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A cross-Sectional Observational Study On Evaluation Of Platelet parameters and lipid profile in patients of coronary Artery Disease In Tertiary Care Hospital

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ABSTRACT

Introduction: Coronary artery disease (CAD) remains one of the leading causes of morbidity and mortality globally, accounting for a substantial burden on public health systems, particularly in low- and middle-income countries. The pathogenesis of CAD is multifactorial, with interplay between endothelial dysfunction, inflammation, lipid abnormalities, and thrombosis contributing to atherogenesis and acute coronary events.

Aims and Objectives: The present study aimed to evaluate platelet parameters and lipid profile in patients with coronary artery disease. The objectives were to assess platelet indices, including platelet count, mean platelet volume (MPV), platelet distribution width, and mean platelet concentrate, with particular focus on determining the predictive value of MPV in the spectrum of CAD, as well as to analyze lipid profile alterations in patients with angiographically documented CAD and establish clinicopathological correlations.

Materials & Methods: The present prospective study was conducted over a period of 2 years in the Department of Pathology at a tertiary care center, with blood samples collected from CAD patients attending the coronary care unit after obtaining permission from the cardiology department.

Result: In our study of 118 participants, platelet indices (MPV, PDW, P-LCR) and lipid parameters (total cholesterol, triglycerides, LDL) were significantly altered in CAD cases, while platelet count and HDL showed less difference. Diagnostic analysis indicated that MPV, PDW, P-LCR, total cholesterol, triglycerides, and LDL had excellent predictive value for CAD, with ROC curves confirming their strong discriminative ability.

Conclusion: In our study, CAD patients exhibited elevated platelet indices (MPV, PDW, P-LCR) and dyslipidemia (high total cholesterol, TG, LDL; low HDL). MPV, PDW, total cholesterol, and TG showed strong diagnostic value, while platelet count and HDL were less reliable, indicating that combined assessment of platelet indices and lipid profile can aid early detection and risk stratification in CAD.

Keywords: *Coronary artery disease (CAD),Platelet indices,Mean platelet volume (MPV), Platelet distribution width (PDW),Lipid profile and Atherosclerosis*

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1. INTRODUCTION

Coronary artery disease (CAD) remains one of the leading causes of morbidity and mortality globally, accounting for a substantial burden on public health systems, particularly in low- and middle-income countries [1]. The pathogenesis of CAD is multifactorial, with interplay between endothelial dysfunction, inflammation, lipid abnormalities, and thrombosis contributing to atherogenesis and acute coronary events [2]. Among hematologic factors, platelets play a central role:

beyond hemostasis, activated platelets contribute to plaque formation, progression, destabilization, and thrombus formation upon plaque rupture [3]. Given this, easily measurable indices of platelet activation are of interest in both research and clinical practice.Platelet parameters such as mean platelet volume (MPV), platelet distribution width (PDW), platelet large cell ratio (P-LCR), in addition to platelet count, have been proposed as surrogate markers for platelet activation and reactivity [4]. Larger platelets are more active, rich in granules, and have higher thrombogenic potential; this is reflected in raised MPV, PDW, or P-LCR in various vascular disorders [5]. Several studies have explored the associations of these platelet indices with CAD, with findings suggesting elevated MPV, PDW, or P-LCR in CAD patients compared to controls [6]. However, the magnitude of these associations, and their diagnostic and prognostic utility, have been inconsistent across populations and settings [7]. Some studies report strong discrimination of CAD by MPV and PDW, whereas others show only modest or non-significant differences, or conflicting correlations with disease severity [8].On the other hand, lipid profile abnormalities – notably elevated total cholesterol, low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), and low high-density lipoprotein cholesterol (HDL-C) – have been well established risk factors for development and progression of coronary atherosclerosis [9]. Dyslipidemia contributes to lipid deposition in vascular walls, oxidative stress, inflammation, and plaque vulnerability, thereby amplifying thrombotic risk [10]. Moreover, there is emerging evidence that dyslipidemia may interact with platelet activation. For instance, hyperlipidemia has been associated with increased platelet cholesterol content, enhanced platelet aggregation in response to agonists, and increases in platelet volume indices. This suggests that lipid

