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Research Article

LIPID PROFILE AND HBA1C LEVELS TO ASSESS THE RISK PROFILE IN STROKE PATIENTS WITH TYPE 2 DIABETES MELLITUS

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Abstract

Background:

T2DM mellitus (T2DM) stroke patients have poor glycemic control and a high burden of lipid abnormalities, which may exacerbate the severity of their stroke and lead to worse outcomes. This study looked into the connection between patients with T2DM, their lipid profile, and their HbA1c levels and the severity of their strokes.

Methods:

A cross-sectional study was conducted on 116 stroke patients with T2DM. Demographic, clinical, and laboratory data were collected, including lipid profile parameters (total cholesterol, triglycerides, HDL cholesterol, and LDL cholesterol) and HbA1c levels. Assessment of stroke severity by using the "National Institutes of Health Stroke Scale" (NIHSS).

Results:

The majority of the participants were male (57.8%), aged between 50 and 64 years (45.7%), and had ischemic stroke (58.6%). The mean HbA1c level was 8.3% (SD=1.1), and 62.9% of the

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participants had severe stroke (NIHSS score 16-42). Participants with dyslipidaemia had significantly higher total cholesterol (229.6 ± 46.9 mg/dL vs. 207.7 ± 41.0 mg/dL, p=0.01), triglycerides (270.3 ± 93.2 mg/dL vs. 228.2 ± 79.0 mg/dL, p=0.01), and LDL cholesterol (143.1 ± 42.7 mg/dL vs. 125.9 ± 36.1 mg/dL, p=0.03) compared to those without dyslipidaemia. HbA1c levels showed positive correlations with total cholesterol (r=0.818, p=0.049) and LDL cholesterol (r=0.712, p=0.021), and a moderate positive correlation with triglycerides (r=0.622, p=0.023). Participants with HbA1c levels ≥7.0% had significantly higher NIHSS scores (22.5 ± 11.9) compared to those with HbA1c levels <7.0% (17.6 ± 10.9), with a p-value of 0.02.

Conclusion:

This study demonstrates the high prevalence of lipid abnormalities and poor glycemic control among stroke patients with T2DM and the significant association between higher HbA1c levels and increased stroke severity. These findings highlight the importance of comprehensive management of diabetes and lipid abnormalities in stroke patients with T2DM to reduce the burden of severe stroke and improve outcomes in this high-risk population.

Keywords:

Stroke, T2DM mellitus, lipid profile, HbA1c, stroke severity, dyslipidaemia, glycemic control.

Introduction

Stroke and T2DM Mellitus (T2DM) are two major global health concerns that often coexist and significantly contribute to morbidity and mortality [1]. Globally, stroke is the primary cause of death and permanent disability, whereas T2DM is a long-term metabolic disease marked by

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insulin resistance and hyperglycemia [2,3]. In addition to raising the risk of stroke, having T2DM also has a negative impact on the prognosis and results for stroke victims [4].

Glycated hemoglobin (HbA1c) and lipid profile are crucial biomarkers for determining the stroke risk profile in T2DM patients. Elevated levels of total cholesterol, low-density lipoprotein (LDL) cholesterol, and triglycerides, together with decreased levels of high-density lipoprotein (HDL) cholesterol, are indicative of dyslipidaemia, a prevalent comorbidity in T2DM [5]. One of the main pathophysiological processes causing ischemic stroke is atherosclerosis, which is facilitated by these anomalies in lipid metabolism [6].

In T2DM patients, HbA1c is a trustworthy measure of long-term glycemic management. It is frequently used in clinical practice for the diagnosis and treatment of diabetes and represents the blood glucose levels over the previous two to three months [7]. In patients with T2DM, elevated HbA1c levels have been linked to a higher risk of cardiovascular problems, such as stroke [8].

