CLINICAL STUDY

Association Between Triglyceride Glucose Index in Type 2 Diabetes Mellitus Patients and Acute Ischemic Stroke

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ABSTRACT

Background: The stroke is a leading cause of mortality and disability globally. Diabetes mellitus increases the risk of stroke. It was observed that the risk of stroke is usually higher among the young diabetic patients. It was evident that prediabetic patients have a great risk of stroke as the presence of glucose in blood results in vascular endothelial dysfunction, increased early-age arterial stiffness, systemic inflammation and thickening of the capillary basal membrane. In this study we aimed to determine the association between triglyceride glucose (TyG) index in type-2 diabetes mellitus patients and acute ischemic stroke. **Methods:** The present prospective observational study was undertaken to elucidate the association between TyG index in type-2 diabetes mellitus patients and acute ischemic stroke. A total of 75 patients with acute ischemic stroke and had history of diabetes mellitus during the period of study were included in the study.**Results:** In our study the mean age of the patients was 58.74 ± 11.37 years and the majority of the patients were males (57%) followed by 43% females. The average NIHSS score of study participants was 5. The mean fasting plasma glucose (FPG) value was as 6.13±2.03 (mmol/L), mean total cholesterol (TC) was 5.76 ± 1.4 (mmol/L), mean triglyceride (TG) 1.98 ± 0.93 was (mmol/L) and mean TyG index was 8.76 ± 0.28. **Conclusion:** The present study concluded that the TyG index is an important risk factor of ischemic stroke as it was observed that the patients with higher TyG index has higher incidence of ischemic stroke.

Keywords: Diabetes, glucose level, triglycerides, ischemia and stroke.

Introduction

Diabetes is known as silent killer, which can start from early stages of life and can be asymptomatic. It is a chronic noncommunicable[1] group of disease characterized by a state of chronic hyperglycemia, resulting from diversity of aetiologies, the environmental and genetic, acting jointly. The underlying cause of diabetes is the defective production or action of insulin, a hormone that controls glucose, fat and amino acid metabolism with variable clinical manifestation and progression.

Diabetes mellitus increases the risk of stroke. It was observed that the risk of stroke is usually higher among

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the young diabetic patients. According to Greater Cincinnati/Northern Kentucky stroke study, diabetes mellitus increases the risk and incidence of ischemic stroke among all age groups, but this risk is most striking before the age of 55 years in African Americans and before the age of 65 years in whites.[2]

It was evident that prediabetic patients have a great risk of stroke as the presence of glucose in blood results in vascular endothelial dysfunction, increased early-age arterial stiffness, systemic inflammation and thickening of the capillary basal membrane.[3]

The stroke is a leading cause of mortality and disability globally.[4] There are multiple risk factors or associated conditions resulting in stroke. The literature suggests that insulin resistance enhances the progression of stroke and is also associated with poor prognosis. To determine the condition (insulin resistance) triglyceride glucose (TyG) index is used, which is derived from fasting blood glucose and triglyceride.[5]

The various studies have concluded that the higher triglyceride index is an important predictor of mortality and outcome of acute ischemic stroke.[6]

Thus, the present study was undertaken to elucidate the association between TyG index in type 2 diabetes mellitus patients and acute ischemic stroke.

Material and Methods

This prospective observational study was done in the Department of Medicine in Acharya Shri Chander College of Medical Sciences and Hospital, Jammu, during the period of 13 months (January 2022 to February 2023) after obtaining approval from the institute ethical committee.

A total of 75 patients with acute ischemic stroke and history of diabetes mellitus during the period of study were included in the study.

Detailed clinical examinations followed by routine laboratory and radiographic investigations were carried out in all cases. A detailed history was collected (including demographic variables, medication history, past history of illness, etc.).

The sample was collected from antecubital vein for TyG index and fasting blood sugar (FBS).