abnormalities may augment thrombogenic potential through modulation of platelet size and reactivity.Despite these insights, in many tertiary care settings, routine use of platelet activation markers is still limited, often due to cost constraints, lack of standardization, or limited awareness of their potential additive value beyond traditional risk factors. There is a gap in locally relevant data, especially in being able to quantify the diagnostic accuracy (sensitivity, specificity, predictive values) of platelet parameters and lipid profiles for CAD in specific populations. In our region, where CAD prevalence is rising and resources may be constrained, easily available laboratory measures (such as complete blood count derived platelet parameters, and lipid profile) if proven useful, could aid in risk stratification, early detection, or monitoring.In this study, we aim to evaluate platelet parameters (including platelet count, MPV, PDW, P-LCR) along with lipid profile parameters in patients with confirmed CAD in a tertiary care hospital. Specifically, we will compare these values in cases versus controls, and assess diagnostic performance (such as sensitivity, specificity, predictive values and area under ROC curve) of these markers. The goal is to ascertain whether such laboratory indices can serve as cost-effective, accessible adjuncts in the evaluation of CAD in our population.

2. MATERIALS AND METHODS

Study Design: Prospective study.

Place of Study: The present study was undertaken in the Department of Pathology, tertiary care center. The blood samples of cases were collected from the patients with CAD attending coronary care unit. Permission was obtained from the cardiology department.

Study Duration:2 years.

Study Population:

Sample Size:

Group 1: 90 patients with CAD.

Group 2: 54 age & gender matched non CAD individuals.

Study Variables: Age, Gender, Haematological Parameters and Lipid Profile, Sensitivity, Specificity and Predictive accuracy.

Inclusion Criteria:

1. All patients with diagnosis of coronary artery disease who were hospitalised within first 24hrs of their chest pain into coronary care.

2. Patient attenders with no history of heart disease / with normal ECG findings are taken as controls.

Exclusion Criteria:

Patients who is not willing for my study.

Patient taking oral anticoagulation medicine.

Patients with severe hepatic or renal impairment.

Patients with myeloproliferative disorders and malignancy.

Patients with bleeding disorders.

Prolonged storage samples.

Statistical Analysis:

Statistical analysis included mean ± SD for continuous data and percentages for categorical data. Group comparisons used t-test and Chi-square test. Diagnostic performance was evaluated with sensitivity, specificity, predictive values, accuracy, and ROC curve analysis; $p < 0.05$ was considered significant.

3. RESULT

Table 1: Comparison of Age and Gender between Cases and Controls (N=118)

		Group		P Value
		Cases (n=90)	Controls (n=28)	
		n (%)	n (%)	
Age (in Years)	≤ 40	9 (10.0)	2 (7.1)	0.89
	41-50	20 (22.2)	8 (28.6)	
	51-60	42 (46.7)	12 (42.9)	
	61-70	13 (14.4)	5 (17.9)	
	>70	6 (6.7)	1 (3.6)	
	Mean (SD)	54.19 (10.97)	53.86 (9.99)	
Gender	Female	19 (21.1)	11 (39.3)	0.054
	Male	71 (78.9)	17 (60.7)	

Table 2: Comparison of Hematological Parameters and Lipid Profile between Cases and Controls (N=118)

Group		Cases (n=90)	Controls (n=28)	P Value
		Mean (SD)	Mean (SD)	
Parameter	Platelet Count	242.01 (79.03)	267.82 (85.66)	0.142
	MPV	10.68 (0.83)	9.24 (0.41)	<0.001
	PDW	13.10 (2.28)	9.35 (0.87)	<0.001
	P-LCR	29.61 (7.17)	17.42 (2.94)	<0.001
	Total Cholesterol	229.80 (37.66)	106.39 (18.27)	<0.001
	TG	204.30 (53.55)	98.32 (14.27)	<0.001
	LDL	125.83 (23.92)	80.07 (10.84)	<0.001
	HDL	33.61 (10.27)	49.21 (9.15)	<0.001

