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Glucose Triglyceride Index as A Predictor of Coronary Artery Severity Assessed with Syntax Score in Acute Coronary Syndrome Patients

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Abstract **Original Research Article**

Background*:** Cardiovascular diseases (CVDs) are a major public health issue around the world. The TyG index has been identified as a credible alternative marker of insulin resistance (IR), which may explain its relationship to CVD. ***Aim of the Study*:** The aim of our study was to assess the angiographic severity of coronary artery disease in patients by the SYNTAX score. ***Methods*:** This cross-sectional observational study was conducted in the department of Cardiology, National Institute of Cardiovascular Diseases and Hospital (NICVD), Dhaka, Bangladesh, from September 2021 to August 2022. The study included 200 patients. All acquired data was entered into a Microsoft Excel Work Sheet and analyzed using descriptive statistics in SPSS 24.0. ***Results: The mean age (in years) for Group 1 was 60.20±4.65 (SD) years, and that for Group 2 was 63.03±6.16 (SD) years. Patients with a high TyG index (OR - 5.27, 95% CI (1.71-16.19)) had a significantly 5.27 times higher chance of having intermediate to high SYNTAX scores than patients with a low TyG index. Male patients had 1.39 times more chances of having intermediate to high SYNTAX scores (≥23) than female patients. High TyG index had significantly 4.81 times higher chances of having intermediate to high SYNTAX score (≥23) than the patients with low TyG index. TyG index and SYNTAX score was significantly positively correlated (r=+0.626, p<0.001) for NSTEMI Patients. ***Conclusion*:** This study found that the high TyG index had a significant positive association with intermediate to high SYNTAX scores, which indicates disease severity.

Keywords: Cardiovascular diseases, Triglyceride-Glucose index, SYNTAX score, Angiographic severity.

INTRODUCTION

Cardiovascular diseases (CVDs) are the major public health problem throughout the world. It is the number one cause of morbidity and mortality world-wide. The economic impact of different types of CVD is enormous [1]. In 2019, an estimated 17.9 million people died from cardiovascular disease, accounting for 32% of all global deaths. 85% of these deaths were caused by heart attacks or strokes. Out of the 17 million premature deaths (under the age of 70) due to non-communicable diseases in 2019, 38% were caused by CVDs. More than three quarters of CVD deaths occur in low- and middle income nations [2]. CVDs account for 50% of all non-communicable disease (NCD) deaths in the world each year and represent a significant threat to human welfare and sustainable development [3]. Bangladesh has always been a developing country with communicable diseases. Over the past few decades, because of epidemiological transition, the prevailing disease pattern in this country changed from predominantly communicable to predominantly non- communicable disease (NCD), CVD contributes to the latter a lot. The burden of CVD, especially the CAD is increasing at a greater rate in South Asia than in any other region globally [1]. In developing countries such as Bangladesh, coronary artery disease (CAD) is also a major and increasing health care issue. The exact prevalence of CAD in Bangladesh is unknown. According to more current data, the prevalence of coronary artery disease ranges between 1.85% and 3.4% in rural communities and 19.6% in an urban sample of working professionals [4]. According to the government heath bulletin 2013, CVDs were the top most causes of deaths (12,149 deaths; 12.2%) across 504 public hospitals in Bangladesh [5]. Acute coronary syndrome (ACS) encompasses ST segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI) and unstable angina (UA) [6]. NST-ACS remains the leading cause of death in individuals with coronary artery disease (CAD).

Metabolic syndrome (MetS) is characterized by the co-occurrence of CVD risk factors such as arterial hypertension, android obesity, hyperglycemia, and dyslipidemia [7]. Abnormal lipid metabolism in MetS is characterized by elevated triglycerides (TGs) and low high-density lipoprotein cholesterol (HDL-C). The prevalence of metabolic syndrome is rising in Western and Asian countries, particularly in developing regions experiencing fast socioeconomic change. Numerous clinical trials have shown that metabolic syndrome is an important risk factor for cardiovascular diseases (CVD), type 2 diabetes mellitus (T2DM) and all-cause mortality [8]. Insulin resistance (IR) is a broad term that refers to insulin's inability to exert its typical effects in insulin-sensitive target tissues such as skeletal muscle, adipose tissue, and the liver, which are the primary targets for insulin action in glucose metabolism. IR promotes pathogenesis of diabetes as well as cardiovascular disease via multiple mechanisms, including changes in classic cardiovascular risk factors and down regulation of the insulin signalling pathways in different tissues. The triglyceride glucose (TyG) index is one of the indirect indicators for metabolic syndrome (MetS) [9], as well as an affordable, simple, and novel clinical surrogate marker for insulin resistance (IR) due to its connection to lipotoxicity and glucotoxicity. It is the logarithm zed product of fasting triglycerides and fasting glucose. Several studies have shown that the TyG index is associated with ASCVD risk factors, including type 2 diabetes [10], hypertension [11] and metabolic syndrome [12]. The TyG index is also associated with other surrogate markers of CVD, including intima media thickness and arterial stiffness [13]. Therefore, researchers began to study the TyG index and found that the TyG index was a reproducible, reliable, and valid surrogate marker of IR [14]. A few studies have demonstrated that the TyG index is associated with CVD in high-risk patients, such as those with diabetes and chronic kidney disease [15]. Several recent investigations have revealed the link between the TyG index and vascular disease. The current study aimed to evaluate the association between the TyG index and CAD severity and assess the angiographic severity of coronary artery disease in patients by the SYNTAX score.

