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DETERMINING ICH SCORE

Can we go beyond?

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Abstract – Spontaneous intracerebral hemorrhage (SICH) still presents a great heterogeneity in its clinical evaluation, demonstrating differences in the enrollment criteria used for the study of intracerebral hemorrhage (ICH) treatment. The aim of the current study was to assess the ICH Score, a simple and reliable scale, determining the 30-day mortality and the one-year functional outcome. Consecutive patients admitted with acute SICH were prospectively included in the study. ICH Scores ranged from 0 to 4, and each increase in the ICH Score was associated with an increase in the 30-day mortality and with a progressive decrease in good functional outcome rates. However, the occurrence of a pyramidal pathway injury was better related to worse functional outcome than the ICH Score. The ICH Score is a good predictor of 30-day mortality and functional outcome, confirming its validity in a different socioeconomic populations. The association of the pyramidal pathway injury as an auxiliary variable provides more accurate information about the prognostic evolution.

KEY WORDS: intracerebral hemorrhage, medical management, outcome, prognosis, clinical scale.

Determinando o ICH Score: podemos ir além?

Resumo – A hemorragia intracerebral (AVCH) espontânea ainda apresenta grande heterogeneidade em sua avaliação clínica, evidenciando diferenças nos critérios de inclusão utilizados nos estudos de tratamento da hemorragia intracerebral (ICH). O objetivo do presente estudo foi avaliar o ICH Score, uma escala simples e confiável, determinando a mortalidade em 30 dias e o resultado funcional após um ano. Pacientes consecutivos com AVCH espontâneo foram incluídos prospectivamente no estudo. O ICH Score variou de 0 a 4 e cada aumento no ICH Score esteve associado com um aumento na mortalidade em 30 dias e com uma progressiva diminuição nas taxas de bom resultado funcional. Entretanto, a ocorrência de injúria da via piramidal esteve melhor relacionada com um pior resultado funcional do que o ICH Score. O ICH Score é um bom preditor de mortalidade em 30 dias e resultado funcional, confirmando sua validade em diferentes populações socioeconômicas. A associação da injúria da via piramidal como variável auxiliar fornece informações mais precisas sobre a evolução prognóstica.

PALAVRAS-CHAVE: hemorragia intracerebral, tratamento clínico, prognóstico, escala clínica.

Intracerebral hemorrhage (ICH) causes 10% to 15% of first-ever strokes, with a 30-day mortality rate of 35% to 52%; half of the deaths occur within the first 2 days[1-3]. Of the estimated 67,000 patients who presented ICH in the United States during 2002, only 20% were expected to be functionally independent after 6 months[3]. Although there are general guidelines for the management of ICH, there is great heterogeneity regarding the use of various surgical and medical therapies for ICH treatment[4]. This heterogeneity is also demonstrated by the different enrollment criteria used for the study of ICH treatment[5-9].

A better understanding of ICH prognosis and its associated factors could reduce the variability in clinical trials and clinical management, improveing the targeting of therapies in order to provide a simple clinical grading scale for ICH. In 2001, Hemphill et al., published the ICH Score, which consists of several factors associated with outcome and can be easily assessed at the time of acute

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ICH presentation[10]. The ICH Score was initially used to determine mortality rates, but, recently, its capacity to predict good functional outcome has been demonstrated. However, it is not capable of predicting the worse functional outcome.

The purpose of the current study was to assess the ICH Score in a tertiary hospital, determining mortality and functional outcome.

METHOD

We studied all patients admitted to the Intensive Care Units of Hospital do Servidor Publico Estadual de São Paulo, São Paulo, Brazil, with a diagnosis of spontaneous intracerebral hemorrhage (SICH), within 24 hours after the stroke onset, between January 1, 2006 and October 31, 2006. This primary referral center has no specific selection criteria for the admission of ICH patients. Informed consent was obtained from all patients or their legal representatives. Our institutional committee approved the study.

SICH has been defined as a neurological deficit documented by a computed tomography (CT) of the brain, indicating the presence of ICH in the absence of trauma or surgery. Individuals that met one of the following criteria were excluded from the study: patients with hemorrhage secondary to brain tumors, trauma, hemorrhagic transformation of cerebral infarction, or to aneurysmal or vascular malformation rupture. Patients evaluated 24 hours after symptom onset, as well as patients that were referred directly from another hospital after diagnosis and initial evaluation, were also excluded.

