



ASSESSMENT OF GLUCOSE AND LIPID DYSREGULATION IN ACUTE STROKE AND ITS IMPACT ON PATIENT OUTCOMES

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ABSTRACT

Background: Acute Stroke is a major cause of mortality and long-term disability worldwide. Metabolic abnormalities such as hyperglycemia and dyslipidemia significantly contribute to stroke pathogenesis, severity, and clinical outcomes. Early identification of glucose and lipid disturbances may improve patient management and reduce complications. The present study aimed to evaluate glucose and lipid abnormalities among patients presenting with acute stroke.

Methodology: This hospital-based observational study was conducted in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences from June 2025 to March 2026. A total of 150 acute stroke patients were included in the study. Demographic and clinical details were recorded. Biochemical investigations including random blood glucose, HbA1c, and lipid profile were performed within 72 hours of admission. Brain CT scans were used to classify stroke types. Statistical analysis was performed using SPSS version 26.0.

Results: The mean age of patients was 63 years, with males constituting 55% of the study population. Ischemic stroke accounted for 78% of cases. Glycemic abnormalities included known diabetes (23.3%), undiagnosed diabetes (13.3%), and stress hyperglycemia (13.3%). Elevated LDL-C (56.7%) and low HDL-C (50%) were the most common lipid abnormalities observed.

Conclusion: Metabolic abnormalities, particularly hyperglycemia and dyslipidemia, were highly prevalent among acute stroke patients. Early metabolic evaluation and appropriate management may improve clinical outcomes and reduce recurrent cerebrovascular events.

Keywords: Acute Stroke, Hyperglycemia, Dyslipidemia, LDL Cholesterol, HDL Cholesterol, Diabetes Mellitus.

INTRODUCTION

Stroke is one of the leading causes of mortality and long-term disability worldwide and represents a major public health burden, particularly in developing countries. Stroke is defined as a sudden onset of neurological deficit resulting from interruption of cerebral blood flow due to either ischemia or hemorrhage.[1] The incidence of stroke has increased significantly over recent decades because of population aging, urbanization, sedentary lifestyle, unhealthy dietary habits, smoking, hypertension, and metabolic disorders. [2] Despite considerable advances in diagnostic techniques and therapeutic interventions, stroke continues to

Contribute substantially to morbidity, mortality, prolonged hospitalization, and reduced quality of life among survivors.

[3] Early identification and management of modifiable risk factors are therefore essential for improving clinical outcomes and reducing healthcare burden.

Metabolic abnormalities play a crucial role in the pathogenesis and prognosis of acute stroke. Among these, disturbances in glucose metabolism and lipid profile are particularly important because they directly influence vascular integrity, endothelial function, inflammation, and atherosclerosis.[4] Hyperglycemia is frequently observed in patients presenting with acute stroke, even among individuals without a prior diagnosis of diabetes mellitus. This elevation in blood glucose may occur as a stress response mediated by increased catecholamine and cortisol secretion during acute cerebral injury. [5] Stress-induced hyperglycemia has been associated with increased infarct size, cerebral edema, hemorrhagic transformation, and poor neurological recovery. [6] Several studies have demonstrated that elevated blood glucose levels



www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 23-05-2026

Date Acceptance: 31-05-2026

Date of Publication: 30-06-2026

during acute stroke are linked to increased mortality and unfavorable functional outcomes.[7]

Diabetes Mellitus is an established risk factor for both ischemic and hemorrhagic stroke. Chronic hyperglycemia contributes to endothelial dysfunction, accelerated atherosclerosis, platelet activation, and microvascular damage, thereby increasing cerebrovascular risk.[8] Furthermore, diabetic patients often present with more severe neurological deficits and poorer prognosis following stroke compared to non-diabetic individuals.[9] Therefore, assessment of glycemic status in acute stroke patients has significant diagnostic and prognostic importance.

Dyslipidemia is another major metabolic abnormality implicated in stroke pathogenesis. Elevated serum total cholesterol, triglycerides, and low-density lipoprotein cholesterol (LDL-C), along with reduced high-density lipoprotein cholesterol (HDL-C), contribute to the development of atherosclerotic plaque formation and vascular occlusion.[10] Abnormal lipid metabolism accelerates narrowing and stiffening of cerebral arteries, predisposing individuals to ischemic stroke.[11] Low HDL-C levels are associated with impaired reverse cholesterol transport and increased vascular inflammation, whereas elevated LDL-C promotes plaque instability and thrombosis.[12] Several epidemiological studies have demonstrated a strong association between dyslipidemia and increased risk of cerebrovascular events.[13]

In low- and middle-income countries such as India, the prevalence of stroke and associated metabolic disorders is increasing rapidly because of changing lifestyle patterns, increased prevalence of obesity, diabetes, and hypertension, along with limited awareness and inadequate preventive healthcare services.[14] The coexistence of glucose and lipid abnormalities in acute stroke patients may significantly influence disease severity, treatment response, and overall prognosis. Hence, early evaluation of metabolic dysregulation in acute stroke patients is essential for risk stratification, therapeutic planning, and prevention of recurrent cerebrovascular events.

