

Etiology of Symptomatic Focal Epilepsy based on Neuroimaging Result in Neurology Outpatient Clinic of Dr. Hasan Sadikin General Hospital

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Abstract

Background: Focal epilepsy is the most common type of epilepsy that can be caused by structural lesions. Images from neuroimaging can show those structural lesions that may point to the etiology of epilepsy and would affect the management of epilepsy. The aim of the study was to explore the possible etiology of symptomatic focal epilepsy from neuroimaging result at the Neurology Outpatient Clinic in Dr. Hasan Sadikin General Hospital.

Methods: This study was a cross-sectional descriptive study. The medical records that fulfilled the inclusion criteria were collected at the Neurology Outpatient Clinic of Dr. Hasan Sadikin General Hospital from the year 2017. The inclusion criteria were symptomatic focal epilepsy patients that had abnormal neuroimaging result.

Results: In total, there were 71 medical records collected of which eight etiologies of symptomatic focal epilepsy were found, that were vascular disorder caused by strokes (33%), tumors (21%), hippocampal sclerosis (20%), infections (11%), head trauma (6%), malformations of cortical development (4%), vascular malformations (3%), and phakomatosis (1%). Vascular disorder was the most abundant etiology found in all brain lobes, except in temporal and frontal lobes, which also most often caused by hippocampal sclerosis and tumors, respectively.

Conclusions: Vascular disorders due to stroke, is the most abundant etiology found in symptomatic focal epilepsy, therefore, stroke patients need to be informed about the possibility of having epilepsy later on.

Keywords: Epilepsy etiology, neuroimaging, symptomatic focal epilepsy

Introduction

Epilepsy is estimated to occur in 50 million people worldwide.¹ More than 80% people with epilepsy come from middle-income countries and tropical areas, such as Indonesia.² It is estimated that there are 1–2 million people with epilepsy in Indonesia, although there is no exact data yet.³ Epilepsy is a brain disorder with predisposition to generate at least one epileptic seizure, which affects neurobiological, cognitive, psychological, and social aspects of an individual. Epileptic seizure is a symptom that occurs momentarily due to abnormal neuronal activity in the brain.⁴

Forty percent of epilepsy cases are caused by symptomatic etiology, meaning epilepsy with structural brain lesions. Most of them begin in one hemisphere of the brain, or known

as focal epilepsy.⁵ Structural lesions that are the etiology of epilepsy can be seen from neuroimaging, such as Computed Tomography scan (CT scan) and Magnetic Resonance Imaging (MRI). CT scans use ionizing radiation technology that is able to generate brain images with excellent hard tissue imaging and moderately good soft tissue imaging. MRI uses a magnetic field that can produce clear imaging of the brain so that it can be used to determine the characteristics and progression of lesions that are the etiology of epilepsy.⁶

Based on the explanation above, it can be concluded that brain imaging is an important tool in epilepsy, especially focal epilepsy, which generally caused by structural abnormalities (symptomatic) that could be seen from neuroimaging results. In Indonesia, there are no data on the etiological distribution

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of symptomatic focal epilepsy that causes epilepsy, which will affect the further management of epilepsy. The aim of this study was to explore the possible etiology of symptomatic focal epilepsy from neuroimaging result at the Neurology Outpatient Clinic in Dr. Hasan Sadikin General Hospital Bandung.

Methods

This study used a cross-sectional descriptive design with total sampling and conducted at the Neurology Outpatient Clinic of Dr. Hasan Sadikin General Hospital Bandung. This study had been approved by the Health Research Ethics Committee of Faculty of Medicine, Universitas Padjadjaran with ethical exemption number 814/UN6.KEP/EC/2018.

Subjects of the study were 368 medical records of symptomatic focal epilepsy patients at the Neurology Outpatient Clinic of Dr. Hasan Sadikin General Hospital in January–December 2017. Data was taken at the Neurology Outpatient Clinic of Dr. Hasan Sadikin General Hospital in September–October 2018. Sample

of the study was obtained by selecting the subject with inclusion and exclusion criteria. The inclusion criteria in this study were symptomatic focal epilepsy patients at the Neurology Outpatient Clinic of Dr. Hasan Sadikin Hospital in 2017 with abnormal neuroimaging results, either from CT scan or MRI. The exclusion criteria were incomplete medical records of patients, such as the absence of electroencephalography (EEG) results or information regarding the epilepsy lobe. In total, there were 71 samples obtained that fulfilled the inclusion criteria.

