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Frequency of Prediabetes in Acute Stroke Patients Presenting at Tertiary Care Hospital, Karachi

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ABSTRACT

Background: Prediabetes, an intermediate state of abnormal glucose metabolism, is increasingly recognized as a risk factor for cardiovascular disease, including stroke. However, limited local data exist on its prevalence among acute stroke patients in Pakistan. **Objective:** To determine the frequency of prediabetes in patients presenting with acute stroke at a tertiary care hospital in Karachi. **Methods:** This cross-sectional study was conducted at a tertiary care hospital in Karachi. A total of 189 patients admitted with a diagnosis of acute stroke were included. Demographic data, clinical history, and laboratory findings were recorded. Prediabetes was defined random blood sugar 100 to 125 mg/dL. Data were analyzed using descriptive statistics and chi-square tests to identify associations between prediabetes and baseline variables. **Results:** Out of 189 patients, 53 (28%) were identified with prediabetes. Prediabetes was more frequent in the 40–60 years age group (43.1%) compared to older patients (20.2%) (p = 0.01). No significant association was found between prediabetes and gender (p = 0.29) or hypertension (p = 0.17). However, a statistically significant association was observed between prediabetes and dyslipidemia (p = 0.01). Smoking status also showed a marginal association with prediabetes (p = 0.05). **Conclusion:** A considerable proportion of acute stroke patients had prediabetes, particularly among middle-aged individuals. Routine screening for prediabetes in stroke patients may help identify at-risk individuals early and enable timely interventions to prevent diabetes and recurrent vascular events.

INTRODUCTION

A stroke happens when the brain's blood supply is disrupted, either by a clot obstructing a blood vessel—resulting in an ischemic stroke—or by a blood vessel rupturing and causing bleeding in the brain, which leads to a hemorrhagic stroke.[1] Prediabetes and diabetes significantly increase the likelihood of having a stroke. People living with diabetes are at approximately twice the risk of suffering a stroke compared to those without the condition. [2] While prediabetes presents a relatively moderate risk for an initial stroke, it is associated with a twofold increase in the risk of experiencing a subsequent stroke. [3] Research indicates that between 23% and 53% of individuals who suffer a stroke are found to have prediabetes, whereas diabetes is present in approximately 14% to 46% of stroke patients. [4-5]

Pre-diabetes is typically characterized by either impaired fasting glucose, impaired glucose tolerance, or a combination of both. Individuals with pre-diabetes already exhibit the key physiological abnormalities—namely insulin resistance and diminished β-cell function—that are fundamental to the progression toward type 2 diabetes.[6-7] Individuals with pre-diabetes often share the same vascular risk factors seen in type 2 diabetes, such as abnormal blood glucose levels, high blood pressure, abnormal lipid profiles, obesity, sedentary lifestyle, insulin resistance, endothelial dysfunction, a tendency for increased blood clotting, and chronic inflammation. While pre-diabetes has been associated with a slight elevation in the risk of general cardiovascular events, its specific impact on the likelihood of experiencing a future stroke remains unclear.[6-7]

Prediabetes is recognized as a contributing factor for stroke recurrence. A clear association exists between elevated fasting plasma glucose and 2-hour post-load glucose levels and the increased risk of both cardiovascular and cerebrovascular events.[8] Research by Qiao et al suggests that glucose levels measured two hours after a glucose load are a more powerful indicator of stroke and future cardiovascular disease than fasting glucose levels. [9] Additionally, a recent meta-analysis by Ford et al found that both impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) are linked to a slight but significant elevation in the risk of developing

cardiovascular disease.[10] A meta-analysis conducted by Lee et al reported comparable findings, suggesting that individuals with prediabetes might face an increased likelihood of experiencing a stroke in the future. However, the study emphasized that the elevated risk is relatively small and could be influenced by underlying confounding factors. [11]

Acute stroke is susceptible to multiple complications. Diabetes is one of the most severe chronic diseases, which is also a contributor to the development of stroke. Prediabetes, as an intermediate metabolic state between normal glucose regulation and diabetes, has an increasing incidence and high risk of developing diabetes. Abnormal glucose regulation worsens the survival of patients with acute stroke. Previous studies have shown wide variation 23–53% [4]. Hence, abnormal glucose regulation of stroke patients might be a therapeutic target for secondary prevention. Therefore, timely diagnoses of abnormal glucose regulation is of great importance. Since there is paucity of local literature and available literature shows variability this study would help in addressing both.

