

## Comparison of Atherogenic Index of Plasma between Patients Suffering From Myocardial Infarction and Adults without Known Cardiovascular Disease

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Received: 01-10-2025 / Revised: 15-11-2025 / Accepted: 21-12-2025

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Conflict of interest: Nil

### Abstract

**Background:** Studies suggest that myocardial infarction is the major cause of mortality worldwide. Atherogenic index of plasma (AIP) is a sensitive marker in the diagnosis of myocardial infarction. In this study, we aim to find out the association of AIP with myocardial infarction.

**Methods:** AIP was calculated by taking the logarithm of the ratio of triglyceride (TG) to high-density lipoprotein cholesterol (HDL-C). The data analyzed using the odds ratio (RR) along with a 95% confidence interval (CI) and univariable logistic regression analysis.

**Results:** Total 28 diagnosed MI patients from emergency ward and 28 patients who attended OPD of Tripura Medical College with no known cardiovascular diseases were selected in the study. Study showed a higher level of TG in MI patients as compared to healthy Non MI patients. HDL-C was higher in Non MI patients than MI patients. The mean atherogenic index of plasma was markedly higher among myocardial infarction patients ( $0.358 \pm 0.310$ ) compared to Non MI patients ( $0.034 \pm 0.159$ ), and the difference was statistically significant ( $p < 0.001$ ).

**Conclusion:** Atherogenic index of plasma (AIP) has a strong association with myocardial infarction and it can be used as a predictive risk factor for cardiovascular diseases like myocardial infarction.

**Keywords:** Atherogenic Index of Plasma, Myocardial Infarction, Triglycerides, High Density Lipoprotein Cholesterol.

**DOI:** 10.25258/ijcpr.18.1.110

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### Introduction

It is now well established that dyslipidemia is one of the major risk factors for cardiovascular diseases. Major alterations include high serum cholesterol, LDL, triglyceride and low in HDL-c which are responsible for major cardiovascular event like myocardial infarction. Among all types of cardiovascular diseases, coronary artery disease (CAD) is the prominent one in respect to mortality and morbidity.

Among all CAD myocardial infarction is the leading cause of death bearing share of 15% mortality [1]. Studies suggest that atherogenic index of plasma (AIP) is a more sensitive independent parameter than lipid profile alone for predicting cardiovascular risks. Atherogenic Index of Plasma is logarithmically transformed ratio of

triglycerides and HDL-c which is considered as a marker of atherogenicity. This ratio is increased in people at higher risk of CAD. The role of HDL-c in cardiovascular disease protection is well established now. Low HDL-c level related to cardiovascular diseases like myocardial infarction but direct role of triglyceride is not extensively studied. In this respect, but evidence shows that high triglyceride is associated with increase cardiovascular event along with increased circulatory LDL. AIP basically determines the fractionated esterification rate of HDL-c and proved nowadays to be more useful than routine lipid profile.

Studies suggest that proper screening and risk stratification and timely intervention can reduce the

death and morbidity in myocardial infarction patient. In this regard, AIP can be a good option than lipid profile alone to assess CVD risk. Calculation of atherogenic index of plasma (AIP) in MI patients may be helpful to establish the relation between myocardial infarction and AIP, hence can be used for screening for cardiovascular diseases.

## Methods

**Study design:** Analytic Cross sectional study.

**Study setting:** The study was carried out at Tripura Medical College and Dr. BRAM Teaching hospital, Tripura, Northeast India.

**Sample size:** The minimum total sample size calculated to 56 (28 in each group) to achieve a power of 80% and a level of significance of 5% (two sided), for detecting a true difference in means between the test and the reference group of 0.22999999999999998 (i.e. 0.47 - 0.24) units<sup>2</sup> using online sample size calculator<sup>3</sup>.

**Study population:** Twenty eight (28) numbers of diagnosed myocardial infarction (MI) patients came to the emergency ward of this hospital, diagnosed by positive Trop I test and another twenty eight (28) numbers of patients who attended OPD of this hospital with no known cardiovascular diseases or diseases that can influence lipid profile.

