DOI:10.62511/vjn.44.2025.051

Clinical and paraclinical characteristics in patients with post-stroke epilepsy

Le Thi Thuy Hong[1]✉, Phan Van Toan[1,2], Phan Duy Phuc[3]

[1] Neurology Center – Bach Mai hospital

[2] VNU University of Medicine and Pharmacy

[3] Hanoi Medical University

Correspondence to

Le Thi Thuy Hong

Neurology Center - Bach Mai hospital

Email: thuyhong.hmu@gmail.com

Manuscripts submission: 27/1/2025

Peer Review: 24/3/2025

Manuscripts accepted: 25/3/2025

ABSTRACT

Objective: This study aims to describe the clinical and paraclinical characteristics and evaluate the treatment effectiveness of post-stroke epilepsy (PSE) in 90 patients diagnosed at the Neurology Center, Bach Mai Hospital, from January 2023 to June 2024.

Results: The study findings showed that the incidence of epilepsy after cerebral infarction (61.11%) was higher than after cerebral hemorrhage (37.78%). The first seizure typically occurred within 6–12 months after the stroke (55.6%), with focal seizures being the most common type (78.9%), particularly focal-to-bilateral tonic-clonic seizures (54.4%). Regarding paraclinical features, electroencephalography (EEG) recorded normal background activity in 66.7% of cases, while 33.3% exhibited epileptiform discharges, predominantly focal slow waves (27.8%). Brain MRI results revealed that combined multi-lobe lesions were the most frequent (53.3%), especially in the temporal lobe (17.8%), with 50% of patients having large-sized lesions.

Conclusion: Post-stroke epilepsy (PSE) usually occurs within 6–12 months after a stroke, with focal seizures being the most common. EEG often does not detect abnormalities in most patients, whereas MRI frequently shows multi-lobe lesions, particularly in the temporal lobe.

Keywords: stroke, epilepsy, antiepileptic drugs.

I. INTRODUCTION

Post-Stroke Epilepsy (PSE) is a serious complication, occurring in approximately 10-12% of stroke patients with a follow-up period of 5 to 10 years. The incidence of stroke increases with age, and cerebrovascular disease is the leading cause of epilepsy

in the elderly. Post-stroke seizures are highly diverse, including focal, generalized, or seizures of unknown onset. Antiepileptic drugs (AEDs) are the primary treatment, helping to reduce seizure frequency and severity while protecting the brain from further damage. However, selecting an appropriate AED requires careful consideration of side effects, tolerability, and drug interactions, especially in elderly patients—who are more susceptible to PSE. Although PSE is a significant medical concern, detailed studies on its clinical features, paraclinical characteristics, and treatment remain limited. Therefore, we conducted this study to evaluate the clinical and subclinical characteristics, as well as the treatment efficacy of PSE, aiming to improve the diagnosis and management of post-stroke epilepsy patients.

II. SUBJECTS AND METHODS

2.1. Study Subjects

The study included 85 patients diagnosed with post-stroke epilepsy (PSE) according to the International League Against Epilepsy (ILAE) criteria, treated at the Neurology Center, Bach Mai Hospital, from January 2023 to June 2024.

Inclusion Criteria:

• At least one unprovoked seizure occurring more than one week after acute stroke.

• Confirmed history of stroke (ischemic or hemorrhagic).

• Brain MRI and angiography performed during hospitalization, showing no other brain lesions except those caused by stroke (cerebral infarction or hemorrhage).

• Electroencephalography (EEG) performed during hospitalization.

Exclusion Criteria:

• Seizures caused by:

- Subarachnoid hemorrhage, brain hemorrhage due to vascular malformations, subdural hematoma, or cerebral venous sinus thrombosis.
- Brainstem or cerebellar hemorrhage/infarction.
- Transient ischemic attack (TIA).
- Central nervous system infections.
- Brain tumors.
- Vasculitis or migraine-related symptoms.
- Traumatic brain injury.

• Patients with pre-existing epilepsy or seizures prior to stroke.

• Stroke-mimicking conditions caused by metabolic disorders (hypoglycemia, hyperglycemia, hyponatremia, alcohol intoxication, etc.).

2.2. Study Location and Duration

• Location: Neurology Center, Bach Mai Hospital.

• Duration: January 2023 – June 2024.

2.3. Sample Size and Sampling Method

• Sample size: Convenience sampling (all eligible patients within the study period).

• Sampling method: Non-randomized, consecutive enrollment (regardless of gender).

2.4. Study Design

A cross-sectional study combining retrospective and prospective data collection.

2.5. Data Management and Analysis

• Data accuracy verification using manual cross-checking techniques.

• Statistical analysis performed using SPSS 29.0.

2.6. Ethical Considerations

• The study solely aims to improve diagnostic and treatment quality, with no commercial purposes.