MATERIAL AND METHODS

This cross-sectional study was carried out at the Department of Medicine, Jinnah Postgraduate Medical Centre (JPMC), Karachi. The research was conducted from 26 December 2025 to 26 June 2026 following the approval of the study protocol by the College of Physicians and Surgeons Pakistan (CPSP). A total of 189 patients were enrolled based on a prevalence rate of 23% for prediabetes, with a 6% margin of error and a 95% confidence interval. The sample size was determined using WHO software, and participants were recruited through non-probability consecutive sampling.

Patients eligible for inclusion were those aged between 40 and 80 years, of either gender, who presented within 24 hours of symptom onset and were diagnosed with acute stroke, confirmed through CT scan findings in line with the defined diagnostic criteria. Patients were excluded if they had a known history of diabetes mellitus, metabolic syndrome, non-alcoholic fatty liver disease (NAFLD), thyroid dysfunction (either hypo- or hyperthyroidism), Cushing's disease, pheochromocytoma, were pregnant (confirmed by history and dating scan), or had conditions such as asthma, chronic renal disease, chronic obstructive pulmonary disease, acute coronary syndrome, or congestive cardiac failure.

Approval from the institutional ethical review committee was obtained prior to initiating data collection. Informed consent was secured from all participants before enrollment. Each patient underwent a brief clinical evaluation that included stroke duration, demographic profile, and smoking history. Blood samples were collected at the time of admission under sterile conditions and sent to the hospital laboratory for measurement of random blood glucose levels. Based on the defined criteria, patients with random blood sugar levels ranging from 100 to 125 mg/dL were identified as having prediabetes. Additional variables such as age, gender, smoking status, hypertension, and dyslipidemia were documented using a structured proforma.

All data were entered and analyzed using SPSS version 16. Quantitative variables were assessed for normality using the Kolmogorov–Smirnov test. Normally distributed variables were presented as mean ± standard deviation, while non-normally distributed variables were summarized using median and interquartile ranges (IQR). Categorical variables including gender, presence of hypertension, dyslipidemia, smoking status, and prediabetes were expressed as frequencies and percentages. To evaluate the influence of potential effect modifiers, stratification was performed for variables such as age, gender, hypertension, dyslipidemia, and smoking status. Following stratification, the chi-square test was applied to assess the statistical significance, with a p-value less than 0.05 considered significant.

RESULTS

Out of the total 189 participants included in the study, most (65.6%) fell within the 61 to 80-year age group, while the remaining 34.4% were between 40 and 60 years old. The gender distribution was fairly balanced, with males making up 52.4% of the group and females comprising 47.6%. When looking at health conditions, 27% of the participants had hypertension, and 46% were diagnosed with dyslipidemia. Regarding smoking habits, 37% reported that they smoked, while 63% did not. In terms of glycemic status, 28% of the individuals were found to have prediabetes, whereas 72% had normal blood sugar levels.

When comparing characteristics between those with and without prediabetes, several patterns emerged. Among patients with prediabetes, a notable 43.1% were in the 40–60 age range, compared to only 20.2% in the non-prediabetic group. This difference was statistically significant (p = 0.01), indicating that prediabetes was more common in younger participants. Although a higher proportion of males (31.3%) had prediabetes compared to females (24.4%), this difference wasn't statistically significant (p = 0.29).