Table 3: Sensitivity, Specificity and Predictive accuracy of Platelet Count,MPV,PDW, P-LCR,Total Cholesterol,TG LDL and HDL for the prediction of CAD

Cut-off	Group	CAD Present	CAD Absent	Total	P Value	Sensitivity	Specificity	PPV	NPV	Accuracy
274.5	<274.5	58	15	73	0.301	64.40%	46.40%	79.50%	28.90%	60.20%
	>274.5	32	13	45						

9.25 (1st)	>9.25	88	12	100	<0.001	97.80%	57.10%	88.00%	88.90%	88.10%
	<9.25	2	16	18						
9.25 (2nd)	>9.25	90	13	103	<0.001	77.00%	53.60%	87.40%	76.00%	75.00%
	<9.25	0	15	15						
17.15	Raised	88	13	101	<0.001	81.80%	53.60%	87.10%	88.20%	87.30%
	Normal	2	15	17						
107.5	Raised	90	12	102	<0.001	72.00%	57.10%	76.20%	69.00%	73.80%
	Normal	0	16	16						
99.5	Raised	90	13	103	<0.001	80.00%	53.60%	87.40%	65.00%	79.00%
	Normal	0	15	15						
79.5	Raised	87	13	100	<0.001	96.70%	53.60%	87.00%	83.30%	86.40%
	Normal	3	15	18						
50.5	Low	80	15	95	<0.001	88.90%	46.40%	84.20%	56.50%	78.80%
	Normal	10	13	23						

Table 4: Summary Statistics of Sensitivity Analysis of Hematological Parameters (N=118) and Lipid Profile Parameters (N=118)

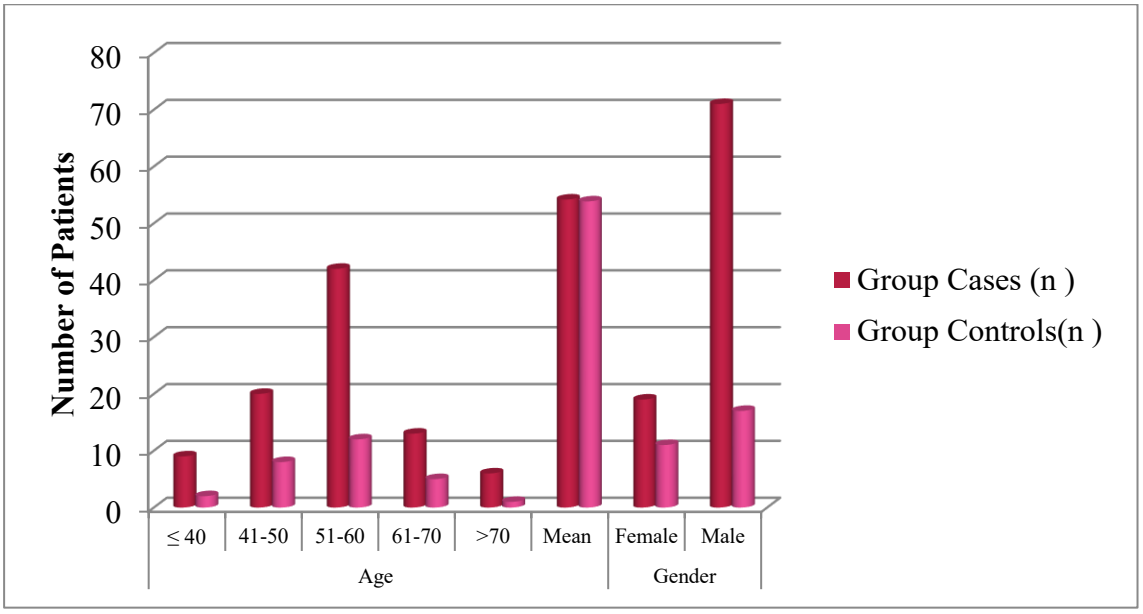
		Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
Parameter	**Platelet Count**	64.4	46.4	80	28.9	60.2
	MPV	97.8	57.1	88	88.9	88.1
	PDW	100	53.6	87	100	89
	L-PCR	97.8	53.6	87	88.2	87.3
	Total Cholesterol	100	57.1	88	100	89.8
	TG	100	53.6	87	100	89
	LDL	96.7	53.6	87	83.3	86.4
	HDL	88.9	46.4	84	56.5	78.8