• Participation was voluntary, and patients could withdraw at any time.

• Patients were fully informed about the study's objectives and procedures.

• Patient confidentiality was strictly maintained.

DOI:10.62511/vjn.44.2025.051

III. RESULTS

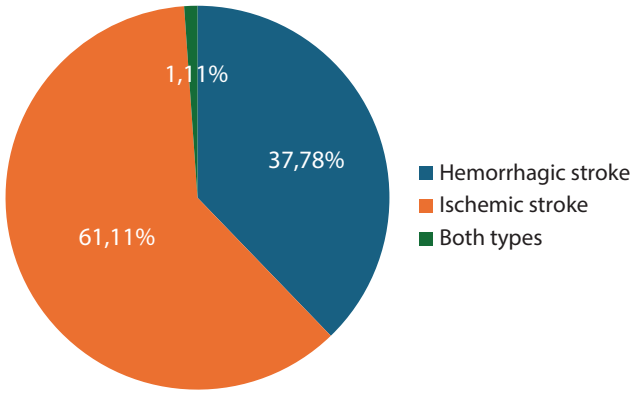

***Chart 1**. Distribution by Stroke Type*

The study cohort predominantly consisted of post-ischemic stroke epilepsy (PISE) cases (n=55, 61.11%), while post-hemorrhagic stroke epilepsy (PHSE) accounted for fewer cases (n=34, 37.78%)

***Table 3.1**. Consciousness Status at Admission*

Consciousness Impairment	Type of stroke			Total	p
	Hemorrhagic Stroke	Ischemic Stroke	Both Types		
Yes	04 (4,4%)	11 (12,2%)	0	15 (16,7%)	0,54
No	30 (33,3%)	44 (48,9%)	1(1,1)	75(83,3%)	
Total	34 (37,8%)	55 (61,1%)	1(1,1)	90 (100%)	

12.2% of ischemic stroke patients and 4.4% of hemorrhagic stroke patients had impaired consciousness. 83.3% of PSE patients were fully conscious at admission. No significant association between stroke type and consciousness impairment ($p > 0.05$).

The incidence of acute symptomatic seizures within 7 days post-stroke was 5.66%, while the majority of patients (94.34%) did not experience acute symptomatic seizures

Among post-stroke epilepsy patients, 41.1% had one comorbidity, while only 3.3% presented with four comorbidities.

***Table 3.2**. Time to First Seizure After Stroke*

Time Interval	Hemorrhagic Stroke		Ischemic Stroke		Both Types		Total	
	N	(%)	N	(%)	N	(%)	N	(%)
<1 month	1	1,1	2	2,2	0	0	3	3,3
1–3 months	0	0	9	10	0	0	9	10

Time Interval	Hemorrhagic Stroke		Ischemic Stroke		Both Types		Total	
	N	(%)	N	(%)	N	(%)	N	(%)
3-6 months	8	8,9	4	4,4	0	0	12	13,3
6-12 months	20	22,2	29	32,2	1	1,1	50	55,6
12-24 months	4	4,4	9	10	0	0	13	14,4
>24 months	1	1,1	2	2,2	0	0	3	3,3
Total	34	37,8	55	61,1	1	1,1	90	100

The first epileptic seizure typically occurred within one year post-stroke in 82.22% of cases, with the highest frequency observed between 6-12 months (55.6%). Analysis by stroke subtype revealed that post-hemorrhagic stroke epilepsy showed peak onset at 6-12 months (58.82%), while post-ischemic stroke epilepsy most commonly developed during the same period (52.73%)

***Table 3.3**. Clinical Seizure Types (ILAE 1981 Classification)*

Seizure Type \ Stroke Type		Hemorrhagic Stroke		Ischemic Stroke		Both Types		Total	
		N	%	N	%	N	%	N	%
Focal Seizures	Simple	5	5,6	14	15,6	1	1,1	20	22,2
	Complex	1	1,1	1	1,1	0	0	2	2,2
	Secondary Generalized	20	22,2	29	32,2	0	0	49	54,4
	Total	26	28,9	44	48,9	1	1,1	71	78,9
Generalized Seizures		6	6,7	9	10	0	0	16	16,7
Status Epilepticus		2	2,2	2	2,2	0	0	4	4,4
Tổng số		**34**	**37,8**	**55**	**61,1**	**1**	**1,1**	**90**	**100**
p		**0,741**							

Focal seizures were the most common type, accounting for 78.9% of all cases. Among them, secondary generalized seizures were predominant, occurring in 49 out of 90 patients (54.4%). There was a clinical difference in seizure types between ischemic and hemorrhagic strokes, but it was not statistically significant (p > 0.05).