The present study was therefore undertaken to evaluate glucose and lipid abnormalities among patients with acute stroke and to analyze their association with clinical outcomes.

Aim

To evaluate metabolic dysregulation, particularly glucose and lipid abnormalities, among patients with Acute Stroke and to assess their association with clinical outcomes.

Objectives

1. To assess blood glucose levels among patients presenting with acute stroke.

2. To evaluate lipid profile abnormalities including total cholesterol, triglycerides, low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) in acute stroke patients.

3. To determine the prevalence of hyperglycemia and dyslipidemia among acute stroke patients.

METHODOLOGY

This hospital-based observational study will be conducted in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences during the study period from June 2025 to March 2026. The study will include patients admitted with Acute Stroke who fulfill the inclusion criteria. After obtaining approval from the Institutional Ethics Committee, informed consent will be obtained from all participants or their legally authorized representatives prior to enrollment in the study.

Detailed demographic and clinical data including age, sex, body mass index (BMI), and history of Diabetes Mellitus, hypertension, smoking, and hyperlipidemia will be documented using a structured proforma. On admission, vital parameters including blood pressure and pulse rate will be recorded for all patients. Biochemical investigations will be performed within 72 hours of admission and will include random blood glucose, glycosylated hemoglobin (HbA1c), and lipid profile parameters such as total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglycerides. HbA1c levels $\geq 6.5\%$ will be considered diagnostic of diabetes mellitus according to the American Diabetes Association guidelines.

Neuroimaging with brain computed tomography (CT) scan will be performed in most patients to differentiate ischemic and hemorrhagic stroke. In situations where CT imaging is unavailable, the Siriraj Stroke Score will be utilized as an alternative diagnostic tool. Stroke will be defined as rapidly developing clinical signs of focal or global cerebral dysfunction lasting more than 24 hours with no apparent non-vascular cause. Stress hyperglycemia will be defined as random blood glucose levels >11.1 mmol/L in the presence of HbA1c $<6.5\%$. Dyslipidemia will be defined as elevated LDL-C (≥ 100 mg/dL), reduced HDL-C (≤ 40 mg/dL in males and ≤ 50 mg/dL in females), elevated triglycerides (≥ 150 mg/dL), or total cholesterol ≥ 200 mg/dL. Patients with random blood glucose >11.1 mmol/L along with HbA1c $\geq 6.5\%$ will be categorized as having previously undiagnosed diabetes mellitus.

The collected data will be entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 26.0. Descriptive statistics such as mean, standard deviation, frequency, and percentage will be used to

summarize demographic and clinical characteristics. The Chi-square test will be applied for comparison of categorical variables, while Student's t-test will

be used for continuous variables. A p-value of less than 0.05 will be considered statistically significant.

RESULT

Table 1: General Characteristics of Patients

Parameter	Value
Total Patients	150
Mean Age (years)	63
Male (%)	55
Female (%)	45
Ischemic Stroke (%)	78
Hemorrhagic Stroke (%)	22

Table 1. Baseline characteristics of stroke patients, including demographic and stroke type distribution.

Table 2: Glycemic Status of Patients

Category	Number of Patients	Percentage (%)
Euglycemia	75	50.0
Known Diabetes	35	23.3
Undiagnosed Diabetes	20	13.3
Stress Hyperglycemia	20	13.3

Table 2. Distribution of glycemic statuses among stroke patients.

Table 3: Lipid Abnormalities in Patients

Parameter	Number of Patients	Percentage (%)
Elevated LDL-C	85	56.7
Low HDL-C	75	50.0
Elevated Total Cholesterol	45	30.0
Hypertriglyceridemia	35	23.3

Table 3. Prevalence of Lipid Abnormalities in the Study Population.

