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Triglyceride and Glucose Index as a Marker on Severity of Ischemic Stroke

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Abstract: ***Background: Triglyceride and glucose (TyG) index a simple tool to assess the severity of stroke. Aims and objectives: To understand the role of triglyceride - glucose index as a marker in determining the neurological outcome. Material and methods: A cross - sectional observational study was conducted amongst the patients with ischemic stroke. The patients initial NIHSS was calculated within 24 hours of arrival of the patient. Fasting blood glucose levels and Triglyceride levels were sent and the TyG index was calculated. The results were then compared. Results: A total of 106 subjects were studied. After a doing a ROC analysis the cut - off for TyG Index was found to be 8.4937. Correlation of TyG with NIHSS was found to be statistically significant with p value of 0.0001 with a correlation co efficient of r=0.758. Conclusion: Higher TyG index may be used as a simple tool to risk stratify patients with ischemic stroke.***

Keywords: Triglyceride - Glucose Index (TyG Index), NIHSS (National Institute of Stroke Scale), Ischemic stroke, Triglyceride levels, Fasting blood glucose levels.

1. Introduction

Stroke is a major of cause of morbidity and mortality worldwide. [1]

Incidence of stroke in India ranged from 105 to 152 per 100, 000 persons per year, and the crude prevalence of stroke ranged from 44.29 to 559 per 100, 000 persons. [2]

There has always been a strong association of between fat, muscles and the pancreatic β - cells. [3] Triglyceride and glucose index (TyG) have been identified as markers for metabolic syndrome initially. [4] It has also been found that TyG index is been associated with coronary artery calcification, carotid atherosclerosis and high risk of Cardiovascular disease (CVD) [5, 6, 7].

Triglyceride - Glucose index (TyG) index is calculated as ln [fasting triglycerides (mg/dL) × fasting plasma glucose (mg (dL) /2].

This index has been used tool to determine the severity of insulin resistance and all - cause mortality and cardiovascular outcome. [8] Insulin resistance has been found to a mediator of chronic inflammation which causes endothelial dysfunction, activation of foam cell, and promote the process of atherogenesis. [9]

Triglyceride – glucose index has been used as a simple, low cost marker for predicting atherosclerotic cardiovascular disease outcomes. [10] Stroke being such an important cause of death and disability, there is limited data with this index being used a tool for poor outcomes. Hence, this study aims at finding the effectiveness of triglyceride – glucose index as an inexpensive marker in determining the severity of stroke.

Aims and Objectives

To understand the role of triglyceride - glucose index as a marker in determining the neurological outcome.

Objectives include

a) To measure fasting triglyceride level and fasting blood glucose levels.
b) To calculate the triglyceride - glucose index (TyG Index).
c) To correlate the severity of stroke with triglyceride - glucose index and the NIHSS stroke scale.

2. Materials and Methods

Data will be collected from a minimum of 96 patients fulfilling the inclusion and exclusion criteria attending the inpatient of Father Muller Medical College Hospital, Mangalore during a period of 3 months. Patients of the age 18 years and above meeting inclusion criteria will be approached and written informed consent will be taken from each patient willing to be enrolled in the study. Patient will receive a patient information sheet explaining the study. All the participants will undergo complete clinical evaluation using the NIHSS stroke severity scaling from the time of admission to 24 hours. Then we will measure the Triglyceride – glucose index. Then triglyceride – glucose index is then compared with the NIHSS and then analysed. The study was approved by Father Muller's Ethics Committee.

Statistical analysis

The data collected were tabulated in MS Excel sheet and were analysed using SPSS version 20 software. Frequency, Accuracy, Sensitivity and Specificity were calculated. Correlation between NIHSS and TyG index were assessed. A significance level was considered as $P<0.05$.

3. Results

The study was done on 106 patients who were newly diagnosed with ischemic stroke. After collection of data, TyG index was calculated. An ROC analysis was done and Cut of was found to be 8.4937. Specificity and sensitivity was 96 % and 87% respectively.

