The ICH Score

A Simple, Reliable Grading Scale for Intracerebral Hemorrhage

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Background and Purpose—Intracerebral hemorrhage (ICH) constitutes 10% to 15% of all strokes and remains without a treatment of proven benefit. Despite several existing outcome prediction models for ICH, there is no standard clinical grading scale for ICH analogous to those for traumatic brain injury, subarachnoid hemorrhage, or ischemic stroke.

Methods—Records of all patients with acute ICH presenting to the University of California, San Francisco during 1997–1998 were reviewed. Independent predictors of 30-day mortality were identified by logistic regression. A risk stratification scale (the ICH Score) was developed with weighting of independent predictors based on strength of association.

Results—Factors independently associated with 30-day mortality were Glasgow Coma Scale score ($P<0.001$), age ≥80 years ($P=0.001$), infratentorial origin of ICH ($P=0.03$), ICH volume ($P=0.047$), and presence of intraventricular hemorrhage ($P=0.052$). The ICH Score was the sum of individual points assigned as follows: GCS score 3 to 4 (=2 points), 5 to 12 (=1), 13 to 15 (=0); age ≥80 years yes (=1), no (=0); infratentorial origin yes (=1), no (=0); ICH volume ≥30 cm^3 (=1), <30 cm^3 (=0); and intraventricular hemorrhage yes (=1), no (=0). All 26 patients with an ICH Score of 0 survived, and all 6 patients with an ICH Score of 5 died. Thirty-day mortality increased steadily with ICH Score ($P<0.005$).

Conclusions—The ICH Score is a simple clinical grading scale that allows risk stratification on presentation with ICH. The use of a scale such as the ICH Score could improve standardization of clinical treatment protocols and clinical research studies in ICH. **(*Stroke*. 2001;32:891-897.)**

Key Words: intracerebral hemorrhage ■ medical management ■ outcome ■ prognosis ■ surgery

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Intracerebral hemorrhage (ICH) constitutes 10% to 15% of all strokes and has a higher risk of morbidity and mortality than cerebral infarction or subarachnoid hemorrhage (SAH).[1,2] Despite advances in the treatment of cerebral infarction and SAH, there remains no therapy of proven benefit in improving outcome after ICH.[3] Studies of surgical hematoma evacuation in ICH using a variety of methods have yielded either negative or inconclusive results.[4–8] Likewise, no medical treatment has been shown conclusively to benefit patients with ICH.[9–12] Studies of ICH treatment have used a variety of selection criteria for patient inclusion. The inconsistency of selection criteria across studies serves to emphasize that there is no standard, widely accepted early prognostic model or clinical grading scale for ICH analogous to those used for cerebral infarction, SAH, or traumatic brain injury.

In contrast to the lack of efficacious treatments for ICH, there exist a number of prognostic models for mortality and functional outcome after ICH.[13–17] These models usually include criteria related to neurological condition, various other clinical and laboratory parameters, and neuroimaging findings. Current models vary in complexity, with some including terms for degree of hydrocephalus or intraventricular hemorrhage (IVH) and some using algebraic equations to calculate predicted outcome.[13,15,16] Thus, while these models may accurately predict outcome, they vary in their ease of use, especially by personnel not specifically trained in neuroimaging and statistical analysis. Despite the accuracy of several of these outcome models, no grading scale for ICH is consistently used for triage and acute intervention, whether as part of clinical care or clinical research. The purpose of this study was to define a clinical grading scale for ICH which uses criteria that are predictive of outcome and that can be rapidly and accurately assessed at the time of presentation, especially by personnel not specifically trained in stroke neurology.

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Subjects and Methods

Institutional Review Board approval was obtained for all aspects of this study. A retrospective review of medical records of patients with nontraumatic ICH treated at the University of California, San

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Francisco (UCSF) was undertaken. We included ICH patients treated at the 2 campuses of UCSF that receive acute ICH patients, Moffitt-Long Hospital and San Francisco General Hospital. A list of patients was generated by searching hospital discharge databases for *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis code 431 (ICH), as well as by searching databases of the neurology and neurosurgery services. Since the purpose of this study was to develop prognostic criteria for use at the time of first evaluation, patients were only included if they presented to the emergency department at either Moffitt-Long or San Francisco General Hospital for initial evaluation of their ICH. Patients who were transferred from an outside clinic or hospital were not included because these patients would not have been candidates for acute intervention at UCSF.