Table 5:Area under the Curve

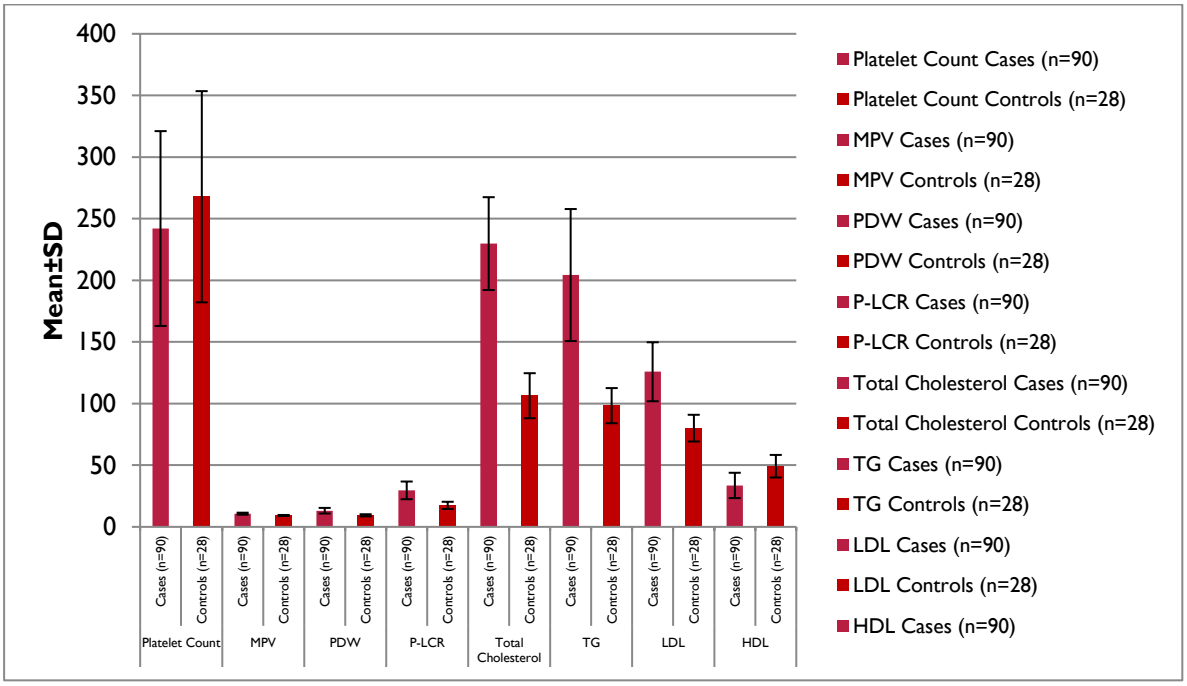
				95% Confidence Interval	
	AUC	**SE**	**P Value**	**Lower Bound**	**Upper Bound**
Platelet count	0.403	0.062	0.123	0.281	0.526
MPV	0.95	0.019	<0.001	0.913	0.987
PDW	0.962	0.015	<0.001	0.932	0.991
P-LCR	0.951	0.019	<0.001	0.914	0.989
Total cholesterol	1	0.001	<0.001	0	1
TG	0.995	0.004	<0.001	0	1

