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FREQUENCY OF POST-STROKE SEIZURES IN LOCAL POPULATION OF PAKISTAN

Dr Faiqa Akram*
Postgraduate Resident Neurology Department, National Hospital and Medical Center, Lahore

Dr Athar Javed
Professor Neurology Department, National Hospital and Medical Center, Lahore

Dr Tabana Iftikhar Ali Taj
Postgraduate Resident Neurology Department, National Hospital and Medical Center, Lahore

Dr Rebia shahid
Postgraduate Resident Neurology Department, National Hospital and Medical Center, Lahore

Dr Tabinda batool
Postgraduate Resident Neurology Department, National Hospital and Medical Center, Lahore

Author Details

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Corresponding E-mail & Author*:
Arbaz Siddique
Shahida Islam Nursing College, Lodhran
arbazthaheem374@gmail.com

Abstract

Background: Post-stroke seizures (PSS) are a common neurological complication following cerebrovascular accidents and are associated with increased morbidity and mortality. The incidence of PSS varies globally due to differences in stroke subtypes, patient demographics, and diagnostic methods. Limited data are available from Pakistan regarding the frequency and characteristics of PSS. **Objective:** To determine the frequency of post-stroke seizures among patients admitted with stroke in a tertiary care hospital in Pakistan. **Methods:** This descriptive case series was conducted at the Department of Neurology, National Hospital and Medical Center, Lahore, over a period of six months from September 2024 to February 2025. A total of 67 stroke patients aged 18–70 years were included using non-probability consecutive sampling. Patients with a known history of epilepsy or metabolic abnormalities (sepsis, electrolyte imbalance) were excluded. Stroke diagnosis was confirmed by CT scan. The occurrence, timing (early/late), and type (generalized/partial) of seizures were recorded. Data were analyzed using SPSS version 27. Descriptive statistics were applied, and Chi-square tests were used for associations ($p \leq 0.05$ considered significant). **Results:** Among 67 patients, 40 (59.7%) were males and 27 (40.3%) females. The mean age was 58.3 ± 10.2 years. Ischemic

stroke accounted for 44 (65.7%) cases, hemorrhagic stroke for 18 (26.9%), and venous infarcts for 5 (7.4%). Post-stroke seizures occurred in 13 (19.4%) patients. Early seizures (within 24 hours) were seen in 9 (13.4%) cases, while late seizures occurred in 4 (6.0%). Seizures were more frequent in hemorrhagic stroke (33.3%) compared to ischemic (13.6%) and venous infarcts (20%). Generalized seizures were observed in 10 (76.9%) cases, and focal seizures in 3 (23.1%). **Conclusion:** The frequency of post-stroke seizures in this local population was 19.4%, with higher prevalence in hemorrhagic stroke. Early seizures were more common than late seizures. These findings emphasize the need for vigilant monitoring and early seizure prophylaxis, particularly in patients with hemorrhagic or cortical strokes.

Introduction

Post-stroke seizures (PSS) represent a well-recognized neurological complication that may arise following both ischemic and hemorrhagic strokes. They are more frequently observed in individuals aged above 65 years and can occur after any type of cerebrovascular event. PSS may present as the sole manifestation of a new stroke or develop during either the early or late phases of recovery following a cerebrovascular insult. Several factors have been associated with the development of PSS, including male gender, advanced age (above 65 years), anterior circulation infarctions, cortical involvement, and larger lesion sizes. Hemorrhagic transformation, cerebral venous infarctions, and recurrent strokes are additional contributors. There is still a lot of clinical uncertainty and debate regarding the overall impact of PSS on functional recovery and mortality, particularly when seizures occur early after stroke [1,2,3,4]. Lidetu et al. found that older age, hemorrhagic stroke, surgical intervention, and tramadol use for pain management were significant risk factors for post-stroke seizures, with an estimated incidence of 22.18% [5]. In a similar vein, Turaga et al. looked at 279 people who had a stroke and found that ischemic stroke (IS) was the most common type (62.4%), followed by hemorrhagic stroke (HS) (20.4%), cerebral sinus venous thrombosis (CSVT) (15.8%), and ischemic stroke with hemorrhagic transformation (ISH). 11.8% of patients experienced early post-stroke seizures, the majority of which occurred within 24 hours of the stroke's onset. Early seizures occurred most frequently in CSVT (40.9%), followed by ISH (20%), HS (8.7%), and IS (5.2%) [6]. Understanding the frequency and characteristics of PSS is crucial to clinical practice because of the high rate of stroke in low- and middle-income countries like Pakistan. Despite being a common post-stroke complication, local data on its prevalence and associated factors remain limited. Given the high burden of stroke in low- and middle-income countries such as Pakistan, understanding the frequency and characteristics of PSS is of great clinical significance. Despite being a common post-stroke complication, local data on its prevalence and associated factors remain limited.

