International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 02, 2020
ISSN: 1475-7192

THE INITIAL FULL OUTLINE OF UNRESPONSIVNESS SCORE AS THE PREDICTOR OF CLINICAL OUTCOME IN ACUTE INTRACEREBRAL HEMORRHAGE WITHIN 30 DAYS OF ONSET

(Running head:The Full Outline Of Unresponsivenessand Intracerebral Hemorrhage)

[1]Andina Yuliani, [*1]Yudha Haryono

ABSTRACT---Background: *Intracerebral hemorrhage (IH) is the most leading cause of death and disability due to the inavaibility of adequate therapy thus regarded as emergency medical condition to determine the prognosis in patients with IH.*

Objective: *To introduce The Initial Full Outline of Unresponsivness FOUR score as a clinical scale alternative used in patients with IH with or without loss of consciousness.*

Methods: *The prospective cohort study was conducted in 64 patients with acute IH who visited emergency unit of Dr. Soetomo Teaching Hospital. It was conducted clinical neurological test, laboratory test, and head CT scan without contrast. FOUR scale measurements were conducted during the first visit and calculated its clinical outcomes with Glasgow Outcome Scale (GOS) within 30 days of onset. Chi Square test was conducted to discern the correlation between initial FOUR score and clinical outcomes within 30 days of intracerebral hemorrhage onset.*

Results: *There was significant correlation between the variables of FOUR score and clinical outcomes in patients with intracerebral hemorrhage with the p value of 0.000 (<0.05). The value of odds ratio (OR) was 36.00 (95% CI 4.378-296.016) which meant the patients with lower FOUR score had the possibility in obtaining 36 times worse clinical outcomes than patients with higher FOUR score.*

Conclusion: *There was a correlation between initial FOUR score and clinical outcomes of acute intracerebral hemorrhage within 30 days of onset.*

Keywords---*FOUR Score, Intracerebral hemorrhage (IH), Predictor of clinical outcomes, consiousness*

I. INTRODUCTION

Intracerebral hemorrhage (IH) is the most leading cause of death (15.4%) in Indonesia and the second leading cause of death in the world(1).This stroke is considered as the most common type that can cause disability and bad functional outcomes because of inadequate therapy(2). The speed of diagnosis and attentive management in the

[1] ***1Department of Neurology, Faculty of Medicine, Universitas Airlangga, Dr. Soetomo Teaching Hospital, Universitas Airlangga 60285 Surabaya, Indonesia***
Corresponding Author: Yudha Haryono
Department of Internal Neurology, Faculty of Medicine, Dr. Soetomo Teaching Hospital,
Universitas Airlangga, Mayjen Prof. Dr. Moestopo 47 60131 Surabaya, Indonesia
Email: yudhaharyono48@gmail.com

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

emergency unit is considered as crucial matter to determine the prognosis of the initial neurological deterioration occurrence (several hours after onset) and long-term clinical outcomes(3). According to Guideline for the Management of Spontaneous Intracerebral Hemorrhage AHA/ASA 2015, the routine procedure to evaluate patients with IH includes the measurement by using standard severity scale to make a decision and communication among health workers 4. In acute IH, patients with decreased consciousness have bad outcomes, especially high severity and mortality, longer hospitalization, high dependency after coming out of hospital than patients without decreased consciousness (4). Therefore, earlier introduction of reduced consciousness can improve clinical outcomes of stroke patients(4). However, in Indonesia, there are many health centers located in peripheral areas, and there is no further investigation such as CT Scan. Based on the recapitulation of CT Scan availability from Directorate General of Health Effort Development Indonesia, recently hospital in Indonesia only had 57 CT Scan and it is not unevenly distributed (mostly in Java Island). In consequence, determining prognostic of IH patients in particular areas is difficult. The severity scales to determine the clinical outcomes for stroke are The National Institutes of Health Stroke Scale (NIHSS) Score(5–8), The ICH Score 5 and The Glasgow Coma Scale (GCS)(9).However, the scales above have several limitations and difficult to be implemented in peripheral areas in Indonesia.

