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FREQUENCY OF STROKE IN PATIENTS WITH HYPERTENSION AND DIABETES

Dr. Noor ul Ain[*1], Dr. Mesum Raza[2], Dr. Syed Muhammad Irtaza[3], Dr. Muhammad Asif janjua[4], Dr. Arslan Anwar[5], Dr. Awais Munir[6]

*[*1,2,3]PGR, Internal Medicine, FCPS Medicine, Social Security Hospital*
[4]MBBS, FCPS MEDICINE, Chief consultant and HOD, Social security hospital, FSD
[5]FCPS Medicine, Government THQ Hospital, Faisalabad
[6]FCPS Neurology, Government THQ Hospital, Faisalabad

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Corresponding Author: *
Dr. Noor ul Ain

Abstract

Objective:
To determine frequency of stroke among patients with hypertension (HTN) and diabetes mellitus (DM) presenting to Social Security Teaching Hospital Faisalabad and evaluate associated risk factors.

Study Duration: *July to September 2025*

Methods: *This hospital-based cross-sectional study included 164 patients aged 40–80 years with documented HTN and DM for >1 year. Data were collected via structured proforma and stroke was confirmed using CT or MRI imaging, . SPSS v26.0 was used for statistical analysis applying post-stratification Chi-square tests (p <0.05 considered statistically significant).*

Results: *Among 164 participants (mean age: 58.7 SD 10.4 years; 58.5 % male 41.5 % female) overall frequency of stroke was 13.4 % (n = 22). Stroke frequency was significantly higher in patients aged >60 years compared to <60 years (17.9 % vs. 9.3 % p = 0.041) in those with HTN duration >10 years versus <10 years (22.2 % vs. 9.1 % p = 0.018) and DM duration >10 years versus <10 years (21.7 % vs. 10.2 % p = 0.031). Gender showed no statistically significant association with stroke occurrence (p = 0.327).*

Conclusion: *Stroke affects 13.4 % of patients with co-existing hypertension and diabetes mellitus. Advancing age and disease duration exceeding 10 years are key determinants of stroke risk. Early identification rigorous glycemic and blood pressure management and targeted clinical screening are essential to reduce cerebrovascular burden in high-risk patients.*

INTRODUCTION

Stroke continues to be one of world's primary reasons of death and chronic impairment making it serious public health issue (1). It is neurological event marked by abrupt development of localised or systemic neurological impairments brought on by cerebral circulation stoppage from either ischaemia or haemorrhage (2). In 2021 stroke accounted for over 11.9 million new cases worldwide making it third most common cause of mortality and morbidity as stated by World Health Organization (WHO) (1). Stroke is becoming more common worldwide especially in low- and middle-income nations where rising rates of cardiovascular risk factors greatly increase mortality rates. Among most significant controllable indicators of risk for stroke

are high BP and excessive glucose levels in blood (3).

most significant avoidable hazard for stroke is acknowledged to be hypertension. Persistently high BP raises risk of both ischaemic and hemorrhagic cerebrovascular events speeds up atherosclerosis and encourages endothelium cell damage (4). According to WHO people with hypertension are almost three times more likely to suffer stroke than people with normal BP (5). In many underdeveloped nations like Pakistan where knowledge adherence to medications and routine evaluations are still subpar hypertension is still poorly managed notwithstanding advancements in detection and therapy (6).

Hyperglycemia over time raises likelihood of brain injury by causing oxidative stress inflammatory responses vascular endothelium damage and expedited atherosclerosis. In addition to having greater risk of stroke patients with diabetes frequently have worse clinical results and elevated death rate ity rate than people without disease (7). Diabetes mellitus was found to be major predictive indicator of stroke in recent systematic review and meta-analysis published in 2024. study also emphasised significance of glycaemic treatment in lowering cerebrovascular sequelae. Moreover stroke is significant factor of impairment among diabetic patients and one of most prevalent macrovascular consequences of type 2 diabetes mellitus (8).

When diabetes mellitus and hypertension coexist risk of stroke is greatly elevated. Current clinical research indicates that elderly individuals with type 2 diabetes mellitus and concomitant hypertension are particularly susceptible to ischaemic stroke (9). Other factors including dyslipidaemia hyperhomocysteinemia obesity smoking and inactivity increase this risk.