DOI:10.62511/vjn.44.2025.051

3.1.3. Paraclinical characteristics

3.1.3.1. Electroencephalography

***Table 3.4**. Abnormal Baseline Activity on EEG*

Stroke Type / EEG Activity	Post-Hemorrhagic Stroke Epilepsy	Post-Ischemic Stroke Epilepsy	Both Types	Total	p
Normal	22 (24,4)	37 (41,1)	1 (1,1)	**60 (66,7)**	**0,32**
Focal Slowing	8 (8,9)	17 (18,9)	0	25 (27,8)	
Diffuse Slowing	1 (1,1)	4 (4,4)	0	5 (5,6)	
Total	31 (34,4)	58 (64,5)	1 (1,1)	**90 (100)**	

Among hemorrhagic stroke cases, 23.5% exhibited unilateral focal slowing and 11.8% showed bilateral diffuse slowing. Among ischemic stroke cases, 1.8% displayed diffuse slowing, while 30.9% had focal slowing.

***Table 3.5**. Epileptiform Discharges by Stroke Type*

Types of Stroke / Epileptiform discharges	Post-Ischemic Stroke	Post-Hemorrhagic Stroke Epilepsy	Both Types	Total	p
Present	13 (14.4)	17 (18.9)	0	30 (33.3)	0,32
Absent	21 (23.3)	38 (42.2)	1 (1.1)	60 (66.7)	
Total	34 (37.8)	55 (61.1)	1 (1.1)	90 (100.0)	

Among the study population, 30 patients (33.3%) exhibited epileptiform discharges on EEG, with 17 cases (18.9%) occurring after ischemic stroke and 13 cases (14.4%) after hemorrhagic stroke.

3.1.3.2. Magnetic resonace imaging

***Table 3.6**. Lesion Location on MRI*

Lesion Location	Hemorrhagic Stroke		Ischemic Stroke		Both Types		Total	
	N	%	N	%	N	%	N	%
Frontal Lobe	6	6,7	5	5,6	0	0	11	12,2
Parietal Lobe	0	0	4	4,4	0	0	4	4,4
Occipital Lobe	8	8,9	8	8,9	0	0	16	17,8
Temporal Lobe	2	2,2	1	1,1	0	0	3	3,3
Basal Ganglia	3	3,3	5	5,6	0	0	8	8,9
Multiple Lesions	15	16,7	32	35,6	1	1,1	48	53,3
Total	**34**	**37,8**	**55**	**61,1**	**1**	**1,1**	**90**	**100**

Among 34 patients with post-hemorrhagic stroke epilepsy, the most common lesion locations involved multiple lobes (44.11%). Similarly, for post-ischemic stroke epilepsy, multiple lesions accounted for 58.18%. For isolated lesion locations, the temporal lobe was the most frequently affected site in both ischemic and hemorrhagic stroke cases.

***Table 3.7**. Lesion Size on MRI*

Lesion Size	Number of Patients	%
Small	20	22,2
Medium	25	27,8
Large	45	50
Total	90	100

On MRI, 20 out of 90 patients (22.2%) had small lesions, while large lesions were the most common, affecting 45 out of 90 patients (50%). Medium-sized lesions accounted for 27.8% of cases

IV. DISCUSSION

In our study, post-ischemic stroke epilepsy (61.11%) was more frequent than post-hemorrhagic stroke epilepsy (37.78%). These findings align with previous studies. Benbir G et al (2015) reported post-ischemic stroke epilepsy in 70.6% of cases compared to 21.6% for hemorrhagic strokes.[1] Similarly, Consoli et al (2013) in a prospective study of 104 stroke patients found 75.96% of post-stroke epilepsy cases occurred after ischemic stroke

DOI:10.62511/vjn.44.2025.051

versus 24.04% after hemorrhagic stroke.[2] This discrepancy may reflect the higher prevalence of ischemic strokes in the general population (approximately 80% vs 20% for hemorrhagic strokes), leading to proportionally higher post-ischemic epilepsy rates.

Among patients with post stroke epilepsy at admission, 12.2% of ischemic stroke and 4.4% of hemorrhagic stroke presented with varying degrees of consciousness impairment. However, the majority (83.3%) were fully alert. No statistically significant association was found between stroke type and consciousness impairment ($p > 0.05$). Among 15 patients with impaired consciousness, 4 cases progressed to status epilepticus - 3 were stabilized and transferred, while 1 86-year-old female patient with multiple comorbidities (renal failure, severe pneumonia, liver failure, hypertension) could not achieve seizure control and became critically ill. These results resemble findings by Doan Van Phuc (2019), where 15.38% of patients had consciousness impairment including 3 cases of status epilepticus.[3]