Hypertension appeared more frequently among prediabetic individuals (35.3%) than among those without prediabetes (25.4%), but this association did not reach statistical significance (p = 0.17). Interestingly, only 17.2% of those with dyslipidemia had prediabetes, while 37.3% of those without dyslipidemia were prediabetic. This inverse relationship proved to be statistically significant (p = 0.01), suggesting that in this group, prediabetes was less common among those diagnosed with dyslipidemia.

As for smoking status, 20% of smokers had prediabetes, while 32.8% of non-smokers were in the prediabetic group. Although this finding approached statistical significance (p = 0.05), it requires further investigation to determine any definitive pattern.

Table 1

Distribution of Baseline Characteristics among the Study Participants.

Variables		n (%)
Age	40 to 60 years	65 (34.4)
	61 to 80 years	124 (65.6)
Gender	Male	99 (52.4)
	Female	90 (47.6)
Hypertension	Yes	51 (27)
	No	90 (47.6)
Dyslipidemia	Yes	(46)
	No	102 (54)

Smoking status	Yes	70 (37)
	No	119 (63)
Prediabetes	Yes	53 (28)
	No	136 (72)
Total		189 (100)

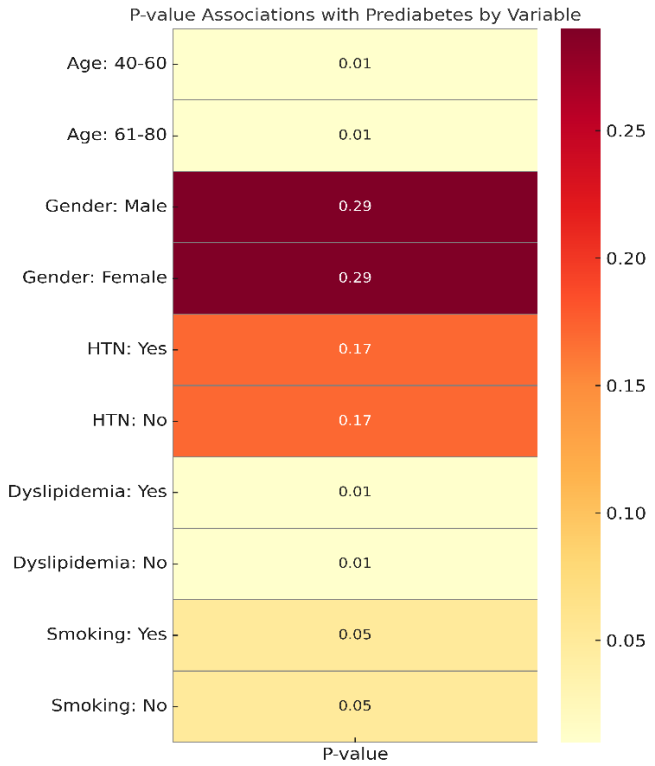
Table 2

Distribution of Patient Characteristics according to the Prediabetes Groups.

Variables		Prediabetes Yes n (%)	Prediabetes No n (%)	P value
Age	40 to 60 years	28 (43.1)	37 (56.9)	0.01
	61 to 80 years	25 (20.2)	99 (79.8)	
Gender	Male	31 (31.3)	68 (68.7)	0.29
	Female	22 (24.4)	68 (75.6)	
Hypertension	Yes	18 (35.3)	33 (64.7)	0.17
	No	35 (25.4)	103 (74.6)	
Dyslipidemia	Yes	15 (17.2)	72 (82.8)	0.01
	No	38 (37.3)	64 (62.7)	
Smoking status	Yes	14 (20)	56 (80)	0.05
	No	39 (32.8)	80 (67.2)	

Figure 1

The Heatmap Showing the p-value Associations between Patient Variables and Prediabetes Status



To summarize, the study identified age and dyslipidemia as factors significantly associated with prediabetes. On the other hand, gender, hypertension, and smoking status showed no significant link to prediabetic status in this sample.

DISCUSSION

This study set out to explore how often prediabetes occurs in patients presenting with acute stroke at a tertiary care hospital in Karachi. Our findings revealed a concerning proportion of stroke patients with undiagnosed prediabetes, emphasizing the importance of addressing this silent yet significant risk factor.