All variables used for outcome model development were abstracted from data available at the time of initial ICH evaluation. Pulse pressure (defined as systolic blood pressure minus diastolic blood pressure), Glasgow Coma Scale (GCS) score, presence of IVH, and ICH volume were recorded because these are components of previously validated ICH outcome models[13,14] and can be accurately assessed by personnel without extensive training in stroke neurology.[18,19] The first blood pressure recorded after hospital arrival was used to determine pulse pressure. The GCS score at the time of transfer from the emergency department (to intensive care unit, operating room, or hospital ward) was used because this is the point at which initial acute intervention would be considered. GCS scores recorded in the medical record were verified against the concurrent documented neurological examination to ensure accuracy of GCS assessment; when the GCS score was not specifically recorded in the medical record, it was calculated from the neurological examination.[14] ICH hematoma volume was measured on the initial head CT scan with the use of the *ABC*/2 method, in which *A* is the greatest diameter on the largest hemorrhage slice, *B* is the diameter perpendicular to *A*, and *C* is the approximate number of axial slices with hemorrhage multiplied by the slice thickness.[19] The presence or absence of IVH was also noted on initial head CT. Other recorded parameters included sex, age, site of ICH, presumed cause (assessed as impression of the attending physician of record at the time of death or hospital discharge), and first serum glucose level obtained after emergency department arrival. Two parameters related to in-hospital treatment (whether external ventricular drain [EVD] placement or surgical hematoma evacuation was undertaken) were also recorded. Outcome was assessed as mortality at 30 days after ICH. For patients in whom 30-day outcome was not available from medical records (n=31), Internet-based mortality records (California Death Records; Social Security Death Index) were searched. Patients who were alive at hospital discharge and did not have a recorded date of death in any of these records were assumed to have been alive at 30 days after ICH.

For univariate analyses, overall frequencies or mean±SD values of specific parameters (as appropriate) were compared by χ^2 statistics for dichotomous variables. GCS, ICH volume, serum glucose level, and pulse pressure were considered continuous variables, with sex, site of ICH, presumed cause, and IVH as categorical variables. Because age was only associated with outcome for patients aged ≥80 years (patients aged <80, $P=0.41$), age was considered a dichotomous categorical variable with a cut point at 80 years. Student's *t* test was used to compare continuous variables, and the Wilcoxon rank sum test was used for categorical variables.

Outcome models were developed for cohorts including all ICH patients and subgroups of infratentorial and supratentorial patients, with 30-day mortality as the dependent variable. Multivariate logistic regression analyses were performed, initially including all potential predictor variables in the model, with stepwise elimination of variables not contributing to the model ($P>0.10$). Independent variables assessed in univariate and multivariate analysis included GCS, ICH volume, IVH, pulse pressure, age ≥80 years at ICH, supratentorial versus infratentorial origin, sex, and serum glucose level. First-order interaction terms were tested in the final model.

An outcome risk stratification scale (the ICH Score) was developed with the use of variables associated with 30-day mortality in the all-patients model, with weighting based on the strength of independent association of the specified parameter. Cut points of variables were chosen to produce a simple and intuitive model and to incorporate values similar to those used in prior reports.[13,14] Cuzick's nonparametric test of trend was used to assess association of the ICH Score with 30-day mortality.[20] Statistical analysis was performed with SPSS (version 10.0) and Stata (version 5.0), and $P<0.05$ was considered statistically significant.

Results

Of 161 patients who presented to UCSF with ICH between January 1, 1997, and December 31, 1998, complete information was available in 152 patients, who formed the cohort for data analysis. Overall 30-day mortality was 45% (n=68). Mean age at ICH was 66±15 years (range, 22 to 91 years), and mean GCS score on admission was 10±4 (range, 3 to 15). Mean ICH volume on initial CT scan was 27±27 cm^3 (range, 1 to 124 cm^3), and mean pulse pressure on hospital arrival was 92±28 mm Hg (range, 29 to 166 mm Hg). Serum glucose level was obtained in 147 patients, with a mean of 155±55 mg/dL (range, 51 to 378 mg/dL). Sites of ICH origin and presumed causes were distributed among the UCSF ICH cohort in a manner similar to that previously described for other series of ICH patients (Table 1).[1,14] In univariate analysis, GCS score ($P<0.001$), ICH volume ($P<0.001$), serum glucose level ($P<0.001$), age ≥80 years, and presence of IVH were all associated with 30-day mortality. Pulse pressure ($P=0.25$), ICH location, sex, and presumed cause were not associated with outcome.

