Clinical Features and Magnetic Resonance Imaging Findings of Post-stroke Epilepsy: A Cross-sectional Study in Hanoi, Vietnam

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ABSTRACT

Objective: To describe clinical features and magnetic resonance imaging findings of post-stroke epileptic patients at Neurology Center of Bachmai Hospital.

Subjects: 131 patients diagnosed with poststroke epilepsy at Bachmai Hospital from June 2020 to July 2023.

Methods: Cross-sectional descriptive study.

Results: Male/female ratio is 3.6, mean age is 58,8±15,8. Ischemic stroke accounted for 72.3% while 27.7% had hemorrhages. Hemiplegia is the most common feature, accounting for 63.1%. The first epileptic seizure occurred almost within one year after the onset of stroke, accounting for 73.9%. Focal seizure is the most common seizure type, accounting for 78.2%; Unknown seizure is 16.5%; and 5.3% had generalized seizures. In brain magnetic resonance imaging (MRI), 60% of patients had lesions in the left hemisphere, 36.9% in the right hemisphere, and 3.1% in both hemispheres. In these patients, ischemic stroke and hemorrhage stroke are 71.8% and 28.2%, respectively - Approximately 83.2% of the lesions involved cortical areas. A hemorrhage stroke has a higher risk of having an early seizure.

Conclusion: Stroke is the leading cause of epilepsy with the elderly who was over 60 years old. The most common seizures type occuring after stroke were within one year of onset, of which focal seizures were the main ones. Magnetic resonance imaging shows most PSE patients had the involvement of cerebral cortex. Haemorrhage stroke has a higher risk of occuring early seizure with statistically significance.

Keywords: Seizures, epilepsy, post - stroke epilepsy.

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1. INTRODUCTION

Stroke is the most common cause of epilepsy in the elderly population, those over 60 years old [1,2]. Poststroke epilepsy (PSE) is an enervated complication of stroke that is linked to higher mortality and poor functional outcomes. According to the ongoing medical studies, approximately one in ten of stroke patients have recurrent seizures. The rate of epilepsy after stroke, when followed for 5-10 years, is 10-12%[3,4]. The onset latency of recurrent seizures after stroke is variable. The incidence of PSE emerging within the first year is 40%-80% [3]. In addition, PSE, in combination with poststroke dementia, leads to the complexity of the recovery process, causing unplanned hospital admissions, extended hospitalization time, increased life-threatening cases, and decreased social life quality [4].

Early seizure is defined as a seizure occurring within seven days of stroke onset; in contrast, a late seizure or remote symptomatic seizure is supposed to be an unprovoked seizure occurring after stroke onset at least one week[5]. In all cases, a late seizure after a stroke should be brain imaging to exclude the appearance of new stroke progression. Besides, the imaging contributes to access lesion severity that can predict the occurrence of PSE [3].

Lesions in the posterior fossa area can cause epileptic seizures, but the mechanism is unclear. Therefore, our research focuses on the hemispheric region. The clinical characteristics and brain lesions on MRI images of PSE patients are diverse and variable. The correlation between clinical and MRI lesions is complicated [7]. The objectives of this study were to assess clinical features and magnetic resonance imaging findings of post-stroke epileptic patients.

2. METHODS

Study design and participants

We conducted a hospital-based cross-sectional study at the Neurology Center of Bach Mai Hospital from June 2020 to July 2023.

In this study, the inclusion criteria were adult patients (aged 18 years old or older) who had at least one late seizure that occurred after the onset of stroke >1 week, based on the criteria of the International League Against Epilepsy (ILAE)[6]. We excluded patients who had brainstem and cerebellar stroke and intracerebral hemorrhage due to ruptured cerebral vascular malformation, those who had seizures or were diagnosed with epilepsy or brain tumor or encephalitis before the first stroke ever onset, those with severe metabolic diseases at the time of seizure onset (renal failure with hyperuremia, cirrhosis with impaired liver function, hyper or hyponatremia, hyper or hypoglycemia) or those who died during hospitalization. In total, 131 consecutive patients participated in the study.

Data collection

All participants were evaluated with a complete examination by neurologists on admission, and a brain MRI by a radiologist confirmed the results. The stroke type and the severity were judged on an MRI scan. Three doctors were involved in this study, all trained to conduct data collection procedures following a standardized protocol.

