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EPIDEMIOLOGY OF STROKE AND RISK FACTORS IN PUNJAB, PAKISTAN: A COMPREHENSIVE HOSPITAL-BASED STUDY

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ABSTRACT

Background and Objective

Stroke is a significant global health challenge, particularly burdening low- and middle-income countries where it leads to substantial mortality and disability-adjusted life years. The objective of this study was to investigate the prevalence of stroke and its subtypes among adults in Pakistan's Punjab region.

Methods

This retrospective hospital-based study was conducted at Lahore General Hospital in Punjab, Pakistan, serving as the primary referral center for stroke cases. Medical records from January 2019 to December 2020 were reviewed using the International Classification of Diseases. A structured data collection form captured demographics, stroke types, risk factors, medical histories, and outcomes. Data was analyzed using SPSS 26.0.

Results

Among 159,824 emergency department visits, 1654 patients were diagnosed with stroke, yielding an incidence rate of 1.03% in Punjab. The majority (26.13%) of stroke patients were aged 60-69 years, with an average age of 57.19 years. Males (51.75%) showed higher susceptibility than females (48.25%). A significant proportion (62.39%) of cases resulted in discharge with disability. Ischemic stroke was predominant (44.2%), followed closely by hemorrhagic stroke (43.4%). Hypertension (61.63%), diabetes (17.65%), and heart disease (8.73%) emerged as prevalent comorbidities. Lahore was the primary location for a substantial number of cases (46.3%).

Conclusion

The high incidence of stroke (1.03%) in Punjab underscores urgent public health needs. Our study highlights prevalent risk factors such as hypertension, diabetes, and ischemic heart disease, emphasizing the necessity for targeted prevention strategies. Comprehensive epidemiological studies are crucial to accurately quantify stroke burden in Pakistan and implement effective interventions.

Keywords

Prevalence, Stroke, South Asian

INTRODUCTION

Stroke is a leading cause of disability among the Asian population, significantly impacting the Sustainable Development Goals (SDGs). The burden of stroke and its associated mortality is notably higher in low- and middle-income countries, particularly in South Asia, which accounts for over 40% of global stroke deaths despite comprising 22% of the world's population.[1] This disparity underscores the urgent need for focused public health interventions in these regions.[2]

Pakistan, the second-largest country in South Asia with a population of 225 million, faces a substantial stroke burden.[3] The latest Global Burden of Disease (GBD) research reported 11.9 million stroke incidents, 104.2 million prevalent cases, 6.2 million fatal cases, and 132.1

million disability-adjusted life years (DALYs) due to stroke in 2017. Although stroke-related deaths and disabilities have decreased since 1990, the absolute numbers have almost doubled, with low- and middle-income countries bearing the brunt of this increase.

Despite the critical impact of stroke, there is a lack of comprehensive demographic data on its prevalence and risk factors in Pakistan. Previous studies, often limited in scope and methodology, have provided fragmented insights. For instance, small-scale research indicated an age- and sex-adjusted stroke incidence of 95 per 100,000 persons per year from 2000 to 2016, and a 2017 community-based study in Khyber Pakhtunkhwa found 1.2% prevalence.[4] However, these studies lacked the rigor and scale needed to accurately represent the national burden.

This study aimed to investigate the prevalence of stroke and its subtypes among adults in Pakistan's Punjab region, providing a clearer understanding of this pressing public health issue.

METHODS

This retrospective cross sectional study targeted stroke patients admitted to Lahore General Hospital in Punjab between January 2019 and December 2020. We reviewed retrospective hospital admission & discharge data, medical records from all departments (emergency, medicine, neurology, outpatient and referral registers) of the public hospital where study was carried out. In addition, all Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) imaging reports, death register, death certificates were scrutinized for identification of stroke patients. Details regarding date of onset of stroke, clinical findings at onset, imaging (CT/MRI) findings, risk factors, and diagnosis of type of stroke were collected on a validated form. Data on vital status was collected at onset of stroke and at discharge. In-hospital death details were noted from medical record and medical certificates of cause of death.
Duplicate records were identified using a 'de duplication' software application that listed probable duplicates using predefined criteria of similar names, age, sex, address, date of onset of stroke, date of diagnosis of stroke and stroke subtype. To maintain anonymity of patients names we have used MR numbers of medical records for data collection. Ethical committee and institutional review board approvals were obtained prior to study commencement.

