A STUDY ON CORRELATION OF SEVERITY AND OUTCOME IN ACUTE CORONARY SYNDROME WITH TRIGLYCERIDE GLUCOSE INDEX

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Abstract:

Aims: Acute coronary syndrome (ACS) is currently most prevalent cause of mortality and morbidity worldwide and India. Asian Indians throughout the world have one of the highest incidences of premature coronary artery disease with clinical manifestations occurring almost ten years earlier than other populations. There is an increase in coronary heart disease (CAD) in past 60 years, from 1% to 10% in urban populations and <1% to 6% in rural populations. The present study was conducted to assess the relationship between severity and outcome of CAD with triglyceride glucose (TYG) index.

Methods: The present study was an observational, analytical, prospective, single centre, hospital based study conducted from May 2020 to Oct 2021 at Department of Cardiology, N.R.S Medical College and Hospital, Kolkata India. Total 156 patients were included in this study.

Result: In this study, it was found that in single vessel disease, the mean TyG index (mean ± S.D.) of patients was 4.6120 ± 0.2596. In Multi vessel disease, the mean TyG index (mean ± S.D.) of patients was 6.4546 ± 14.3391. Distribution of mean Glucose TG Index with number of vessels involved was statistically significant ($p = 0.0240$).

Conclusion: The elevated TyG index was independently associated multivessel disease which was statistically significant. High TyG index had positive correlation with SYNTAX I and II

score, number of drug eluting stents, total stent length and Killip class but correlation was not statistically significant.

Running Title: Relationship of triglyceride glucose index with acute coronary syndrome

Keywords: Triglyceride glucose index, ACS, CAD, Percutaneous Intervention.

Introduction:

ACS is currently the most prevalent cause of mortality and morbidity worldwide and in India. Asian Indians throughout the world have one of the highest incidences of premature CAD with clinical manifestations occurring almost ten years earlier than other populations. There is increase in coronary heart disease in past 60 years, from 1% to 9%-10% in urban populations and <1% to 4%-6% in rural populations. Early assessment of severity may expedite early initiation specific therapy causing significant mortality and morbidity benefit. Newer novel markers which predict coronary artery disease in earlier phase poses significant financial burden. TYG index is an inexpensive index which independently correlate with insulin resistance (IR), can hypothetically predict cardiovascular severity and outcome as IR plays a central role in pathophysiology. High levels of triglyceride (TG) and fasting blood glucose (FBG) are the components of metabolic syndrome which is one of the most important risk factors for CVD. The combination of both indicators, the triglyceride-glucose (TyG) index, has been reported to be significantly correlated with IR and has been proposed as a reliable surrogate marker of IR. However, most of the relevant studies focused on the impact of the TyG index on metabolic diseases. Although several recent studies have showed the association of the TyG index with vascular disease, no studies have further explored the role of the TyG index in ACS. Therefore this study was conducted with the primary objective to assess the relationship between severity and outcome of coronary artery disease (CAD) with triglyceride glucose (TYG) index. Secondary objective was to evaluate angiographic profile of ACS patients and calculate SYNTAX score.

Materials and Methods:

An observational, analytical, cross sectional, single centre study was conducted in the Department of Cardiology at N.R.S Medical College and Hospital, Kolkata during May 2020 to Oct 2021. After obtaining the approval from the Institutional Ethics Committee, adult patients of both sexes admitted with presentation as ACS or STEMI / NSTEMI/unstable angina as defined by the European college of cardiology (ESC) and American association of cardiology were included in the study. Patients not giving consent, age less than 18 years, severe liver and/or renal insufficiency, thyroid dysfunction, extreme body mass index (BMI >45 kg/m2), suspected familial hyper tryglyceridemia, taking triglyceride reducing drugs or history of active alcohol intake were excluded.

Sample size calculation: There are approximately 100 new admissions of Myocardial Infarction of all age groups in a month in department of cardiology. Taking into consideration the current prevalence profile which is approximately 20 to 30% of patients with ACS a total of approximately 100 patients admitted with ACS was enrolled in this study over a period of 6 months. Acute coronary syndrome was diagnosed with typical symptoms, ECG changes and cardiac enzyme assay.

After admission patients were recruited as per inclusion/exclusion criteria and their informed consent were obtained and evaluated for their clinical presentation, risk profile with proper medical history with emphasis on the risk factors like Diabetes Mellitus, Hypertension, family history of premature coronary artery disease, smoking, tobacco chewing, physical inactivity was taken and relevant biochemical investigations were done. Parameters which were assessed include blood pressure, peripheral pulse, height, weight, BMI, waist circumference, vital parameters. Bodyweight was measured in kilograms to the nearest 0.1 kg using a digital scale, which was calibrated regularly. Height was measured to the nearest 5 mm using a height gauge. Body mass index (BMI) was calculated using Quetlet's formula as weight in kg/square of the height in meters. Obesity was defined as BMI > 25 kg/mm2. Waist circumference was measured. Waist circumference of >80 cm in female and >90 cm in male was considered abnormal. Blood pressure was recorded in left arm in supine position with an appropriately sized cuff using a sphygmomanometer. Hyperlipidemia was defined as serum cholesterol of $\geq$ 200 mg/dl, triglyceride (TG) >150 mg/dl, low-density lipoprotein > 130 mg/dl, HDL-C < 50 mg/dl for female and < 40 mg/dl for male, a total cholesterol/HDL-C value of $\geq$ 4.5, known cases of dyslipidemia and/or those on medication for dyslipidemia.