Outcome prediction models for the UCSF ICH cohort were developed for the subsets of supratentorial and infratentorial ICH patients as well as for the entire group of all ICH patients. The purpose of this was to assess whether different characteristics were predictive of outcome for these different sites of ICH origin and whether all ICH patients could be considered in a single risk stratification scale or whether infratentorial and supratentorial ICH require separate outcome prediction tools. Table 2 summarizes these outcome prediction models, which in turn form the basis for the ICH Score.

For the group of supratentorial ICH patients, GCS score, age ≥80 years, and ICH volume were independent predictors of outcome, with GCS score being most strongly associated with outcome. For the group of infratentorial ICH patients, only GCS score was a statistically significant independent predictor of outcome, although there was a strong trend for IVH. ICH volume was not a statistically significant predictor of outcome ($P=0.21$) in infratentorial ICH patients. In both groups, sex, pulse pressure, and serum glucose level were not statistically significant independent outcome predictors. For the group of all ICH patients, GCS score, age ≥80 years, ICH volume, IVH, and infratentorial ICH origin were all strong predictors of outcome. Once again, sex, pulse pressure, and serum glucose level were not predictive of 30-day mortality.

Neither of the 2 treatment parameters assessed (EVD placement and surgical hematoma evacuation) was associated with outcome in univariate analysis. Additionally, when EVD placement and surgical hematoma evacuation were tested in the final outcome prediction models, neither parameter was independently associated with 30-day mortality. This was

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TABLE 1. Univariate Analysis of Characteristics of UCSF ICH Cohort (n=152)

	n (%)	30-day Mortality, n (%)	*P*
Sex			
Male	80 (53)	34 (43)	0.56
Female	72 (47)	34 (47)	
Location 1			
Supratentorial	122 (80)	52 (43)	0.29
Infratentorial	30 (20)	16 (53)	
Location 2			
Basal ganglia	51 (34)	23 (45)	0.67
Lobar	38 (25)	17 (45)	
Thalamus	33 (22)	12 (36)	
Cerebellum	15 (10)	7 (47)	
Pons	15 (10)	9 (60)	
Presumed cause			
Hypertension	111 (73)	48 (43)	0.96
Amyloid	13 (9)	6 (46)	
Illicit drugs	11 (7)	6 (55)	
Underlying lesion	9 (6)	4 (44)	
Other	8 (5)	4 (50)	
Presence of IVH			
Yes	84 (55)	55 (66)	<0.001
No	68 (45)	13 (19)	
Age ≥ 80 y			
Yes	33 (22)	22 (67)	0.004
No	119 (78)	46 (39)	
Surgical hematoma evacuation			
Yes	19 (13)	8 (42)	0.81
No	133 (87)	60 (45)	
EVD placement			
Yes	20 (13)	9 (45)	0.98
No	132 (87)	59 (45)	

true for the group of all ICH patients as well as for the supratentorial and infratentorial patient groups individually.

The ICH Score

An outcome risk stratification scale (the ICH Score) was developed from the logistic regression model for all ICH patients. The 5 characteristics determined to be independent predictors of 30-day mortality (and therefore included in the logistic regression model) were each assigned points on the basis of the strength of association with outcome. The total ICH Score is the sum of the points of the various characteristics. Table 3 indicates the specific point assignments used in calculating the ICH Score. Because GCS score was most strongly associated with outcome, it was given the most weight in the scale. The GCS was divided into 3 subgroups (GCS scores of 3 to 4, 5 to 12, and 13 to 15) to more accurately reflect the very strong influence of GCS score on outcome. Of note, in the UCSF ICH cohort, only 1 of 35 patients with a presenting GCS score of 3 or 4 survived to 30 days, and only 5 of 60 patients with a presenting GCS score of 13 to 15 died, whereas 29 of 57 patients with a GCS score of 5 to 12 died within 30 days. Age ≥80 years was also very strongly associated with 30-day mortality. Because age in the prediction models was dichotomized around the cut point of 80 years and was not associated with outcome in the infratentorial group of patients, only 1 point was assigned for patients aged ≥80 years. IVH, infratentorial ICH origin, and ICH volume all had relatively similar strengths of outcome