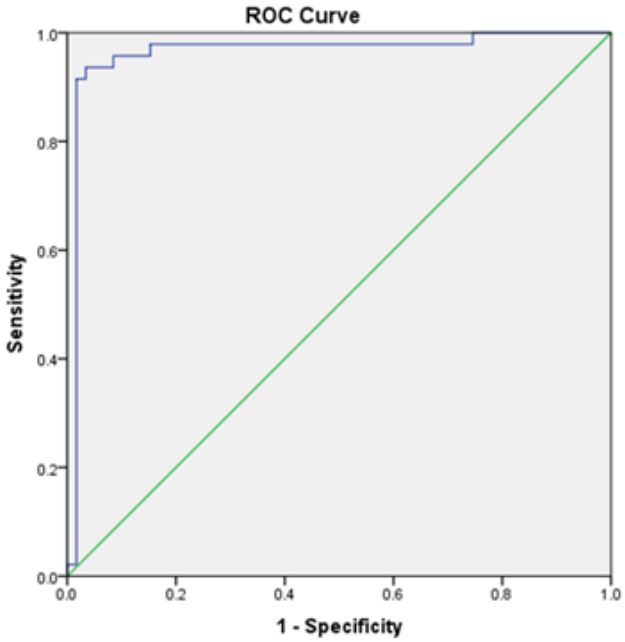

Figure 1: ROC curve for TGL index to predict severity of stroke

After ROC analysis,

1) TGL index to predict severity of stroke

TGL index	Values (95% confidence interval)
AUC	0.963 (0.919, 1.00)
Accuracy	0.925
Specificity	0.966
Sensitivity	0.872
Cut - off value	8.4937

2) Comparison of Gender with TyG Index

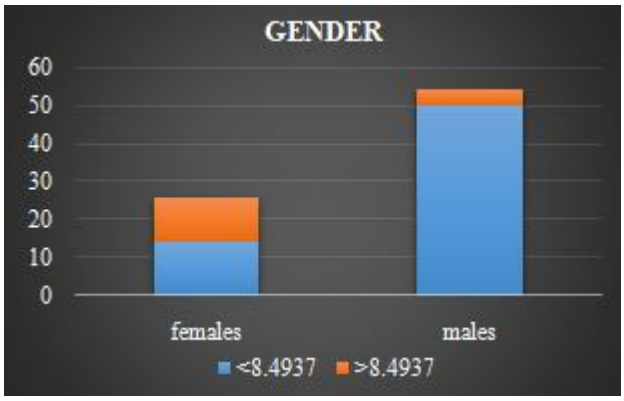

Figure 1: Showing the comparison of TyG index with gender

It was seen that males had a higher TyG index in our study and its comparison between two genders, which was not statistically significant with a p value of (0.433)

3) Comparison of Age with TyG Index:

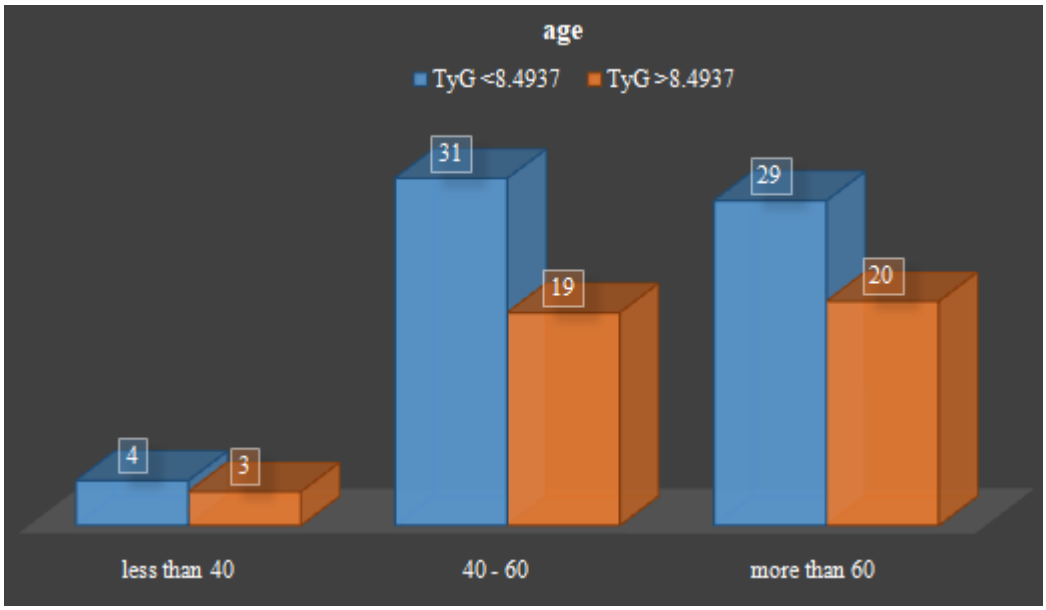

Figure 2: Showing the distribution of Age

Most the people with ischemic stroke fell between 40 – 60 years of age and comparison with age and TyG index were not statistically significant with p value (0.944).