This overview concludes by highlighting the importance of the lipid profile and HbA1c in determining the stroke risk profile of T2DM patients. This article attempts to add to the ongoing efforts to lessen the burden of stroke and improve the outcomes of T2DM patients by offering a thorough assessment of the current data and analyzing the implications for clinical practice.[9]

METHODOLOGY:

The current cross sectional study was conducted on patients admitted in medical wards at Ballari Medical College & Research Centre ,Ballari fulfilling the inclusion criteria, after obtaining approval and clearance from the institutional ethics committee. A total of 116 participants were

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selected after explaining the purpose of the study and procedure in detail and, after attaining their consent in written format for each patient. Demographic data, history, clinical examination and details of investigations were recorded in the study proforma. The history was collected by direct interview of the patient and patient relatives accompanying the patient

Relevant investigations were done to confirm diagnosis and detection of complications. The study was conducted for a total duration of 18 months. The collected Data entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. Qualitative data will be expressed in terms of proportions Quantitative data will be expressed in terms of Mean and Standard deviation Association between two qualitative variables will be seen by using Chi square/ Fischer's exact test Comparison of mean and SD within same groups will be done by using paired t test to assess whether the mean difference between groups is significant or not Descriptive statistics of each variable will be presented in terms of Mean, standard deviation, standard error of mean. A p value of <0.05 will be considered as statistically significant.

RESULTS:

1. The study included a total of 116 participants, with the majority (45.7%, n=53) falling within the age group of 50-64 years.(Table 1)
2. In the study 57.8% (n=67) were male, and 42.2% (n=49) were female (Table 2).
3. Ischemic stroke was more prevalent among the participants, with 58.6% (n=68) of the total cases. Hemorrhagic stroke accounted for 41.4% (n=48) of the cases. (Table 3).
4. Half of the participants (50%, n=58) had a previous history of stroke, and a similar proportion (50.9%, n=59) had hypertension. Dyslipidemia was present in 51.7% (n=60)

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of the participants. Cardiovascular disease (CVD) was reported in 41.4% (n=48) of the cases, while chronic kidney disease (CKD) was present in 31% (n=36). (Table 4).

5. The majority of the participants (46.6%, n=54) had never smoked, while 27.6% (n=32) were former smokers, and 25.9% (n=30) were current smokers. (Table 5).
6. The most common symptom at presentation was deviation of the mouth (30.2%, n=35), followed by weakness of limbs (25%, n=29), slurring of speech (23.3%, n=27), and altered sensorium (21.6%, n=25). (Table 6).
7. The mean HbA1c level among the participants was 8.3% (SD=1.1). The mean total cholesterol level was 219.0 mg/dL (SD=45.4), while the mean triglyceride level was 249.9 mg/dL (SD=88.7). The mean HDL cholesterol level was 41.2 mg/dL (SD=9.1), and the mean LDL cholesterol level was 134.8 mg/dL (SD=40.5). (Table 7).
8. HbA1c levels showed a strong positive correlation with total cholesterol (r=0.818, p=0.049) and LDL cholesterol (r=0.712, p=0.021), which were both statistically significant. A moderate positive correlation was observed between HbA1c and triglycerides (r=0.622, p=0.023), which was also statistically significant. (Table 8).
9. The mean NIHSS score among the participants was 21.3 (SD=11.8), indicating a high level of stroke severity. (Table 9).
10. Participants with HbA1c levels ≥7.0% had significantly higher NIHSS scores (22.5 ± 11.9) compared to those with HbA1c levels <7.0% (17.6 ± 10.9), with a p-value of 0.02, indicating a statistically significant association between higher HbA1c levels and increased stroke severity. (Table 10).

DISCUSSION:

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This study's age distribution revealed that 45.7% of participants were between the ages of 50 and 64, and 35.3% were over the age of 65.

According to a research by Khoury et al. [10], stroke patients with T2DM had an average age of 67.8 ± 10.7 years. In a similar vein, a large-scale study conducted by Lau et al. with 1,070,000 individuals showed that the prevalence of stroke rose with age, peaking at 20.1% in the 60–69 age group [11]. These results highlight the significance of age as a major risk factor for stroke in T2DM patients.

There were more male participants in our study (57.8%) than female participants (42.2%). This result is consistent with earlier research showing a greater incidence of stroke in men with type 2 diabetes. According to a meta-analysis by Peters et al., the relative risk of stroke linked to diabetes was 1.83 (95% CI: 1.60-2.08) in males and 2.27 (95% CI: 1.95-2.65) in women across 64 cohorts and 775,385 persons [12].