TABLE 2. Multivariate Analysis of Significant Independent Predictors of 30-Day Mortality After ICH

Patient Characteristic	Odds Ratio (95% CI)	*P*
Supratentorial only (n=122)		
GCS	0.69 (0.58–0.82)	<0.001
Age (≥80 y)	9.55 (2.40–38.07)	0.001
ICH volume	1.40 (1.06–1.84)	0.017
Infratentorial only (n=30)		
GCS	0.64 (0.46–0.88)	0.007
IVH	10.52 (0.84–131.19)	0.067
All ICH patients (n=152)		
GCS	0.69 (0.59–0.80)	<0.001
Age (≥80 y)	9.84 (2.58–37.47)	0.001
Infratentorial	4.24 (1.15–15.65)	0.030
IVH	2.97 (0.99–8.92)	0.052
ICH Volume	1.31 (1.00–1.71)	0.047

Odds ratio is expressed per point on the GCS score and per 10 cm^3 of ICH volume.

TABLE 3. Determination of the ICH Score

Component	ICH Score Points
GCS score	
3–4	2
5–12	1
13–15	0
ICH volume, cm^3	
≥30	1
<30	0
IVH	
Yes	1
No	0
Infratentorial origin of ICH	
Yes	1
No	0
Age, y	
≥80	1
<80	0
Total ICH Score	0–6

GCS score indicates GCS score on initial presentation (or after resuscitation); ICH volume, volume on initial CT calculated using *ABC*/2 method; and IVH, presence of any IVH on initial CT.

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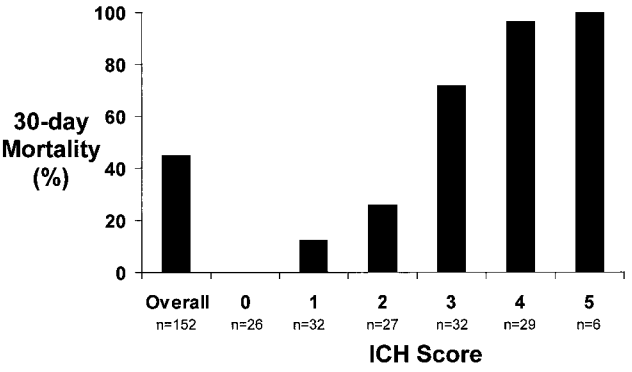

The ICH Score and 30-day mortality. Thirty-day mortality increases as ICH Score increases. No patient with an ICH Score of 0 died. All patients with an ICH Score of 5 died. No patient in the UCSF ICH cohort had an ICH Score of 6, although this would be expected to be associated with mortality.

association and were therefore weighted the same in the ICH Score. IVH and infratentorial ICH origin are dichotomous variables with points assigned when present. ICH volume was dichotomized to <30 and ≥ 30 cm^3. Thirty cubic centimeters was chosen because it represented a cut point for increased mortality in the UCSF ICH cohort, is easy to remember, and is similar to ICH volume cut points used in prior models.[13,14] Furthermore, no patient with infratentorial ICH origin in the UCSF ICH cohort had a hematoma volume ≥ 30 cm^3. Additional points were not assigned for larger hematomas (eg, >60 cm^3) because, when tested, this did not improve the accuracy of the ICH Score and would have represented equal weighting with the GCS score, which was not justified on the basis of strength of outcome association in the logistic regression model.