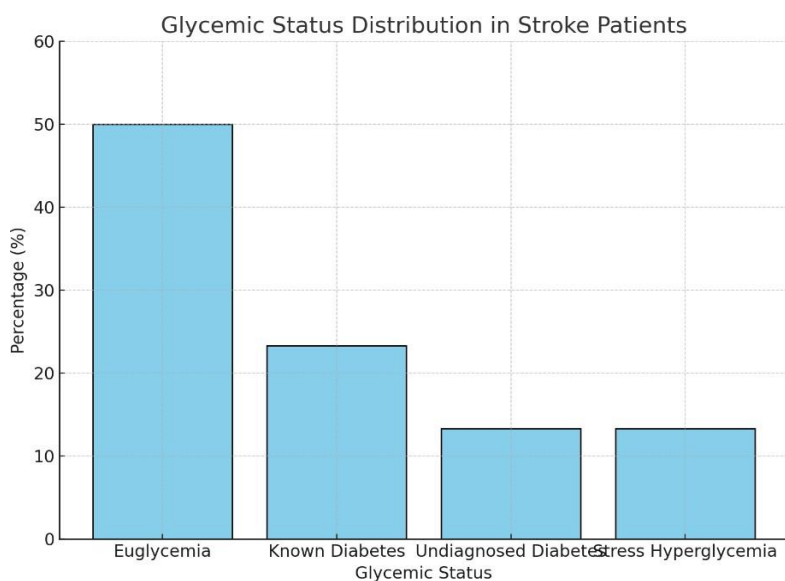


Figure 1: Glycemic Status Distribution

Figure 1. Glycemic status distribution among stroke patients, showing the proportions of

euglycemia, known diabetes, undiagnosed diabetes, and stress hyperglycemia.

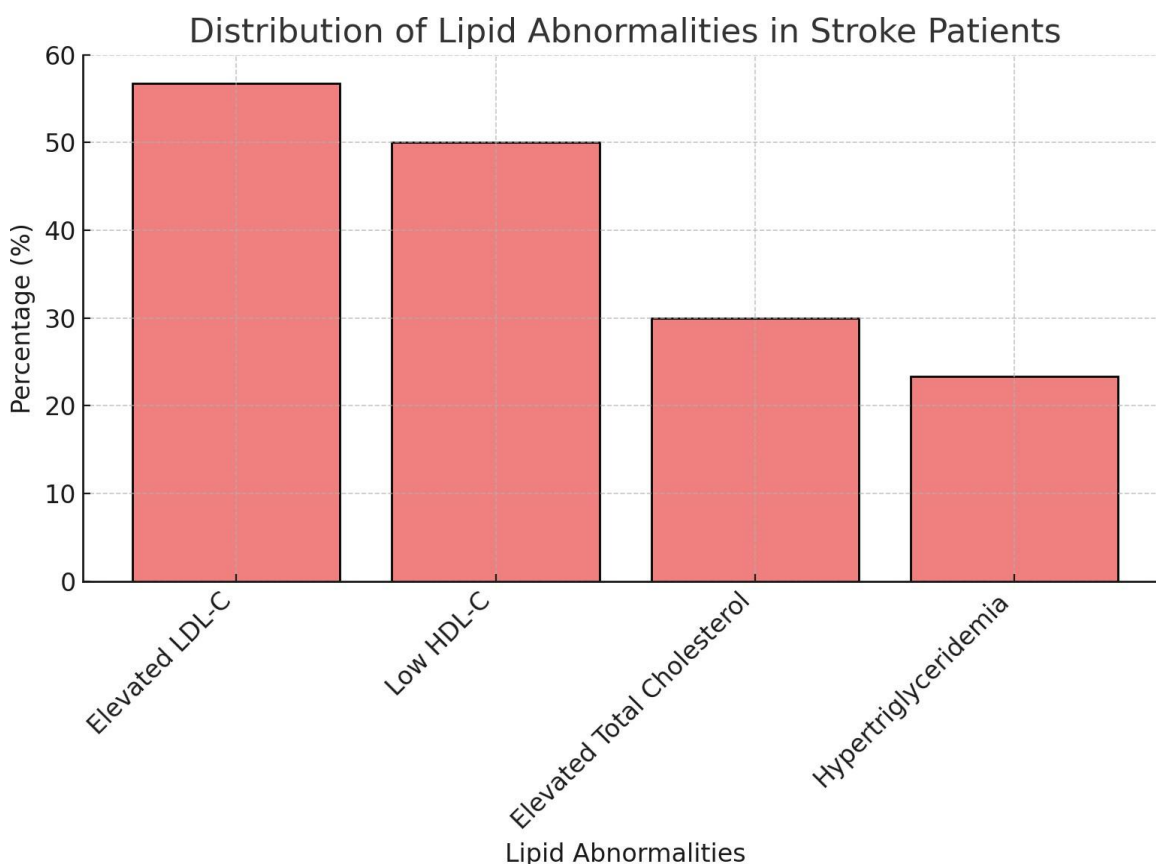


Figure 2 Distribution of Lipid Abnormalities in Stroke Patients

Figure 2. Distribution of lipid abnormalities, showing the prevalence of elevated LDL-C, low HDL-C, elevated total cholesterol, and hypertriglyceridemia.