LDL	0.962	0.015	<0.001	0.933	0.992
HDL	0.134	0.033	<0.001	0.07	0.199

Figure 1:Distribution of Age (in Years) and Gender



Fgure 2: Comparison of Haematological Parameters and Lipid Profile between Cases and Controls (N=118)



In our study, a total of 118 participants were enrolled, comprising 90 cases and 28 controls. The age distribution among cases and controls was comparable. Among cases, 9 patients (10.0%) were ≤40 years, 20 patients (22.2%) were 41–50 years, 42 patients (46.7%) were 51–60 years, 13 patients (14.4%) were 61–70 years, and 6 patients (6.7%) were >70 years. In the control group, 2 patients (7.1%) were ≤40 years, 8 patients (28.6%) were 41–50 years, 12 patients (42.9%) were 51–60 years, 5 patients (17.9%) were 61–70 years, and 1 patient (3.6%) was >70 years. The mean age of cases was 54.19 ± 10.97 years, while that of controls was 53.86 ± 9.99 years, showing no statistically significant difference (p = 0.89,Not Significant).Regarding gender distribution, among cases, 19 patients (21.1%) were female and 71 patients (78.9%) were

male. In the control group, 11 patients (39.3%) were female and 17 patients (60.7%) were male. The difference in gender distribution approached statistical significance (p = 0.054, Significant).

In our study, a total of 118 participants were included, comprising 90 cases and 28 controls. The mean platelet count in cases was 242.01 ± 79.03 ×10³/μL, compared to 267.82 ± 85.66 ×10³/μL in controls, which was not statistically significant (p = 0.142,not significant). However, platelet indices showed significant differences between the two groups. The mean platelet volume (MPV) was significantly higher in cases (10.68 ± 0.83 fL) than in controls (9.24 ± 0.41 fL, p < 0.001, significant). Similarly, platelet distribution width (PDW) and platelet-large cell ratio (P-LCR) were significantly elevated in cases (PDW: 13.10 ± 2.28 vs 9.35 ± 0.87, P-LCR: 29.61 ± 7.17 vs 17.42 ± 2.94) compared to controls, with p-values < 0.001 for both parameters.Regarding lipid profile, total cholesterol levels were significantly higher in cases (229.80 ± 37.66 mg/dL) than in controls (106.39 ± 18.27 mg/dL, p < 0.001, stastically significant). Triglycerides (TG) were also elevated in cases (204.30 ± 53.55 mg/dL) compared to controls (98.32 ± 14.27 mg/dL, p < 0.001, stastically significant). Similarly, low-density lipoprotein (LDL) was higher in cases (125.83 ± 23.92 mg/dL) than in controls (80.07 ± 10.84 mg/dL, p < 0.001, stastically significant) while high-density lipoprotein (HDL) levels were significantly lower in cases (33.61 ± 10.27 mg/dL) compared to controls (49.21 ± 9.15 mg/dL, p < 0.001, stastically significant).