All data was analyzed using SPSS Software V26 and percentages were calculated. The descriptive statistics method was adopted to represent the sample's different demographic characteristics, and the individuals' multi-morbidity status. Cross tabulations and Chi-Square tests were done to examine the variation and existence of a correlation between stroke prevalence and different demographic characteristics and multi-morbidity conditions. The cases were assessed for their medical outcome, which could be categorized as either death or patient discharge from the hospital. The discharge was categorized as with a major disability, minor disability, or no disability. A patient was considered to have major disability if they couldn't perform most of their usual activities or required extensive assistance to manage daily life. These manifested as significant weakness or paralysis, inability to communicate effectively, severe cognitive deficits (like memory or attention problems), or requiring constant nursing care.

Minor disability involved slight limitations where patients were still able to manage their own affairs, though they may struggle with certain tasks. Functional Limitations included minor speech difficulty, weakness in one limb that doesn't prevent all daily activities, slight cognitive issues, or a reduced ability to perform certain physical activities like climbing stairs.

RESULTS

From January 2019 to December 2020, 159,824 patients were reported to the emergency department, of which 1.03% (1,654) had a stroke. This signifies that the incidence of stroke is about 1.03% in Punjab, which concludes that about 1,030 per 100,000 people suffered a stroke in this province during this time.

The average age of stroke patients was 57.19 years, with a standard deviation of 14.90 years, and most of the patients were between the ages of 60 and 69 years (26.13%). The number of male patients was slightly higher (51.75%) than female patients (48.25%).

The cases were assessed for their medical outcome, which could be categorized as either death or patient discharge from the hospital. The discharge was categorized as with a major disability, minor disability, or no disability. A large number of patients were discharged (62.39%), and there were no prominent gender influences on the medical outcome since rates of discharge and death are nearly similar for all genders. Gender-wise data and types of strokes in the study population are given in Table 1.

Table 1: Patient Outcomes According to Age & Type of Infarcts

		Patient Outcome		95% Confidence Interval		
		Death	Discharged	Odds Ratio	Upper	Lower
Gender	Male	302	547	0.852	1.041	0.697
	Female	311	480			
Infarct Type	Ischemic CVA	254	471			
	ICH	307	405			
	SAH	48	110			
	CVT	2	26			
	TIA	0	9			
	Stroke Mimics	2	6			
Age	Age <60	282	517	0.84	1.027	0.688
	Age >60	331	510			

With regards to all the comorbidities reported with stroke, hypertension was presented most frequently (61.63%), with a considerable number of people also having diabetes (17.65%) and ischemic heart disease (8.73%).

In addition, 214 (12.94%) of the cases also reported geographical data, which can help gauge the disease burden from a geographical perspective. Most of these cases reported Lahore as the location (46.3%).

A mean of 46 hours was noted regarding the hour of presentation for all patients, with a standard deviation of 50. It was observed that the sooner a patient was presented, the better their outcome was.

Comorbidities and risk factors were identified as independent variables, and their impact on outcome was noted. It was seen that patients who had risk factors generally exhibited poorer recovery compared to those who did not. The risk factors assessed included hypertension, diabetes, ischemic heart disease, chronic obstructive pulmonary disease, addiction & drug abuse, obesity, smoking, and chronic kidney disease (Table 2).