Table. Characteristics of the enrolled patients.

Variables	Values
Age (years)	67.7±11.2
Female (%)	51.4
Glasgow Score	12.0 (10.0–14.0)
ICH volume (cm^3)	13.5 (5.4–38.5)
Infratentorial origin (%)	10.8
Intraventricular hemorrhage (%)	40.5
Systolic pressure (mmHg)	173.8±35.7
Diastolic pressure (mmHg)	103.3±21.8
Median pressure (mmHg)	126.8±25.2
Glucose (mg/dL)	144.1±62.8
Location (%)	
Lobar	37.8
Putamen	29.7
Thalamus	21.6
Cerebellum	10.8
Surgical hematoma evacuation (%)	21.6
External ventricular drain (EVD) placement (%)	8.1
Mortality rate (%)	37.8

All values between parentheses represent the observed 25–75% percentiles; all values represent mean ± standard deviation.

The ICH Score was applied to our prospective cohort. The score consists of five components related to the outcome after spontaneous intracerebral hemorrhage (SICH): Glasgow Outcome Scale (GOS), ICH volume, presence of intraventricular hemorrhage, infratentorial origin, and age. The 5 characteristics considered to be independent predictors of 30-day mortality were assigned points based on the strength of its association with outcome. The total ICH Score is the sum of these points[10-19].

Neuroradiological findings were determined during the initial CT scan and classified according to location (supratentorial or infratentorial), site of ICH (basal ganglia, thalamic, lobar, pontine, or cerebellar), hematoma volume (using the ABC/2 method in which a representative slice at the center of the hematoma was selected: the maximum linear length (A) in cm was multiplied by the maximum width (B) in cm and the maximum depth (C) in cm. The depth (C) was determined by multiplying the number of slices on which the hematoma was visible by the slice thickness listed on the CT scan. To obtain the volume in cm^3, the final product was divided by 2), intraventricular extension of hemorrhage, and presence of hydrocephalus. The pyramidal pathway injury was clinically (by neurologic exam) and radiologically[20] (through identification at the tomography of the posterior internal capsule and precentral gyrus injuries) evaluated. Some patients presented neurological deficit due to the compressive effect or damage caused by the coagulum.

Outcome was assessed as the 30-day mortality after ICH. The one-year functional outcome was assessed using the Glasgow Outcome Scale categorized as dead (GOS 1), worse (GOS 2 to 3) and good (GOS 4 to 5) functional outcome[18,19]. For patients whose 30-day outcome was not available in their medical records, follow-up data were obtained at the follow-up visits, direct contact with the patient or patient's family or physician, and from mortality records, if necessary. We were able to obtain current information on all enrolled patients.

RESULTS

Baseline characteristics

Between January 1, 2006, and October 31, 2006, 53 patients with clinical signs attributable to ICH were identified. After comprehensive evaluation, 37 were included in the present study. Of the 16 patients that were excluded from the study, five presented hemorrhage secondary to brain tumors, two had hemorrhagic transformation of cerebral infarction, and nine presented aneurysmal or vascular malformation ruptures. Baseline characteristics of patients are summarized in the Table.

Thirty-day mortality

Overall, 30-day mortality was 37.83% and did not differ from the one-year mortality. The ICH Score was an accurate predictor of outcome, assessed as 30-day mortality. Thirty-day mortality rates (Fig 1) for patients with ICH Scores of 0, 1, 2, 3, and 4 were 11.11%, 12.5%, 44.44%, 70%