Hemorrhagic stroke (41.4%) was less common in this study than ischemic stroke (58.6%). According to a study by Sui et al., out of 1,134 stroke patients with T2DM, 81.7% experienced ischemic stroke and 18.3% hemorrhagic stroke [13].

According to the current study, hypertension (50.9%), dyslipidemia (51.7%), and cardiovascular disease (41.4%) were the most common comorbidities among stroke patients with T2DM. A research by Echouffo-Tcheugui et al., which revealed that 36.7% had coronary heart disease, 56.3% had dyslipidemia, and 79.2% had hypertension [14].

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The mean HbA1c level was 8.3% (SD=1.1), which suggests inadequate glycaemic management. According to a research by Kamouchi et al. with 3,627 stroke patients, those with T2DM had a mean HbA1c level of 7.8% (SD=1.6) [15].

Our research revealed a strong positive link in terms of lipid profile between HbA1c levels and LDL cholesterol (r=0.712, p=0.021), triglycerides (r=0.622, p=0.023), and total cholesterol (r=0.818, p=0.049). These results imply that in T2DM stroke patients, lipid abnormalities are linked to inadequate glycaemic management. . In stroke patients with T2DM, Hasan et al.'s study [100] discovered a positive correlation between HbA1c levels and LDL cholesterol (r=0.309, p<0.001), triglycerides (r=0.292, p<0.001), and total cholesterol (r=0.325, p<0.001). [16]

Compared to individuals without dyslipidaemia, those with dyslipidaemia had considerably higher levels of LDL cholesterol, triglycerides, and total cholesterol. This research emphasizes how crucial it is to treat dyslipidemia in T2DM stroke patients.

In the current study, the in-hospital death rate was significant (44%) and the majority of individuals (62.9%) experienced severe stroke (NIHSS score 16–42). These results imply that there is a significant risk of severe stroke and poor outcomes for stroke patients with type 2 diabetes.

Those with HbA1c levels ≥6.5% had significantly higher NIHSS ratings on admission (8.0 ± 6.1 vs. 5.9 ± 5.7, p<0.001) compared to those with HbA1c levels <6.5%, according to a Lattanzi et al. study involving 540 stroke patients [17].

CONCLUSIONS:

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In conclusion, this study provides valuable insights into the complex relationship between diabetes, lipid abnormalities, and stroke severity in patients with T2DM mellitus (T2DM). The findings highlight the high prevalence of lipid abnormalities and poor glycaemic control among stroke patients with T2DM, with a significant association between higher HbA1c levels and increased stroke severity. The study also demonstrates the significant differences in lipid profile parameters between participants with and without dyslipidaemia, emphasizing the importance of managing dyslipidaemia in this high-risk population.

The strong positive correlations between HbA1c levels and total cholesterol, LDL cholesterol, and triglycerides underscore the need for comprehensive management of both glycaemic control and lipid abnormalities in stroke patients with T2DM. The high prevalence of severe stroke and the high in-hospital mortality rate among the study participants further emphasize the importance of early identification and aggressive management of these risk factors to improve outcomes and reduce the burden of severe stroke in this population.

Future research should focus on larger, multicentre studies with longitudinal follow-up to further elucidate the complex interactions between diabetes, lipid abnormalities, and stroke severity. The inclusion of a control group of stroke patients without T2DM would provide valuable insights into the specific impact of T2DM on these factors. Additionally, identifying optimal targets for lipid and glycaemic control in stroke patients with T2DM may help guide clinical practice and improve outcomes for this high-risk population.

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RESULTS

Table 1: Age Distribution

Characteristic	**N**	**%**
<50	22	19
50-64	53	45.7
≥65	41	35.3

Table 2: Sex Distribution

Characteristic	**n**	**%**
Gender		
Male	67	57.8
Female	49	42.2

Among the 116 participants, 57.8% (n=67) were male, and 42.2% (n=49) were female. The difference in the proportion of male and female participants was not statistically significant, as no p-value was provided.

