Biomedical & Pharmacology Journal, March 2019. Vol. **12**(1), p. 463-467

Combination Intracerebral Hemorrhage-graeb Score Improves Prediction of Outcome in Spontaneous Intracerebral Hemorrhage

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http://dx.doi.org/10.13005/bpj/1661

(Received: 04 October 2018; accepted: 06 December 2018)

Intraventricular extension of intracerebralhemorrhage (IVH) is anpoor independent outcomepredictor in spontaneous intracerebral hemorrhage (ICH). IVH volume important in prediction of outcome and management; however, it is hard to measure routinely. Large IVH volume and increased number of affected ventricles have been associated with worse prognosis. Easy-to-use ICH scoring systems inform physicians of the severity and help to decide the course of management. ICH scoring system used to translate the severity into a score, allows quantification of severity, to predict outcome and clinical research.Graeb score can estimate the probability of survivalin IVH volume. Purpose of this study is to combine original ICH score andGraeb score, to predict outcome in patients spontaneous ICH and determined the combination would improve the prediction. This prospective observational study of 88 patients who demonstrated spontaneous ICH with and without IVH on initial brain computed tomography (CT) were enrolled at Sanglah General Hospital Denpasar throughout 2017. Independent mortality or good outcome evaluation disability using modified Rankin Scale (mRS) at 30 days. Combination ICH-Graeb score was created by adding Graeb Score into original ICH. Mortality rate was 53.4%, and 34% has good outcome. Statistical result in terms of predictive power ICH score for in-hospital unfavourable outcome with cutoff point³3 {Area Under Curve (AUC): 0.7546} risk ratio 1.8 (Confidence Interval/CI 95%: 1.29-2.67; p=0.0002). While predictive power Graeb score for in-hospital unfavourable outcome with cutoff point³1 (AUC: 0.6365) risk ratio 1.7 (Confidence Interval/CI 95%: 1.11-2.61; p=0.0034). Combined ICH and Graeb score risk ratio 1.9 (Confidence Interval/CI 95%: 1.16-3.14; p=0.0012). The combination ICH-Graeb score better tools for prediction of unfavourable outcome. Combination of ICH and Graeb score improves the prediction of outcome in spontaneous ICH. Provides as accurate, simple, applicable and reliable screening tools.

Keywords: Spontaneous intracerebral hemorrhage, Intraventricular hemorrhage, Outcome, prognosis.

Spontaneous intracerebral hemorrhage (ICH)constitutes10 to 15% of all strokesand related high risk of mortality and morbidity in world wide.[1]Intraventricularhemorrhage (IVH) secondary to spontaneous intracerebral hemorrhage (ICH) results 32% in death, and 43% of poor functional outcome in most survivors.[2] There is well validated means of assessing ICH volume which is rapid and reliable.[3] IVH volume assessment can be measure by reliable, simple, quick and clinical

meaningful approximation. Graeb score is a semi quantitative score ranging which could be used for this purpose.[3]

Standardized supportive management for ICH debate continues over the development and widely accepted clinical grading scale, with outcome prediction model for ICH.[4] Several prognostic models for unfavourable outcome after ICH have been proposed and validated;[2] however, none of them have been used consistently in routine clinical practice or research.[4] These models include neurological features, and neuroimaging findings. Several score models needs complex algebraic calculation. Lack of a simple, standard, and well accepted clinical grading scare as early prognostic model for ICH, presence and degree of IVH.[4]

Aim of this study was to combine of ICH and Graeb score, to see if combining both factors better to predict the outcome.

MATERIAL METHODS

Prospective observational study in Sanglah General Hospital, Denpasar, Indonesia. Subjectwere taken from an eligible patients who presented with nontraumatic spontaneous ICH and IVH who were admitted to emergency department on 2017, identified for a detailed review of CT findings. Both ICH and Graeb score were recorded at the first 60 minutes since the patients admitted.

