

Early Post-Stroke Seizures: A Comparison Between Acute Ischemic and Haemorrhagic Stroke Patients

Imran Khan, Zubair Waheed Khan, Abdul Latif Khattak, Javed Anwar*, Tahir Ibrahim**, Fayyaz Hassan

Department of Medicine, Combined Military Hospital/National University of Medical Sciences (NUMS) Pakistan, *Department of Radiology, Combined Military Hospital/National University of Medical Sciences (NUMS) Pakistan, **Department of Medicine, Avicenna Medical and Dental College, Lahore Pakistan

ABSTRACT

Objective: To compare the frequency of post-stroke seizure between acute ischemic and haemorrhagic stroke patients.

Study Design: Comparative, prospective study.

Place and Duration of Study: Combined Military Hospital, Rawalpindi Pakistan, from Oct 2021 to Oct 2022.

Methodology: A total of 180 patients with acute stroke, were included in the study. CT brain and/or MRI brain were performed to diagnose all patients. Patients were divided into haemorrhagic and ischemic stroke groups. Patients were followed for four weeks.

Results: The mean age of the patients was 48.92 ± 7.80 years. The majority were males 127(70.5%), 125(69.4%) patients had an ischemic stroke, while 55(30.6%) had haemorrhagic. Post-stroke seizures were seen in 12(7.07%). In haemorrhagic stroke patients, the frequency was 5/55(9.09%), while 7/125(5.6%) in ischemic ones. The difference in frequencies was 4.03%. There was no significant difference in seizure frequencies between the two groups ($p=0.298$).

Conclusion: This study concluded that there is no significant statistical difference in frequencies of post-stroke seizure in haemorrhagic stroke compared to ischemic stroke patients.

Keywords: Epilepsy, Haemorrhagic stroke, Ischemic stroke, Seizures.

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INTRODUCTION

The Post-stroke seizure is defined as single or multiple convulsive episodes cropping up following the stroke, regardless of the time of onset.¹ These convulsions are probably related to cerebral damage or intracranial biochemical changes after stroke.² These seizures are categorized into early seizures, which occurred up to 2–4 weeks and late seizures developed later than four weeks.³ Risk factors for developing post-stroke seizures include cortical involvement, anterior hemisphere location of the lesion, and possible cardioembolic events.⁴

The available data suggested a significant association between the occurrence of post-stroke seizures and the region of the brain parenchyma affected due to stroke.^{5,6} The frequency is highest with intraparenchymal haemorrhage and large supratentorial ischemic strokes and lower after transient ischemic attacks, lacunar infarcts, and brainstem strokes.⁷ Results of previously conducted studies show a higher incidence of acute seizure in intracranial haemorrhage 10–16% in comparison with ischemic stroke (2–4%). There is a variation of post-stroke seizure frequencies in different

studies ranging from 2–18%, mainly due to the difference in the parenchymal stroke site.^{8,9} Managing stroke and different aspects of post-stroke scenarios has been improved significantly. Nevertheless, despite its importance as a crucial complication of stroke, no proper guidelines for poststroke seizure management have been developed.¹⁰

We planned to conduct this study to find out the frequencies of early seizures in patients with acute ischemic and hemorrhagic strokes. We aimed to determine the magnitude of the problem. The evaluation of the extent of the problem helps to determine the need for prophylactic anti-seizure therapy according to the type of stroke. Despite the availability of previously determined data about the extent of post-stroke seizure, this morbid complication of stroke still fails to be recognized routinely in the majority of healthcare setups. Our study will give empirical evidence to guide early recognition and management of this condition. It may help to reduce the mortality and morbidity of stroke patients in our community.

METHODOLOGY

The comparative prospective study was conducted at the Department of Medicine, Combined Military Hospital, Rawalpindi Pakistan, from October 2021 to October 2022 after approval from the

Correspondence: Dr Imran Khan, Department of Medicine, Combined Military Hospital, Rawalpindi Pakistan

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Institutional Ethical Committee (letter no. IRB 311/21). The sample size was calculated by using the WHO calculator with the percentage of post-stroke seizures was taken as 7.1%.¹¹

Inclusion Criteria: Patients of either gender, aged 20-65 years, who were admitted with acute stroke and diagnosed on a CT Brain or MRI brain were included.

Exclusion Criteria: Patients with a known history of epilepsy; recurrent stroke; head injury within the last one week; diagnosed patients of acromegaly or hypergonadism; patients with a history of a brain tumour or space-occupying lesion (assessment based on the history and medical record) and patients with severe electrolyte abnormalities were excluded.