METHODOLOGY

This cross-sectional observational study was conducted in the department of Cardiology, National Institute of Cardiovascular Diseases and Hospital (NICVD), Dhaka, Bangladesh, from September 2021 to August 2022. After careful history taking fulfilling inclusion and exclusion criteria, a total of 200 NSTEMI patients admitted into NICVD undergoing coronary angiography during hospitalization irrespective of their age, sex, race and ethnic group and divided them between two groups: Group 1: Low TyG index (≤8.805) (n=100), Group 2: High TyG index (>8.805) (n=100). All acquired data was entered into a Microsoft Excel Work Sheet and analyzed using descriptive statistics in SPSS 24.0.

RESULT

The mean age (in years) for Group 1 was 60.20±4.65 (SD) years, and that for Group 2 was 63.03±6.16 (SD) years. The majority of the studied patients were male from both groups (69.0% of Group-1 and 71.0% of Group-2). Age was significantly different between groups (p0.05 when compared [Table-1]. The mean BMI was significantly higher for Group 2 patients than Group 1 when compared as the p value was 0.05) [Table 2]. [Table-3] reveals that in terms of symptoms, the majority of the patients in both groups had chest pain (75.0% in Group 1 and 80.0% in Group 2), palpitations were present in 60.0% of Group 1 and 65.0% of Group 2 patients, and shortness of breath was present in 69.0% of Group 1 and 65.0% of Group 2 patients. No significant difference was seen regarding symptoms between groups (p>0.05). There was no significant difference regarding SBP, DBP and pulse between groups when compared, as the p value was >0.05. The mean LVEF (%) was significantly different between groups when compared, as the p value was 0.05) [Table-5]. Study findings in [Table-6] reveals that multivariate regression analysis also showed that patients with high TyG index had significantly 4.81 times higher chances of having intermediate to high SYNTAX score (≥23) than the patients with low TyG index. Besides, patients with smoking, DM, HTN and family H/O CAD had non-significant but more chances of getting intermediate to high Syntax Score (p>0.05). TyG index and SYNTAX score was significantly positively correlated (r=+0.626, p<0.001) for NSTEMI patients [Table 7].

Table -1: Age and gender distribution of the studied patients between groups (N=200)

Variables	Group-I (n=100) (Low TyG index)	Group-II (n=100) (High TyG index)	P-value
Age (in years)	60.20±4.65	63.03±6.16	0.001*
Gender			
Male	69.0	71.0	0.758**
Female	31.0	29.0	

Table-2: BMI distribution of the studied patients (N=200)

BMI (in kg/m2)	Group-I (n=100) (Low TyG index)	Group-II (n=100) (High TyG index)	P-value
Mean±SD	23.54±4.08	25.22±6.86	0.038*
BMI category			
Underweight (<18.5)	15.0	4.0	0.070**
Normal (18.5-22.9)	33.0	37.0	
Overweight (23-24.9)	21.0	23.0	
Obese >25	31.0	36.0	

Table-3: Distribution of the studied patients by symptoms (N=200)

Symptoms	Group-I (n=100) (Low TyG index)	Group-II (n=100) (High TyG index)	P-value
Chest pain	75.0	80.0	0.397
Palpitation	60.0	65.0	0.465
Shortness of breath	69.0	65.0	0.547

Table-4: Clinical characteristics of the studied patients between groups (N=200)

Variables	Group-I (n=100) (Low TyG index)	Group-II (n=100) (High TyG index)	P-value
SBP (in mmHg)	156.45±30.79	150.10±23.50	0.917
DBP (in mmHg)	95.65±25.57	92.95±20.12	0.105
Pulse (in beats/minute)	91.90±19.67	90.60±20.38	0.914
LVEF (%)	52.95±8.45	39.87±9.75	<0.001

Table-5: Univariate logistic regression showing independent predictors of intermediate to high SYNTAX score (≥23) (N=200)

Variables	OR	95% CI (Lower Upper)	P-value
TyG index (High TyG index vs Low TyG index)	Family H/O CAD	1.71-16.19	0.004
Gender (Male vs female)	1.39	0.55-3.49	0.491
Smoking (Yes vs No)	1.67	0.65-4.29	0.287
HTN (Yes vs No)	1.16	0.40-3.36	0.784
DM (Yes vs No)	2.72	1.02-7.33	0.047
Family H/O CAD	1.68	0.34-8.21	0.522