4) Comparison with hypertension

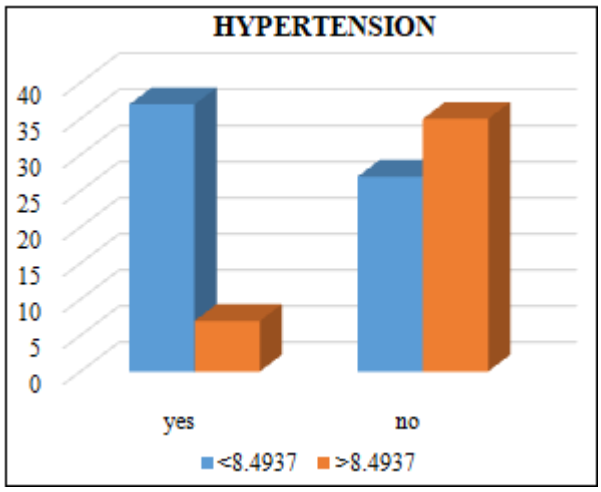

Figure 3: Showing the comparison of Hypertensives with TyG index

Hypertension was found to be the most common risk factor and correlation with TyG index was found to be statistically significant.

5) Comparison with tobacco consumption

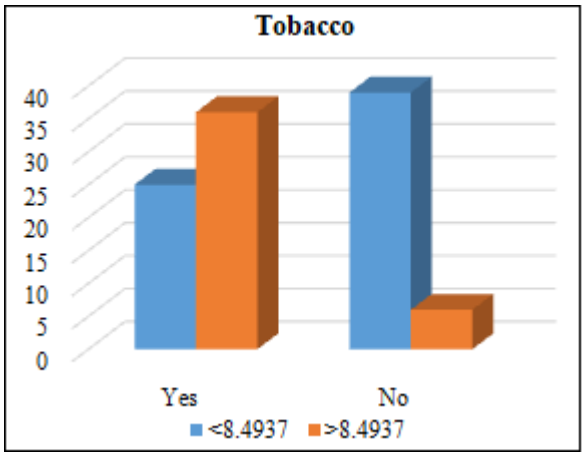

Figure 4: Bar Chart showing the comparison of tobacco compared with TyG index

Many of the patients were smokers (59 %) and also found to statistically significant with a p vale <0.0001.

6) Comparison with Fasting Triglyceride with TyG Index

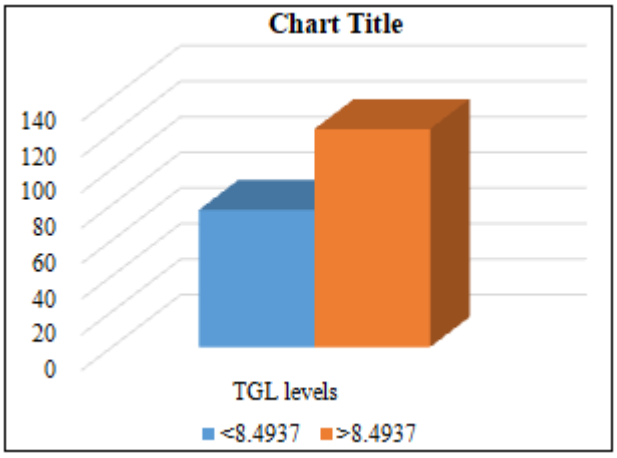

Figure 5: Bar Chart showing the distribution triglyceride levels with the TyG index

Correlation of Triglycerides levels and TyG index was found to be statistically significant with p value of (0.0001)