The results highlight that 78% of patients had ischemic strokes (Table 1), with glycemic abnormalities being prominent. Approximately 50% of patients were euglycemic, while 23.3% had known diabetes, and 13.3% each were diagnosed with undiagnosed diabetes and stress hyperglycemia (Table 2). Lipid abnormalities, particularly elevated LDL-C (56.7%) and low HDL-C (50.0%), were prevalent among the population (Table 3). The distribution of glycemic status is further visualized in Figure 1, emphasizing the importance of glycemic management in stroke care.

DISCUSSION

The present study evaluated glucose and lipid abnormalities among patients with Acute Stroke and demonstrated a high prevalence of metabolic dysregulation in the study population. A total of 150 patients were included, with a mean age of 63 years. The majority of patients had ischemic stroke (78%),

while hemorrhagic stroke accounted for 22% of cases. These findings are consistent with previous epidemiological studies showing that ischemic stroke is the most common subtype of stroke worldwide.[15] Increasing age is an important non-modifiable risk factor for stroke because aging is associated with vascular endothelial dysfunction, atherosclerosis, and metabolic disturbances.[16]

In the present study, males constituted 55% of the study population, while females accounted for 45%. The higher prevalence among males may be related to increased exposure to vascular risk factors such as smoking, hypertension, alcohol consumption, and dyslipidemia.[17] Similar gender distribution has been observed in several stroke registries and population-based studies.[18]

Glycemic abnormalities were highly prevalent among the stroke patients included in the study. Although 50% of patients were euglycemic, 23.3% had known diabetes mellitus, while 13.3% each had undiagnosed diabetes and stress hyperglycemia. Hyperglycemia during acute stroke is a common metabolic response and may occur due to increased release of stress hormones such as cortisol and catecholamines.[19] Stress hyperglycemia has been

shown to worsen cerebral ischemic injury by increasing oxidative stress, inflammation, lactic acidosis, and disruption of the blood-brain barrier.[20] Patients with elevated glucose levels during acute stroke often experience larger infarct size, increased neurological deficits, and poorer functional outcomes.[21]

The detection of undiagnosed diabetes in 13.3% of patients highlights the importance of routine glycemic screening in stroke patients. Undiagnosed diabetes may remain asymptomatic for years and contributes to accelerated atherosclerosis and endothelial dysfunction, thereby increasing cerebrovascular risk.[22] HbA1c estimation is therefore valuable in differentiating stress-induced hyperglycemia from chronic glucose dysregulation.[23]

Lipid abnormalities were also commonly observed in the present study. Elevated LDL-C was found in 56.7% of patients, while low HDL-C was present in 50% of cases. Elevated total cholesterol and hypertriglyceridemia were observed in 30% and 23.3% of patients, respectively. Dyslipidemia is a well-established risk factor for ischemic stroke because abnormal lipid accumulation promotes atherosclerotic plaque formation and vascular occlusion.[24] LDL-C contributes significantly to endothelial injury and plaque instability, whereas HDL-C exerts protective vascular effects through reverse cholesterol transport and anti-inflammatory mechanisms.[25]

The high prevalence of elevated LDL-C and low HDL-C in this study is comparable with previous studies evaluating lipid abnormalities among stroke patients.[26] These findings emphasize the importance of lipid profile assessment and aggressive lipid-lowering strategies in stroke prevention and secondary risk reduction. Early recognition and management of metabolic abnormalities such as hyperglycemia and dyslipidemia may improve neurological recovery and reduce recurrent cerebrovascular events.[27]

Overall, the present study highlights the significant burden of glucose and lipid abnormalities among acute stroke patients. Comprehensive metabolic evaluation should therefore form an integral component of stroke management protocols to improve clinical outcomes and reduce long-term morbidity.

CONCLUSION

The present study demonstrated a high prevalence of metabolic abnormalities among patients with Acute Stroke, particularly hyperglycemia and dyslipidemia. Ischemic stroke was the predominant subtype, and significant proportions of patients had known diabetes, undiagnosed diabetes, stress hyperglycemia, elevated LDL-C, and low HDL-C levels. These findings emphasize the important role

of glucose and lipid disturbances in stroke pathogenesis and prognosis. Early identification and appropriate management of glycemic and lipid abnormalities may help improve neurological recovery, reduce complications, and prevent recurrent cerebrovascular events. Routine metabolic evaluation should therefore be incorporated into comprehensive stroke management strategies.

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How to cite this article: Dr. Vikash. M, Dr. Selvarajan Chettiyar. K. P, ASSESSMENT OF GLUCOSE AND LIPID DYSREGULATION IN ACUTE STROKE AND ITS IMPACT ON PATIENT OUTCOMES, *Asian J. Med. Res. Health Sci.*, 2026; 4 (2):1387-1392.

Source of Support: Nil, Conflicts of Interest: None declared.