

Late Seizures after Stroke in Clinical Practice: The Prevalence of Non-convulsive Seizures

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Abstract

Objective The prevalence of the non-convulsive type of late seizure after stroke is unknown. The aim of the present study was to clarify the characteristics of late seizure in clinical practice, mainly focusing on the prevalence of non-convulsive seizure.

Methods A total of 178 consecutive patients who were admitted and diagnosed with late seizure after stroke were retrospectively enrolled, and the data of 127 patients for whom the complete seizure was observed by a bystander were analyzed. Clinical information was obtained from the medical records and nursing notes.

Results A non-convulsive seizure was observed in 37 patients (29%). A focal seizure and its secondary generalization accounted for 79% of the seizure types. Status epilepticus was observed in 60 patients (47%), including 11 patients (9%) without convulsion. The patients with non-convulsive seizures were significantly younger than those with convulsive seizures, but there were no other significant differences between the two groups with respect to sex, classification or the lesion of stroke.

Conclusion There was a high rate of non-convulsive seizures in patients with late seizure after stroke. A non-convulsive seizure may be caused by any type or location of preceding stroke. More attention is needed in the differential diagnosis of neurological deterioration after stroke.

Key words: late seizure, post-stroke seizure, post-stroke epilepsy, non-convulsive seizure, non-convulsive status epilepticus, seizure symptoms

(Intern Med 56: 627-630, 2017)

(DOI: 10.2169/internalmedicine.56.7162)

Introduction

In stroke patients, seizures may occur at any time from the acute phase to years after the stroke. Due to the huge numbers of stroke patients, stroke is the most common cause of seizures in the elderly population (1). Louis et al. classified the seizure into two groups according to the time of the onset of the first seizure: early seizure (within the first two weeks after the stroke) and late seizure (onset subsequent to the second week) (2). Late seizure occurs in ap-

proximately 5% of stroke patients (3-5); the recurrence rate in patients with post-stroke epilepsy is 2-3% (4, 5). Late seizure is not difficult to diagnose when bystanders, such as emergency department staff, primary care doctors, the patient's family, and even the patients themselves, witness the complete typical clinical course, which is characterized by hemi-convulsion on the paralyzed side followed by disturbance of consciousness and a generalized convulsion. However, some seizures are not associated with convulsive clinical symptoms. In such cases, the differential diagnosis is difficult because physicians must also consider other pos-

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Received for publication January 21, 2016; Accepted for publication July 10, 2016

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Table 1. The Background Information of the Patients with Convulsive and Non-convulsive Seizures.

	Total (n = 127)	Convulsive (n = 90 [71%])	Non-convulsive (n = 37 [29%])	p value
Age (years)	72 ± 11	73 ± 11	68 ± 10	0.037
Male	73 (57%)	48 (53%)	25 (68%)	0.098
Classification of stroke				
Subarachnoid hemorrhage	19 (15%)	14 (16%)	5 (14%)	0.769
Intracerebral hemorrhage	34 (27%)	14 (16%)	14 (38%)	0.071
Cerebral infarction	74 (58%)	56 (62%)	18 (49%)	0.159
Lesion of stroke				
Left	55 (43%)	39 (43%)	16 (43%)	0.993
Frontal lobe	51 (40%)	38 (42%)	13 (35%)	0.459
Temporal lobe	17 (13%)	12 (13%)	5 (14%)	0.591
Parietal lobe	11 (9%)	7 (8%)	4 (11%)	0.404
Occipital lobe	14 (11%)	10 (11%)	4 (11%)	0.616
Frontal + temporal lobe	15 (12%)	9 (10%)	6 (16%)	0.242
Frontal + parietal lobe	9 (7%)	6 (7%)	3 (8%)	0.518
Temporal + parietal lobe	6 (5%)	6 (7%)	0 (0%)	0.120
Parietal + occipital lobe	3 (2%)	2 (2%)	1 (3%)	0.648
Frontal + temporal + parietal lobe	1 (1%)	1 (1%)	0 (0%)	0.709
Interval between stroke and seizure (days)	151 ± 210	149 ± 209	156 ± 214	0.867

sibilities, which include the recurrence of stroke or transient ischemic attack (TIA) and seizure with unwitnessed convulsion followed by continuous neurological deficits such as Todd's palsy (6). Nevertheless, the prevalence of non-convulsive seizures in patients with late seizures remains unknown. The aim of the present study was to clarify the manifestations of late seizures in clinical practice, focusing on the prevalence of non-convulsive seizures.

Materials and Methods

A total of 178 consecutive patients who were diagnosed with late seizure after stroke and who were admitted to the Department of Neurology, Neurosurgery and Stroke Medicine of Yokohama Sakae Kyosai Hospital between January 2003 and November 2013 were retrospectively enrolled in this study. For the purpose of ensuring the accuracy of the seizure type, the data of 127 (71%) patients for whom the complete clinical course of the seizure (from its onset to cessation) was observed by a bystander were analyzed. Late seizures were defined as seizures that occurred more than 2 weeks after the primary stroke. Status epilepticus was defined as a seizure that repeated frequently enough to produce a fixed and enduring neurological condition lasting for at least 30 minutes. The patients' clinical information, including the classification, the lesion of stroke and seizure symptoms observed during the clinical course, was obtained from the medical records and nursing notes. The diagnosis of late seizure and status epilepticus for each patient was made comprehensively with reference to clinical information such as the clinical course (including witness reports from of multidisciplinary hospital staff members and family members) the response to antiepileptic drugs, the results of electroencephalography (EEG), laboratory tests, and imaging

studies, including computed tomography, magnetic resonance imaging (MRI), and single photon emission computed tomography. Through these procedures, a careful differential diagnosis that excluded other neurological disorders, including TIA, was retrospectively made.