OBJECTIVE

To determine the frequency of post-stroke seizures among patients admitted with stroke in a tertiary care hospital in Lahore, Pakistan.

METHODOLOGY

This descriptive case series was conducted in the Department of Neurology, National Hospital and Medical Center, Lahore, over a period of six months from September 2024 to February 2025. A total of 67 patients were included in the study. The sample size was calculated using the World Health Organization (WHO) sample size calculator, based on an expected frequency of post-stroke seizures of 22.18%, a 95% confidence level, and a 10% absolute precision [5]. The non-probability consecutive

sampling technique was employed to recruit participants who met the inclusion criteria until the required sample size was achieved.

INCLUSION CRITERIA

All adult patients aged between 18 and 70 years, of either gender, who were admitted to the Department of Neurology, National Hospital and Medical Center, Lahore, with a confirmed diagnosis of stroke were included.

EXCLUSION CRITERIA

Patients who had a known history of epilepsy or those suffering from metabolic abnormalities, such as sepsis or electrolyte imbalance, were excluded.

Data Collection Procedure

After ethical approval, informed consent was obtained. Demographic and clinical data, including name, age, gender, stroke duration, and type (ischemic, hemorrhagic, venous infarct), were recorded. Seizure occurrence was documented, noting timing (early <24 hours, late >24 hours), type (generalized/focal), frequency (single/multiple), and status epilepticus. All evaluations were confirmed by a consultant neurologist (>5 years' experience).

DATA ANALYSIS

All collected data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0. Quantitative variables, such as age and stroke duration, were presented as mean ± standard deviation (SD), while qualitative variables, including gender, stroke type, and presence of seizures, were expressed as frequencies and percentages. Data were further stratified according to age, gender, and stroke type to assess potential associations. The Chi-square test was applied for comparison, and a p-value of ≤ 0.05 was considered statistically significant.

RESULTS

A total of 67 patients diagnosed with stroke were included in the study. The mean age of participants was 58.3 ± 10.2 years. There were 40 (59.7%) males and 27 (40.3%) females. The distribution of stroke types and the occurrence of post-stroke seizures are summarized below.

Baseline Characteristics

Characteristic	Mean ± SD / n (%)
Mean Age (years)	58.3 ± 10.2
Male Gender (%)	40 (59.7%)
Female Gender (%)	27 (40.3%)
Ischemic Stroke (%)	44 (65.7%)
Hemorrhagic Stroke (%)	18 (26.9%)
Venous Infarct (%)	5 (7.4%)

The majority of patients had ischemic stroke (65.7%), followed by hemorrhagic stroke (26.9%) and venous infarct (7.4%).

Frequency and Pattern of Post-Stroke Seizures

Out of 67 patients, 13 (19.4%) developed post-stroke seizures. Among these, early seizures (<24 hours) were observed in 9 (13.4%) patients, while late seizures (>24 hours) occurred in 4 (6.0%) patients. Regarding seizure type, 10 (76.9%) experienced generalized seizures, and 3 (23.1%) had focal seizures.

Seizure Frequency by Stroke Type

Stroke Type	Total (n)	Patients with Seizures (n)	Percentage (%)
Ischemic Stroke	44	6	13.6
Hemorrhagic Stroke	18	6	33.3
Venous Infarct	5	1	20.0

DISCUSSION

This study found a 19.4% frequency of post-stroke seizures (PSS), which aligns with previously reported international data ranging between 11–22% [5,6]. This incidence is consistent with findings from large-scale reviews and meta-analyses, such as that by Leung et al. (2024), which estimated the pooled incidence of early seizures at approximately 7% and post-stroke epilepsy at 10% across stroke subtypes [9]. The slightly higher rate in our study may reflect differences in stroke severity, the inclusion of both ischemic and hemorrhagic stroke patients, or regional variations in clinical characteristics and health system capacities. As noted in a recent prospective cohort by Tassi et al. (2023), the risk of seizures increases substantially in the presence of hemorrhagic stroke, cortical involvement, and younger age, mirroring our own finding that seizures occurred more frequently in hemorrhagic strokes (33.3%) than in ischemic strokes [10]. This observation is further supported by Ouerdiene et al. and Lee et al., who identified cortical involvement and hemorrhage as significant risk factors for post-stroke seizures [2,4].