7) Comparison of Fasting Blood Sugars with TyG index

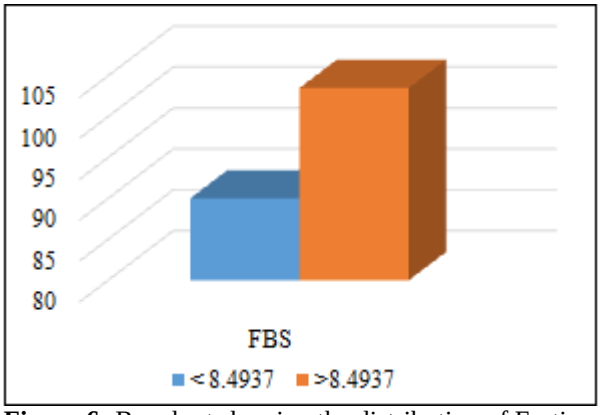

Figure 6: Bar chart showing the distribution of Fasting blood sugars with TyG index

Higher Fasting blood sugars were found in the severe group and statistically significant with p values of 0.0001.

Distribution of study participants according to NIHSS stroke classification

Table 1: Showing the distribution of NIHSS

NIHSS stroke classification	score	Frequency	Percentage
Minor	0 - 4	59	55.7
Moderate	5 - 15	42	39.6
Moderate to severe	16 - 20	3	2.8
severe	21 - 42	2	1.9
Total		106	100.0

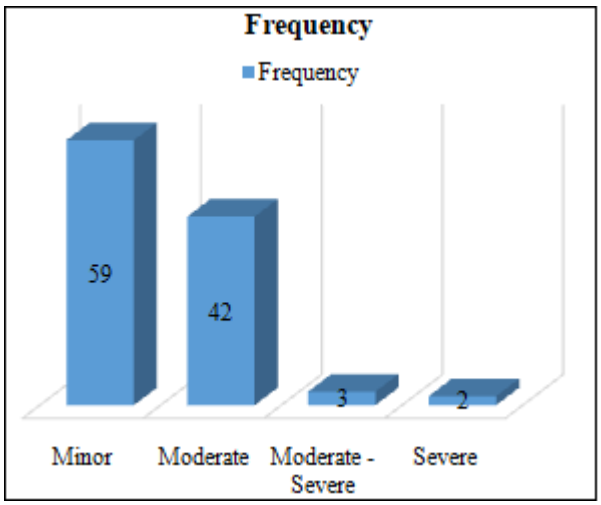

Figure 7: Bar Chart showing the distribution of NIHSS

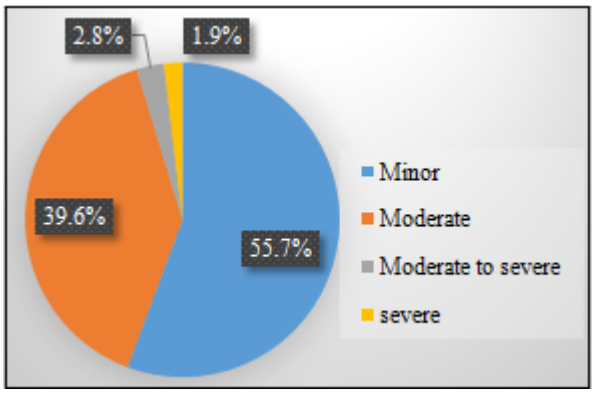

Figure 8: Pie chart showing the percentage of NIHSS

8) Association of NIHSS with Tyg Index

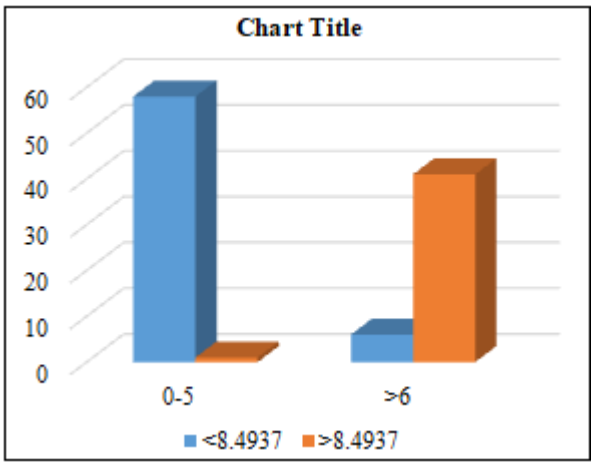

Figure 8: Bar chart showing the Distribution of NIHSS with the TyG Index

9) Correlation of TyG index with NIHSS stoke scale

	NIHSS score	
	Correlation coefficient	P value
TGL index	0.758	0.0001*

Chi square test analysis was and the correlation coefficient was 0.758 with p value of 0.0001.

