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Original research article

PRECISION APPROACHES IN STROKE MANAGEMENT, RECENT ADVANCES, CHALLENGES, AND INNOVATIONS IN ACUTE AND SECONDARY PREVENTION STRATEGIES

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Abstract: *The recent advances in stroke management have given rise to the so-called 'precision' strokes designed and tailored to meet the diverse challenges that are associated with this brain and vascular condition.* ***Objectives****: The main of the study is to find the precision approaches in stroke management, as well as recent advances, challenges, and innovations in acute and secondary prevention strategies.* ***Methods:*** *This retrospective study was conducted at Services Hospital Lahore from August 2022 to November 2023. Data were collected from 220 patients with stroke. Patient demographics, including age, sex, ethnicity, and relevant medical history, were meticulously extracted from electronic health records (EHR) or paper-based medical charts. Clinical characteristics were systematically recorded, such as stroke subtype, ischemic, hemorrhagic, or transient ischemic attack, presenting symptoms, time of symptom onset, and initial National Institutes of Health Stroke Scale (NIHSS) scores.* ***Results:*** *Data were collected from 220 patients. The mean age of the patients was 38.2±9.87 years. There were 55% male and 45% female patients. Among the stroke subtypes, ischemic stroke was the most common, comprising 70 cases, followed by hemorrhagic stroke with 30 cases, and cryptogenic stroke with 20 cases. Hypertension was the most common, affecting 60% of patients, followed by dyslipidemia at 40% and diabetes mellitus at 30%. Hypertension demonstrated a statistically significant association with both ischemic and hemorrhagic strokes, with prevalence rates of 55% and 75%, respectively ($p<0.05$). Conversely, diabetes mellitus, dyslipidemia, smoking, and genetic predispositions did not show significant differences between the two stroke types ($p>0.05$).****Conclusion:*** *It is concluded that the study highlights the multifaceted nature of stroke management, emphasising the importance of tailored interventions based on individualised risk profiles and clinical presentations.*

Keywords: Stroke, Hypertension, Diabetes Mellitus, Dyslipidemias, Ischemic Stroke

Introduction

The recent advances in stroke management have given rise to the so-called 'precision' strokes designed and tailored to meet the diverse challenges associated with this brain and vascular condition. Given that stroke remains one of the leading causes of mortality and long-term disability on a global scale, there is much need to explore practical interventions for enhancing acute stroke care and secondary stroke prevention (1). Current developments in the field have improved our knowledge about potential stroke pathophysiology and resulted in the establishment of personalised treatment methods, which may significantly improve injury outcomes (2). Stroke is a phenomenon identified as an issue for older individuals and is now realised to be a significant health concern for young adults. Stroke in people under 45 years of age is increasing frequently, and authors have sought to understand better the disease in the young populations' clinical phenotype, associated risk factors, and implications for early diagnosis and management (3). Even though stroke in young adults is a relatively small portion of stroke cases, it can have a more significant effect on the population due to stroke-related disability, loss of productivity, and quality of life among the young population. Stroke in young adults differs from older populations, like risk factors for stroke, with young stroke patients often affected by comorbidities, such as obesity or illicit drug use (4). Stroke continues to be a significant source of death and disability in all levels of society, from newborns to the aged population. However, there are age-related differences in the understanding and managing of stroke in terms of mechanisms, pathophysiology, aetiology, recovery, and prognosis (5). Recent literature highlights a concerning trend: an increased trend in the number of stroke hospitalisations among young adults; a group of adults usually refers to those aged between 18 and 50 years; this has occurred at the same time as the decrease in hospitalisations in older adults in a given population (6). This trend presents significant implications for stakeholders such as individuals, families, society, healthcare consumers, and macroeconomists. Ischemic strokes also account for the majority of deaths and disabilities, and the social and economic impact is enormous, with families at the core of the effect. People who have suffered a stroke are young and are, in most cases, in the prime of their working career; post-stroke disability comes on suddenly and can reduce or stop work and income as well as deprive the affected person and society of their contribution (7). Even though stroke accounts for about 10-15% of all strokes in adults aged 18 to 50 years, the long-term cultural effects of it are more vital, and the effect is widespread; therefore, the need to address this issue is eminent (8). The incidence rate of strokes in younger populations or people under the age of 50 ranges from 10 to 14 per cent of all strokes. In contrast to ischemic stroke prevalence in older patients, overall