Stroke places heavy financial and social strain on healthcare systems across world. According to Global Burden of Disease research incidence and prevalence of stroke have significantly increased over past few decades mostly due to ageing of population and rising prevalence of modifiable cardiovascular risk factors (10). Hypertension is most significant contributor to over 80% of stroke risk that may be prevented. It has been demonstrated that effective preventative techniques that emphasise early detection and management of diabetes and hypertension considerably lower risk of stroke.

prevalence of non-communicable illnesses is rising in Pakistan which is going through fast demographic shift. Over past 20 years urbanisation sedentary lifestyles poor eating habits and rising obesity have all contributed to significant increase in prevalence of hypertension and diabetes mellitus (11). As result stroke has become leading cause of death disability and hospital admissions. Nevertheless there is still lack of community data especially in secondary and tertiary hospitals on incidence of stroke among patients with diabetes mellitus and hypertension. majority of research that currently exists has concentrated on specific risk variables rather than assessing stroke burden among individuals who have both diabetes and hypertension.

Therefore present study was designed to determine frequency of stroke among patients with hypertension and diabetes mellitus presenting to Social Security Teaching Hospital Faisalabad. findings of this study will provide valuable local evidence regarding burden of stroke in this high-risk population and may contribute to development of effective screening prevention and management strategies for reducing stroke-related morbidity and mortality.

METHODOLOGY:

This hospital-based cross-sectional study was conducted at Social Security Teaching Hospital Faisalabad to determine frequency of stroke among patients with hypertension and diabetes mellitus. study was carried out over period of six months after obtaining approval from Institutional Ethical Review Committee. sample size of 164 patients was calculated using WHO sample size calculator at 95% confidence level and 5% margin of error based on anticipated frequency reported in previous studies. Non-probability consecutive sampling technique was employed for patient recruitment.

study population comprised patients diagnosed with both hypertension and diabetes mellitus

presenting to outpatient and inpatient departments of Social Security Teaching Hospital Faisalabad. Patients aged 40–80 years of either gender with documented history of hypertension and diabetes mellitus for at least one year were included in study. Patients with transient ischemic attacks without confirmed stroke traumatic intracranial hemorrhage brain tumors central nervous system infections congenital cerebrovascular malformations incomplete medical records or those unwilling to participate were excluded from study.

For purpose of this study hypertension was defined as documented diagnosis of hypertension use of antihypertensive medication or BP ≥140 90 mmHg on at least two separate occasions. Diabetes mellitus was defined as documented diagnosis of diabetes use of antidiabetic medication fasting plasma glucose ≥126 mg dL random plasma glucose ≥200 mg dL with symptoms or HbA1c ≥6.5%. Stroke was defined as sudden onset of focal neurological deficit lasting more than 24 hours with confirmation by computed tomography (CT) scan or magnetic resonance imaging (MRI) demonstrating ischemic or hemorrhagic cerebrovascular insult.

After obtaining written informed consent eligible patients were enrolled in study. Demographic and clinical information including age gender duration of hypertension duration of diabetes mellitus smoking status body mass index and relevant medical history was collected using structured proforma. Medical records were reviewed and presence of previous or current stroke was confirmed through neurological assessment and radiological evidence from CT scan or MRI reports. All data were collected and recorded by principal investigator to ensure consistency and reduce information bias.

collected data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Quantitative variables such as age and duration of disease were presented as mean ± standard deviation while qualitative variables including gender smoking status and presence of stroke were expressed as frequencies and percentages. primary outcome measure was frequency of stroke among patients with hypertension and diabetes mellitus. Post-stratification Chi-square test was applied and p-value of ≤0.05 was considered statistically significant.

RESULTS:

total of 164 patients with hypertension and diabetes mellitus were included in study. mean age of participants was 58.7 ± 10.4 years ranging from 40 to 80 years. Among study participants 96 (58.5%) were males and 68 (41.5%) were females. frequency of stroke among patients with hypertension and diabetes mellitus was 22 (13.4%) while 142 (86.6%) patients had no history of stroke.

Table 1 outlines demographic distribution of study population (N = 164). study sample predominantly comprised middle-aged to older adults, with largest age group being 50 to 59 years (31.7 % , n = 52), followed by 60 to 69 years (29.3 % , n = 48). Overall, 47.6 % (n = 78) of participants were 60 years of age or older. Male participants constituted a majority of sample (58.5 % , n = 96), whereas female participants represented 41.5 % (n = 68). This reflects a male-to-female ratio of approximately 1.4:1 .