Most initial seizures occurred within 6-12 months post-stroke (55.6%), with 82.22% occurring within the first year. For hemorrhagic strokes, 58.82% of seizures appeared at 6-12 months (85.3% within 1 year), while ischemic strokes showed 52.73% and 80% respectively. These findings correlate with Bladin CF et al (2000) reporting 75-90% of post-stroke seizures occurring within 6 months,[4] and Jungehulsing GJ (2006) finding 83.33% within 1 year.[5]

Focal seizures predominated (78.9%), particularly focal-to-bilateral tonic-clonic seizures (54.4%). Hemorrhagic stroke patients showed 28.9% focal seizures, 6.7% generalized seizures and 22.2% focal-to-bilateral seizures; ischemic stroke patients had 48.9% focal seizures including 32.2% focal-to-bilateral seizures. These results align with Doan Van Phuc (2019) (88.33% focal seizures, 51.67% focal-to-bilateral)3 and Yosuke Miyaji et al (2014) (51% focal seizures).[6]

Most patients (41.1%) had one comorbidity, while only 3.3% had four. Common comorbidities included hypertension, diabetes mellitus, dyslipidemia, and cardiovascular diseases. However, evidence regarding comorbidity-epilepsy risk remains inconsistent, with some studies suggesting diabetes, hypertension and dyslipidemia may increase risk (Zhang et al, 2017).[7] EEG showed normal background in 66.7% of patients, while 33.3% demonstrated abnormalities. Focal slowing was most common (18.9% ischemic, 8.9% hemorrhagic), resembling Trinh Thi Phuong Lam (2018) (31.66% normal EEG).[8] However, Sivaci (2001) reported higher abnormality rates (35.8% combined theta+delta waves and epileptiform discharges),[9] possibly due to different EEG timing or antiepileptic drug effects. MRI revealed predominantly multi-lobar lesions (53.3%), particularly temporal lobe involvement. Hemorrhagic strokes showed 44.11% multi-lobar involvement versus 58.18% for ischemic strokes, consistent with Benbir et al (2015) (mainly middle cerebral artery territory lesions).[1] Contrastingly, Yosuke Miyaji (2014) found frontal lobe lesions most common (43.3%),6 possibly reflecting sample/methodological differences. Regarding lesion size, 77.8% had medium/large lesions versus 22.2% small lesions, correlating with Doan Van Phuc (2019) and Bladin CF (2000).[3,4] Larger lesions often indicate severe strokes and poorer prognosis.

V. CONCLUSION

Post-stroke epilepsy (PSE) most commonly manifests within 6-12 months after stroke onset,

with focal seizures being the predominant seizure type. While electroencephalography typically fails to detect abnormalities in most patients, magnetic resonance imaging frequently reveals multi-lobar lesions, particularly in the temporal lobe, as the most common finding.

REFERENCES

1. Benbir G, Ince B, Yilmaz M, et al. Clinical and neurophysiological differences between subjects with subcortical ischemic stroke and epileptic seizures. *Epilepsia*. 2015;56(8):143-150. doi:10.1111/epi.13012
2. Consoli D, Bosco D, Postorino P, et al. Early-onset seizures after stroke: incidence and risk factors. *Stroke*. 2013;44(5):1432-1438. doi:10.1161/STROKEAHA.111.000749
3. Feigin VL, Stark BA, Johnson CO, et al. Global, regional, and national burden of stroke and its risk factors, 1990-2019. *Lancet Neurol*. 2021;20(10):795-820. doi:10.1016/S1474-4422(21)00252-0
4. Doan VP. Clinical characteristics of post-stroke epilepsy. *Vietnam Med J*. 2019;478(2):45-50.
5. Bladin CF, Alexandrov AV, Bellavance A, et al. Seizures after stroke: a prospective multicenter study. *Stroke*. 2000;31(10):2332-2336. doi:10.1161/01.STR.31.10.2332
6. Jungehulsing GJ, Heuschmann PU, Holtkamp M, et al. Incidence and predictors of post-stroke epilepsy. *Cerebrovasc Dis*. 2006;22(1):13-17. doi:10.1159/000093092
7. Miyaji Y, Miyakawa T, Asano T, et al. Clinical features of post-stroke epilepsy. *Epilepsy Res*. 2014;108(8):1361-1368. doi:10.1016/j.eplepsyres.2014.07.003
8. Zhang C, Wang X, Wang Y, et al. Risk factors for post-stroke epilepsy. *Neurology*. 2017;89(4):338-343. doi:10.1212/WNL.0000000000004149
9. Trinh TP. Electroencephalographic features in post-stroke epilepsy. *Vietnam J Neurosci*. 2018;15(3):12-18.
10. Sivaci R, Yildiz GB, Komur M, et al. EEG findings in post-stroke epilepsy. *Clin EEG Neurosci*. 2001;32(1):11-14. doi:10.1177/155005940103200104