Globally, researchers have drawn clear connections between disrupted glucose metabolism and stroke risk. Prediabetes—defined by elevated fasting glucose or impaired glucose tolerance that hasn't yet progressed to diabetes—is increasingly recognized as more than just a warning sign. It actively contributes to the risk of cardiovascular disease, including stroke.[12] The American Diabetes Association notes that prediabetes significantly raises the risk of both stroke and heart attack. In line with these concerns, a Japanese study by Tanaka et al. reported that stroke patients frequently had undiagnosed diabetes or prediabetes, and even those with prediabetes showed poorer early outcomes. [13-14]

One of the largest global investigations into stroke risk, the INTERSTROKE study, highlighted impaired glucose regulation as one of the key modifiable risk factors for stroke worldwide. [15] Regionally, data from Bangladesh support this association. A study conducted at CMH Dhaka found that more than 70% of stroke patients had high fasting glucose, and many fulfilled criteria for metabolic syndrome. [16] In India, similar trends have emerged. Studies have shown that stroke patients often present with undiagnosed prediabetes or diabetes, with urbanization and lifestyle changes acting as key contributors. [17-19]

Closer to home, the data tells a similar story. A study from Jinnah Postgraduate Medical Centre in Karachi found that 20% of stroke patients had previously unrecognized diabetes. [20] Another Karachi-based study reported that two-thirds of ischemic stroke patients had metabolic syndrome, [21] while Amir and colleagues also observed strong associations between central obesity, hypertension, and dyslipidemia with stroke in local settings. [22]

Notably, in our study, patients aged 40 to 60 showed a higher frequency of prediabetes than older age groups. This trend aligns with research indicating that metabolic disorders are increasingly affecting younger populations in South Asia. [23-24] It also reflects shifting health patterns driven by dietary habits, reduced physical activity, and limited preventive healthcare.

The challenge with prediabetes is that it's easy to miss—patients don't usually have symptoms. However, its impact is real. Studies have shown that people with impaired glucose tolerance face a much higher risk of recurrent strokes compared to those with normal glucose metabolism. [25-26] This could be due to mechanisms like insulin resistance, vascular inflammation, and oxidative stress, which gradually damage the blood vessels and promote atherosclerosis. [27-28]

Fortunately, prediabetes is one of the few cardiovascular risk factors we can actively reverse. Interventions such as diet modification, regular exercise, and modest weight loss have been shown to significantly reduce the risk of progressing to diabetes or experiencing major cardiovascular events. [29] Identifying and managing prediabetes in stroke patients, therefore, isn't just beneficial—it's essential.

Limitations

While our study provides valuable insights, it does have limitations. Since we conducted it at a single tertiary care hospital, the findings may not fully represent the broader population. Also, our cross-sectional design doesn't allow us to assess causality or long-term outcomes. Even so, these results highlight an important gap in routine stroke

care: the need for early detection of prediabetes. Routine glucose screening in stroke patients—even those without a history of diabetes—could help us catch this condition early and potentially reduce future complications.

CONCLUSION

We found that a considerable number of patients admitted with acute stroke also had undiagnosed prediabetes. This finding draws attention to a critical yet often overlooked risk factor that could play a significant role in preventing future strokes and improving recovery. When healthcare providers identify prediabetes early, they have a real chance to step in before it progresses to full diabetes or leads to additional vascular complications.

In a city like Karachi—where non-communicable diseases are rising and many people remain unaware of their health risks—routine screening for blood glucose levels in stroke patients could make a meaningful impact. By catching these metabolic changes early, clinicians can guide patients toward simple but effective interventions, like improving diet, increasing physical activity, and scheduling regular follow-up.

Our study adds to the growing evidence that we need to take prediabetes seriously, especially in people already at high risk, like stroke patients. Looking ahead, we recommend larger studies that follow patients over time to better understand how early action can shape long-term outcomes and reduce the risk of stroke recurrence.

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