Predictors of Early Mortality in Young Adults After Intracerebral Hemorrhage

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Background and Purpose—Patient and radiological characteristics of intracerebral hemorrhage (ICH), surgical treatment, and outcome after ICH are interrelated. Our purpose was to define whether these characteristics or surgical treatment correlate with mortality among young adults.

Methods—We retrospectively reviewed clinical and imaging data of all first-ever nontraumatic patients with ICH between 16 and 49 years of age treated in our hospital between January 2000 and March 2010 and linked these data with national causes of death registry. A logistic regression analysis of factors associated with 3-month mortality and a propensity score comparison between patients treated conservatively and operatively was performed.

Results—Among the 325 eligible patients (59.4% men), factors associated with 3-month mortality included higher National Institutes of Health Stroke Scale score, infratentorial location, hydrocephalus, herniation, and multiple hemorrhages. Adjusted for these factors, as well as demographics, ICH volume, and the underlying cause, surgical evacuation was associated with lower 3-month mortality (odds ratio, 0.06; 95% confidence interval, 0.02–0.21). In propensity score–matched analysis, 3-month case fatality rates were 3-fold in those treated conservatively (27.5% versus 7.8%; P<0.001).

Conclusions—The predictors of short-term case fatality are alike in young and elderly patients with ICH. However, initial hematoma evacuation was associated with lower 3-month case fatality in our young patients with ICH. (Stroke. 2014;45:2454-2456.)

Key Words: cerebral hemorrhage ■ etiology ■ mortality

Young adult intracerebral hemorrhage (ICH) has gone understudied. Limited information is available on prognosis in this patient population.1 We aimed to describe the relationship of characteristics of ICH with 3-month mortality and to evaluate whether neurosurgical interventions are associated with improved survival in young patients with ICH.

Methods
All the patients treated in the Helsinki University Central Hospital from January 1, 2000, to March 31, 2010, having an International Classification of Diseases, 10th Revision, diagnosis code of Q28.1, Q28.3, I60.8, I61, I67.3, I67.4, I67.5, I67.6, I67.7, I67.8, I67.9, I68, or I78 were screened for nontraumatic first-ever ICH. The outcome measure was 3-month case fatality. Data about mortality was obtained by the slice thickness).2 Presence of intraventricular extension and multiple hemorrhages was recorded. Hydrocephalus was defined as increased radius or decreased ventricular angle in frontal horns, rounding and enlargement of atrium with sulcal effacement, increased width of third ventricle, or ballooning of fourth ventricle.1 Herniation was defined as ≥28 mm of horizontal displacement of pineal body from the midline, or any displacement of brain parenchyma behind tentorium, or through the foramen magnum.

Operative treatment was not systematically guided by any guideline but individually considered in patients with a large ICH, declining Glasgow Coma Scale, symptomatic hydrocephalus, or imminent brain herniation who were still considered salvageable. Patients with intraventricular extension received an external ventricular drain and an intraventricular injection of tissue-type plasminogen activator. The evacuation of the hemorrhage was always performed through a small open craniotomy using standard microsurgical techniques and a neurosurgical high magnification microscope. Mini-invasive or other experimental surgical techniques were not used.

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Categorical variables were compared with the χ² test. Comparisons of continuous variables with a skewed distribution were performed with Mann–Whitney U or Kruskal–Wallis tests. Binary logistic regression analysis with backward likelihood ratio method was performed to identify factors independently associated with 3-month case fatality. A propensity score for the probability of hematoma evacuation was calculated based on known variables influencing treatment decisions (age, sex, National Institutes of Health Stroke Scale score, hematoma location and volume, structural cause, presence of intraventricular extension, hydrocephalus, herniation, and multiple hemorrhages), and patients undergoing surgery were matched to those treated conservatively using the nearest neighbor matching method. A 2-sided \( P < 0.05 \) was considered significant. All analyses used SPSS 20 for Windows.

Results
In 325 eligible patients (193 [59%] men), cause of ICH was hypertensive microangiopathy in 84 (26%), structural in 84 (26%), other in 52 (16%), and unknown in 105 (32%).

Higher National Institutes of Health Stroke Scale scores, infratentorial hematoma location, and multiple hemorrhages associated with higher 3-month mortality in both univariable (Table 1) and multivariable (Table 2) analyses. On the contrary, hematoma evacuation associated with lower mortality.

In the propensity score analysis with matching criteria of ±0.28 probability difference, 3-month mortality was >3× higher among those not operated (27.5% versus 7.8%; \( P<0.001 \); Table 3). Analysis with a stricter criteria for matching (±0.03 probability difference) and the groups entirely balanced resulted in a 4-fold higher mortality in the nonsurgical group (n=5, 7.7% versus n=22, 33.8%; \( P<0.001 \)).

Discussion
In our study of young adult ICH, surgical hematoma evacuation associated with reduced 3-month mortality: odds for
Our results on the general clinicoradiologic prognostic characteristics are in line with previous studies involving younger and older patients. These have reported higher mortality in patients with intraventricular extension, hydrocephalus, Glasgow Coma Scale <8, and hematoma volume of >30 mL, as well as infratentorial ICH location.

According to previous randomized trials, no advantage over conservative treatment has been achieved with surgical treatment. However, our study and the randomized trials are not comparable because of our study’s observational nature, older study populations of the trials, and the fact that trials excluded patients with infratentorial ICH and ICH related to structural causes. Structural causes were frequent in our patients and equally distributed among those operated and those not. In our series, evacuation operation was associated with lower mortality, whether the cause was structural or not. A future randomized trial on surgical evacuation of ICH in the young patients is warranted.

Our study has limitations. It is retrospective, and we had only mortality outcome data. No definite uniform guidelines were available on initiation of surgical treatment. Selecting only salvageable hematomas to be evacuated may have caused bias favoring surgery. Less than half of our patients underwent MRI and less than two thirds underwent angiographic imaging. This may have led to underestimation of structural causes underlying ICH. Strengths of our study include its large sample size and the fact that although our study is hospital based, it can be considered virtually nearly a population-based study because of the centralization of treatment of young patients with stroke in our hospital.

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