One part of this studied population was completed with data from a clinical interview with the out-patients who visited the hospital for a regular monitor check-up. In the others, we selected all the inpatients in the stroke unit who had a seizure after 7 days of stroke onset. Those patients performed an MRI brain scan right after they had a seizure to exclude all deteriorated stroke cases or acute symptomatic seizures instead of PSE.

Variable definitions

Seizures were classified into unknown, focal, and generalized seizures based on the ILAE 2017 classification of seizure. Poststroke epilepsy is defined as there is at least one unproved seizure occurring after stroke onset more than one week, excluding all other causes that can create a seizure [5].

Other variables include patient-related personal data (age, sex, medical history, comorbidities, smoking, and alcohol consumption), admission clinical data (time intervals between onset and patients' arrival to the health center, extent of motor paralysis, facial nerve paralysis, Aphasia, Magnetic Resonance Imaging (MRI) (stroke type, stroke location, volume of the lesion).

Statistical analysis

Data were entered using the Epidata software version 3.1, and all statistical analysis was performed by the SPSS software version 16.0. We presented quantitative data as means and standard deviations, whereas qualitative data as frequencies and percentages. We performed Chi-square or Fisher-exact tests for qualitative variables to compare group differences. A two-sided P-value of <0.05 was considered statistically significant.

3. RESULTS

A total of 131 patients were enrolled in the study. Male patients accounted for 78.5% of the total number of patients. The mean age was 52.8 years. Approximately two-thirds of total cases had a history of hypertension and a half had alcohol drinking (Table 1).

***Table 1**. Background characteristics of the study participants*

Variable	N (%)
Sex	
Male	103 (78.5%)
Female	28 (21.5%)
Age	
Mean ± SD	58.8 ± 15.8
Medical history	
Hypertension	95 (72.5%)
Diabetes	31 (23.7%)
Hyperlipidemia	18 (13.7%)
Smoking	46 (35.1%)
Alcohol drinking	72 (55.0%)

Table 2 illustrates the clinical characteristics of the studied population. The final study comprised 72.3% of patients with primary ischemic stroke and 27.7% of patients with primary intracranial hemorrhage. Hemiplegia was the most common symptom, followed by

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nerve palsy, accounting for 63.1% and 56.9%, respectively. Most late seizures occurring in the first year after stroke onset was 73.9%. The generalized, focal, and unknown seizure percentages were 5.3%, 78.2%, and 16.5%, respectively. Early seizures occurred in 15.7% and were significantly associated with hemorrhage stroke ($p < 0.05$).

***Table 2**. Clinical characteristics of the study participants*

Characteristics	Primary Ischemic stroke (N=94)	Primary intracranial haemorrhage (N=37)	Total (N=131)	P-value
Clinical features				
Hemiplegia	51 (54.3%)	32 (86.5%)	83 (63.1%)	0.81
Nerve palsy	53 (56.4%)	21 (56.8%)	74 (56.9%)	0.46
Aphasia	12 (12.8%)	7 (18.9%)	19 (13.9%)	0.78
Coma	4 (4,3%)	5 (13,5%)	9 (9,1%)	
Characteristics of seizure				
Generalised	4 (4.3%)	3 (8.1%)	7 (5.3%)	0.78
Focal	77 (81.9%)	25 (67.6%)	102 (78.2%)	0.61
Unknown	15 (16.0%)	7 (18.9%)	22 (16.5%)	0.36
Onset late seizure from 1 week to 1 year	78 (83.0%)	18 (48.6%)	96 (73.9%)	0.28
Acute symptomatic seizure	3 (3.2%)	9 (24.3%)	12 (15.7%)	**0.03**

Table 3 presents the MRI brain scan characteristics of the patients with 60% of patients had lesions in the left hemisphere, 36.9% in the right hemisphere, and 3.1% in both hemispheres. Most cases had the location of stroke involving the cortex, accounting for 83.3% with hemorrhage stroke and 85.1% with Ischemic stroke. Approximately half of the participants had lesions with multilobar involvement (49.7%), followed by deep region involvement (38.7%).