Data was organized, tabulated, analyzed and interpreted in both descriptive and inferential statistics i.e. frequency and percentage distribution, mean by using statistical package for social sciences (SPSS) software version 21. Categorical variables were expressed as number and percentage.

Observations and results

In the present study, 75 cases with acute ischemic stroke and history of diabetes mellitus were evaluated.

In our study the mean age of the patients was 58.74 ± 11.37 years and the majority of the patients were males (57%) followed by 43% females. The average NIHSS score of study participants was 5.

The observed mean systolic blood pressure (SBP) was as 145 ± 26.3 mmHg and mean diastolic blood pressure (DBP) was 90.2 ± 18.6 mmHg as depicted in Table 1.

It was reported that the most of the patients were smoker as shown in Figure 1.

Present study showed that 69.33% subjects were on antidiabetic drug, followed by antihypertensive (61.33%), lipid lowering drugs (50.66%), anticoagulants (16%) and antiplatelets (14.66%) as depicted in Table 2.

Present study revealed that mean fasting plasma glucose (FPG) value was as 6.13 ± 2.03 (mmol/L), mean total cholesterol (TC) was 5.76 ± 1.4 (mmol/L), mean triglyceride (TG) 1.98 ± 0.93 was (mmol/L) and mean TyG index was 8.76 ± 0.28 depicted in Table 3.

Table 1. Blood Pressure

Blood pressure	Mean ± SD
SBP (mmHg)	145 ± 26.3
DBP (mmHg)	90.2 ± 18.6

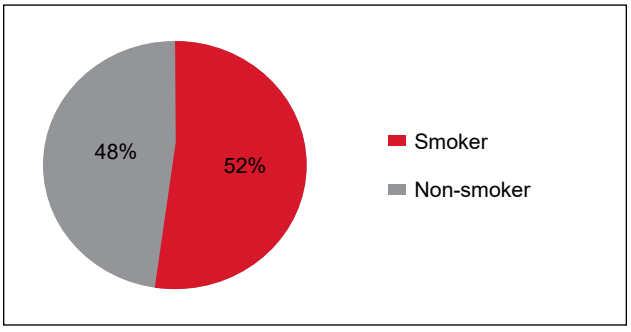


Figure 1. Smoking status.

Table 2. Drug History

Drug	No. of cases	Percentage
Antidiabetic	52	69.33
Anticoagulants	12	16
Antihypertensive	46	61.33
Lipid lowering drugs	38	50.66
Antiplatelets	11	14.66

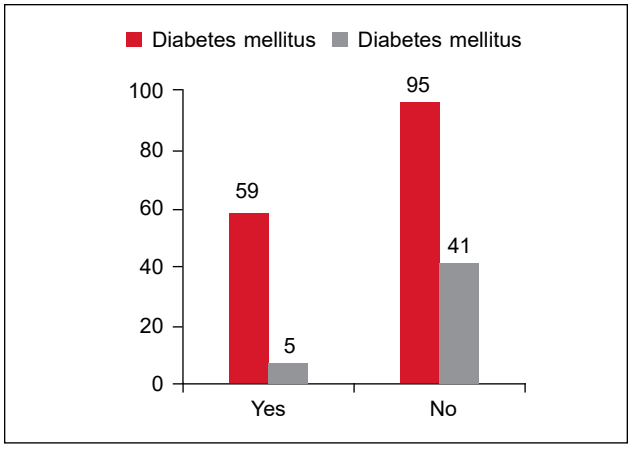


Figure 2. Family history of diabetes mellitus and stroke.

Table 3. Laboratory Findings

Parameters	Mean ± SD
FPG (mmol/L)	6.13 ± 2.03
TC (mmol/L)	5.76 ± 1.4
TG(mmol/L)	1.98 ± 0.93
TyG index	8.76 ± 0.28

Table 4. TyG Index vs. Stroke

TyG index	Incidence of stroke N (%)	P value
Q1 (4.31-5.48)	10 (13.33)	0.27
Q2 (5.48-5.81)	15 (20)	0.21
Q3 (5.81-6.22)	21 (28)	0.04
Q4 (6.22-8.17)	29 (38.66)	0.03

The present study showed that the patients with higher TyG index showed a higher incidence of stroke (p = 0.03) as presented in Table 4.