The ICH Score was an accurate predictor of outcome assessed as 30-day mortality (Figure). The range of ICH Scores was 0 to 5, and ICH Scores from the cohort were distributed among the various categories. Each increase in the ICH Score was associated with a progressive increase in 30-day mortality ($P<0.005$ for trend). This was evident in the entire cohort of ICH patients, as well as when patients were divided into supratentorial and infratentorial subgroups ($P<0.005$ for both subgroups), suggesting that the ICH Score is an applicable risk stratification tool to all ICH patients, not just a particular subgroup. No patient with an ICH Score of 0 died, whereas all patients with an ICH Score of 5 died. Thirty-day mortality rates for patients with ICH Scores of 1, 2, 3, and 4 were 13%, 26%, 72%, and 97%, respectively. No patient in the UCSF ICH cohort had an ICH Score of 6 because no patient with an infratentorial ICH had a hematoma volume ≥ 30 cm^3. However, given that no patient with an ICH Score of 5 survived, an ICH Score of 6 would be expected to be associated with a very high risk of mortality.

Discussion

Clinical grading scales play an important role in the evaluation and management of patients with acute neurological disorders, especially traumatic brain injury and various types of stroke. Examples of widely used clinical grading scales include the GCS for traumatic brain injury (and other disorders), the Hunt-Hess and World Federation of Neurological Surgeons (WFNS) scales for aneurysmal SAH, the National Institutes of Health Stroke Scale (NIHSS) for ischemic stroke, and the Spetzler-Martin scale for arteriovenous malformations.[21–25] However, despite the common occurrence and high morbidity of ICH, there remains no widely used clinical grading scale for ICH.

Clinical grading scales serve several valuable purposes that follow from the standardization of assessment afforded by these tools. While many grading scales are used for prognostication and treatment selection in neurological disease, the foremost purpose of these scales is to improve communication and consistency among healthcare providers. This, in fact, was the initial purpose behind the GCS[21] and has become a fundamental aspect of the clinical care of patients with traumatic brain injury (GCS), aneurysmal SAH (Hunt-Hess and WFNS), and ischemic stroke (NIHSS). From this standardized assessment has followed the ability to use these scales for risk stratification for treatment selection in clinical care and enrollment criteria for clinical research.

Several prognostic models for ICH have been previously developed and validated.[13–16,26–28] These models have found several characteristics associated with outcome, as measured by mortality and functional outcome. Among these various characteristics, level of consciousness on hospital admission (often assessed as GCS score) and hematoma volume have usually been the most robust outcome predictors, with other factors, such as presence and amount of IVH, also associated with outcome in some models.[13–16,28] A number of these models have been demonstrated as highly accurate in predicting long-term outcome, and this finding has led to the use of GCS score and ICH hematoma volume as enrollment criteria for various studies of intervention in ICH.[7,8,29] However, several of these models use complex algebraic equations in outcome prediction, and none have been simplified into a standard clinical grading scale analogous to the GCS, NIHSS, Hunt-Hess, WFNS, or Spetzler-Martin scales. It is likely that this lack of a uniform ICH scale has contributed to variability in enrollment criteria for ICH studies as well as to heterogeneity in clinical ICH care.

To be generally applicable, a clinical grading scale must be simple enough to use without significant special training, statistical knowledge, or extensive time commitment. It also must be reliable in patient stratification and should be composed of elements that are associated with outcome and that would likely be assessed, in general, as part of routine clinical care. In essentially every clinical grading scale there exists a compromise between simplicity and accuracy of outcome prediction. To strike the appropriate balance between these 2 factors, the general purpose of the grading scale must be considered. The ICH Score is a clinical grading scale composed of factors related to a basic neurological examination (GCS), a baseline patient characteristic (age), and initial neuroimaging (ICH volume, IVH, infratentorial/supratentorial origin). The purpose of this grading scale is to provide a standard assessment tool that can be easily and rapidly determined at the time of ICH presentation by physicians without special training in stroke neurology and that will

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allow consistency in communication and treatment selection in clinical care and clinical research.

Specific elements of the ICH Score deserve discussion. The GCS score is now a standard neurological assessment tool that is reproducible and reliable.[18] It has been associated with ICH outcome in other prediction models, as it is in the UCSF ICH cohort.[13–15,28] The unique element of the GCS component of the ICH Score compared with other ICH prediction models is the division of the scale into 3, not 2, subgroups. Most other prediction models have grouped patients into those with GCS score >8 versus those ≤8.[13,14] This assumes that the influence of level of consciousness on outcome is very similar for a patient with a GCS score of 8 and a patient with a GCS score of 3. This was not the case in the UCSF ICH cohort since patients with GCS scores of ≤4 did much worse than those with higher GCS scores regardless of other factors. In fact, this is being increasingly recognized in other diseases, such as traumatic brain injury, in which patients with GCS scores of 3 or 4 have been analyzed separately regarding outcome or are being considered for exclusion from certain clinical trials.[30] Likewise, patients with GCS scores of ≥13 tend toward much better long-term outcome, as in the UCSF ICH cohort. Because the GCS score is overwhelmingly the strongest outcome predictor in acute ICH, weighting this component of the ICH Score more than others is justified, and dividing it into these 3 groups is more clinically meaningful than dichotomizing toward the middle of the range of possible GCS scores (range, 3 to 15).