ICH score variables were: Age, Glasgow Coma Scale (GCS), ICH volume (calculation with the ABC/2 method; A is the biggestdiameter on the greatestslice of haemorrhage, B is diameter perpendicular to A, and C is the axial slices number haemorrhage multiplied by the slice thickness),[5]IVH, and the origin of ICH.[7]Graeb score is a semi quantitative ranging from 0-12 based on the third, fourth and left lateral ventricles expanded and blood filled. Maximum score of lateral ventricle is 4 and 2 for the third and fourth ventricles.[6] Evaluate the outcome with modified Rankin (mRS) score 30 days after, unfavourable outcome was defined by score of ³3.

We calculated the predictive power of each ICH score, Grab Score and combination of both to generate the highest Youden's index.The unfavourable outcomeat 30 days as dependent variable of ICH patients. Statistical analysis were carried out using SPSS (version 16.0), and $p<0.05$ (2 tailed) was considered statistically significant. Different cut off point of the ICH Scores, Graeb score and both combination were used to compare the best Youden's index of diagnostic test.[8]

RESULTS

Eighty eight patients were total sample size for this study with acute nontraumatic spontaneous ICH in 2017. The outcome patient at 30 days (n = 47) were dead, good outcome (n = 30),andalive with significant impairment (n = 11). Main characteristic cohort described in Table 1.

Cut-off values of the ICH score, Graeb score and combination of both were tested to

Table 1. Subject's Characteristic

Variables	n =88 (%)
Age, y	56.2±15.2
Sex	
Male	41 (46.6)
Female	47 (52.4)
Hypertension	56(63.6)
Diabetes mellitus	29 (32,9)
Ischemic heart disease	5 (5.7)
Atrial fibrillation	3 (3.4)
History of smoking	4 (4.5)
History of drinking	4 (4.5)
GCS score	8.6±3.6
Location ICH	
Superior tentorial	20 (22.7)
Inferior tentorial	68 (77.3)
Site of ICH	
Ganglia basalis	45 (51.1)
Thalamus	20 (22.7)
Lobar	11 (12.5)
Pontine	4 (4.5)
Cerebellar	15 (17)
Presume cause	
Hypertension	56 (63.6)
Vascular Malformation	6 (6.8)
Other	2 (2.3)
ICH volume, ml	45.1±37.9
IVH	
Yes	59 (67.1)
No	29 (32.9)
Graeb score	4.6±4.2
Surgical evacuation	66 (75)
Ventricular drainage	33 (37.5)
Modified Rankin scale	
Unfavourable (³3)	58 (65.9)
Favourable (£2)	30 (34.1)

identify the highest possible Youden's index. Best result were obtained with any of the ICH scores of ³3 with area under receiver operating characteristic (ROC)curve 0.7546 risk ratio 1.8 (Confidence Interval/CI 95%: 1.29-2.67; p=0.0002), and Graeb score ³1 with area under ROC curve 0.6365 risk ratio 1.7 (Confidence Interval/CI 95%: 1.11-2.61; p=0.0034). The combination ICH-Graeb score has higher sensitivity and risk ratio 1.9 (Confidence Interval/CI 95%: 1.16-3.14; p=0.0012)