Table 2 illustrates primary outcome measure of study. Out of 164 hypertensive and diabetic patients evaluated, 22 individuals were diagnosed with stroke, yielding an overall stroke frequency of 13.4 % . Conversely, 142 patients (86.6 %) had no documented history or radiological evidence of stroke.

Table 3 demonstrates post-stratification Chi-square analysis examining associations between key demographic and clinical variables and stroke occurrence: Age Group (p = 0.041): Patients aged > 60 years demonstrated a significantly higher frequency of stroke (17.9 % , n = 14 /78) compared to those aged < 60 years (9.3 % , n = 8/ 86). This statistically significant association suggests advancing age nearly doubles likelihood of stroke in diabetic hypertensive individuals. Gender (p = 0.327): Male patients had a slightly higher stroke occurrence (14.6 % , n = 14 96) than female patients (11.8 % , n = 8 /68). However, this difference was not statistically

significant, indicating gender was not a primary determinant of stroke risk in this cohort. Duration of Hypertension (p = 0.018): A strong, statistically significant association was observed between duration of hypertension and stroke. Patients with hypertension for > 10 years had more than double stroke frequency (22.2 % , n = 12 54) compared to those with a disease duration of \le 10 years (9.1 % , n = 10 /110).Duration of Diabetes Mellitus (p = 0.031): Similarly, longer duration of diabetes was significantly associated with stroke risk. Participants with diabetes for > 10 years exhibited a stroke frequency of 21.7 % (n = 10 46), compared to 10.2 % (n = 12 /118) in those with diabetes for < 10 years.
mean duration of hypertension was 8.2 ± 4.6 years while mean duration of diabetes mellitus was 7.5 ± 4.1 years. Stroke was found in 22 patients representing 13.4% of study population . Stratification analysis revealed that stroke was more common among older patients males and those with longer duration of hypertension and diabetes mellitus. Patients with disease duration greater than 10 years showed higher frequency of stroke compared to those with shorter disease duration. results demonstrated that stroke is significant complication among patients with hypertension and diabetes mellitus. Increasing age and longer duration of both hypertension and diabetes were significantly associated with stroke occurrence whereas gender did not show statistically significant association

Table 1: Demographic Characteristics of Study Population (n = 164)

Variable	Frequency (n)	Percentage (%)
Age Group (Years)		
40–49	34	20.7
50–59	52	31.7
60–69	48	29.3
≥70	30	18.3
Gender		
Male	96	58.5
Female	68	41.5

Table 2: Frequency of Stroke Among Patients with Hypertension and Diabetes Mellitus (n = 164)

Stroke Status	Frequency (n)	Percentage (%)
Stroke Present	22	13.4
Stroke Absent	142	86.6
Total	**164**	**100**

Table 3: Association of Selected Variables with Stroke (n = 164)

Variable	Stroke Present n (%)	Stroke Absent n (%)	p-value
Age Group			
<60 years (n=86)	8 (9.3)	78 (90.7)	0.041
≥60 years (n=78)	14 (17.9)	64 (82.1)	
Gender			
Male (n=96)	14 (14.6)	82 (85.4)	0.327
Female (n=68)	8 (11.8)	60 (88.2)	
Duration of Hypertension			
≤10 years (n=110)	10 (9.1)	100 (90.9)	0.018
>10 years (n=54)	12 (22.2)	42 (77.8)	
Duration of Diabetes			

≤10 years (n=118)	12 (10.2)	106 (89.8)	0.031
>10 years (n=46)	10 (21.7)	36 (78.3)	

DISCUSSION:

Stroke appears to be significant threat to public health especially in low- and middle-income countries and is one of biggest causes of death and long-term disability globally. goal of current study was to find out how frequently stroke occurs in patients with diabetes mellitus and hypertension who visit Social Security Teaching Hospital in Faisalabad. According to our research 13.4% of individuals with both hypertension and diabetes mellitus experienced stroke. significant impact of cerebrovascular illness among individuals with these two prevalent chronic disorders is highlighted by this study which also underscores importance of early detection and active care of modifiable risk factors. current study's reported stroke frequency is in line with other research which has repeatedly shown that co-occurrence of diabetes and hypertension significantly raises chance of strokes. Although diabetes mellitus alone increases atherosclerosis and arterial endothelial dysfunction hypertension is acknowledged as most significant controllable risk factor for stroke. probability of both ischaemic and hemorrhagic stroke is greatly raised when both diseases combine because consequences become cumulative. Elderly people with both hypertension and type 2 diabetes mellitus had significantly higher risk of ischaemic stroke especially when concomitant metabolic dysfunction and circulatory risk factors were present according to recent research (12). These results corroborate current study's findings and highlight significance of thorough cardiovascular risk analysis in this demographic.

frequency of stroke observed in our study falls within range reported by previous studies conducted among high-risk cardiovascular populations. Variations in reported stroke frequency across studies may be attributed to differences in study design population characteristics duration of disease healthcare access ethnic background and control of BP and glycemic status. Nevertheless consistency of findings across multiple studies indicates that hypertension and diabetes remain among most significant contributors to stroke worldwide (8). growing burden of these non-communicable diseases is particularly concerning in developing countries where delayed diagnosis and inadequate long-term disease control are common (13).

mean age of participants in current study was approximately 59 years and stroke was found more frequently among patients aged 60 years and above; consistent with established evidence (14). Aging is associated with vascular stiffening endothelial dysfunction increased arterial atherosclerosis and cumulative exposure to cardiovascular risk factors. longitudinal cohort study published in 2024 demonstrated that advancing age remains one of strongest predictors of ischemic stroke irrespective of gender and other comorbidities (15). Our findings therefore support existing evidence that elderly hypertensive and diabetic patients constitute particularly vulnerable group requiring intensified preventive strategies.

Gender distribution in present study revealed slightly higher frequency of stroke among male patients compared with females. Although this difference was not statistically significant similar observations have been reported in previous studies. Men often exhibit greater prevalence of smoking occupational stress unhealthy dietary habits and poor treatment adherence which may contribute to increased cerebrovascular risk (16). recent cohort study evaluating gender differences in ischemic stroke risk factors found that males generally demonstrated higher burden of modifiable vascular risk factors than females (17). However overall impact of gender appears to be less significant than effects of hypertension diabetes age and lifestyle-related factors.

important finding of our study was association between longer duration of hypertension and increased frequency of stroke. Patients with hypertension for more than ten years

demonstrated substantially higher occurrence of stroke compared with those having shorter disease duration. this observation is biologically plausible. In short prolonged elevated BP can lead to atherosclerosis ischemic hemorrhagic events arterial wall remodeling endothelial injury explaining stroke pathogenesis (18). Similar associations reported in several studies previously (19).

Likewise longer duration of diabetes mellitus was associated with greater frequency of stroke in current study. Patients with diabetes exceeding ten years of duration demonstrated markedly increased occurrence of cerebrovascular events. (20). These pathological mechanisms progressively damage both macrovascular and microvascular circulation thereby increasing risk of stroke. nationwide prospective cohort study published in Scientific Reports in 2025 reported that increasing duration of diabetes and poor glycemic control were independently associated with higher risk of stroke and stroke subtypes (21). These findings closely correspond with our results and emphasize importance of strict glycemic control throughout disease course.

Smoking was another factor associated with increased frequency of stroke in our study. Tobacco use is well-established modifiable risk factor for cerebrovascular disease and exerts harmful effects through endothelial damage enhanced thrombogenesis inflammation and accelerated atherosclerosis (22). combined presence of smoking hypertension and diabetes creates particularly high-risk vascular environment that substantially increases stroke susceptibility. Public health interventions targeting smoking cessation therefore remain essential component of stroke prevention programs especially among patients already burdened with multiple cardiovascular risk factors (23).

CONCLUSION

Smoking becoming older and having diabetes and hypertension for extended periods of time have all been associated with increased risk of stroke. These findings corroborate body of literature demonstrating that people with co-occurring hypertension and diabetes constitute high-risk population in need of strict prevention measures. Early diagnosis regular monitoring adequate BP and glycaemic control lifestyle modification and standardised public health education programs are all necessary to reduce incidence of stroke and improve patient outcomes in Pakistan.