Results

The patients' demographic and clinical data are summarized in Table 1. Nineteen patients (15%) had subarachnoid hemorrhage, 34 (27%) had intracerebral hemorrhage, and 74 (58%) had cerebral infarction. The lesion was most often located in the frontal lobe (40%).

The interval between stroke and seizure was 151±210 days. Regarding the clinical manifestations of the seizures on arrival, convulsion was observed in 90 patients (71%), but was not observed in 37 (29%). Lateralizing signs such as hemi-convulsion, hemiparesis, and aphasia were observed in 100 patients (79%); the seizure types included focal seizure (n=73; 57%) and secondary generalization (n=27 patients; 21%). The remaining 27 patients (21%) did not have any lateralizing signs and were classified as having a generalized seizure. Status epilepticus was observed in 60 patients (47%), including 11 patients (9%) without a convulsion.

The results of a univariate analysis of the background characteristics of patients with non-convulsive seizures and those with convulsive seizures are shown in Table 1. Patients without convulsions were significantly younger, but there were no other significant differences between the two groups with respect to the sex classification, the lesion of stroke, or the interval between stroke and seizure.

Next, the symptoms of 37 patients with non-convulsive seizures were analyzed. The results are shown in Table 2. The symptoms of the patients included: disturbance of con-

Table 2. The Symptoms of Non-convulsive Seizure Patients on Arrival.

	n = 37
Disturbance of consciousness	24 (65%)
Hemiparesis	11 (30%)
Aphasia	8 (22%)
Psychiatric symptom	2 (5%)
Unilateral spatial neglect	2 (5%)
Disturbance of vision	2 (5%)
Disturbance of sensation	2 (5%)

consciousness (n=24, 65%), hemiparesis (n=11, 30%), aphasia (n=8, 22%), psychiatric symptoms (n=2), unilateral spatial neglect (n=2), vision disturbance (n=2), and sensation disturbance (n=2).

Discussion

In the present study, late seizure after stroke was comprehensively diagnosed after the intensive investigation of hospitalized patients according to their clinical course, clinical tests, imaging findings, and response to therapy. In particular, information was carefully collected from witnesses, including the patients themselves, their family, and healthcare workers, such as the ambulance crew and hospital staff. The complete clinical course of the seizure including the onset, subsequent development, and the cessation of symptoms was witnessed for 127 patients (71%). These patients were the prime focus of this study because the information about the presence or absence of convulsions was especially important. In 29% of the analyzed cases, the presence of convulsions was not confirmed; this rate was unexpectedly high.

The seizure type was determined based on the clinical course and symptoms. Focal seizures and their secondary generalization accounted for 79% of the seizures, which is in line with the results of previous reports (4, 5, 7). In principle, a late seizure should be a focal seizure, because it originates in a focal stroke lesion. Nevertheless, 21% of patients showed generalized seizures without any lateralizing signs. In contrast to previous reports, which showed a frequency of 9-20% (5, 7, 8), almost half of the patients in the present study had status epilepticus. This discrepancy may be due to differences in the background characteristics of the recruited patients, because the present subjects were exclusively inpatients. The high frequency of status epilepticus without convulsion (9% of all patients) is particularly noteworthy.

Next, the symptoms of 37 patients with non-convulsive seizures were analyzed (Table 2). The most frequent symptom was disturbance of consciousness followed by hemiparesis and aphasia. In particular, paresis due to seizure has been reported as non-convulsive seizure paralysis (9), focal inhibitory seizure (10), inhibitory motor seizure (11, 12), ictal paresis (13), or focal akinetic seizure (14), and language abnormality due to seizures is also known as ictal aphasia (15). These seizures should be adequately differentiated

from the recurrence of stroke or TIA when patients with a past history of stroke present to the emergency department.

An EEG is essential and useful for this purpose, but in many emergency departments it will not always be available. Moreover, the prevalence of specific findings in relation to the seizures, i.e. epileptiform discharges among patients with post-stroke seizure is low (5) and epileptiform discharges are also found among post-stroke patients without seizure (16). Thus, the usefulness of EEG is limited in post-stroke patients with suspected seizures (16). In addition, although video-EEG is the most reliable tool for accurately evaluating the complete clinical course of the seizure and the convulsive or non-convulsive state (17), most patients with late seizure are transferred to emergency departments rather than epilepsy centers. The difficulties in the diagnosis of non-convulsive late seizure in the emergency department where EEG or video-EEG is unavailable prompted us to explore the characteristic clinical backgrounds, including the classification and lesion of stroke, suggesting the diagnosis of non-convulsive seizure. The only background difference observed between the convulsive and non-convulsive groups was the younger age of the non-convulsive group; however, the reasons for this result are unclear. No other significant differences were observed in the characteristics of the two groups, including such as sex, stroke classification, and lesion of stroke, or the interval between the stroke and the patient's seizure. It is therefore necessary to be aware that at any time after stroke, any type and location of stroke may cause a non-convulsive late seizure. As we recently reported (18), the demonstration of increased cortical perfusion by arterial spin-labeling MRI, which does not require a contrast agent, might be helpful in the early diagnosis of late seizures in the emergency department.

Conclusion

Non-convulsive seizure occurred in 29% of our cases, which was an unexpectedly high rate, and was associated with status epilepticus in 9% of 127 consecutive patients with late seizure after stroke. The results of the present study demonstrated that any type or location of preceding stroke may cause a non-convulsive seizure. We should therefore pay more attention to this type of seizure in the face of acute neurological deficits such as disturbance of consciousness, hemiparesis, and aphasia in post-stroke patients.

The authors state that they have no Conflict of Interest (COI).

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