Discussion

In this study 75 patients with acute ischemic stroke were included. Detailed clinical examinations followed by routine hematological and radiographic investigations were carried out in all cases and results were discussed.

In our study the mean age of the patients was 58.74 ± 11.37 years and the majority of the patients were males (57%) followed by 43% females. The average NIHSS score of study participants was 5. It was reported that the most of the patients were smoker. The results are correlated with the study conducted by Liu D, et al., (2022)[7] found that the mean age of the study participants was 65.0 (57.0-73.0) years, most of the patients were males (59.2%) and the median NIHSS score was 4.0 (2.0-7.0). In similar study conducted by Toh EMS, et al., (2022)[8] found that the most of the patients were males (61.5%) the median age of the study patients was 65.00 (55.00, 76.00) years and the median NIHSS score was 6.0 (2.0, 15.0). Zhou Y, et al., (2020) found that 44.4% subjects were smoker.[9]

The observed mean SBP was as 145 ± 26.3 mmHg and mean DBP was 90.2 ± 18.6 mmHg. 59% patients had family history of diabetes mellitus and 5% patients had family history of stroke. The findings are consistent with the study conducted by Zhou Y, et al., (2020)[9] reported that the mean SBP and DBP was 149.2 ± 23.0 mmHg and 87.44 ± 13.4 mmHg. In similar study conducted by Kourtidou C, et al., (2022) observed that the mean SBP and DBP was 151 ± 27 mmHg and 81 ± 15 mmHg.[10]

Present study showed that 69.33% subjects were on antidiabetic drug, followed by antihypertensive (61.33%), lipid-lowering drugs (50.66%), anticoagulants (16%) and antiplatelets (14.66%). These findings are similar to the study conducted by Zhou Y, et al., (2020)[9] analyzed that 19.6% subjects were on antiplatelet drug, 1% were on anticoagulation, 44.9% were on antihypertensive drugs, 6.8% were on lipid-lowering drugs and 16.0% were on hypoglycemic agent.

Present study revealed that mean FPG value was as 6.13 ± 2.03 (mmol/L), mean TC was 5.76 ± 1.4 (mmol/L), mean TG 1.98 ± 0.93 was (mmol/L) and mean TyG index was 8.76 ± 0.28. The results are in accordance with the study conducted by GuoY, et al., (2021)[11] found that the mean fasting glucose value was as 4.9, 5.1, 5.4 and 7.1 (mmol/L) among 4 groups, mean TC was 1.0, 1.2. 1.4 and 1.6 (mmol/L) among 4 groups, and mean TG was 2.5, 3.3, 4.0 and 4.6 (mmol/L) among 4 groups. In similar study conducted by Zhou Y, et al., (2020)[9] found that the mean TG was 119.5 (mg/dL) and mean FBS was 114.1 ± 46.9 (mg/dL).

The present study showed that the patients with higher TyG index showed a higher incidence of stroke (p = 0.03). The outcomes of the study are correlated with the studies conducted by Liu D, et al., (2022)[7], Toh EMS, et al., (2022)[8], Hu L, et al., (2022)[12] and Zhou Y, et al., (2020)[9] reported that there was significant association between TyG index in type 2 diabetes mellitus patients and acute ischemic stroke.

Conclusion

The present prospective study found that there was significant association between TyG index in type 2 diabetes mellitus patients and acute ischemic stroke.

Thus, it is concluded that the TyG index is an important risk factor of ischemic stroke as it was observed that the patients with higher TyG index has higher incidence of ischemic stroke.

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