A Comparison of the Intracerebral Hemorrhage Score and the Acute Physiology and Chronic Health Evaluation II Score for 30-Day Mortality Prediction in Spontaneous Intracerebral Hemorrhage

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Background: The intracerebral hemorrhage (ICH) score is well established as a reliable prognostic score in ICH, whereas recently, Acute Physiology and Chronic Health Evaluation II (APACHE II) has been observed to have a better discrimination in predicting mortality in primary pontine hemorrhage. Further, physiological parameters of APACHE II have been associated with outcome in ICH. This study is the first to observe a direct comparison between APACHE II and ICH scores in predicting 30-day mortality in spontaneous intracerebral hemorrhage (SICH). *Materials and Methods:* This study was a prospective observational study where we compared the receiver operating characteristic (ROCs) of baseline ICH and APACHE II scores in patients with SICH for predicting 30-day mortality outcome. *Results:* We observed that both APACHE II and ICH scores were good for predicting 30-day mortality with both having an area under the ROC curve of more than .8 (.831 [95% confidence interval {CI}, .740-.922; $P < .001$] and .892 [95% CI, .757-.932; $P < .001$], respectively). However, the ICH score was better discriminative (area under the curve AUC, .892 versus .831; $P = .040$) and better calibrated ($P = .037$ versus $P = .089$, Hosmer–Lemeshow goodness-of-fit test for logistic regression) for the same. Both APACHE II and ICH scores had a sensitivity of 87% at cutoff values of 19 and 3, respectively; however, the ICH score had a better specificity (90% versus 76.5%). *Conclusion:* The ICH score was observed to have a better discrimination and calibration for predicting 30-day mortality in SICH.
Key Words: ICH score—APACHE II score—intracerebral hemorrhage—receiver operating characteristic—mortality.

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Introduction

Scoring systems are considered vital for predicting outcomes in patients with critical illnesses. These scoring systems help in resource allocation, clinical decisions, and quality assurance of intensive care patients.[1] Spontaneous intracerebral hemorrhage (SICH) is considered to be the stroke subtype with the worst prognosis. Until a decade ago, no standard early prognostic grading scale for acute hemorrhagic stroke existed. Thereafter, logistic regression was used to identify independent predictors of 30-day mortality in case of acute intracerebral hemorrhage (ICH), and a risk stratification scale, named as the ICH score, was developed based on the strength of association of the predictors.[2] Subsequently, several studies have proved the ICH score as a reliable and accurate predictor of 30-day mortality in SICH.[3-5] On the other hand, the Acute Physiology and Chronic Health Evaluation II (APACHE II) score is a simple and probably the most widely used score to assess the severity of illness in patients admitted to the intensive care unit.[6,7] The APACHE II score has been reported to be useful in predicting the outcomes in patients with intracranial infections, acute stroke, and traumatic brain injury, besides being useful in non-neurological conditions as well. In consideration of the fact that the APACHE II score is based on physiological parameters, whereas the ICH score is calculated primarily on the basis of volume, origin, and extent of ICH, both scores may have a bearing on the outcome of patients admitted with SICH. Niskanen et al studied 2 models of APACHE II score in patients with head injury and nontraumatic ICH and reported that "model A," based on physiological parameters, performed better for mortality prediction in comparison with "model B" based on the Glasgow Coma Scale (GCS) alone. Huang et al compared the ICH score with the APACHE II sore in predicting 30-day mortality in primary pontine hemorrhage (PPH) and found APACHE II to be more discriminative.[8] In another study, the APACHE II score was observed to be more discriminative than the simplified acute physiology score II, GCS, and the National Institutes of Health Stroke Scale (NIHSS) scores for mortality prediction in hemorrhagic stroke (ICH).[9] There is no published data on the comparison of APACHE II and ICH scores in ICH. Based on the promising results of the above-mentioned studies, we aimed to compare APACHE II and ICH scores for predicting 30-day mortality outcome in SICH.

Materials and Methods

The present study was a hospital-based prospective observational comparative study that started on February 2015 and continued up to July 2016. The study protocol was approved by the institutional ethical committee. The study population comprised patients with SICH admitted in the critical care unit and neurology ward of the Institute of Post Graduate Medical Education and Research at Kolkata. ICH was diagnosed on the basis of a computerized tomography (CT) scan of the brain.

Study Group

Patients aged 18 years or older who were admitted with symptoms of acute stroke and were subsequently diagnosed to have SICH were enrolled in the study after a written informed consent.

Exclusion Criteria

All the patients having ICH secondary to a brain tumor, trauma, or vascular malformation were excluded from the study. Those having hemorrhagic transformation of a cerebral infarct also met the exclusion criteria. Further, patients with a past history of stroke and those having other comorbid fatal conditions like end-stage renal disease, ischemic heart disease, and sepsis were excluded from the study.

The study group comprised only SICH patients undergoing medical management, and any patient who underwent surgery was excluded from the study.

Methodology and Patient Evaluation

All patients with a suspected diagnosis of acute stroke were subjected to an urgent noncontrast CT scan of the brain within 1 hour of admission. Soon after, those diagnosed as SICH were enrolled and physically examined along with an evaluation for APACHE II and ICH scores. The scores used for 30-day mortality prediction were based on the first evaluation after the enrollment.

The data of the study subjects were collected by oral questionnaire regarding age, sex, education level, and risk factors for SICH (hypertension, diabetes, alcoholism, smoking, and anticoagulant and antiplatelet medications). Pulse, blood pressure (BP), respiratory rate, temperature, and GCS score were noted on admission. The patients were classified into 3 groups based on the GCS score: (1) GCS 3-4, (2) GCS 5-11, and (3) GCS 12-15.[10]

Treatment Protocol

All enrolled patients were initially assessed and treated for airway patency, breathing sufficiency, BP, and signs of raised intracranial pressure. Emergent measures for lowering intracranial pressure (head end elevation to 30°, intravenous 20% mannitol infusion at a dose of .25-1.0 g/kg, and hyperventilation to achieve a pCO_2 of 30-35 mm Hg) were instituted in all those cases that presented with a comatose or stuporous state of consciousness and those having signs of brainstem herniation. Early intensive BP reduction was done in all patients with elevated systolic blood pressures (SBPs) to achieve a target of SBP of less than 140 mm Hg.[11-15] BP monitoring was done every 15 minutes for an initial 2 hours and then on an hourly