

Original research article**Evaluation of capillary blood glucose levels as a predictive marker in acute ischemic stroke****¹Dr. D.V.C. Shobhan Kumar, ²Dr. M. Pramod Kumar Reddy, ³Dr. B. Kavitha**¹Assistant Professor, Department of General Medicine, Mamata Medical College, Khammam, Telangana, India²Assistant Professor, Department of Psychiatry, Mamata Medical College, Khammam, Telangana, India³Associate Professor, Department of Obstetrics and Gynaecology, Mamata Medical College, Khammam, Telangana, India**Corresponding Author:**

Dr. M. Pramod Kumar Reddy

Email: dr_mpramod@yahoo.co.in**Abstract**

Introduction: Acute ischemic stroke (AIS) outcomes are influenced by various factors. The relationship between capillary blood glucose levels at admission and AIS outcomes remains an area of research interest. This study aimed to evaluate the prognostic value of capillary blood glucose levels in AIS patients.

Material and Methods: This was an observational cross-sectional study conducted at the Department of General Medicine, Mamata Medical College, with a sample size of 120 patients. Capillary blood glucose levels were measured upon admission. Outcomes such as mortality, hemorrhagic transformation, functional recovery, and neurological deficits were assessed and correlated with glucose levels.

Results: A third of the patients (40 out of 120) presented with hyperglycemia (>140 mg/dL). Elevated glucose levels were associated with poorer outcomes. Mortality was higher in patients with an average glucose level of 160 mg/dL. Hyperglycemic patients exhibited a higher risk of mortality and hemorrhagic transformation compared to non-hyperglycemic counterparts. Age also influenced outcomes, with the 50-70 years age bracket facing the highest number of adversities.

Conclusion: Capillary blood glucose levels upon admission serve as a significant prognostic indicator in AIS. Elevated levels, particularly in conjunction with older age, are associated with poorer outcomes. These findings highlight the importance of glucose management in the acute phase of ischemic stroke.

Keywords: Acute ischemic stroke, capillary blood glucose, prognosis, hyperglycemia, outcomes

Introduction

Acute ischemic stroke (AIS) remains one of the leading causes of mortality and long-term disability worldwide. The complexity of the pathophysiological mechanisms and the myriad of factors influencing stroke outcomes make it imperative to identify prognostic indicators that can guide clinical decision-making and predict patient outcomes. One such potential marker is the capillary blood glucose level.

Historically, diabetes mellitus and hyperglycemia have been linked to an increased risk of stroke and poorer outcomes post-stroke. A study by Capes *et al.* (2001) revealed that hyperglycemia on admission, irrespective of a previous diagnosis of diabetes, was associated with increased mortality and morbidity in stroke patients^[1]. The mechanisms through which elevated blood glucose levels exert their detrimental effects include increased oxidative stress, inflammation, and blood-brain barrier disruption, among others^[2].

In a seminal research conducted by Gray *et al.* (2007), it was demonstrated that even transient hyperglycemia during the acute phase of a stroke could negatively impact the patient's outcome by exacerbating the size of the ischemic lesion and impeding neurological recovery^[3]. Moreover, Poppe *et al.* (2009) highlighted the potential of blood glucose levels as a predictor of hemorrhagic transformation in ischemic stroke patients, especially those undergoing reperfusion therapies^[4].

However, while the relationship between chronic hyperglycemia (as seen in diabetes) and stroke outcomes has been extensively studied, the role of acute fluctuations in capillary blood glucose levels remains a topic of ongoing research. The capillary blood glucose level, being easily measurable at the bedside, offers a promising avenue for rapid assessment and prognostication in AIS. Furthermore, understanding the precise relationship between these glucose levels and AIS outcomes could provide therapeutic targets and guide the optimization of glucose management in the acute phase.

While several prior studies have underscored the significance of glucose levels in AIS, there is a pressing need to further elucidate the role of capillary blood glucose as a distinct predictive marker. This research

aims to bridge this gap and offer insights into the prognostic potential of capillary blood glucose levels in the context of AIS. Aim of the study was to determine the association between capillary blood glucose levels and acute ischemic stroke outcomes.

Materials and Methods

This was an observational cross-sectional study conducted at the Department of General Medicine, Mamata Medical College. A total of 120 patients with acute ischemic stroke were enrolled in the study.

Inclusion criteria

- Patients diagnosed with acute ischemic stroke based on clinical examination and confirmed by CT/MRI.
- Age greater than 18 years.

Exclusion criteria

- Patients with hemorrhagic stroke.
- Patients with a history of chronic diseases that could influence glucose metabolism, such as uncontrolled diabetes mellitus.
- Patients on medications that can alter glucose levels.

Data Collection:

Upon admission, demographic data including age, gender, and medical history were recorded for each patient. The severity of the stroke was assessed using specific scale, "The National Institutes of Health Stroke Scale (NIHSS)".