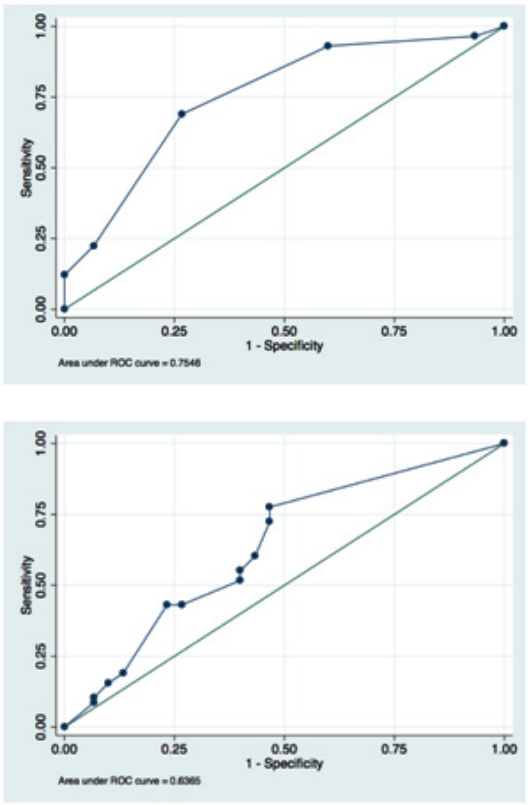

Fig. 1. ROC analysis ofICH score with mRS (left) and ROCanalysis of Graeb score with mRS

for screening tools of unfavourable outcome (Figure 1).

Table 2 shows that while combination of ICH and Graeb score is superior in risk ratio, sensitivity, and negative predictive value. ICH score is still superior in term of specificity and negative predictive value. Combination of ICH-Graeb score improves the prognostic of outcome and connect the correlation in between.

The efficacy of surgical intervention of combination ICH-Graeb score improved sensitivity to predict outcome, maybe the management of hydrocephalus decreased the intracranial pressure (ICP).

DISCUSSION

Scoring systemtools provide information and important in determining the management of patients with acute neurological disorders. Useful clinical grading scales attempts to quantitatively assess the severity permit standardization of assessment, estimate the outcome and risk stratification for clinical treatment selection and also useful for research purpose.[7]

Various predictors have been demonstrated prognostic models for unfavourable outcome after ICH.[9-12] The total score of the ICH is 6, and the volume of ICH hematoma is 30 mL.[13]IVH remains a poorly understood, less information on the grading of IVH volume in ICH score. Hard to measuredvolume of IVH in routine clinical practice, unlike ICH where the volume is relatively well defined volume approximation with ABC/2 methods.[5]

Previous studydemonstrated important factor contributing to unfavourable outcome is volume of IVH, it is more diffuse and involves multiple structures. The volume can be estimated

Table 2. Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value of ICH Score, Graeb score and Combination ICH-Graeb score for unfavourablemRS

	RR	Sensitivity CI 95%	Specificity (%)	NPP (%)	NPN (%)	Accuracy (%)
ICH score	1.8	69	73.3	83.3	55	70.4
Graeb score	1.7	77.6	53.3	76.3	55.2	69.3
Combination ICH-Graeb	1.9	82.8	50	76.2	60	71.6
If Conservative		76.9	77.8	83.3	70	
If Surgical		84.4	38.1	74.5	53.3	

closelyusing Graeb score with association between high Graeband poor outcome.[6,14] Another study showed that volume of IVHcorrelated independently with mortality of the Glasgow coma scale (GCS).[16]

Graeb score, a simple semiquantitative score that takes calculation which user assesses the scan, is a valid and reliable measure of IVH volume. Using simple exponential algebra calculation to closely predict the IVH volume in mL, and correlates well.[17]Our data studies shown that Graeb score has good Youden's index diagnostic test.

Predicting ICH outcome is a problem for all healthcare professional working in this filed. The most frequently asked questions by patients and their families within mostly surround mortality, morbidity and prospect for short and long term recovery. Most healthcare professionals are unable to accurately predict the prognosis since recovery is quite variable. This results may be used to be evaluate the chance of recovery an guide an appropriate care plan.

CONCLUSION

The simple combination of grading system, ICH score can simply calculated which ICH and IVH volume can be closely estimated as simple to use, include minimal necessities of neurological testing in impaired consciousness, and specifically applicable to calculate with improves in accuracy and reliability.

Combination ICH-Graeb score may be used as screening in clinical research rather than using single score: by showing an increased in the unfavourable outcome with ICH score $^{3}3$ and Graeb score $^{3}1$.

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