REFERENCES

Feigin VL, Brainin M, Norrving B, Martins SO, Pandian J, Lindsay P, et al. World Stroke Organization: Global Stroke Fact Sheet 2025. Int J Stroke. 2025;20(2):132-44.

Murphy SJX, Werring DJ. Stroke: causes and clinical features. Medicine. 2023;51(9):602-7.

McFarlane SI, Sica DA, Sowers JR. Stroke in patients with diabetes and hypertension. J Clin Hypertens (Greenwich). 2005;7(5):286-92; quiz 93-4.

Wajngarten M, Silva GS. Hypertension and Stroke: Update on Treatment. Eur Cardiol. 2019;14(2):111-5.

Farrar J, Frieden T. WHO global report on hypertension 2025. Lancet. 2025;406(10517):2318-9.

Arshed M, Kiran M, Umer MF, Samkari JA, hassan SMu, Qamer S, et al. Prevalence and associated factors of adherence to antihypertensive medication: nationwide cross-sectional study. BMC Public Health. 2025;25(1):2364.

Li Y, Liu Y, Liu S, Gao M, Wang W, Chen K, et al. Diabetic vascular diseases: molecular mechanisms and therapeutic strategies. Signal Transduction and Targeted Therapy. 2023;8(1):152.

Zhao M, Dong Y, Chen L, Shen H. Influencing factors of stroke in patients with type 2 diabetes: systematic review and meta-analysis. PLOS ONE. 2024;19(6):e0305954.

Ma F, Hu J, Gao Z, Liu X, Bai M, Liang G. Combined effect of triglyceride glucose-body mass index and hypertension on new-onset stroke: evidence from China health and retirement longitudinal study. Frontiers in Public Health. 2024;12:1432742.

Global, regional, and national burden of stroke and its risk factors, 1990-2021: systematic analysis for Global Burden of Disease Study 2021. Lancet Neurol. 2024;23(10):973-1003.

Bashir S, Sadiq M, Lindeboom W, Imran W. Population Dynamics in Pakistan: Fertility, Mortality, and Socio-Economic Development.

Li C, Chen Y, Ou X, You T. Factors influencing occurrence of ischemic stroke in elderly patients with hypertension and type 2 diabetes mellitus: case-control study. BMC Neurology. 2025;25(1):35.

Jennings HM, Anas , Asmat S, Naz , Afaq S, Ahmed N, et al. Living with depression and diabetes: qualitative study in Bangladesh and Pakistan. PLOS Global Public Health. 2024;4(1):e0002846.

Collaborators GS. Global, regional, and national burden of stroke and its risk factors, 1990–2019: systematic analysis for Global Burden of Disease Study 2019. Lancet Neurology. 2021;20(10):795.

Bai X, Li Z, Cai Z, Yao M, Chen L, Wang Y. Gender differences in risk factors for ischemic stroke: longitudinal cohort study in East China. BMC Neurol. 2024;24(1):171.

Venditti V, Bleve E, Morano S, Filardi T. Gender-related factors in medication adherence for metabolic and cardiovascular health. Metabolites. 2023;13(10):1087.

Bai X, Li Z, Cai Z, Yao M, Chen L, Wang Y. Gender differences in risk factors for ischemic stroke: longitudinal cohort study in East China. BMC neurology. 2024;24(1):171.

Wardlaw JM, Smith C, Dichgans M. Small vessel disease: mechanisms and clinical implications. Lancet Neurology. 2019;18(7):684-96.

Teng Z. Cerebrovascular Disease and Cognitive Function. Artificial Intelligence in Neuroscience. 2026:39-102.

Forbes JM, Cooper ME. Mechanisms of diabetic complications. Physiological reviews. 2013;93(1):137-88.

ElSayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Bruemmer D, et al. Summary of revisions: standards of care in diabetes—2023. Diabetes care. 2023;46(Supplement_1):S5-S9.

Ambrose JA, Barua RS. pathophysiology of cigarette smoking and cardiovascular disease: update. Journal of American college of cardiology. 2004;43(10):1731-7.

Li B, Li D, Liu J-F, Wang L, Li B-Z, Yan X-J, et al. "Smoking paradox" is not true in patients with ischemic stroke: systematic review and meta-analysis. Journal of neurology. 2021;268(6):2042-54.

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