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STUDY OF INSULIN RESISTANCE IN NON-DIABETIC PATIENTS OF CORONARY ARTERY DISEASE

Medicine

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ABSTRACT

Background: Coronary artery disease (CAD) remains a major global health concern, with insulin resistance (IR) emerging as an independent risk factor even in non-diabetic individuals. The Triglyceride-Glucose (TyG) index is a simple, cost-effective surrogate marker of IR. **Objectives:** Study of Triglyceride glucose index in non diabetic patients of coronary artery disease. **Methods:** This cross-sectional study included 126 non-diabetic CAD patients aged 20–65 years. Clinical evaluation, biochemical tests, and coronary angiography were performed. IR was assessed using the TyG index, and its association with angiographic findings was analyzed. **Results:** The TyG index was significantly higher in patients with triple vessel disease (p=0.01) and showed a significant association with Killip class (p=0.01). No significant correlation was found between the TyG index and Troponin I levels. **Conclusion:** The TyG index is a reliable marker for detecting insulin resistance and assessing CAD severity in non-diabetic individuals.

KEYWORDS

Coronary artery disease; Insulin resistance; TyG index; Non-diabetic; Atherosclerosis.

INTRODUCTION

Coronary artery disease (CAD) remains a major global health challenge and is the leading cause of mortality worldwide. In India, CAD prevalence ranges between 7% to 13%, with South Asians demonstrating a significantly higher susceptibility compared to other populations, often independent of traditional risk factors such as diabetes, hypertension, or dyslipidemia [1,2]. Among emerging risk factors, insulin resistance (IR) has garnered attention for its critical role in the pathogenesis of atherosclerosis, the underlying cause of CAD. IR is defined as a reduced biological response to insulin, leading to compensatory hyperinsulinemia, endothelial dysfunction, lipid abnormalities, and chronic inflammation—all of which accelerate coronary atherosclerosis [3,4]. While the association between IR and CAD is well-established in diabetic individuals, its impact in non-diabetic patients remains underexplored, particularly in resource-limited settings like India. The Triglyceride-Glucose (TyG) index, calculated from fasting triglyceride and glucose levels, is a reliable, cost-effective surrogate marker for assessing IR. Studies have shown that higher TyG index values correlate with increased CAD severity and adverse cardiovascular outcomes, even in non-diabetic individuals [5,6]. Given the simplicity and accessibility of the TyG index, it holds significant potential for early risk identification in CAD patients without diabetes.

This study aimed to assess the presence and extent of insulin resistance using the TyG index in non-diabetic patients with coronary artery disease, with the objective of improving risk stratification and guiding preventive strategies.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Medicine at BRD Medical College, Gorakhpur, over a period of 12 months.

Sample Size Calculation

The sample size was determined based on an anticipated 9.1% prevalence of coronary artery disease (CAD), with a 95% confidence interval and a 4% margin of error. The standard formula used for calculation was:

$n = Z^2 \times P \times (1-P) / d^2$

Where:

- n = required sample size
- Z = 1.96 (standard normal deviate for 95% confidence)
- P = estimated prevalence (0.091)
- d = margin of error (0.04)

Substituting these values, the calculated sample size was 126 participants, who were subsequently enrolled for the study.

Inclusion Criteria

- Patients aged between 20 to 65 years.
- Non-diabetic individuals presenting with symptoms of CAD, including stable angina, unstable angina, ST-segment elevation myocardial infarction (STEMI), and non-ST-segment elevation myocardial infarction (NSTEMI).
- Individuals who provided written informed consent.

Exclusion Criteria

- Patients who refused consent.
- Known cases of Type 2 diabetes mellitus.
- Individuals receiving corticosteroid therapy.
- Patients with chronic renal insufficiency.
- Individuals with diagnosed valvular heart diseases.

Study Procedure

After obtaining informed consent, eligible patients from the Medicine outpatient and inpatient departments were evaluated. A detailed clinical history and thorough examination were conducted for all participants. Investigations included an electrocardiogram (ECG), blood tests such as fasting blood sugar, HbA1c, lipid profile with fasting triglyceride levels, and cardiac enzymes (Troponin-I). Coronary angiography was performed to confirm the diagnosis and assess the severity of coronary artery disease.

Assessment of Insulin Resistance

Insulin resistance was evaluated using the Triglyceride-Glucose (TyG) index, a reliable and convenient surrogate marker. The index was calculated using the formula:

TyG index = Ln [fasting triglycerides (mg/dL) × fasting glucose (mg/dL) / 2]

This index was determined for all enrolled CAD patients and correlated with disease severity.

Statistical Analysis

Data were analyzed using SPSS version 23.0. Continuous variables were expressed as mean ± SD, and categorical variables as percentages. Chi-square test and independent t-test were used for

comparisons. Pearson's correlation assessed the relationship between TyG index and clinical parameters. A p-value <0.05 was considered significant.

RESULTS

Table 1: Age and Gender Distribution of Patients

Age Distribution	No. of Female		No. of Male		Total	
	No. of Patients	Percentage (%)	No. of Patients	Percentage (%)	No. of Patients	Percentage
30-45	6	13.33	4	4.94	10	7.94
46-60	20	44.44	31	38.27	51	40.48
>60	19	42.22	46	56.79	65	51.59
Total	45	100.00	81	100.00	126	100.00

Figure 1 shows the mean of key biochemical parameters in the study population. The mean Troponin I level was 10.56±14.66, while fasting triglyceride and fasting blood sugar levels were 148.82 and 122.68, respectively. The triglyceride-glucose index had a mean value of 4.84.