Following were the criteria for inclusion and exclusion of the study population -

### Inclusion Criteria

1. Patients more than 18 years of age and of any sexes with diagnosis of acute myocardial infarction admitted in this hospital.
2. Patients more than 18 years of age attended hospital OPD with no known cardiovascular

disease and willing to participate in this study will be considered as "control".

### Exclusion Criteria

1. Patient with history of previous MI
2. Patient with history of other cardiovascular diseases.
3. Patients with Chronic kidney disease (CKD), autoimmune diseases, diabetes, inflammatory diseases, obesity, malignancies, pregnancy, thyroid disorders etc.
4. Patients who are on statin therapy
5. Patients who are not willing to participate in study.

**Data Collection Procedure:** After taking informed consent detailed history of the study participants were taken. Then the blood was collected in a plain vial after overnight fasting of minimum 10 hours, and for diagnosed myocardial infarction patient blood was collected from emergency department itself before any prior intervention and was processed for lipid profile test on the same day. Beckman Coulter AU-480 full auto analyzer used for analysis of fasting lipid profile. Then atherogenic index of plasma (AIP) calculated using an online AIP calculator.

**Statistical Analysis:** The data was collected and tabulated as percentage of value, mean, standard deviation etc. These were calculated using SPSS software. Chi square test, independent t test and logistic regression were applied at appropriate places. A p value <0.05 was taken as a statistical significance.

**Ethical Consideration:** Permission of ethical committee of Tripura Medical College and Dr. BRAM Teaching Hospital was taken prior to the start of the study.

## Results

**Table 1: Baseline Characteristics of Study Participants**

Characteristic	MI Group (n = 28)	Non-MI Group (n = 28)	p-value
Age (years), Mean ± SD	63.57 ± 16.58	45.18 ± 13.52	< 0.001
Sex, n (%)			
Male	15 (53.6%)	18 (64.3%)	0.587
Female	13 (46.4%)	10 (35.7%)	
Triglycerides (mg/dL), Mean ± SD	163.25 ± 96.30	120.96 ± 38.69	0.038
HDL-C (mg/dL), Mean ± SD	31.36 ± 13.29	47.43 ± 9.42	< 0.001
LDL-C (mg/dL), Mean ± SD	89.89 ± 45.57	109.82 ± 31.86	0.064
Atherogenic Index of Plasma (AIP), Mean ± SD	0.358 ± 0.310	0.034 ± 0.159	<0.001

\*Continuous variables were compared using Welch's independent samples t-test, and categorical variables were compared using Chi-square test, p value < 0.05 statistically considered as significant.

Mean age of MI group was 63.57 ± 16.58 and Non MI group was 45.18 ± 13.52 with p value < 0.001. Out of 28 numbers of MI patients 53.6% were male and remaining 46.4% were female. Among 28 subjects of control group (Non MI) male and female percentage were 64.3% and 35.7%

respectively. The sex ratio of two groups was not statistically significant as p value is 0.587.

The mean triglyceride value in MI group and Non MI group were 163.25 ± 96.30 mg/dl and 120.96 ± 38.69 mg/dl respectively and the difference between the groups was statistically significant as p

value is 0.038. The MI and Non MI groups were having a mean HDL cholesterol value of  $31.36 \pm 13.29$  mg/dl and  $47.43 \pm 9.42$  mg/dl respectively shown a statistically significant difference with a p value  $< 0.001$ . The mean LDL cholesterol value of MI and Non MI groups were  $89.89 \pm 45.57$  mg/dl