Table-6: Multivariate logistic regression showing independent predictors of intermediate to high Syntax score (≥23) (N=200)

Variables	OR	95% CI (Lower Upper)	P-value
TyG index (High TyG index vs Low TyG index)	4.81	1.55-14.92	0.007
Smoking (Yes vs No)	1.10	0.21-1.51	0.257
HTN (Yes vs No)	1.25	0.41-3.86	0.689
DM (Yes vs No)	2.03	0.72-5.72	0.181
Family H/O CAD (Yes vs No)	1.30	0.25-6.75	0.754

Table-7: Correlation between SYNTAX score and TyG index of NSTEMI patients (N=200)

Variables	Correlation coefficient (r)	P-value
Syntax score	+0.626	<0.001 (s)

DISCUSSION

In this study, 200 patients with NSTEMI were included and divided into two groups: Group 1 –Patients with low TyG index and Group 2- Patients with high TyG index. In the current study, the mean age (in years) for the low TyG index patients was 60.20±4.65 (SD) years, and for high index patients, the mean age was 63.03±6.16 (SD) years. The majority of the studied patients were male from both groups (69% of Group-1 and 71% of Group-2). Age was significantly different between groups (p0.05 when compared. A similar study showed that the median age for the patients in the low TyG index group was 60 and for the high TyG index group was 64 years, and they also found a significant difference between groups regarding age (in years) [16]. Another study that was performed to see the association of age and sex with NSTEMI found that men have a 2.4-fold overall risk for NSTEMI when compared with females [17]. In this study, the mean BMI was significantly higher for Group 2 patients than for Group

1 when compared as the p value was 0.05). The mean BMI was 23.55±4.08 (SD) kg/m2 for patients with a low TyG index and 25.22±6.86 (SD) for patients with a high TyG index. Mao *et al.*, showed that the mean BMI was 23.90±2.96 (SD) and 24.76±3.32 (SD) for patients with a low TyG index and high TyG index, respectively [16]. In terms of symptoms, the majority of the studied patients in both groups had chest pain (75% in Group 1 and 80% in Group 2), palpitation was present in 60% of Group 1 and 65% of Group 2 patients, and shortness of breath was present in 69% of Group 1 and 65% of Group 2 patients. No significant difference was seen regarding symptoms between groups (p>0.05). A study was performed to determine the clinical presentation of AMI, and they found that 84% of the patients with acute myocardial infarction had chest pain [18]. In the present study regarding DM status, DM was significantly higher among Group 2 patients than Group 1 patients as the p-value was<0.05. So, patients with high TyG index had a higher incidence of diabetes. In addition, the mean TyG index, fasting blood glucose (FBG), mean total cholesterol (TC), mean triglyceride (TG), mean high-density lipoprotein, and mean low-density lipoprotein were significantly different (p<0.05) between patients with a low TyG index and those with a high TyG index. Additionally, the mean SYNTAX score was significantly higher for patients with a high TyG index. LVEF (%) was significantly higher for patients with a low TyG index. Nearly similar findings were seen in other studies [16, 19]. Zhang *et al.*, also found similar findings [19]. According to this study, patients with a high TyG index (OR - 5.27, 95% CI (1.71-16.19)) had a significantly 5.27 times higher chance of having intermediate to high SYNTAX scores than patients with a low TyG index. Male patients had 1.39 times more chances of having intermediate to high SYNTAX scores (≥23) than female patients. In addition, a significant association was seen between the TyG index and SYNTAX score in the present study. In conclusion, the high TyG index had a significant positive association with intermediate to high SYNTAX scores, which indicates disease severity. In addition, the present study showed that the TyG index had a significantly positive correlation with age and the SYNTAX score. With an increasing TyG index, the SYNTAX score also increased. In addition, a study by Mao *et al.*, found that the number of diseased vessels and the SYNTAX score increased with increasing TyG index levels and that the SYNTAX score was related to cardio metabolic risk factors [16].

Limitation of the Study:

This study was a single-center study with a small sample size and a short duration of follow-up, so these findings may not reflect the actual scenario.

CONCLUSION & RECOMMENDATION

This study found that the high TyG index had a significant positive association with intermediate to high SYNTAX scores, which indicates disease severity. Additionally, the TyG index was significantly positively correlated with the SYNTAX score, which means that with the increase in the TyG index, the SYNTAX score also increased. So, glucose triglyceride index as a predictor of coronary artery severity assessed with syntax score in acute coronary syndrome patients. However, a larger multicenter study is necessary, since it may provide additional information about the impact of the TyG index on predicting coronary artery disease severity and in-hospital outcome.

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