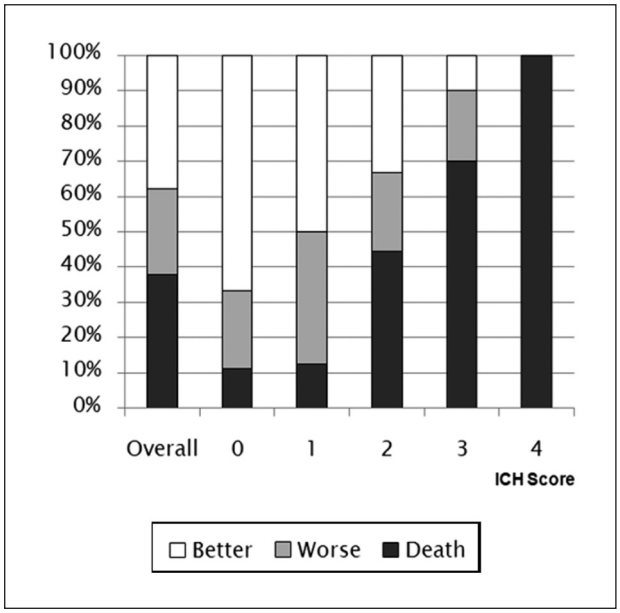

Fig 1. One-year functional outcome in pacients with different results in the ICH Score. Better prognosis (GOS 4 and 5); worse prognosis (GOS 2 and 3) and death (GOS 1).

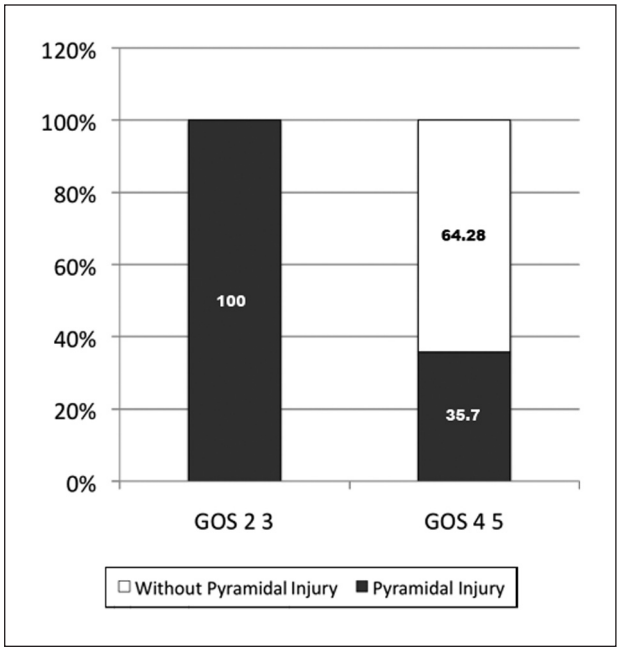

Fig 3. One-year pyramidal injury in patients with better functional outcome (GOS 4 and 5) and worse functional outcome (GOS 2 and 3) show the association with the pyramidal pathway injury. p<0.001, Odds Ratio 32.8%.

and 100%,respectively, showing a progressive increase in 30-day mortality (p<0.05). The area under the ROC curve was 0.804 (95% CI 0.65 to 0.95), with p=0.002 for the ICH Score. Sensitivity was 85.7% and specificity was 65.2%, with a cutoff >2 in the ICH Score. Kaplan Meier survival charts showed the highest difference regarding ICH Score > or ≤2 (Fig 2), p<0.03.

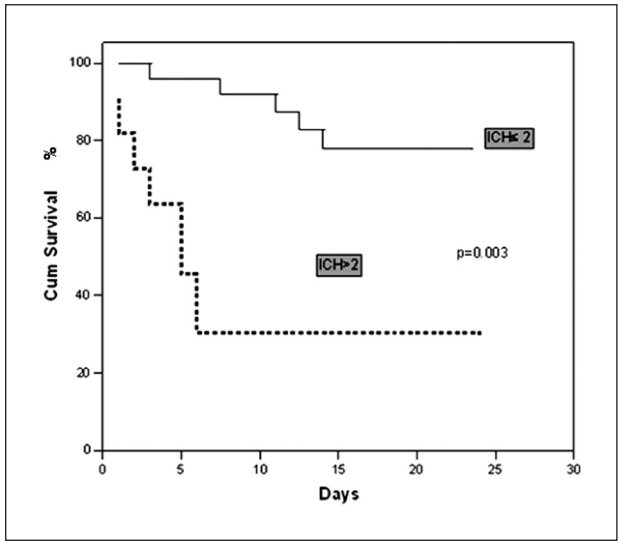

Fig 2. 30-Day Kaplan Meier survival curve show the difference between ICH Score > or ≤ 2, p<0.03.