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incidence in young adults is increased. For example, in the United States, stroke incidence among adults 20 to 44 years old went up from 17 cases per 100,000 in 1993 to 28 per 100,000 in 2015 (9). Likewise, a large observational study performed in the Netherlands showed that the number of strokes among young adults in the entire country increased from 1998 to 2010, with the primary impact on individuals aged over 35 years and ischemic strokes. It should also be noted that some trends are worrisome and visible in low- and middle-income countries (10).

Thus, the study's main objective is to identify precision approaches to stroke management and recent advances, challenges, and innovations in acute and secondary prevention strategies.

Methodology

This retrospective study was conducted at Services Hospital Lahore from August 2022 to November 2023. Data were collected from 220 patients with stroke. Patient demographics, including age, sex, ethnicity, and relevant medical history, were meticulously extracted from electronic health records (EHR) or paper-based medical charts. Clinical characteristics were systematically recorded, such as stroke subtype, ischemic, hemorrhagic, or transient ischemic attack, presenting symptoms, time of symptom onset, and initial National Institutes of Health Stroke Scale (NIHSS) scores. Imaging studies, comprising computed tomography (CT) scans, magnetic resonance imaging (MRI), and angiography findings, were scrutinised to determine stroke localisation, infarct size, presence of vascular occlusion, and other radiological features. Laboratory investigations, including routine blood tests, coagulation profiles, lipid panels, and biomarker assays, were analysed to elucidate potential risk factors and prognostic indicators. A comprehensive assessment of treatment modalities administered during the acute phase of stroke management was conducted. This encompassed thrombolytic therapy, mechanical thrombectomy, blood pressure management, and neuroprotective interventions. Each patient's treatment regimen was meticulously documented, accounting for variations in therapeutic approaches based on stroke subtype, severity, and individual patient characteristics. Secondary prevention strategies aimed at reducing the risk of recurrent stroke events and optimising long-term outcomes were meticulously evaluated. This included the implementation of antiplatelet or anticoagulant therapy, statin use, blood pressure control, lifestyle modifications, and access to rehabilitation services. Adherence to secondary prevention measures was closely monitored during follow-up visits, focusing on promoting patient education and empowerment. Data were analysed using SPSS v27. Descriptive statistics were utilised to summarise patient demographics, clinical characteristics, treatment modalities, and outcomes. Subgroup analyses explored potential associations between patient variables, treatment approaches, and clinical outcomes.

Results

Data were collected from 220 patients. The mean age of the patients was 38.2±9.87 years. There were 55% male and 45% female patients. Among the stroke subtypes, ischemic stroke was the most common, comprising 70 cases, followed by hemorrhagic stroke with 30 cases, and cryptogenic stroke with 20 cases (Table 1). Hypertension was the most common, affecting 60% of patients, followed by dyslipidemia at 40% and diabetes mellitus at 30%. Smoking was reported in 35% of cases, while obesity and genetic predispositions were observed in 25% each. Migraine and substance abuse were less frequent, documented in 15% and 20% of patients, respectively, while hypercoagulable states were identified in 10% of cases (Table 2).

Table 1: Demographic data of patients

Characteristic	Value
Total Patients	220
Mean Age (years)	38.2±9.87
Gender	
- Male	55%
- Female	45%
Stroke Subtype	
Ischemic Stroke	70
Hemorrhagic Stroke	30
Cryptogenic Stroke	20

Table 02: Risk factors associated with stroke

Risk Factor	Percentage of Patients (%)
Hypertension	60
Diabetes Mellitus	30
Dyslipidemia	40
Smoking	35
Obesity	25
Migraine	15
Substance Abuse	20
Hypercoagulable States	10
Genetic Predispositions	25

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An in-hospital mortality rate of 8% highlights the severity of the conditions under investigation. However, 60% of patients achieved functional independence, indicating successful recovery and rehabilitation efforts. 30% of patients still required assistance for daily activities (Table 3).

