triggers inflammation, while decreased HDL-C weakens its protective function [12]. An increased ratio may more sensitively reflect the patient's "dual imbalance of lipid metabolism" and is associated with the deterioration of coronary artery disease and adverse clinical outcomes. This study showed that, with increasing severity of coronary artery disease, levels of TC, LDL-C, LDL-C/HDL-C ratio, fasting blood glucose, and uric acid in patients increased stepwise. TG was significantly higher in the severe group than in the moderate and mild groups, and HDL-C levels progressively decreased. Correlation analysis confirmed that TC, TG, LDL-C, and this ratio were positively correlated with the severity of coronary artery disease, whereas HDL-C was negatively correlated. This indicates that the lipid metabolism imbalance and glucose metabolism disorder, centered on this ratio, constitute a significant metabolic feature associated with the severity of coronary artery lesions in early-onset coronary heart disease, consistent with the findings of Qin L *et al*. [13]. The reason is that the lipid status that promotes atherosclerosis increases this ratio, which fully reflects the damage of lipid metabolism disorder to blood vessels; the pathological effects caused by metabolic syndrome, such as the synergistic effect of hyperglycemia and hyperuricemia, promote the progression of coronary artery lesions [14].

Blood routine indicators are of great significance for early-onset coronary heart disease, and have transcended the traditional scope of hematology. They are a key window for understanding the pathophysiological changes of atherosclerosis. Previous studies have shown that elevated RDW is closely related to systemic inflammatory response and oxidative stress, and inflammation and oxidative stress are core factors for promoting the formation, development and instability of atherosclerotic plaques [15]. Elevated MPV and PDW directly reflect platelet activation and accelerated turnover, increasing the risk of thrombosis in pa-

Table 6. Logistic regression analysis of factors influencing MACE occurrence.

Variable	*B*	SE	Wald	df	*p*	OR	95% CI	
							Lower limit	Upper limit
Severity of coronary artery disease (reference: mild)			18.841	2	<0.001			
Severity of coronary artery disease (moderate)	0.843	0.518	2.648	1	0.104	2.324	0.842	6.42
Severity of coronary artery disease (severe)	2.499	0.583	18.354	1	<0.001	12.171	3.88	38.183
LDL-C/HDL-C ratio	1.763	0.311	32.208	1	<0.001	5.828	3.171	10.713
Fasting blood glucose	1.448	0.336	18.612	1	<0.001	4.254	2.203	8.211
Uric acid	0.024	0.006	18.458	1	<0.001	1.024	1.013	1.035
PT	2.291	0.767	8.922	1	0.003	9.884	2.198	44.44
PTR	12.091	7.841	2.378	1	0.123	171.837	12.038	841.395
APTT	0.577	0.214	7.296	1	0.007	1.781	1.172	2.707
TT	0.353	0.146	5.799	1	0.016	1.423	1.068	1.896
FIB	2.267	0.767	8.737	1	0.003	9.648	2.146	43.369
RDW-CV	0.265	0.516	0.264	1	0.607	1.304	0.474	3.584
RDW-SD	0.568	0.147	14.896	1	<0.001	1.765	1.323	2.356
MPV	0.539	0.341	2.509	1	0.113	1.715	0.88	3.343
PDW	4.415	1.32	11.185	1	<0.001	82.694	6.219	1099.534

tients [16]. Early-onset coronary heart disease progresses rapidly and poses a high risk for patients. Abnormal blood routine indicators may be more prominent and are related to the complexity of coronary artery lesions and the risk of poor prognosis. This study showed that RDW-CV, RDW-SD, MPV, and PDW were highest in the severe group, followed by the moderate group, and lowest in the mild group. Kendall's correlation coefficient showed that these indices were all positively correlated with the severity of coronary artery lesions. This suggests that increased erythrocyte heterogeneity and enhanced platelet activation—independent of anemia—are hematological features closely related to the severity of coronary artery lesions. The reason is that coronary atherosclerosis is a chronic inflammatory disease. Continuous inflammation inhibits the maturation of red blood cells and shortens their lifespan, thereby increasing RDW, while also stimulating megakaryocytes to produce large and highly active platelets, which increases MPV and PDW. These changes may promote local thrombosis and aggravate the risk of coronary events. Zavragiu *et al*. [17] also showed that the increase in MPV and PDW in patients with acute coronary syndrome was significantly associated with the increased anatomical complexity of coronary lesions.