The sampling technique was non-probability, consecutive sampling. The data of 5 included patients who died during the study period before the collection of appropriate desired data were excluded. Cut-off values for electrolyte disorders were as follows: serum sodium levels of <120 or >145 mmol/L, serum calcium levels of <5 mg/dL, and serum magnesium levels of <0.8 mg/dL.¹²

Informed written consent in the language that patients or their attendants understand was taken from the patients. For the patients with altered conscious levels or not in the capacity to give consent, an attendant or guardian of the patient was asked for consent. Depending on the type of stroke, the patients were divided into two groups: ischemic stroke and hemorrhagic stroke groups. These patients were followed for up to 4 weeks by the study team members for the onset of post-stroke seizures in each type. These patients were monitored both indoors and after discharge from the hospital as outdoor cases. Admitted patients were observed as indoor cases, while outdoor patients were interviewed on the telephone or in the outdoor patient departments (OPD) during their follow-up visits. They were observed/asked for all types of simple and generalized seizures, including tonic, clonic, myoclonic, atonic, and tonic-clonic seizures.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

One hundred eighty patients admitted to the medical wards at CMH Rawalpindi Pakistan, fulfilling

the inclusion criteria, were included in the study. The mean age of the patients was 48.92±7.80 years. There were 127 males (70.5%) and 53 females (29.5%). Ischemic stroke was diagnosed in 125(69.4%) and hemorrhagic stroke in 55(30.6%) of patients. Post-stroke generalized seizures were seen in 12(6.66%) of patients. In Ischemic stroke patients, seizures occurred in 7(5.6%) patients while 5(9.09%) in hemorrhagic stroke patients. The difference in frequencies was 4.03% (*p*-value 0.298). There was no significant difference between hemorrhagic and ischemic stroke patients for post-stroke seizure, (*p*=0.298). Among the patients with post-stroke seizures, generalized tonic-clonic fits occurred in 8(4.4%) patients, complex partial seizures in 3(1.66%) patients, and simple partial seizures in 1(0.6%) patients shown in Table.

Table: Post Stroke Seizure according to different types of Strokes (n=180)

| Type of stroke | Post-Stroke Seizure | | Total | <i>p</i> -value |
|----------------|---------------------|------------|-----------|-----------------|
| | Yes | No | | |
| Ischemic | 7(5.6%) | 118(94.4%) | 125(100%) | 0.298 |
| Hemorrhagic | 5(9.09%) | 50(90.01%) | 55 (100%) | |

DISCUSSION

Factors linked with the pathogenesis of early stroke seizures are ischemia-related metabolic abnormalities and an imbalance between excitatory and inhibitory neurotransmitters.^{12,13} This study was designed to compare the frequencies of post-stroke seizures in ischemic and hemorrhagic strokes. The results of this study revealed that in patients with hemorrhagic stroke, post-stroke seizures developed in 9.03% of patients compared to 5.6% of those who had an ischemic stroke. Although, in comparison, the frequency of post-stroke seizure was found to be higher in haemorrhagic strokes than in ischemic ones, the chi-square test of independence showed that there was no significant statistical difference between haemorrhagic and ischemic strokes for the occurrence of the post-stroke seizure. Moreover, the post-stroke seizure was not found to be significantly associated with the age and gender of the stroke patients. In our study, we found an overall frequency of post-stroke seizures of 6.66%. Hussaini *et al.* and Ferlazzo, *et al.* in their studies, found a nearly similar overall frequency of early post-stroke seizure but a higher incidence in hemorrhagic strokes.^{14,15} A regional study in Pakistan by Khealani *et al.* reported a frequency of 8% of early-onset seizures in acute ischemic stroke patients.¹⁶ Different studies have reported variations in the rates of post-stroke seizure (from 5-15%) in patients with acute stroke.^{17,18}

Our study found no significant statistical difference in post-stroke seizure frequency between the haemorrhagic and ischemic groups. Naydenov *et al.* and Holtkamp *et al.* in their studies, also observed that the type of stroke is not associated with an increased frequency of post-stroke seizure.^{19,20} A meta-analysis (comprised of published studies of the 1990–2014 period) found increased numbers of early seizures in hemorrhagic stroke in comparison with ischemic ones, but simultaneously, no significant difference was found for the incidence of late seizures.²¹ In our study, patients with secondary ICH were counted with the original ischemic aetiology. We found a significant number of post-stroke seizure cases in the study included patients. It determines the significance of prophylactic use of anti-seizure medicine both in ischemic and hemorrhagic stroke.

Moreover, the pathogenesis of post-stroke seizures is still not determined precisely. Therefore, further research is recommended to define the new protocols for the prevention and management of post-stroke seizures.

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LIMITATIONS OF STUDY

This study has limitations commonly associated with small registry studies with short-duration follow-ups. Firstly, to establish guidelines for prophylaxis of post-stroke seizure, large population-based data is required that may complement this study. Moreover,

this study lacks data related to the severity of strokes and co-morbid conditions like diabetes or hypertension; these factors may act as confounding factors and could have an impact on the frequency of post-stroke seizures.

CONCLUSION

This study concluded that there is no significant statistical difference in the frequency of post-stroke seizure in hemorrhagic stroke patients in comparison with ischemic stroke patients. Post-stroke seizure is a significant complication of the stroke; therefore, early and appropriate management may ultimately reduce the incidence of early-onset seizures and subsequently improve the prognosis in such patients.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

IK: & ZWK: Data acquisition, data analysis, critical review, approval of the final version to be published.

ALK: & JA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

TI: & FH: Concept, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Acute Ischemic and Haemorrhagic Stroke Patients

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