Table 3: Outcomes after stroke

Outcome	Value
In-hospital Mortality Rate (%)	8
Functional Independence (%)	60
Assistance Needed (%)	30
Severe Disability/Deceased (%)	10

Hypertension demonstrated a statistically significant association with both ischemic and hemorrhagic strokes, with prevalence rates of 55% and 75%, respectively ($p<0.05$). Conversely, while diabetes mellitus, dyslipidemia, smoking, and genetic predispositions did not show significant differences between the two stroke types ($p>0.05$), substance abuse and hypercoagulable states exhibited substantial associations. Substance abuse was more prevalent among patients with ischemic stroke (15%) compared to hemorrhagic stroke (25%) ($p<0.05$) (Table 4).

Table 4: Comparative analysis of risk factors among stroke

Risk Factor	Ischemic Stroke (%)	Hemorrhagic Stroke (%)	p-value
Hypertension	55	75	<0.05
Diabetes Mellitus	25	35	>0.05
Dyslipidemia	35	25	>0.05
Smoking	30	40	>0.05
Substance Abuse	15	25	<0.05
Hypercoagulable States	5	15	<0.05
Genetic Predispositions	20	30	>0.05

Discussion

Even though stroke in young adults is a relatively small portion of stroke cases, it can have a more significant effect on the population due to stroke-related disability, loss of productivity, and quality of life among the young population. Stroke in young adults differs from older populations, like risk factors for stroke, with young stroke patients often affected by comorbidities, such as obesity or illicit drug use (11). Stroke continues to be a significant source of death and disability in all levels of society, from newborns to the aged population. However, there are age-related differences in the understanding and managing of stroke in terms of mechanisms, pathophysiology, aetiology, recovery, and prognosis (12). Recent literature highlights a concerning trend: an increased trend in the number of stroke hospitalisations among young adults; a group of adults usually refers to those aged between 18 and 50 years; this has occurred at the same time as the decrease in hospitalisations in older adults in a given population (13). This trend presents significant implications for stakeholders such as individuals, families, society, healthcare consumers, and macroeconomists. Ischemic strokes also account for the majority of deaths and disabilities, and the social and economic impact is enormous, with families at the core of the effect. People who have suffered a stroke are young and are, in most cases, in the prime of their working career; post-stroke disability comes on suddenly and can reduce or stop work and income as well as deprive the affected person and society of their contribution (14). Even though stroke accounts for about 10-15% of all strokes in adults aged 18 to 50 years, the long-term cultural effects of it are more vital, and the effect is widespread; therefore, the need to address this issue is evident. The incidence rate of strokes in younger populations or people under the age of 50 ranges from 10 to 14 percent of all strokes. In contrast to ischemic stroke prevalence in older patients, overall incidence in young adults is increased (15). For example, in the United States, stroke incidence among adults 20 to 44 years old went up from 17 cases per 100,000 in 1993 to 28 per 100,000 in 2015. Likewise, a large observational study performed in the Netherlands showed that the number of strokes among young adults in the entire country increased from 1998 to 2010, with the primary impact on individuals aged over 35 years and ischemic strokes. It should also be noted that some trends are worrisome and visible in low- and middle-income countries, too (16).

Conclusion

It is concluded that the study highlights the multifaceted nature of stroke management, emphasising the importance of tailored interventions based on individualised risk profiles and clinical presentations. By addressing modifiable risk factors, optimising acute treatment modalities, and implementing robust secondary prevention strategies, we can strive towards improving patient outcomes and reducing the burden of stroke-related disability and mortality.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

Approved by the department concerned. (SHL-IRBEC-5684 DATED 25-6-22)

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