Age has been found to be an independent predictor of ICH outcome in some prior prediction models, while age has not been associated with outcome in others.[13–15,28] In the UCSF ICH cohort, only very old age (≥80 years) was associated with 30-day mortality. The fact that age has been an inconsistent ICH outcome predictor among various models and may have its strongest influence among the group of very elderly patients suggests 2 possibilities. Either the very elderly sustain worse neurological injury from ICH irrespective of size or location, or overall medical care decisions in elderly patients are less aggressive even if ICH-related neurological injury is not as profound. In the UCSF ICH cohort, 3 elderly patients who would have been expected to survive their ICH on the basis of clinical neurological condition were provided hospice care because of concurrent medical problems such as dementia or newly diagnosed cancer. This care approach was not taken in any patients aged <80 years. While age is not a component of other risk stratification scales such as the GCS, the Hunt-Hess or WFNS scales, the NIHSS, or the Spetzler-Martin scale, very old age is frequently among exclusion criteria for enrollment in various clinical studies of aggressive intervention in traumatic brain injury and stroke. Validation of the ICH Score on other patient populations will help to elucidate the impact of age on risk stratification after ICH and may help to delineate whether this influence is due to age-related ICH injury, differences in clinical care of the very elderly, or both.

ICH volume is consistently associated with outcome in ICH prediction models.[13,14] Often ICH volume has been divided into 3 groups representing small, medium, and large hematoma size.[13,14] While the specific volume cut points vary depending on the specific model, small hematomas have often been considered as <30 cm^3 and large hematomas as >60 cm^3.[14] While ICH volume is a component of the ICH Score, its association with outcome was not as strong as some other predictors. In fact, ICH volume was not an independent predictor for outcome in infratentorial hemorrhages. This may be because small hemorrhages in the brain stem or cerebellum may have catastrophic consequences, making location, not size, the more important predictor for infratentorial ICH. Additionally, while larger supratentorial ICH volumes were associated with increased mortality, the addition of a "large hematoma" group did not improve the model because patients with larger hematomas who died also had other predictors such as low GCS score, advanced age, or IVH that influenced outcome to a greater degree. This has practical implications for patient treatment in that we believe that the logistic regression model and ICH Score derived from the UCSF ICH cohort would not justify exclusion of a patient for treatment solely on the basis of a large hematoma in the absence of other poor outcome predictors such as low GCS score, advanced age, or IVH. Thus, the ICH volume component of the ICH Score is dichotomized to reflect the strength of association with outcome and weighted accordingly. Importantly, assessment of ICH volume by the *ABC*/2 method has been shown as accurate and with good interrater reliability.[19]

The presence of any IVH and infratentorial hemorrhage origin were the other factors independently associated with 30-day mortality in the UCSF ICH cohort and therefore included in the ICH Score. Both are easy to assess and are dichotomous variables. Undoubtedly, further characterization of the degree of IVH and IVH-associated hydrocephalus could provide additional prognostic information,[16] but these are also more subjective measures that are more complicated to assess and therefore were not included in this model. We believed that it was important to create a single model that would include all ICH and not limit the assessment to supratentorial ICH, as in some other models.[13,15,16,27] Including a term for infratentorial hemorrhage and selecting the cut point for ICH volume as previously described allowed this to be accomplished. Other factors may have prognostic value after ICH, such as medical comorbidities, changes on follow-up neuroimaging, and progression of neurological deficit. These were not included in the ICH Score because they are not readily assessable on initial ICH presentation or might require more complex medical judgments. Additionally, while serum glucose level was associated with 30-day mortality in univariate analysis, it was not independently associated with outcome in multivariate logistic regression analysis for any group (all patients, supratentorial only, or infratentorial only). Thus, any contribution to outcome prediction afforded by initial serum glucose level was taken into account by other factors that are independently associated with outcome and already components of the ICH Score. Whether hyperglycemia is injurious to the brain after ICH and deserves treatment is a separate issue not addressed by this study.