The demographic data assessed were gender and age. Age was grouped into several groups, with a division per 10 years. The clinical data assessed were epilepsy lobe type. Types of epilepsy lobe are categorized as frontal lobe epilepsy (FLE), occipital lobe epilepsy (OLE), parietal lobe epilepsy (PLE), and temporal lobe epilepsy (TLE). The etiological data was obtained from neuroimaging results and will be grouped according to the findings. Etiology data of symptomatic focal epilepsy based on epilepsy lobe was presented in frequency

Table 1 Characteristic of Subjects

	n (%)
Gender	
Male	33 (46)
Female	38 (54)
Age (years), mean (SD)	39.66 (17.32)
10–19 years	10 (14)
20–29 years	13 (18)
30–39 years	15 (21)
40–49 years	14 (20)
50–59 years	7 (10)
60–69 years	8 (11)
70–79 years	4 (6)
Clinical Epilepsy lobe	
Temporal lobe epilepsy (TLE)	51 (72)
Frontal lobe epilepsy (FLE)	10 (14)
Parietal lobe epilepsy (PLE)	6 (8)
Occipital lobe epilepsy (OLE)	4 (6)
Neuroimaging	
CT scan	38 (54)
MRI	33 (46)
Total	71 (100)

Table 2 Etiology of Symptomatic Focal Epilepsy at the Neurology Outpatient Clinic Dr. Hasan Sadikin General Hospital in January–December 2017

	Neuroimaging		n = 71 (% per total)
	CT scan N (%)	MRI N (%)	
Vascular disorders			24 (33)
Ischemic stroke	15 (21)	7 (9)	
Hemorrhagic stroke	2 (3)	-	
Tumors			15 (21)
Low-grade glioma	4 (6)	-	
High-grade glioma	-	2 (3)	
Arachnoid cyst	1 (1)	5 (7)	
Meningioma	1 (1)	-	
Cancer metastasis	1 (1)	1 (1)	
Hippocampal sclerosis	3 (4)	11 (15)	14 (20)
Infections			8 (11)
Tuberculoma	6 (8)	1 (1)	
Toxoplasma	1 (1)	-	
Head trauma	3 (4)	(1)	4 (6)
Malformations of cortical development			3 (4)
Focal cortical dysplasia	-	3 (4)	
Vascular malformations			2 (3)
Cavernosum malfomation	-	1 (1)	
Arteriovenous malformation	0 (0)	1 (1)	
Phakomatosis			1 (1)
Sturge-Weber syndrome	1 (1)	-	

Results

The number of epilepsy patients in the Neurology Outpatient Clinic of Dr. Hasan Sadikin Hospital was 368 patients, in which 231 patients with focal epilepsy, and only 113 patients had neuroimaging, either CT scan or MRI. From the neuroimaging results, only 71 patients had an abnormal brain imaging as shown in Table 1.

The data showed that there were 38 (54%) females and 33 (46%) males. The majority of epilepsy patients (n=42; 59%) were aged 20–49 years with the mean age was 39.6 (range 14–79 years old). The most common type of epilepsy lobe was temporal lobe epilepsy (n=51; 72%). Neuroimaging in the form of CT scan was

carried out in 38(54%) subjects and MRI was performed on 33(46%) subjects.

The most abundant etiology was vascular disorders, accounting for 24 (33%) patients. The vascular disorders found in this study were caused by two things; ischemic stroke (n 22; 30%) and hemorrhagic stroke in (n=2;3%) subjects. The etiology of symptomatic focal epilepsy obtained from neuroimaging results was listed in Table 2.