Coagulation function testing is closely related to early-onset coronary heart disease, focusing on the core of coronary thrombotic events, namely, the imbalance of the coagulation-anticoagulation system [18]. Abnormal parameters can reflect the activation of intrinsic and extrinsic coagulation pathways or changes in anticoagulation function. Exploring the relationship between the two is of great significance for improving the risk assessment system. This study showed that PT, PTR, APTT, TT, and FIB in the severe group exhibited the highest, followed by the moderate group, and the lowest in the mild group, and all were positively correlated with the severity of coronary artery lesions. This indicates that changes in the coagulation system in patients with early-onset coronary heart disease are closely related to the anatomical severity of coronary artery lesions. This may be explained by the fact that systemic hypercoagulability and inflammation, as well as widespread activation and consumption of coagulation pathways, lead to changes in related indicators.

Meanwhile, this study showed that the incidence of MACE in the severe lesion group was significantly higher than that in the moderate and mild lesion groups. Binary logistic regression analysis revealed that the severity of coronary artery disease (severe), LDL-C/HDL-C ratio, fasting blood glucose, uric acid, coagulation function indicators (PT, APTT, TT, FIB), and blood routine parameters (RDW-SD, PDW) were independent factors influencing MACE in patients with early-onset coronary heart disease [19–21]. The reasons are as follows: Severe coronary artery disease is the anatomical basis for the occurrence of MACE, which exposes the myocardium to a higher ischemic risk, and plaque instability is prone to triggering serious events. Among metabolic and inflammatory factors, an elevated LDL-C/HDL-C ratio reflects a "double imbalance" in lipid metabolism, driving plaque progression. Elevated fasting blood glucose accelerates atherosclerosis and increases myocardial damage, while elevated uric acid exacerbates vascular inflammation and increases the risk of MACE. Coagulation and blood routine indicators are also closely related. Abnormal coagulation function indicators reflect the imbalance of the coagulation-anticoagulation-fibrinolysis system, with elevated FIB indicating an increased thrombosis tendency. Elevated RDW-SD indicates systemic inflammation and heavy oxidative stress, whereas increased PDW indicates increased platelet activation, making it easier to form occlusive thrombi. A previous study by Zhang XR

et al. [22] has shown that glycated hemoglobin is closely related to the severity of coronary artery lesions; however, this study did not reach this conclusion, which may be related to individual differences among patients [22].

Conclusion

In summary, in patients with early-onset coronary artery disease, the LDL-C/HDL-C ratio, coagulation function indicators (PT, APTT, TT, FIB), and complete blood count parameters (RDW-SD, PDW) were significantly positively correlated with the anatomical severity of coronary artery lesions and closely associated with an increased risk of poor short-term prognosis. This study has several limitations: it was a single-center retrospective analysis with a limited sample size, especially in the severe subgroup, which may have reduced statistical power and limited the generalization of conclusions. Additionally, no sample size estimation was performed, and the relatively short follow-up period failed to assess the long-term prognostic value of these indicators. Therefore, large-sample prospective studies are needed to further validate these findings.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

YMZ designed the research study. JL and XKW performed the research. XFW and JL analyzed the data. YMZ and XKW drafted the article. All authors contributed to the important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study protocol has been approved by the ethics committee of Guoyang County People's Hospital. This study complies with the requirements of the Declaration of Helsinki, and informed consent was obtained from both patients and their families, with approval from the medical ethics committee (Ethical batch number: 20250926).

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Conflict of Interest

The authors declare no conflict of interest.

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