Table 2: Prevalence of Comorbid Risk Factors in Stroke

	Frequency	Percentage
Hypertension	1156	70.5
Diabetes Mellitus	326	19.9
Ischemic Heart Disease	125	7.6
Smoking	65	4
Chronic Kidney Disease	13	0.8
Addiction and Drug Abuse	2	0.1

A crosstab of age mortality above 60 was carried out, and it was observed that patients aged 60+ had an approximately 50% expiry rate, concluding that younger patients had a higher likelihood of recovering. Chi-Square, Continuity correction, Likelihood ratio, and Fisher exact tests were conducted on this topic, and all confirmed the validity of the result postulated above. Gender and its relation to mortality were also stratified and cross-tabbed, showing clearly that women had a slight advantage over men when it came to stroke survival. A total of 547 women survived against 480 men, leading us to the hypothesis that women had a greater likelihood of survival in such cases.

Mortality in different types of infarcts was also tested, and it was found that ischemic CVA had the highest survival rate compared to hemorrhagic CVA, which had a near 50/50 chance of patient survival.

DISCUSSION

This study showed the prevalence of stroke in the Punjab province of Pakistan to be 1.03% (1,030 per 100,000 Population). Previous studies carried out in Pakistan showed a crude age- and sex-adjusted stroke incidence of 95 per 100,000 persons per year for the years 2000 to 2016 in one study, and a prevalence of stroke in the KPK province of Pakistan at 1.2% (1,200 per 100,000 populations) in a 2017 study.[4] Our findings are comparable with other studies from South Asian countries. Gupta R et al. conducted the PURE Study in 2020, reporting a stroke prevalence of 0.9% in India, Pakistan, and Bangladesh.[5] A recent study conducted in 2022 in India showed a crude incidence of stroke ranging from 108 to 172 per 100,000 people per year, a crude prevalence from 26 to 757 per 100,000 people per year, and one-month case fatality rates from 18% to 42%.[6] A demographic cross-sectional study carried out in Bangladesh in 2022 observed a stroke prevalence of 11.39 per 1,000 population.[7] In Sri Lanka, the prevalence of stroke was 10.4 per 1,000 with a 2:1 male-to-female ratio.[8] Jiang et al. carried out a study in China showing the weighted prevalence of stroke increased annually from 2013 to 2019, reaching 2.58% in 2019.[9]

Variations in the epidemiology of stroke have been reported across the globe as well as in South Asian countries. These variations can occur within the same country and may represent actual differences in stroke epidemiology, heterogeneity in study methodologies, or time trends. The average age of stroke patients in our group was 57.19 years, with a standard deviation of 14.90 years, matching data from a Bangladeshi stroke registry. Most stroke patients in a U.S. registry had a stroke at approximately 71 years old. On average, stroke patients in China are 66.4 years old, about ten years younger than those in white European populations.[9]

Recent studies in India report an average age of 62.2 years for stroke patients, with higher incidence rates for men compared to women.[6] In our study, the mean age of stroke patients was unaffected by gender. However, the stroke prevalence varied in different age groups in Bangladesh, with 30.10 per thousand in those over 60 years old and 4.60 per thousand in those under 40 years old.[7] The prevalence of stroke among males was twice that of females (13.62 versus 8.68 per thousand). Conversely, a U.S. registry revealed differences in incidence rates and outcomes between genders, with men having higher age-specific stroke rates but women having more stroke occurrences due to longer life expectancy and higher incidence at older ages.

In our study, the lower percentage of female stroke cases suggests either a low prevalence of stroke in women or a lack of access to tertiary care hospitals for female stroke patients. Smoking cessation programs should include females, even though a small percentage of women smoke. These findings support earlier research suggesting a lower prevalence of stroke in Asian women compared to Asian men, but possibly higher than in European men and women.[10] Our study showed a high prevalence of stroke in the low socioeconomic group.