The symptomatic etiology of focal epilepsy was based on epileptic lobes (Table 3). In temporal lobe epilepsy, the most abundant etiology found was vascular disorders and hippocampal sclerosis, both were in similar percentage (n=14; 27%). Vascular disorders were most often caused by ischemic stroke, occurring in 13 (26%) patients. In frontal lobe epilepsy, the most abundant etiology found

Table 3 Etiology of Epilepsy Based on Epilepsy Lobes

		Neuroimaging		Total N (%)
		CT N (%)	MRI N (%)	
Temporal lobe epilepsy (N=51)	Vascular disorders			14 (27)
	Ischemic stroke	8 (16)	5 (10)	
	Hemorrhagic stroke	1 (2)	-	
	Hippocampal sclerosis	3 (6)	11 (21)	14 (27)
	Tumors			10 (20)
	Low-grade glioma	3 (6)	-	
	High-grade glioma	-	1 (2)	
	Arachnoid cyst	-	3 (6)	
	Meningioma	1 (2)	-	
	Cancer metastasis	1 (2)	1 (2)	
	Infections			4 (8)
	Tuberculoma	3 (6)	-	
	Toxoplasma	1 (2)	-	
	Malformations of cortical development			3 (6)
	Focal cortical dysplasia	-	3 (6)	
	Head trauma	2 (4)	1 (2)	3 (6)
	Vascular malformations			2 (4)
	Cavernosum malformation	-	1 (2)	
	Arteriovenous malformation	-	1 (2)	
	Phakomatosis			1(2)
Sturge-Weber syndrome	1 (2)		-	
Frontal lobe epilepsy (N=10)	Vascular disorders			4(40)
	Ischemic stroke	2 (20)	1 (10)	
	Hemorrhagic stroke	1 (10)	-	
	Tumors			4(40)
	Low-grade glioma	1 (10)	-	
	High-grade glioma	-	1 (10)	
	Arachnoid cyst	1 (10)	1 (10)	
	Infections			1(10)
	Tuberculoma	1 (10)	-	
	Head trauma	1 (10)	-	1(10)
Parietal lobe epilepsy (N=6)	Vascular disorders			3(50)
	Ischemic stroke	2 (33)	1 (17)	
	Tumors			1(17)
	Arachnoid cyst	-	1 (17)	
	Infections			2 (33)
	Tuberculoma	1 (17)	1 (17)	
Occipital lobe epilepsy (N=4)	Vascular disorders			3(75)
	Ischemic stroke	3 (75)	-	
	Infection			1(25)
	Tuberculoma	1 (25)	-	

was vascular disorders and tumors (n=4; 40%). Vascular disorders were most often caused by ischemic strokes in 3 (30%) patients and the most common tumor found was arachnoid cyst, found in 2 (20%) patients. In parietal and occipital lobe epilepsy, the most abundant etiology found was vascular disorders in the form of ischemic stroke, occurring in 3 (50%) patients and 3 (75%) patients, respectively.

Discussions

Focal epilepsy is the most common type of epilepsy, caused by structural lesions. There are eight etiologies found in this study, which are vascular disorders, tumors, hippocampal sclerosis, infections, and malformations of cortical development, head trauma, vascular malformations, and phakomatosis. The most abundant etiology found in this study is vascular disorders (33%) consisting of ischemic stroke (30%) and hemorrhagic stroke (3%). This result is similar to several other studies in India² and Hongkong⁷, showing that cerebrovascular disease, such as stroke, is the most abundant etiology in epilepsy.

About 30–50% of patients with brain tumors experience seizures.⁸ The brain tumors in our study consist of high-grade and low-grade gliomas, arachnoid cysts, meningioma, and cancer metastasis. Furthermore, our study, hippocampal sclerosis occurs only in 20%, making it the third most abundant etiology, however, hippocampal sclerosis occurred in slightly lower (10%) in China.⁷

Tuberculomas and toxoplasmosis infections occur a small portion (11%) in our study, similar to study in China⁷ including tuberculomas (4.3%) and other infection (11.9%). Interestingly, in Sub-Saharan Africa⁹ region, epilepsy cases in adults can be caused by a parasitic infection, including toxoplasmosis.