***Table 3**. Imaging characteristics of the study participants*

MRI characteristics	Primary Ischemic stroke (N=94)	Primary intracranial haemorrhage (N=37)	Total (N=131)	P value
Right	27/94 (28,7%)	21/37 (56,8%)	48/131 (36,9%)	0,76
left	53/94 (56,4%)	26/37 (70,1%)	79/131 (60,0%)	0,88
Both	4/94(4,1%)	0	4/131 (3,1%)	

MRI characteristics	Primary Ischemic stroke (N=94)	Primary intracranial haemorrhage (N=37)	Total (N=131)	P value
Cortex involvement	78 (83.3%)	31 (85.1%)	109 (83.2%)	0.65
Multilobar involvement	17 (18.1%)	7 (18.9%)	24 (18.3 %)	0.78
Deep region involvement	36 (38.3%)	21 (56.8%)	57 (43.5%)	0.45

4. DISCUSION

Our study found that the average age of the study group was 58.8. Our results are similar to previous studies [2,6]. The rate of PSE increases with age, which is appropriate because the older the age, the greater the risk of stroke [7]. Age was not a significant risk factor in multivariate analysis of stroke types, but when we looked at cardioembolic and macroangiopathic ischaemic stroke, age was a substantial factor again. In our study group, the male/female ratio was 3.6. This result is higher than that of the other authors' study. The number of studied populations can cause this difference to not be significant like other authors' research. However, in most studies, the male ratio is higher than the female [6].

In our study, the results showed that there were 37 patients with cerebral hemorrhage, accounting for 27.7% (male 77.78%; female 22.22%); there were 94 patients with cerebral infarction, accounting for 72.3% (male 78.72%; female 21.28%). This result is equivalent to Benbir's study, with 70.6% cerebral infarction and 21.6% cerebral hemorrhage [3]. The rate of early seizure occurring after stroke differs between ischemic stroke and hemorrhage stroke, in which acute symptomatic seizure after hemorrhage stroke is more common significantly [6].

The most common neurological symptoms are hemiplegia (63.1%), cranial nerve palsy (56.9%), and aphasia (13.9%). Other studies support this result. In the United States, up to 65% of patients have mild to severe sequelae after a stroke [2,6]. The time of the first seizure after a stroke is within one year at a rate of 73.9%. Our results are consistent with Tanaka and Pitkanen's studies [3,6]. The primary type of clinical seizure is focal seizure (78.2%). Our results are similar to many other international authors [2,6]. This may be explained by the fact that stroke is a local lesion, causing localized discharges from the lesion site and, clinically, localized onset seizures. However, in our study, 5.3% were generalized seizures. This can be caused by the short time from focal to general; it is challenging to realize clearly.

In our study on brain magnetic resonance imaging scans, the results showed that the incidence of epilepsy after ischemic stroke (71.8%) is more common than cerebral hemorrhage (28.2%), mainly damage to the cerebral cortex, was 83.3% and 85.1%, respectively. Most cases of lesion stroke involved the cortex area in our study, which is similar to other authors' studies [8]. The cerebral cortex is where the nerve cell bodies are concentrated [9]. Cortical superficial siderosis is also strongly associated with PSE [9]. Moreover, late seizures after a hemorrhage stroke are associated with exclusively lobar cerebral microbleeds. While these neuron bodies are damaged, abnormal electrical discharges will occur, forming clinical epileptic seizures. Many PSE studies confirmed that cerebral cortex damage is the primary decisive condition contributing to epileptic

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seizures and is a prognostic factor causing late epileptic seizures [6].

The strengths of our study include a broad variety of clinical risk factors. However, our study had a few limitations. First, all study patients were obtained from a single institution. Second, our results might have been influenced, to some extent, by the lack of clinical data before the patient was referred to our hospital, as some patients were referred from another hospital to our center. Third, a detailed subgroup analysis was not performed for hemorrhages at different locations nor for hematoma volumes in this study. Finally, because this was a cross-sectional study design, caution should be exercised when interpreting the results related to the causal relationship.

5. CONCLUSION

In summary, the result of our study showes most PSE cases is epilepsy after ischemic stroke. The elderly who was over 60 years old accounting for a higher rate. The most common seizures type occuring after stroke were within one year of onset, of which focal seizures were the main ones. Magnetic resonance imaging shows most PSE patients had the involvement of cerebral cortex. Haemorrhage stroke has a higher risk of occuring early seizure with statistically significance.

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