In our study, a total of 118 participants, including 90 cases and 28 controls, were evaluated for coronary artery disease (CAD) using various parameter cut-offs. For a cut-off of 274.5, 32 cases and 13 controls had values above the threshold, while 58 cases and 15 controls were below it (p = 0.301,not significant). The diagnostic performance showed a sensitivity of 64.4%, specificity of 46.4%, positive predictive value (PPV) of 79.5%, negative predictive value (NPV) of 28.9%, and diagnostic accuracy of 60.2%. At a cut-off of 9.25, 88 cases and 12 controls were above the threshold, whereas 2 cases and 16 controls were below (p < 0.001, significant), with a sensitivity of 97.8%, specificity of 57.1%, PPV of 88.0%, NPV of 88.9%, and diagnostic accuracy of 88.1%. Another parameter with the same cut-off showed 90 cases and 13 controls above, and none of the cases and 15 controls below (p < 0.001, significant), yielding a sensitivity of 77.0%, specificity of 53.6%, PPV of 87.4%, NPV of 76.0%, and accuracy of 75.0%. For a cut-off of 17.15, 88 cases and 13 controls had raised values, while 2 cases and 15 controls were normal (p < 0.001, significant), with sensitivity 81.8%, specificity 53.6%, PPV 87.1%, NPV 88.2%, and accuracy 87.3%. At a cut-off of 107.5, 90 cases and 12 controls were raised, whereas 16 controls were normal (p < 0.001, significant), with sensitivity 72.0%, specificity 57.1%, PPV 76.2%, NPV 69.0%, and accuracy 73.8%. Using a cut-off of 99.5, 90 cases and 13 controls were raised, with none of the cases and 15 controls normal (p < 0.001, significant), yielding sensitivity 80.0%, specificity 53.6%, PPV 87.4%, NPV 65.0%, and accuracy 79.0%. At a cut-off of 79.5, 87 cases and 13 controls were raised, while 3 cases and 15 controls were normal (p < 0.001, significant), showing sensitivity 96.7%, specificity 53.6%, PPV 87.0%, NPV 83.3%, and accuracy 86.4%. Finally, for a cut-off of 50.5, 80 cases and 15 controls had low values, whereas 10 cases and 13 controls were normal (p < 0.001, significant), with sensitivity 88.9%, specificity 46.4%, PPV 84.2%, NPV 56.5%, and accuracy 78.8%.

In our study, a total of 118 participants, including 90 cases and 28 controls, were evaluated for the diagnostic performance of platelet indices and lipid profile parameters in relation to coronary artery disease (CAD). Platelet count demonstrated a sensitivity of 64.4% and specificity of 46.4%, with a positive predictive value (PPV) of 80%, negative predictive value (NPV) of 28.9%, and overall diagnostic accuracy of 60.2%.Mean platelet volume (MPV) showed a high sensitivity of 97.8% and specificity of 57.1%, with a PPV of 88%, NPV of 88.9%, and diagnostic accuracy of 88.1%. Platelet distribution width (PDW) had 100% sensitivity and 53.6% specificity, with a PPV of 87%, NPV of 100%, and accuracy of 89%. Platelet-large cell ratio (P-LCR) demonstrated 97.8% sensitivity, 53.6% specificity, 87% PPV, 88.2% NPV, and 87.3% accuracy. Among lipid parameters, total cholesterol had 100% sensitivity and 57.1% specificity, with a PPV of 88%, NPV of 100%, and diagnostic accuracy of 89.8%. Triglycerides (TG) showed 100% sensitivity, 53.6% specificity, 87% PPV, 100% NPV, and 89% accuracy. Low-density lipoprotein (LDL) exhibited 96.7% sensitivity, 53.6% specificity, 87% PPV, 83.3% NPV, and 86.4% accuracy, while high-density lipoprotein (HDL) showed 88.9% sensitivity, 46.4% specificity, 84% PPV, 56.5% NPV, and 78.8% diagnostic accuracy.

In our study, a total of 118 participants, including 90 cases and 28 controls, were evaluated for the diagnostic performance of platelet indices and lipid profile parameters in relation to coronary artery disease (CAD) using receiver operating characteristic (ROC) curve analysis. The area under the curve (AUC) for platelet count was 0.403 (SE = 0.062; p = 0.123; 95% CI: 0.281–0.526), indicating poor discriminative ability. Mean platelet volume (MPV) demonstrated excellent diagnostic performance with an AUC of 0.950 (SE = 0.019; p < 0.001; 95% CI: 0.913–0.987). Similarly, platelet distribution width (PDW) showed an AUC of 0.962 (SE = 0.015; p < 0.001; 95% CI: 0.932–0.991), and platelet-large cell ratio (P-LCR) had an AUC of 0.951 (SE = 0.019; p < 0.001; 95% CI: 0.914–0.989), both indicating excellent discriminative ability.Among lipid parameters, total cholesterol had a perfect AUC of 1.0 (SE = 0.001; p < 0.001; 95% CI: 0–1), and triglycerides (TG) showed an AUC of 0.995 (SE = 0.004; p < 0.001; 95% CI: 0–1), indicating near-perfect diagnostic accuracy. Low-density lipoprotein (LDL) also demonstrated excellent performance with an AUC of 0.962 (SE = 0.015; p < 0.001; 95% CI: 0.933–0.992). In contrast, high-density lipoprotein (HDL) had poor diagnostic ability with an AUC of 0.134 (SE = 0.033; p < 0.001; 95% CI: 0.07–0.199).