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Table 3: Type of Stroke Distribution

Characteristic	**N**	**%**
Type of Stroke		
Ischemic	68	58.6
Hemorrhagic	48	41.4

Ischemic stroke was more prevalent among the participants, with 58.6% (n=68) of the total cases. Hemorrhagic stroke accounted for 41.4% (n=48) of the cases.

Table 4: Comorbidities Distribution

Characteristic	**N**	**%**
Previous Stroke History	58	50
Hypertension	59	50.9
Dyslipidemia	60	51.7
CVD	48	41.4
CKD	36	31
None	32	27.6

Table 5: Smoking and Alcohol Distribution

Characteristic	**n**	**%**
Smoking Status		
Current	30	25.9
Former	32	27.6
Never	54	46.6

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Alcohol Consumption	54	46.6

The majority of the participants (46.6%, n=54) had never smoked, while 27.6% (n=32) were former smokers, and 25.9% (n=30) were current smokers.

Table 6: Clinical Presentation of Stroke Patients with T2DM

Characteristic	**n**	**%**
Symptoms at Presentation		
Weakness of limbs	29	25.0
Slurring of speech	27	23.3
Deviation of mouth	35	30.2
Altered sensorium	25	21.6
Signs at Presentation		
Facial palsy	45	38.8
Hypo/hypertonia	28	24.1
Abnormal reflexes	31	26.7
Involuntary movements	12	10.3
Blood Pressure	Mean	SD
Systolic (mmHg)	149.2	15.7
Diastolic (mmHg)	95.0	15.1

Table 7: Laboratory Findings in Stroke Patients with T2DM

Characteristic	**Mean**	**SD**
HbA1c (%)	8.3	1.1
Total Cholesterol (mg/dL)	219.0	45.4
Triglycerides (mg/dL)	249.9	88.7
HDL Cholesterol (mg/dL)	41.2	9.1
LDL Cholesterol (mg/dL)	134.8	40.5

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The mean HbA1c level among the participants was 8.3% (SD=1.1). The mean total cholesterol level was 219.0 mg/dL (SD=45.4), while the mean triglyceride level was 249.9 mg/dL (SD=88.7).

Table 8: Correlation between HbA1c Levels and Lipid Profile Parameters

Lipid Parameter	**Pearson's Correlation Coefficient (r)**	**p-value**
Total Cholesterol (mg/dL)	0.818	0.049*
Triglycerides (mg/dL)	0.622	0.023*
HDL Cholesterol (mg/dL)	-0.629	0.032
LDL Cholesterol (mg/dL)	0.712	0.021

*Statistically significant at $p<0.05$

HbA1c levels showed a strong positive correlation with total cholesterol (r=0.818, p=0.049) and LDL cholesterol (r=0.712, p=0.021), which were both statistically significant.

Table 9: Stroke Severity and Functional Outcome at Discharge

Characteristic	**n**	**%**	**Mean**	**SD**
NIHSS Score			21.3	11.8
Mild (0-4)	14	12.1		
Moderate (5-15)	29	25.0		
Severe (16-42)	73	62.9		
Length of Hospital Stay (days)			15.2	8.4
In-Hospital Mortality	51	44.0		

The mean NIHSS score among the participants was 21.3 (SD=11.8), indicating a high level of stroke severity. The majority of the participants (62.9%, n=73) had severe stroke (NIHSS score

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16-42), while 25% (n=29) had moderate stroke (NIHSS score 5-15), and 12.1% (n=14) had mild stroke (NIHSS score 0-4).

Table 10: Association between Clinical and Laboratory Parameters with Stroke Severity

Parameter	**NIHSS Score**	**p-value**
HbA1c (%)		0.02*
<7.0	17.6 ± 10.9	
≥7.0	22.5 ± 11.9	
Total Cholesterol (mg/dL)		0.57
<200	20.6 ± 11.5	
≥200	21.7 ± 12.0	
Triglycerides (mg/dL)		0.30
<150	19.5 ± 11.1	
≥150	21.8 ± 12.0	
HDL Cholesterol (mg/dL)		0.09
<40	22.6 ± 12.1	
≥40	19.8 ± 11.3	
LDL Cholesterol (mg/dL)		0.78
<100	21.0 ± 11.6	
≥100	21.5 ± 12.0	

*Statistically significant at $p<0.05$