As for the incidence of epilepsy might be occurred after head trauma over 15 years, mild trauma (3.5%) and severe trauma (12.2%).¹⁰ Malformations of cortical development in the form of focal cortical dysplasia might be also occurred. Focal cortical dysplasia is the most common cause of refractory epilepsy in children and the second most common etiology of intractable seizure in adults.¹¹

Vascular malformations can be caused by cavernous malformations or arteriovenous malformations. The risk of first seizure occurrence is about 2.4% person per year in people with cavernous malformation and 1.1% per year in people with arteriovenous malformation.¹²

The Sturge-Weber syndrome (SWS), as one of the most common forms of phakomatosis, is a segmental neurocutaneous vascular disorder associated with port-wine stains, ocular vascular abnormalities-associated glaucoma, and leptomeningeal capillary-venous type malformation. Seizures in SWS occur in 75–80% of all kind of SWS and more than 90% in patients with bilateral involvement.¹³ In this study, phakomatosis in the form of Sturge-Weber syndrome is only found in 1% patients.

The limitation of this study is that this study has been conducted for a short period at only one hospital in Bandung, thus, it could not describe the etiology of symptomatic focal epilepsy in Indonesia as a whole.

In conclusion, vascular disorders, i.e. stroke, are the most abundant etiology of symptomatic focal epilepsy found in the Neurology Outpatient Clinic of Dr. Hasan Sadikin General Hospital. Other etiologies found in this study are tumors, hippocampal sclerosis, infections, malformations of cortical development, head traumas, vascular malformations, and phakomatosis. Therefore, stroke patients need to be informed about the possibility of experiencing epilepsy in the future.

References

1. WHO Epilepsy Internet. 2019. [cited 2019 March 15] Available from: <http://www.who.int/mediacentre/factsheets/fs999/en/>
2. Sheikh NA, Shabnum N, Bhat GA, Kawoosa A, Mushtaq M, Wani MA. Etiological profile of adult onset seizures: a hospital based prospective study from Kashmir, India. *Int J Adv Med.* 2017;4(3):793–8.
3. Tendean PG, Karema W, Mawuntu A. Gambaran penyandang epilepsi berdasarkan ILAE 1989 di Poliklinik Saraf RSUP Prof. Dr. R. D. Kandou Manado tahun 2014. *Jurnal e-Clinic (eCl).* 2016;4(1):4.
4. Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE, et al. ILAE Official Report: A practical clinical definition of epilepsy. *Epilepsia.* 2014;55(4):475–82.
5. Hui Yin Y, Ahmad N, Makmor-Bakry M. Pathogenesis of epilepsy: Challenges in animal models. *Iran J Basic Med Sci.* 2013;16(11):1119–32.
6. Roy T, Pandit A. Neuroimaging in epilepsy. *Ann Indian Acad Neurol.* 2011;14(2):78–80.
7. Si Y, Liu L, Hu J, Mu J, Fang JJ, An DM, et al. Etiological features of newly diagnosed

- epilepsy: hospital-based study of 892 consecutive patients in West China. *Seizure*. 2012;21(1):40-4.
8. You G, Sha Z, Jiang T. The pathogenesis of tumor-related epilepsy and its implications for clinical treatment. *Seizure*. 2012;21(3):153-9.
 9. Kamuyu G, Bottomley C, Mageto J, Lowe B, Wilkins PP, Noh JC, et al. Exposure to multiple parasites is associated with the prevalence of active convulsive epilepsy in sub-Saharan Africa. *PLoS Negl Trop Dis*. 2014;8(5):e2908.
 10. Lamar CD, Hurley RA, Rowland JA, Taber KH. Post-traumatic Epilepsy: review of risks, pathophysiology, and potential biomarkers. *J Neuropsychiatry Clin Neurosci*. 2014;26(2):iv-113.
 11. Josephen CB, Leach JP, Duncan R, Roberts RC, Counsell CE, Al-Shahi Salman R. Seizure risk from cavernous or arteriovenous malformations. *Neurology*. 2011;76(18):1548-54.
 12. Lv X, Li Y, Jiang C, Yang X, Wu Z. Brain arteriovenous malformations and endovascular treatment : effect on seizures. *Interv Neuroradiol*. 2010;16(1):39-45.
 13. Pinto A, Sahin M, Pearl PL. Epileptogenesis in neurocutaneous disorders with focus in Sturge Weber syndrome. *F1000Research*. 2016;5(F1000 Faculty Rev):370.