Capillary blood glucose levels were measured using a standard glucometer at the time of admission. The readings were taken from the patients' fingertip after ensuring that the hand was clean and dry.

Statistical analysis: Data was analysed by specific software SPSS. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Demographic and Clinical Characteristics of Patients

Characteristic	Number (or mean)
Total Patients	120
Male	72
Female	48
Mean Age (years)	65
Average NIHSS Score on Admission	12
Patients with Hyperglycemia (>140 mg/dL)	40

This table presents the basic demographic and clinical characteristics of the 120 patients included in the study. A significant portion (60%) of the patients were male. The average age of the participants was 65 years. On admission, the average score on the NIHSS (a measure of stroke severity) was 12. Interestingly, a third of the patients (40 out of 120) had hyperglycemia, with blood glucose levels exceeding 140 mg/dL.

Table 2: Correlation Between Capillary Blood Glucose Levels and 30-day Outcomes

Outcome	Number with Outcome	Average Glucose Level (mg/dL)
Mortality	15	160
Hemorrhagic Transformation	10	155
Functional Recovery	85	110
Neurological Deficits	25	140

Table 2 showcases the relationship between capillary blood glucose levels at admission and various 30-day outcomes post-stroke. Patients who faced mortality had an average glucose level of 160 mg/dL, suggesting higher glucose might be linked with poorer outcomes. On the other hand, those who experienced functional recovery had a notably lower average glucose level of 110 mg/dL.

Table 3: Comparison of Outcomes based on Hyperglycemia Status

Outcome	Hyperglycemic Patients (n=40)	Non-Hyperglycemic Patients (n=80)
Mortality	10	5
Hemorrhagic Transformation	8	2
Functional Recovery	30	55
Neurological Deficits	12	13

This table compares the outcomes of patients based on their hyperglycemia status. Out of the 40 hyperglycemic patients, 10 faced mortality and 8 experienced hemorrhagic transformation. In contrast, among the 80 patients without hyperglycemia, only 5 faced mortality and 2 experienced hemorrhagic transformations. This might imply that hyperglycemic patients are at a higher risk of adverse outcomes post-stroke.

Table 4: Outcomes based on Age Groups

Age Group	Mortality	Hemorrhagic Transformation	Functional Recovery	Neurological Deficits
<50 years	2	1	25	5
50-70 years	8	6	40	12
>70 years	5	3	20	8

The outcomes of patients are categorized based on different age groups in Table 4. Patients in the 50-70 years age bracket seem to have experienced the highest number of adverse outcomes, with 8 facing mortality and 6 undergoing hemorrhagic transformation. Younger patients (below 50 years) had better functional recovery rates. However, it's worth noting that the elderly group (>70 years) also faced significant challenges, suggesting age might be a factor influencing stroke outcomes.

Discussion

Our study delves into the potential relationship between capillary blood glucose levels and outcomes in patients suffering from acute ischemic stroke. The results underscore several pivotal findings that align with, and in some instances, expand upon existing literature.

A notable observation from our study is the significant number of patients (33%) presenting with hyperglycemia upon admission. Previous research has highlighted the prevalence of hyperglycemia in stroke patients, even in those without a prior history of diabetes^[5]. Our findings resonate with this observation, suggesting a potential pathophysiological link between acute glucose dysregulation and ischemic stroke.

The association between elevated glucose levels and adverse outcomes post-stroke, as evidenced in Table 2, is of particular concern. Patients who faced mortality had discernibly higher glucose levels compared to those who experienced functional recovery. This observation is congruent with studies such as that by Capes et al., which found that hyperglycemia on admission, even in the absence of diabetes, is associated with increased mortality in stroke patients^[6]. The mechanisms underlying this observation could range from increased oxidative stress to augmented inflammation^[7].

Our comparison of outcomes based on hyperglycemia status, as shown in Table 3, further underscores the potential risk posed by elevated glucose levels. Hyperglycemic patients demonstrated a higher propensity for both mortality and hemorrhagic transformation. This is particularly alarming given the implications of hemorrhagic transformation in patients undergoing reperfusion therapies^[8].

The age-based outcomes in Table 4 present an intriguing narrative. While younger patients exhibited better recovery rates, both the middle-aged (50-70 years) and elderly (>70 years) groups faced substantial adversities. This is consistent with the well-established notion that age is a determinant of stroke outcomes^[9].

While our study offers valuable insights, it is not without limitations. The cross-sectional nature restricts our ability to establish causality. Additionally, factors such as pre-existing medical conditions, the exact time from stroke onset to hospital arrival, and variations in post-stroke care could also influence outcomes.

In conclusion, our study accentuates the potential prognostic value of capillary blood glucose levels in acute ischemic stroke. Elevated glucose levels, especially in conjunction with older age, appear to portend poorer outcomes. These findings underscore the need for rigorous glucose management in the acute phase of ischemic stroke, possibly paving the way for improved patient outcomes.

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