How might the ICH Score be used? Prognosis after ICH or other acute neurological disorders is often a fundamental

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question, and the various scales discussed above are often used to provide initial information regarding this. While prognostication is undoubtedly important to assess treatment benefits and risks and to provide patients and families with information regarding severity of illness, attempts to precisely prognosticate outcome may lead to inappropriate "self-fulfilling prophecies." The ICH Score and other clinical grading scales are most appropriately used to provide a framework for clinical decision making and to provide reliable criteria for assessing efficacy of new treatments.[31] 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. However, before this should be considered, validation of the ICH Score on an independent data set, especially using functional outcome (such as modified Rankin Scale score) at a meaningful time point, such as 6 or 12 months, should be undertaken. Additionally, factors not represented in the ICH Score, such as location of ICH (eg, basal ganglia, cerebellum), time of onset, medical comorbidities, and patient or family treatment preferences, will always play an important role in selection of patients for clinical treatment or clinical research studies. Despite these issues, improved standardization of clinical assessment with the use of a grading scale such as the ICH Score is likely to provide more consistency in clinical care and clinical research for ICH, just as similar assessment scales have provided consistency in traumatic brain injury, aneurysmal SAH, and ischemic stroke. This in turn could provide an important step in developing new treatments for ICH, a disease with no current treatment of proven benefit.

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Editorial Comment

In the preceding article, Hemphill and colleagues describe a grading scale for intracerebral hemorrhage (ICH) patients that can be used in a manner analogous to well-known scales for subarachnoid hemorrhage and head trauma. The work largely confirms many previous studies that have identified the Glasgow Coma Scale score, ICH volume, and intraventricular extension of hemorrhage as independent predictors of outcome in cohorts limited to supratentorial ICH[1,2] and also including brain stem hemorrhage.[3] Hemphill et al extend this work by converting the results of their multivariate model to a 6-point scale. The scale appears to stratify accurately the cohort from which it was developed in terms of mortality. Validation will depend on its performance in an independent cohort. If it proves as reliable for brain stem and cerebellar hemorrhage, as well as supratentorial ICH, it could be a useful general-purpose risk stratification tool.

The current study considered patients in the Emergency Department (ED). This is certainly a clinically important phase in the assessment and treatment of an ICH patient, but patients present to the ED at varying times from onset of their illness, and spend variable amounts of time in the ED. These times are not reported in the current study but may play an important part in determining which factors are most salient in determining treatment and predicting outcomes.[2] A patient with a large hematoma may present awake if evaluated with in an hour after onset but could be comatose at 6 hours. Conceivably, early intervention would be helpful in this situation but not if postponed until deterioration occurs. Certainly in cerebellar hematoma this seems to be the case. Consequently, we must be cautious in applying prognostic instruments which suggest that awake patients do well irrespective of ICH size.

In the current report, patients older than 80 years fared less well, and this factor was included in the scale. Age has been reported to be a significant independent outcome predictor in some[2,4] but not the majority of previous studies. Age may appear important for several reasons. Younger patients tend to present to hospital sooner after ictus[2]; conceivably, although no specific therapy has been demonstrated to have a significant effect on outcome in controlled trials, earlier treatment may reduce mortality. Second, the elderly, as the authors correctly point out, may not receive life-sustaining treatment as aggressive as that given to younger patients. Finally, age may serve as a proxy for many variables not included in the multivariate model, such as heart disease or other intercurrent illnesses that complicate the clinical situation. Too often the very elderly are excluded from clinical trials because of the assumption that their outcome may be different simply as a consequence of their age. Whether designing clinical trials or providing clinical care, we should never lose sight of the individual because of the date of birth.

ICH remains a condition with little proven effective therapy. Logistic regression modeling has helped to focus attention on potential targets for intervention (eg, intraventricular blood)[5] as well as to suggest which patients are most likely to have their outcome affected by a successful intervention. What is required now is the development and testing of those interventions.

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