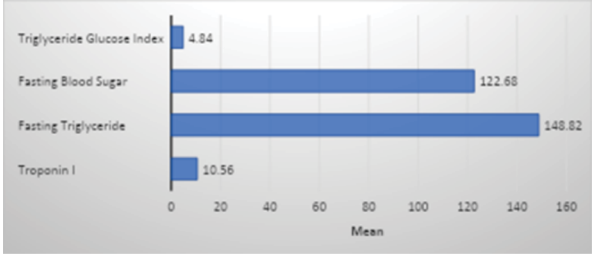

Figure 1: Biochemical Parameters of Patients

Table 2: Distribution of Patients by Killip Class, Fasting Triglyceride Levels, Fasting Blood Sugar, and Triglyceride Glucose Index

Killip Class	Fasting Triglyceride		Fasting Blood Sugar		Triglyceride Glucose Index	
	Mean	SD	Mean	SD	Mean	SD
Class 1	138.47	79.54	117.67	25.34	4.76	0.27
Class 2	105.79	26.54	121.31	27.52	4.71	0.14
Class 3	198.17	60.87	126.52	19.96	4.96	0.54
Class 4	148.13	82.8	127.43	22.06	4.86	0.2
P-Value	<0.001		0.3		0.01	

Statistically significant ($p < 0.001$), Not Significant ($p = 0.3$), Significant difference ($p = 0.01$)

Table 3: Distribution of Patients by CAG Findings and Fasting Triglyceride Levels

Angiography	Fasting Triglyceride		Fasting Blood Sugar		Triglyceride Glucose Index	
	Mean	SD	Mean	SD	Mean	SD
TVD	182.3	81.83	122.96	25.65	4.96	0.25
DVD	147.14	52.31	126.64	31.04	4.87	0.16
SVD	134.48	60	112.74	16.64	4.62	0.56
Slow Flow	143.5	127.46	130.5	43.52	4.75	0.48
P-value	0.09		0.22		0.01	

not significant ($p = 0.09$), not significant ($p = 0.22$), statistically significant ($p = 0.01$)

Figure 2 shows the correlation analysis between Troponin I and the triglyceride-glucose index. A very weak negative correlation was observed ($r = -0.02$), indicating almost no relationship between the two parameters. The p-value (0.8) suggests that this correlation is not statistically significant.

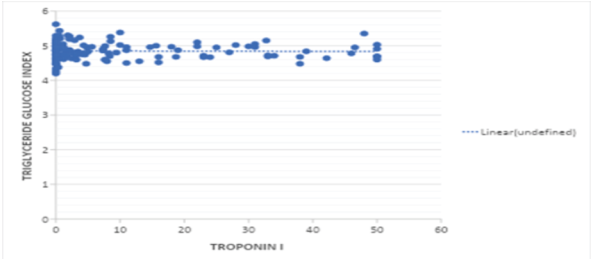

Figure 2: Pearson's Correlation Between Troponin I and Triglyceride-Glucose Index

DISCUSSION

In the present study, the majority of CAD patients were above 60 years of age, with a mean age of 59.27±6.76 years. Males constituted 64.29% of the cohort. Similar demographic patterns have been observed in previous studies. Vafaeimanesh et al. reported a mean age of 58.3±12.03 years and a higher prevalence of CAD among males (60.1%) compared to females [7]. Shenoy et al. also noted a male predominance (81%) with a mean age of 57.36±8.08 years [8]. Lempiainen et al. and Srinivasan et al. similarly found a higher CAD prevalence in older individuals [9,10]. Karrowni et al. and Kim et al. highlighted that advancing age and male gender are important contributors to both insulin resistance (IR) and CAD development [11,12]. In this study, Triple Vessel Disease (TVD) was the most common angiographic finding (26.19%), followed by Single Vessel Disease (21.43%) and Double Vessel Disease (11.11%). These results align with Regmi et al. and Varun et al., who also reported TVD as the most frequent finding, especially among high-risk patients [13,14]. The TyG index, used as a surrogate marker for IR, showed significantly higher values in the TVD group (4.96±0.25, p=0.008). This supports previous studies by Sánchez-Íñigo et al. and Tang et al., who demonstrated a positive association between TyG index, coronary atherosclerosis severity, and cardiovascular events [15,16]. Karrowni et al., Granér et al., and others have also reported that IR independently predicts the extent and severity of coronary artery disease in non-diabetic individuals [12,17-19]. A significant correlation was observed between Killip class and CAD severity, with higher Killip classes associated with more extensive disease (p=0.04). However, no significant correlation was found between Troponin I and TyG index (r=-0.02, p=0.8), suggesting that biochemical markers of myocardial injury may not reflect insulin resistance levels directly.

Limitations of the Study: The limitations of the study include its single-center design, relatively small sample size, and cross-sectional nature, which restricts the ability to establish causality or long-term prognostic implications.

Strengths of the study: The strengths of the study include the exclusive focus on non-diabetic CAD patients, use of the practical TyG index for assessing insulin resistance, and correlation with both clinical and angiographic parameters, enhancing its clinical relevance.

CONCLUSION

We concluded that insulin resistance, assessed by the TyG index, is significantly associated with the severity of coronary artery disease in non-diabetic individuals, highlighting its role as a simple, cost-effective marker for early risk identification.

Conflict of Interest: None.
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Ethical Approval: Obtained.
Consent: Written consent secured.

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