10) Correlation of baseline characteristics with TyG index

Baseline characteristics		TGL index		Test statistics	P value
		<8.4937	≥ 8.4937		
Gender	Female	14 (53.8)	12 (46.2)	0.614	0.433
	Male	50 (62.3)	30 (37.5)		
Age	<40	4 (57.1)	3 (42.9)	0.115	0.944
	40 - 60	31 (62.0)	19 (38.0)		
	>60	29 (59.2)	20 (40.8)		
Hypertension	Yes	37 (84.1)	7 (15.9)	17.682	0.0001*
	No	27 (43.5)	35 (56.5)		
	No	41 (61.2)	26 (38.8)		
Alcohol	Yes	22 (59.5)	15 (40.5)	0.020	0.887
	No	42 (60.9)	27 (39.1)		
Tobacco	Yes	25 (41.0)	36 (59.0)	22.591	0.0001*
	No	39 (86.7)	6 (13.3)		
NIHSS stroke classification	0 - 5	58 (98.3)	1 (1.7)	80.012	0.0001*
	>6	6 (12.8)	41 (87.2)		

4. Discussion

The study was intended to find the Simple, efficient marker to help health care worker to explain the severity of stroke. Triglyceride and Glucose index (TyG index) have been studied as surrogate marker for insulin resistance. [11] There is considerable evidence thatinsulin resistance, by promoting dyslipidaemia and other metabolic abnormalities, promote a proatherogenic milieu. [12]

Our study was done on totally 106 patients of ischemic stroke. Our study had a male preponderance with Male to female ratio of 3: 1 which was similar to all studies done by Anxin Wang et al [13]. The mean age of our study group was 60.61 ± 12.822 years with minimum being 28 and maximum being 89 years. This is in accordance with various other studies

Emma M. S. Toh et al [14], Zegui Huang et al [15]. In our study Hypertension was the most common risk factor detected in 62 percent of the patients followed by smoking (49 %) and then alcoholism. This was similar to studies Xiaomeng Yang et al [16], Takao Hoshino [17]. Fasting blood sugar levels were found to be higher amongst the higher TyG group which were statistically significant, similar to other studies Nachimuthumaithilikarpagaselvi et al [18], Seyed Ali Nabipoorashrafi et al [19], Su Zou [20] and it was statistically significant (p <0.001). Mean Triglyceride levels was 97.05 which was also increased amongst the higher index group. These findings correlated with previous study done by Xiao - cong Liu1 [21], Gisela Unger [22], Mohsen Mazidi [23]. To the best of our knowledge, this is the first study which has tried to correlate the value of TyG with NIHSS score at the time of admission. In our study positive, moderately strong and statistically significant correlation. Our study is similar to the studies done by Minwoo Lee et al [24], Xiao Feng [25], Fang Wang et al [26] in which there was a positive correlation between TyG index and NIHSS score at the time of admission. In our study, a statistically significant positive correlation between TyG Index and NIHSS was also observed (p=0.0001) and with correlation co efficient of r=0.758.

5. Conclusion

Triglyceride – Glucose Index (TyG) is a simple, cost effective and easily obtainable novel inflammatory marker that may help in predicting the severity of disease by it strong positive correlation with NIHSS score. This ratio can be obtained even at primary health set ups and may be used for decision making in urgent referral of the patient for better outcome. Though, more studies are needed to validate our results, our study completely supports the routine calculation of this ratio that may add to risk stratification of patients with acute ischemic stroke.

Limitation of Study

Despite our best efforts our studies had few limitations

1) The sample size of our study was small involving only single centre patients of acute ischemic stroke.
2) Owing to lack of long term follow up for our patients, we cannot comment whether platelet to lymphocyte ratio is a useful predictor of long termprognostic outcome in patients with AIS or not.

3) Our study was carried out in a tertiary centre where the cases are either serious or referred. Our study may thus be biased towards more serious cases.

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