

Association between Seizures and Outcomes among Intracerebral Hemorrhage Patients: The China National Stroke Registry

Zixiao Li, MD,^{*†} Xingquan Zhao, MD, PhD,^{*†} Yilong Wang, MD, PhD,^{*†}
Chunxue Wang, MD, PhD,^{*‡} Liping Liu, MD, PhD,^{*‡} Xiaoqiu Shao, MD, PhD,^{*}
Wenjue Wang, MD, PhD,^{*§} Yuesong Pan, MD,^{*‡} Chunjuan Wang, MD, PhD,^{*§}
Ruijun Ji, MD, PhD,^{*} Changqing Zhang, MD,^{*} Jing Jing, MD, PhD,^{*}
and Yongjun Wang, MD^{*†}

Background: To determine whether the presence of seizures in patients with spontaneous intracerebral hemorrhage (ICH) was associated with in-hospital complications and measured outcomes. *Methods:* This prospective cohort study from the China National Stroke Registry included consecutive patients with ICH between August 2007 and September 2008. In-hospital complications, functional outcomes, and mortality at 3, 6, and 12 months were compared between patients with seizures and those without seizures occurring at ICH onset and during hospitalization. Poor functional outcome was defined as a modified Rankin Scale score between 3 and 6. Poor functional outcome and mortality were stratified by stroke severity using Glasgow Coma Scale scores on admission. *Results:* The study included 3216 patients with ICH and 139 of them (4.3%) experienced seizures. The presence of seizures was associated with high in-hospital complications including atrial fibrillation ($P = .004$), pneumonia ($P = .001$), as well as lower rehabilitation assessment rates ($P = .033$) compared with patients without seizures. ICH patients with seizures had poorer functional outcome at 3-month ($P = .012$), 6-month ($P = .007$), and 12-month ($P = .001$) follow-up. They also had higher mortality at 3 months ($P = .045$), 6 months ($P = .005$), and 12 months ($P = .002$). Patients with mild strokes had poorer functional outcome and higher mortality ($P < .005$) if seizures occurred.

From the ^{*}Department of Neurology, Beijing TianTan Hospital, Capital Medical University, Beijing; [†]China National Clinical Research Center for Neurological Diseases, Beijing; [‡]Center of Stroke, Beijing Institute for Brain Disorders, Beijing; and [§]Beijing Key Laboratory of Translational Medicine for Cerebrovascular Disease, Beijing, China.

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Z.L. and X.Z. were responsible for literature review, data collection, data analysis, drafting the article, and review of submitted versions; Y.W. was responsible for research design, study conception, and data collection; C.W. and X.S. were responsible for draft revisions and review of submitted versions; L.L. was responsible for study conception; W.W., C.W., C.Z., and J.J. were responsible for data collection; Y.P. conducted statistical consultation and data analysis; R.J. was responsible for literature review; Y.W. was responsible for research design and concept development, critical revisions, and approval of submitted versions.

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Address correspondence to YongJun Wang, MD, Department of Neurology, Beijing TianTan Hospital, Capital Medical University, No. 6 Tiantan Xili, Dongcheng District, Beijing, China. E-mail: yongjunwang1962@gmail.com.

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Conclusions: The presence of seizures in patients with ICH was associated with high in-hospital complications and indicates poor outcomes at 3-, 6-, and 12-month follow-up. Quality improvement strategies targeting ICH patients with seizures especially mild stroke may help improve prognoses. **Key Words:** Intracerebral hemorrhage—all epilepsy/seizures—outcome research—risk factors.

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Clinical seizures after spontaneous intracerebral hemorrhage (ICH) are encountered in clinical practice relatively frequently with incidence varying from 2.7% to 17%.¹⁻⁶ However, the impact of seizures on stroke outcome remains a matter of debate. In several prospective and population-based studies, clinical seizures did not have a negative impact on neurologic outcomes or mortality.^{3,5-8} On the contrary, findings from 1 study showed that post-ICH seizures were associated with worsening neurologic function and a trend toward poorer outcomes.⁹ Interestingly, most of the available data came from cohorts with stroke including ischemic and hemorrhagic stroke, which are 2 very different diseases with different prognoses. Additionally, not many previous studies took into account patients' and health care providers' perspectives, particularly on resource utilization, performance measures,¹⁰ and influence of seizures on stroke outcome.¹¹ So, we hypothesized the following: (1) the presence of seizures in patients with ICH might be associated with higher in-hospital complications and (2) the presence of seizures might have a negative impact on short- and long-term stroke outcomes.

The primary aim of this study was to assess the association between seizure occurrence and outcomes after ICH stroke, including in-hospital complications, short- and long-term functional outcomes, and mortality.

Methods

This study was conducted from the largest stroke registry in China, the China National Stroke Registry (CNSR), which is a national hospital-based, multicenter, and prospective registry of consecutive patients with acute cerebrovascular events sponsored by the Ministry of Health between August 2007 and September 2008. A total of 132 hospitals were selected as registry hospitals. The study was approved by the central Institutional Review Board at Beijing Tiantan Hospital, and all patients or their designated relatives gave informed consents. Further details of CNSR have been published elsewhere.¹²

The current analysis included all patients in CNSR who had been diagnosed with ICH according to World Health Organization criteria.¹³ Patients were excluded if they met any following criteria: history of seizures, primary intraventricular hemorrhage or prestroke modified Rankin Scale (mRS) of more than 2, neoplastic cause of ICH,

unavailable data of ICH hematoma volume, disagreement to participate in the study, or loss to follow-up.¹⁴

Demographic Characteristics and Medical History

In the present study, we prospectively collected demographic information: age (stratification: <60, 60-79, and ≥80 years of age), gender, and vascular risk factors: history of stroke, hypertension, diabetes mellitus, dyslipidemia, atrial fibrillation, cardiovascular disease, current smoking, moderate or heavy alcohol consumption (2 standard alcoholic beverages per day).¹⁴

Clinical Evaluation at Admission

We assessed the severity of neurologic impairment by using the National Institutes of Health Stroke Scale (NIHSS; 3 categories: mild [0-3], moderate [4-14], and severe [15-42]) and Glasgow Coma Scale (GCS) at admission (3 categories: mild [13-15], moderate [9-12], and severe [3-8]).

Image Analysis

Initial noncontrast computed tomography (NCCT) scans were employed with a slice thickness of 9 mm supratentorially and 4.5 mm infratentorially. ICH hematoma volume was measured on the initial head NCCT scan using the ABC/2 method.¹⁵ Additionally, the locations of ICH were considered as follows: (1) strictly deep locations (putamen, caudate nucleus, internal capsule, thalamus, brain stem, and cerebellar); (2) deep and lobe locations; and (3) strictly lobe locations (frontal, parietal, temporal, and occipital). The presence or absence of intraventricular extension was also noted on the initial head NCCT.

All images were prospectively viewed by a neuroradiologist blinded to clinical data at different study centers. The neuroradiologists of the study centers received the same training regarding the computed tomography protocol.

Definition of Seizures

The status of seizures was based on clinical diagnosis. According to International League Against Epilepsy criteria, seizures were defined as paroxysmal disorders of the central nervous system, possible subsequent loss of consciousness, and/or with or without motor involvement at any point since stroke onset or during the period

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