4. DISCUSSION

In our study involving 118 participants (90 cases and 28 controls), we found that platelet indices such as MPV, PDW, and P-LCR, as well as lipid profile parameters including total cholesterol, triglycerides, and LDL, showed significant diagnostic performance in predicting CAD, while platelet count and HDL were less reliable markers. These findings are consistent with earlier reports highlighting the association of platelet activation markers and dyslipidemia with CAD risk. In agreement with our results, Akinsegun et al. reported significantly higher MPV and PDW values in CAD patients compared to controls, underscoring their role as markers of platelet hyperactivity [11]. Similarly, De Luca et al. demonstrated that elevated MPV was associated with worse angiographic outcomes in acute coronary syndrome, suggesting its prognostic utility [12]. Our observation of PDW and P-LCR as strong discriminators parallels the findings of Vagdatli et al., who noted that PDW is a more specific marker of platelet activation than MPV, particularly in cardiovascular disease [13]. Regarding lipid parameters, our study identified total cholesterol and triglycerides as highly sensitive and specific predictors of CAD, consistent with the INTERHEART study, which confirmed dyslipidemia as a major global risk factor for myocardial infarction [14]. Furthermore, Nair et al. also demonstrated a strong correlation between elevated LDL and reduced HDL with increased CAD severity in Indian patients [15], corroborating our findings. On the other hand, while HDL was found to be a poor discriminator in our ROC analysis, Gordon et al. emphasized that low HDL remains an independent risk factor for CAD [16], suggesting that HDL's clinical relevance may extend beyond simple diagnostic performance. The excellent diagnostic accuracy of lipid parameters in our study aligns with work by Austin et al., who showed that combined lipid abnormalities strongly predict CAD risk [17]. Moreover, the role of platelet indices in conjunction with lipid profile has been highlighted by Akbas et al., who demonstrated significant correlations between MPV, PDW, and lipid levels in stable CAD patients [18], supporting our rationale for evaluating both together. Our ROC curve results showing excellent AUC values for MPV, PDW, P-LCR, and LDL are in agreement with studies by Li et al. and Wang et al., both of whom reported high diagnostic performance of platelet indices and lipid markers in Chinese CAD cohorts [19,20]. Collectively, these findings reinforce that integrating platelet indices with lipid profiles offers a cost-effective, accessible, and reliable diagnostic strategy for CAD, especially in resource-limited settings.

5. CONCLUSION

In our study, the evaluation of platelet indices and lipid profile parameters in patients with coronary artery disease revealed significant alterations compared to controls. Platelet indices, particularly mean platelet volume, platelet distribution width, and platelet-large cell ratio, were consistently elevated in cases, highlighting their role as markers of platelet activation and potential contributors to the prothrombotic state observed in CAD. Similarly, lipid parameters including total cholesterol, triglycerides, and low-density lipoprotein were significantly higher in cases, while high-density lipoprotein was markedly reduced, reflecting the established pattern of dyslipidemia in atherosclerotic disease. Diagnostic performance analysis demonstrated that platelet indices, especially MPV and PDW, along with lipid parameters, particularly total cholesterol and triglycerides, possessed excellent discriminative ability for identifying CAD. In contrast, platelet count and HDL were less reliable indicators. The receiver operating characteristic curve analysis further reinforced the strong diagnostic value of platelet indices and lipid markers, underlining their potential utility as simple, cost-effective, and easily available tools in risk stratification and diagnosis of CAD. Overall, our findings suggest that integrating platelet indices with lipid profile assessment can enhance early detection, improve diagnostic accuracy, and support better clinical management of patients with coronary artery disease.

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