One-year functional outcome

Twelve months after SICH, 14 (37.83%) patients had died, 14 (37.83%) presented a better functional outcome (GOS 4 to 5), and 9 (24.32%) were alive, but presented significant impairment (GOS 2 to 3).

Better functional outcome (GOS 4, 5) rates for patients with ICH Scores of 0, 1, 2, 3 and 4 were 66.66%, 50%, 33.33%, 10% and 0%, respectively, showing a progressive decrease (p<0.05) (Fig 1). The area under the ROC curve was 0.77 (95% CI 0.60 to 0.89), with p=0.0006 for the ICH Score. Sensitivity was 100% and specificity was 42.3%, with a cutoff ≤2 in the ICH Score.

Worse functional outcome (GOS 2, 3) rates for patients with ICH Scores of 0, 1, 2, 3 and 4 were 22.22%, 37.5%, 22.22%, 20 and 0%, respectively, showing no correlation with the Score (Fig 1).

While the ICH Score showed a poor correlation with GOS results (2 to 3), the pyramidal pathway injury was associated with GOS (2 to 3) in 100% and GOS (4 to 5) in 37.5%, of the patients, with p<0.001, OR=32.8% and 95%CI (1.58–680.3) (Fig 3).

DISCUSSION

"How might the ICH Score be used? Thus, a scale such as the ICH Score could be used as part of risk stratification for ICH treatment studies, but not as a precise predictor of outcome"[10]. This question was asked and answered in the original paper in 2001; however, the wish of neuroscientists to go beyond demonstrated that the ICH Score could predict not only mortality, but also the good outcome.

As the original paper stated, the external validation of the ICH Score was necessary to confirm its accuracy in different populations and thus, provide an important tool in the standardization of guidelines.

This study confirms the literature data about high mortality in SICH and reinforces the external validation of ICH Score as good tool to evaluate 30-day mortality and the one-year functional outcome. The ICH Score provided a regular prediction of worse functional outcome (GOS 2 to 3), i.e., there was no correlation between the increase in the ICH Score and the patient's functional dependence, as observed by another author[17]. The Glasgow Outcome Scale evaluates levels of independence. The assessment of the pyramidal pathway injuries showed that this is a frequent cause of functional dependence after 12 months. This factor is indirectly evaluated by GOS, but it is not included in the ICH Score. We also analyzed the high association between GOS (2 to 3) and pyramidal pathway injuries, however one must consider that it is a small cohort. The inclusion of the pyramidal pathway injuries in the assessment of ICH provided sounder data about the patient's neurological condition and was able to predict the prognosis more accurately, without leading to inappropriate "self-fulfilling prophecies".

Fernandes et al. stated that "We feel that some sort of system to predict those capable of making an independent recovery from their ICH would be more helpful and is not provided by this simple ICH grading score" [11,12]. In spite of these words, the authors demonstrated in their study that the ICH Score accurately risk stratified patients with regard to mortality across the range of scores.

Jamora et al.[13, 14] applied the ICH Score prospectively to their Asian population, which represents an ethnically and culturally distinct group of patients. Godoy et al.[15], likewise, applied the ICH Score to their Argentinean population, obtaining similar results.

In 2004, Clarke et al.[16] reproduced the validation of the score, by applying it to a population from the Stanford Medical Center and Santa Clara Valley Medical Center. However, a potential weakness of this study was that the hospitals used in the study could have ICH populations similar to the original ICH cohort from the University of California, San Francisco.

In 2006, Godoy et al.[15, 17] brilliantly contributed with the literature by showing that, at the 6-month follow-up, the ICH Score could predict not only mortality, but also the better functional outcome (GOS 4 to 5).

This suggests that specific and culturally unique aspects related to the patients or the physician's decision-making in ICH do not establish a bias for the applicability of the ICH Score.

In conclusion, the ICH score is a good predictor of the 30-day mortality and functional outcome, confirming its validity in different socioeconomic populations.

The association of the pyramidal pathway injuries as an auxiliary variable for the ICH Score could provide more accurate information about the prognostic evolution, mainly about worse functional outcome (GOS 2 to 3), as the ICH Score does not adequately discriminate this group of patients.

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