Laboratory investigations like Fasting blood glucose, Random blood glucose, cardiac enzymes serum urea and creatinine, creatinine clearance, eGFR (by CKD-EPI formula), lipid profile, and complete hemogram was done. Electrocardiogram, chest radiograph and echocardiography were also done. TYG index was calculated with the formula [fasting TG (mg/dl) x fasting FBS (mg/dl)] x 0.5. TYG index was correlated with other clinical, biochemical, angiographic parameters. Data regarding age, sex, weight, height, history of COPD, Peripheral vascular disease, and creatinine clearance (using CKD-EPI formula) were collected for the calculation of SYNTAX II Score. Syntax II was calculated using SYNTAX II Calculator (Boston-Scientific).

ACS patients were treated as per the clinical status and the recommended guidelines of management. Coronary angiography was performed wherever it is indicated after adequate preparation of the patient using the standard technique. All coronary lesions with > 50 % stenosis in the vessels with diameter of > 1.5 mm was scored with Syntax scoring algorithm. Syntax score I and II was calculated using the online calculator (www.syntaxscore.com) and severity of the lesion as noted in the angiography was graded as follows:

▪ Low Syntax score: $\leq$ 22

▪ Intermediate Syntax score: 22-32

▪ High Syntax score: $\geq$ 33

Data analysis and interpretation: Data was put into the Microsoft office excel sheet and statistical calculation was done using SPSS software version 23. Continuous variables were presented as Mean ± Standard deviation. Categorical variables were given as number and percentage. Comparison between groups was done by Mann-Whitney U test for the continuous variables whereas chi square test and Fisher test was used for the categorical variables. P value <0.001 was considered significant.

Results

Total 156 patients were included in this study. It was found that male population [132 (84.6%)] was higher than Female population [24 (15.4%)]. In our study, all patients [156 (100.0%)] had

chest pain. It was found that, lower number of patients had dyspnoea [19 (12.2%)], nausea/vomiting [21 (13.5%)], diarrhoea [10 (6.4%)], S3 [26 (16.7%)], crepitation [43 (27.6%)] which were statistically significant (p<0.0001). It was also found that most of the patients had diaphoresis [131 (84.0%)] which was statistically very significant (p<0.0001), (z=12.0021).Our study showed that, higher number of patients had effort intolerance [90 (57.7%)] which was statistically significant (p=.00652), (z=2.7175). Our study showed that, majority number of patients had no hypertension [85 (45.5%)] but this was not statistically significant (p=.11184), (z=1.5852). In this study, lower number of patients had diabetes mellitus [32 (20.5%)], dyslipidaemia [21 (13.5%)], COPD [8 (5.1%)], stress [58 (37.2%)] which were statistically significant (p<0.0001). We observed that, higher number of patients had STEMI [126 (80.8%)]. However, NSTEMI [18 (11.5%)] followed by unstable angina [6 (3.8%)] which was statistically significant (p<0.0001) (z=13.751).In this study, Glucose TG Index vs TIMI Risk Score [.037], LVEF (%) [.076], Syntax I [.001], Syntax II [.042], DES Number [.076] and Stent Length (mm) [.048] were positive correlation which were not statistically significant. We found that, Glucose TG Index vs Waist/Hip ratio [-.007], BMI [-.050], Wall Motion Score [-.141] were negative correlation which were not statistically significant.

Discussion

Lee EY et al [1] (2016) aimed to investigate the association between coronary artery stenosis (CAS) and triglyceride glucose index (TyG index), a simple insulin resistance marker, in asymptomatic subjects with type 2 diabetes Mean age was 63.8 ± 9.5. da Silva A et al [2] (2019) examined that the triglyceride-glucose index (TyG index) is a tool for insulin resistance evaluation, however, little is known about its association with coronary artery disease (CAD), which is the major cardiovascular death cause, and what factors may be associated with TyG index. They evaluated 2330 patients, which the majority was male (58.1%). In the present study, male population [132(84.6%)] was higher than female [24 (15.4%)]. Male: Female ratio was 5.5:1 but this was statistically significant (p<0.0001), (z=12.2286). Wei A et al [3] (2022) showed that over the past decade, the incidence and global burden of coronary heart disease (CHD) have increased in the young population. Significantly higher dyslipidaemia prevalence was found in female patients with premature CHD (OR=1.412, 95% CI: 1.029 to 1.936). Hu C et al 4 (2020) showed that previous studies have investigated the relationship of the triglyceride glucose (TyG) index with the incidence of cardiovascular events; diabetes: 43.9% and dyslipidaemia: 76.8%). In the current study, lower number of patients had DM [32 (20.5%)], Dyslipidaemia [21 (13.5%)], COPD [8 (5.1%)], stress [58 (37.2%)] which were statistically significant (p<0.0001).