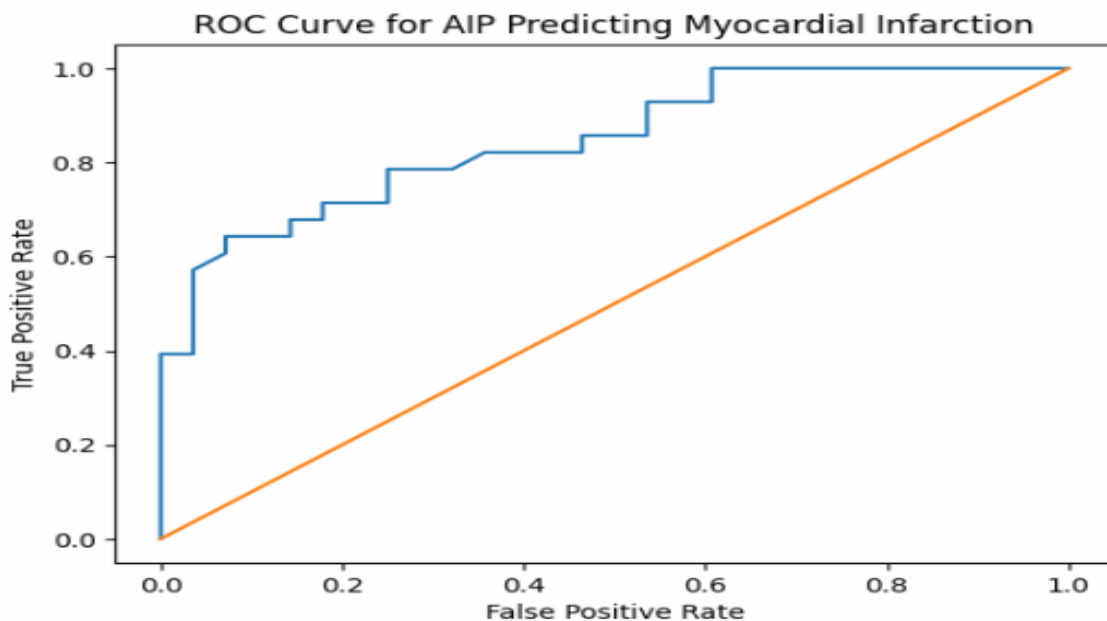
and  $109.82 \pm 31.86$  mg/dl respectively with a p value of 0.064 which is statistically insignificant. The mean Atherogenic Index of Plasma (AIP) of MI group was  $0.358 \pm 0.310$  and in Non MI group was  $0.034 \pm 0.159$  with a p value  $< 0.001$  which is very much statistically significant.

**Table 2: Univariable Logistic Regression Analysis Showing Association between Atherogenic Index of Plasma (AIP) and Myocardial Infarction**

Variable	$\beta$ Coefficient	Standard Error	Odds Ratio (OR)	95% Confidence Interval for OR	p-value
Constant	-1.33	0.48	0.26	0.10 – 0.68	0.006
Atherogenic Index of Plasma (AIP)	8.37	6.31	4311.39	34.59 – 537377.99	$< 0.001$

Univariable logistic regression analysis was performed to assess the association between atherogenic index of plasma (AIP) and myocardial infarction. Higher AIP values were associated with markedly increased odds of myocardial infarction (OR = 4311.39; 95% CI: 34.59–537377.99;  $p < 0.001$ ). The logistic regression model demonstrated good overall fit. The likelihood ratio test indicated

a significant improvement of the model over the null model ( $\chi^2 = 24.95$ ;  $p < 0.001$ ), with a McFadden’s pseudo  $R^2$  of 0.32, suggesting good explanatory power. Model calibration assessed using the Hosmer–Lemeshow goodness-of-fit test showed no evidence of lack of fit ( $\chi^2 = 7.32$ ;  $df = 8$ ;  $p = 0.503$ ), indicating adequate agreement between observed and predicted outcomes.



**Figure 1: Receiver operating characteristic (ROC) curve showing the ability of atherogenic index of plasma to predict myocardial infarction. The area under the curve (AUC) was 0.85, indicating good discrimination.**

**Discussion**

In this present study it was found that patients with myocardial infarction were significantly older than controls. Triglyceride levels were higher, while HDL-C levels were significantly lower in the myocardial infarction group. The mean atherogenic index of plasma was markedly higher among myocardial infarction patients ( $0.358 \pm 0.310$ ) compared to adults without known cardiovascular disease ( $0.034 \pm 0.159$ ), and the difference was

statistically significant ( $p < 0.001$ ). LDL-C levels did not differ significantly between the two groups.

