

Clinical Characteristics of Subarachnoid Hemorrhage with an Intracerebral Hematoma and Prognostic Factors

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Background: Subarachnoid hemorrhage (SAH) with an intracerebral hematoma (ICH) shows an unfavorable prognosis. In the present study, we examined the characteristics of SAH with ICH and its prognosis. *Methods:* Subjects comprised 218 patients with SAH who underwent surgery between January 2007 and December 2015. We compared age, sex, the location of the aneurysm, treatment procedures, medical history (hypertension, diabetes, and heart disease), the Glasgow Coma Scale (GCS) score on admission, rerupture rate, hydrocephalus, the diameter of the aneurysm, cerebral vasospasm, perioperative cardiopulmonary complications, and the Glasgow Outcome Scale (GOS) score after 2 months between patients with SAH with and without ICH. The interval from the onset of SAH until surgery, the location of ICH, and hematoma volume were investigated as prognostic factors for SAH with ICH. *Results:* Among all subjects, 82 had SAH with ICH. GCS scores on admission were poorer in patients with SAH with ICH than in those without ICH ($P < .001$), and middle cerebral artery aneurysms were more likely to form hematomas ($P < .001$). GOS scores after 2 months were also poorer in patients with SAH with ICH ($P < .01$). The size of aneurysms was larger in the 82 patients with SAH with ICH than in those without ICH ($P < .001$), and the rerupture rate was higher ($P < .001$). The unfavorable prognosis of patients with SAH with ICH was associated with age and GCS score on admission. *Conclusions:* A young age and a favorable GCS score on admission may be associated with a favorable prognosis for patients with SAH with ICH, and SAH with ICH may easily rerupture. **Key Words:** Subarachnoid hemorrhage—intracerebral hematoma—aneurysmal size—rerupture.

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Introduction

At the onset of subarachnoid hemorrhage (SAH) with an intracerebral hematoma (ICH), brain injury is marked, leading to an unfavorable prognosis.¹⁻⁵ However, among patients with SAH with ICH, the proportion of those with a favorable outcome despite a poor World Federation of Neurological Surgeons (WFNS) grade score on admission is high.^{3,6} Previous studies implicated the hematoma size or interval from the onset of SAH until surgery in the prognosis of patients with SAH with ICH.^{3,6} However, the underlying mechanisms have not yet been elucidated in detail.

The aim of the present study was to clarify the clinical characteristics of SAH with ICH by comparing patients with SAH with and without ICH. We also examined prognostic factors for SAH with ICH by comparing favorable and unfavorable prognosis groups among patients with SAH with ICH.

Subjects

Subjects comprised 274 patients with SAH who were treated at the Toho University Omori Medical Center between January 2007 and December 2015 (9 years). Patients with the formation of a hematoma measuring 1.5 cm or larger in diameter in the lobe or cistern or involving both in addition to SAH on computed tomography (CT) were regarded as having SAH with ICH. Clipping or coil embolization was successfully performed on WFNS grades I-IV patients with SAH with and without ICH. Among WFNS grade V patients, we excluded those for whom lifesaving was difficult on admission and also those whose families did not consent to surgery despite sufficient explanations when indicating surgery.

Methods

Comparison of SAH with and without ICH

Among 274 subjects, we investigated surgically treated patients with SAH with and without ICH. We compared age, sex, the location of the ruptured aneurysm, treatment procedures, medical history (hypertension, diabetes, and heart disease), the Glasgow Coma Scale (GCS) score on admission, the rerupture rate, hydrocephalus, the maximum diameter of the aneurysm, symptomatic cerebral vasospasm, perioperative cardiopulmonary complications, and the Glasgow Outcome Scale (GOS) score after 2 months between those with and without ICH. The location of the ruptured aneurysm was divided into the anterior cerebral artery (anterior communicating artery and distal anterior cerebral artery), the middle cerebral artery, the internal artery (IC) (IC-ophthalmic artery, IC-posterior communicating artery, IC-anterior choroidal artery, and IC bifurcation), and posterior circulation.

Patients with the rapid deterioration of neurological symptoms, including consciousness disorders, between the onset of SAH and surgery or with an increase in the hematoma size on CT were regarded as having rerupture. The maximum diameter of the aneurysm was measured on computer software accompanying electronic charts using cerebral angiography or 3-dimensional CT angiography. Patients with cerebral ischemia on CT or magnetic resonance imaging in addition to the deterioration of neurological symptoms 4 or more days after onset were regarded as having symptomatic cerebral vasospasm. Furthermore, patients requiring shunts were considered to have hydrocephalus.

Comparison of Favorable and Unfavorable Prognosis Groups among Patients with SAH with ICH

Patients were divided into 2 groups, favorable (good recovery + moderate disability) and unfavorable (severe disability + vegetative state + dead) prognosis groups, based on the GOS score after 2 months. We compared age, the GCS score on admission, medical history (hypertension, diabetes, and heart disease), perioperative cardiopulmonary complications, the rerupture rate, hydrocephalus, symptomatic cerebral vasospasm, the maximum diameter of the aneurysm, the interval from the onset of SAH until surgery, and hematoma size, and the location of the ICH was divided into frontal, bifrontal, temporal, frontotemporal, the Sylvian fissure, and interhemispheric cistern. The protocol of the present study was approved by the Ethics Review Board of the Toho University Omori Medical Center (inspection number: 26-307).

Statistical Analysis

In a univariate analysis, numerical data were compared using the Mann-Whitney *U* test, and enumeration data using the chi-square test. In a multivariate analysis, a binomial logistic regression analysis was adopted, and the odds ratio and confidence interval were calculated. The results of the binomial logistic regression analysis for all variables and on variable selection were presented.

The relationship between the location of the ruptured aneurysm and SAH with ICH and that between the ICH location and the prognosis of SAH with ICH were examined using the chi-square test.

A *P* value of .05 was considered significant. We used IBM SPSS Statistics software (version 24, IBM Company, Armonk, NY, USA).

Results

Among the 274 surgically or medically treated patients, 104 had SAH with ICH and 170 had SAH without ICH. No significant differences were observed in age or sex. Of the 218 surgically treated patients, 82 had SAH with ICH and 136 had SAH without ICH.

Comparison of Surgically Treated Patients with SAH with and without ICH

In the univariate analysis, the GCS score on admission was poorer in patients with SAH with ICH than in those without ICH ($P < .0001$) (Table 1). The incidence of rerupture and hydrocephalus was higher in the former ($P < .0001$ and $P < .001$, respectively). The maximum diameter of the aneurysm before surgery was larger in the former than in the latter ($P < .0001$). Regarding treatment procedures, the rate of patients who underwent

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