Regarding risk factors, more than 70% of stroke patients in our pooled data were hypertensive, making hypertension the most potent and crucial modifiable risk factor for stroke, presented frequently (61.63%). Our findings on hypertension replicate those from a study conducted in Karachi by Taj F et al.[11] A large case-control study in China also reported hypertension as the highest exposure rate among risk factors (59.1%), similar to our study. Diabetes mellitus was the second most common risk factor for stroke in our study, with a frequency of 17.65%. In Bangladesh, hypertension was the most common risk factor among stroke patients (79.2%), followed by dietary habits, dyslipidemia, smoking, and diabetes.

Hypertension and diabetes mellitus were the most common comorbidities in the Indian population, followed by ischemic heart disease and familial history of stroke.[12] This trend is similar to our study, where major risk factors included hypertension, diabetes mellitus, and heart disease with a frequency of 8.73%. Smoking is a causative factor in various pathological conditions, such as cancer, stroke, heart diseases, and chronic respiratory diseases.[13]

When categorizing stroke subtypes, the number of ischemic strokes was almost equal to hemorrhagic strokes (44.2% vs. 43.4%). This finding contradicts previous studies conducted in Pakistan and other South Asian countries. A systematic review carried out in 2010 in Pakistan showed 80% of patients had an ischemic stroke, 15% had an intracerebral hemorrhage, 3% had a subarachnoid hemorrhage, and 2% were unspecified.[14] Another study in 2010 with a cohort of 159 patients found 67.9% had ischemic strokes, 21.4% had hemorrhagic strokes, and 10.7% had transient ischemic attacks.[15] A hospital-based study from Karachi in 2007 reported 70.1% had cerebral infarction and 29.9% had cerebral hemorrhage.

A 2019 study showed about 75% had ischemic strokes, while 25% had hemorrhagic strokes.[12]
When comparing our findings with neighboring countries, ischemic stroke rates ranged from 65% in Kolkata to 84% in Trivandrum, and intracerebral hemorrhage rates from 11% in Trivandrum to 35% in Kolkata. In Bangladesh, a nationwide survey in 2022 found 79.7% had ischemic strokes, and 15.7% had hemorrhagic strokes. In Sri Lanka, 79.7% had ischemic strokes, and 20.3% had hemorrhagic strokes.8 In Nepal, ischemic stroke was more common (63%) than hemorrhagic stroke (37%).[16]

In the studied population of stroke patients in Punjab, stroke incidence and mortality rates were significantly related to known comorbid risk factors, but no significant association was found with ethnicity. The relatively high prevalence of stroke in the elderly differs from trends in other South Asian countries, with almost 50.5% of patients over 60. In India, a recent study found an incidence rate of 46 strokes per 100,000 people in the 19-49 age group.[17] In Uganda, a 2022 study found a mean age of 36.8 years for stroke patients and controls, highlighting different causes and risk factors for ischemic stroke in young adults compared to older adults.[18]

Our study has several limitations. Prevalence and incidence studies done in Pakistan were performed at different times, involved different methods, and covered different communities, making the data not directly comparable. Our study is hospital-based and prone to selection bias, with a limited sample not representative of the whole country. Additionally, our study is retrospective, limiting the identification of all risk factors due to the available data. However, the study has several strengths. It includes up-to-date reliable data from the largest neurosciences institute, the referral center for the entire province. The study provides valuable input for future research on the incidence of stroke.

CONCLUSION

Population-based studies focusing on the incidence and prevalence of stroke are much needed. The incidence of stroke is alarmingly high in the Asian population, as observed in our study. Most studies related to Pakistan are limited to one or a few centers, and we lack a national stroke registry. Extensive, multicenter studies with nationally representative distribution patterns are required to plan community-based interventions to combat the high incidence of stroke in the Asian population.

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Hira Jamil; Data collection and analysis, manuscript writing
Hamid Mahmood; Data analysis, manuscript writing
Kausar Tayyab; Data interpretation, manuscript revision
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All the authors have approved the final version to be published and agree to be accountable for all aspects of the work.