In the present study, the subjects of MI group were older than the Non MI group and the difference is statistically significant. Older age groups are more prone to develop coronary artery diseases. In a study, conducted by Cai G et al found that patients in the CAD group were older than those in the control group [4]. Age is also a non-modifiable risk factor to develop CAD as found in another study conducted by Mirzadeh et al [5].

The present study showed that triglycerides levels were higher and HDL-C levels were significantly lower in MI group. Ghuge D, Zine R conducted a study in rural population of Marathwada region and found that serum triglycerides were significantly higher in acute MI patients as compared to healthy controls; and HDL-C was significantly lower in acute MI patients as compared to controls. They also found a statistically significant higher value of LDL-C in acute MI patients as compared to healthy control group [2]. But in the present study the LDL-C values were higher in Non MI cases although this finding was statistically insignificant. Cai G et al conducted a hospital based case – control study on Chinese Han population and found that CAD patients had higher levels of triglycerides, LDL-C and a lower level of HDL-C as compared to the control [4]. The mean Atherogenic Index of Plasma (AIP) of MI group was  $0.358 \pm 0.310$  and in Non MI group was  $0.034 \pm 0.159$  with a p value  $<0.001$  which is very much statistically significant. This finding of the present study was in agreement the result found in the study conducted by Ghuge D, Zine R [2]. They found statistically significant higher AIP values in MI patients as compared to healthy controls. Similarly higher AIP values were found in CAD patients as compared to healthy controls in the study conducted by Cai G et al [4]. In the study, conducted by Mirzadeh et al also found statistically higher values of AIP in CAD patients [5].

In the present study, univariable logistic regression analysis found that higher AIP values were associated with markedly increased odds of myocardial infarction (OR = 4311.39; 95% CI: 34.59–537377.99;  $p < 0.001$ ). Mirzadeh et al in their study found that AIP, associated with an increase of 86% in the likelihood of developing CAD (OR = 1.86; 95% CI 1.12, 3.08) considering other risk factors of CAD like age, hypertension, physical activity and smoking as independent variables. Cai G et al also found in their study a strong association of AIP with the development of CAD (OR of 1.782, 95% CI: 1.490–2.131,  $P < .001$ ). AIP is a calculated ratio of triglyceride and HDL-C values; and from numerous studies it was found that increased triglycerides are associated with an increased risk of atherosclerosis.

HDL-C values inversely related to CAD as discussed above. High triglycerides and low HDL-C are associated with atherosclerosis. Gaziano et al in their study also found AIP as a strong predictor of MI [6].

### Conclusion

From the above discussion we can conclude that AIP has a strong association with myocardial infarction. AIP value can be used as a predictive risk factor for cardiovascular diseases like myocardial infarction.

### Limitation

The study was conducted with a relatively small sample size. However similar study with large study participants is needed for the support of the result of present study.

### References

1. Jayarj JC, Davatyan K et al: Epidemiology of myocardial infarction, Nov 5, 2018, DOI:10.5772/intechopen.74768.
2. Ghuge D, Zine R.: Atherogenic index of plasma in myocardial infarction in rural population of Marathwada region, journal of evolution of medical and dental sciences/vol-1/issue-3/july-sept 2012 page238.
3. Dhand, N. K., & Khatkar, M. S. Statulator: An online statistical calculator. Sample Size Calculator for Comparing Two Independent Means. 2014. Accessed 22 June 2024 at <http://statulator.com/SampleSize/ss2M.html>
4. Cai G, Liu W et al: Gender Specific Association between atherogenic index of plasma and presence and severity of acute coronary syndrome in very young adults, a hospital based observational study. April, 2019
5. Mirzadeh, M., Nikparvar, M., Rafati, S. et al. Atherogenic index of plasma as a predictor of coronary artery disease: a cohort study in south of Iran. Egypt Heart J. 2024; 76:65. <https://doi.org/10.1186/s43044-024-00497-z>
6. Gaziano JM, Hennekens CH, O'Donnell CJ, Breslow JL, Buring JE. Fasting triglycerides, high-density lipoprotein, and risk of myocardial infarction. Circulation 1997; 96:2520-2525.