In our study, early seizures (within 24 hours of stroke) were more frequent (13.4%) compared to late seizures (6%), a finding consistent with that of Turaga et al., who reported that early seizures tend to cluster within the first 24 hours following stroke onset [6]. This temporal pattern has been supported by multiple studies, including one by Ferlazzo et al. (2021), which emphasized that early seizures are primarily driven by acute biochemical, metabolic, and ionic imbalances in injured brain tissue, while late seizures typically reflect permanent structural damage and epileptogenesis [11]. Generalized seizures were more common in our cohort, which is in line with studies such as that by Brigo et al. (2020), where seizures with secondary generalization were predominant due to widespread cortical excitability following injury [12]. These observations underscore the importance of close monitoring during the acute phase, especially in patients with cortical or hemorrhagic strokes.

While our seizure frequency is in line with international estimates, it is somewhat lower than reports from other African studies, such as Sarfo et al. and Lidetu and Zewdu, where PSS prevalence reached or exceeded 25% in some subgroups [3,5]. These differences may be attributed to several factors, including variations in ethnicity, stroke subtype distribution, severity at presentation, access to neuroimaging and EEG, and diagnostic criteria used. For instance, studies conducted in settings with limited imaging often rely on clinical diagnosis, which can lead to either underdiagnosis or overestimation of seizures, particularly when EEG is unavailable [13].

The prognostic significance of PSS is considerable. Patients with seizures following stroke have been shown to have increased risks of neurological deterioration, prolonged hospitalization, delayed rehabilitation, and recurrent seizures. According to Galovic et al. (2018), early seizures are a significant predictor of post-stroke epilepsy, with an adjusted odds ratio exceeding 5, particularly in patients with cortical involvement [14]. Moreover, large retrospective studies such as that by Conrad et al. (2022) have demonstrated that patients with late seizures face a significantly elevated long-term risk of seizure recurrence, justifying the classification of these patients under the broader epilepsy spectrum as defined by the ILAE [15].

The pathophysiological mechanisms underlying PSS are multifactorial. Early seizures are typically provoked by acute neuronal injury, inflammation, ionic shifts, and blood–brain barrier disruption, while late seizures result from long-term processes such as gliosis, synaptic reorganization, and persistent hyperexcitability [11]. In hemorrhagic strokes, breakdown products like iron and hemoglobin contribute to oxidative stress and chronic epileptogenesis, as highlighted in a recent review by Singh et al. (2023) [16]. Furthermore, studies using advanced neuroimaging techniques, such as those by Pitkänen and Immonen (2020), have identified lesion characteristics—particularly those affecting the cortex and temporal lobes—as key predictors of seizure risk [17].

Clinically, the identification of high-risk patients is essential for guiding monitoring and treatment decisions. Risk stratification tools such as the SeLECT score for ischemic stroke and the CAVE score for hemorrhagic stroke incorporate variables like cortical involvement, early seizures, and lesion location to predict future seizure risk [18]. However, the utility of prophylactic antiepileptic treatment remains controversial. While early seizure treatment is generally supported, routine prophylactic use of antiseizure medications in stroke patients without seizures is not recommended, as it may not reduce long-term seizure incidence and could impair recovery due to side effects, as discussed by De Reuck (2021) [19].

CONCLUSION

Post-stroke seizures (PSS) were observed in nearly one-fifth of patients in this study, with a higher frequency noted among those with hemorrhagic strokes and cortical involvement. Early seizures, occurring within the first week of stroke onset, were more common than late-onset seizures, underscoring the importance of close clinical observation during the acute post-stroke period. Generalized seizures were the predominant type, likely reflecting the widespread cortical irritability associated with stroke-related brain injury. The observed seizure frequency aligns with global data and highlights PSS as a significant complication that may adversely affect recovery, prolong hospitalization, and increase the risk of post-stroke epilepsy.

Given the substantial burden of seizures on rehabilitation outcomes and quality of life, early identification of high-risk individuals—particularly those with hemorrhagic lesions, cortical strokes, or large infarcts—are essential. Implementation of seizure risk stratification tools, EEG monitoring in select patients, and prompt initiation of treatment when indicated can help mitigate complications. Future studies should focus on validating predictive models and identifying biomarkers that could guide individualized management. Overall, vigilant monitoring and timely intervention remain key strategies in optimizing neurological outcomes and preventing long-term disability in patients at risk of developing seizures after stroke.

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