The present study revealed that, lower number of patients had Glyceryl trinitrate (GTN) [7 (4.5%)], oral hypoglycaemic agents [30 (19.2%)], NORAD-IV [10 (6.4%)], Atropine –IV [5(3.2%)], Diuretic –IV [41 (26.3%)], Amiodarone –IV [4 (2.6%)], GTN –IV [3 (1.9%)], Milrinone –IV [1 (0.6%)], NS -IV [8 (5.1%)], CHB [7 (4.5%)] AF [2 (1.3%)], Cardio Shock [13 (8.3%)], Pulmonary Embolism/ tamponade [2 (1.3%)], Mechanical Com [2 (1.3%)], HF [21 (13.5%)], ACESS Site [7 (4.5%)], Bleeding [1 (0.6%)]and VT/VF/DC SCHK-Complication [8 (5.1%)] which were statistically significant (p<0.0001). Karadeniz FÖ et al [5]

(2023) examined that the triglyceride-glucose (TyG) index is calculated from fasting triglycerides and fasting glucose levels and is an indicator of insulin resistance. This retrospective study included 646 patients with ST-elevation myocardial infarction (STEMI) and 1048 patients with non–STelevation myocardial infarction (NSTEMI). We observed that, higher number of patients had STEMI [126 (80.8%)]. However, NSTEMI [18 (11.5%)] followed by UA [6 (3.8%)] which was statistically significant (p<0.0001) (z=13.751). Hu C et al [4] (2020) showed that previous studies have investigated the relationship of the triglyceride glucose (TyG) index with the incidence of cardiovascular events. BMI: 26.2 ± 9.21 kg/m2, The mean waist circumference of patients were [86.8349± 16.3212], mean Waist/Hip ratio of patients was [1.1319 ± 2.5849], mean BMI of patients was [24.6710± 4.1779], mean Hb of patients was [13.3538 ± 1.6707], mean Sr. Creatinine of patients was [1.1185± .2257] and mean BUN of patients was [13.7660± 4.3642].

Farooq V et al [6] (2013) observed that the residual Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery (SYNTAX) Score is an objective measure of the degree and complexity of residual stenosis after percutaneous coronary intervention (PCI). In the PCI cohort, the mean baseline and residual SYNTAX Scores were 28.4±11.5 and 4.5±6.9, respectively. Our study showed that, mean Syntax I of patients was [14.9776± 9.7845] and mean Syntax II of patients was [23.3665± 10.0684]. We found that, the mean Number of Vessel of patients was [1.6346± .8657], mean DES Number of patients was [1.1523± .9916] and mean Stent Length (mm) of patients was [28.4805± 25.5592].

In this study, mean Glucose TG was significantly higher in multi vessel [6.4546± 14.3391] compared to Single vessel [4.6120± .2596]. (p=0.0240).Lee et al [1] (2016) have shown that a higher TyG index is related to a raised risk of coronary artery stenosis in asymptomatic patients with type 2 diabetes, especially when they have risk factors for CAD. Thus, in our study, we evaluated the TyG index to determine correlation with SSII in non diabetic NSTEMI patients. In our study, Glucose TG Index vs TIMI Risk Score [.037], LVEF (%) [.076], Syntax I [.001], Syntax II [.042], DES Number [.076] and Stent Length (mm) [.048] were positive correlation which were not statistically significant. We found hat, Glucose TG Index vs Waist/Hip ratio [-.007], BMI [-.050], Wall Motion Score [-.141] were negative correlation which were not statistically significant.

Conclusion

Significant elevation in mean TyG index in multivessel subjects was found as compared to single vessel patients. TyG index has positive correlation with Killip's class, however it was statistically not significant. Although TYG index has positive correlation with both SYNTAX I and II it is statistically non-significant. TYG index tends to be higher in multivessel and complex coronary disease with high SYNTAX score but again not statistically significant. TYG index also correlates positively with DES number and total DES length which are independent risk factors for in stent restenosis (ISR), but statistically not significant. Based on these promising findings, the TyG index could be a simple, easy-to-use, and reliable indicator for predicting ACS patient prognosis and suggesting ways to improve ACS risk classification but need larger and more robust studies for validation.

Limitations

There are certain limitations of this study like the sample size was small and the study has been done in a single centre which follows a certain protocol for management of ACS patients which may vary from institute wise.

Conflict of Interest: None

Financial Support: Nil

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