The Full Outline of Unresponsiveness (FOUR) Score was proposed Wijdicks et al in 2005 and used recently to determine the decrease level of consciousness(9). Several previous studies have validated and supported the FOUR Score as the best alternative beside GCS to predict the outcomes of stroke and non stroke diseases (10–12).FOUR Score is a reliable score system with the kappa value of 0.82(9). It is reported that FOUR Score provides more information than GCS. The FOUR Score shows details of neurology better than GCS, able to recognize locked-in syndrome and more superior in determining the brainstem reflexes, breathe pattern, and recognizing the level of herniation(12,13).This scale ignores the disorientation or delirium of verbal assessment, but provides a good scoring ability for eye movement, brainstem reflex, and ventilator ventilation in patients. Another advantage of FOUR Score is that it can still be used in patients with acute metabolic disturbances, shock, or other nonstructural brain damage because it can detect early awareness changes. With the same range of scoring scales in each component of 0-4, FOUR Score also has other advantages over GCS as it becomes easier to remember (13). Glasgow Outcome Scale (GOS) was first discovered by Jennet and Bond in 1975 and has been established as a primary measure of clinical outcome in phase 3 traumatic brain injury (TBI) trials(14). According to the European Medicine Agency in 2001, GOS is one of the scales to measure functional outcomes in stroke trials(15).Quin et al in 2009 in a systematic review states that among the 47 clinical trial measurements studied, GOS is the one used in >5% stroke trial(15).

Until recently, there has been no research conducted about FOUR Score especially in IH patients. Therefore, this study is conducted to recognize FOUR Score can be an alternative scale that can be used in patients with IH with and without consciousness decline It is not only evaluating the death outcome after IH but also other clinical outcomes, reliable and easy to use in the ER and can be applied in peripheral areas.

II. METHODS

This study used analytical observational research. It also used perspective cohort design. The research was conducted for 11 months from April 2016 until May 2017 in the Emergency Unit Dr. Soetomo Teaching Hospital Surabaya, Indonesia. 64 research subjects were acute intracerebral hemorrhage patients in the emergency unit Dr. Soetomo Teaching Hospital Surabaya that fulfilled inclusion criteria: acute intracerebral hemorrhage in within 24

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

hours of onset based on clinical neurological test and head CT Scan results without contrast, aged above 18 years old, willing to follow the research, and not consumed neuromuscular blocking agent. It was collected by using consecutive sampling.Afterwards, anamnesis, physical examination of neurology, and head CT Scan without contrast were conducted. The results of CT Scan was examined by radiologist. Then, it was assessed by using FOUR Score system. GOS (Glasgow Outcome Scale) was assessed 30 days after onset. The data analysis was conducted by using SPSS software (SPSS, Inc., Chicago, IL).

III. RESULTS

There were 64 subjects that consisted of 44 subjects (68.75%) with the assessment result of GOS ≤3. It showed that the subjects attained bad clinical outcomes or death within 30 days of stroke hemorrhage onset. On the other hand, 20 subjects (31.25%) obtained GOS test result of >3 that showed the subjects obtained good clinical outcomes within 30 days after stroke hemorrhage. There were 8 patients (12.5%) that were excluded because they cannot be contacted in the 30^{th} day to be assessed their GOS value.

Validity and Inter-rater Reliability

Two times assessments using FOUR Score were conducted in 64 patients by residents in training of Neurology, Dr. Soetomo General Hospital Surabaya including eye response, motor response, brainstem response, and respiratory response.The validity assessment of FOUR Score was conducted by using product moment Pearson correlation and obtained smaller p value of 5%. It can be concluded that the result of FOUR Score was valid. On the other hand, inter-rater reliability assessment with Kappa statistic showed the value of 1000 that indicated a high consistency of FOUR Score (100% approval rate among evaluators) (table 1).

Demographic Data

There were a total of 64 subjects consisting of 33 subjects with high FOUR Score (>10) and 31 subjects with low FOUR score (≤10). The demographic data of study subjects included age and gender. The clinical data included increased systolic blood pressure, elevated body temperature, hyperglycemia, bleeding sites, hemorrhage volume, intra-ventricular hemorrhage, hydrocephalus, and severe consciousness decline.

In the demographic data of age, the oldest age was 77 years old and the youngest age was 41 years old with an average age of 54 ± 8.77 years. From the group of poor clinical outcomes (GOS ≤ 3), the subjects aged <65 years were 92.5% and the subjects aged ≥ 65 years were 64.7%. The results of the analysis with the exact fisher test due to the number of samples more than 40 and there is a hope frequency <5 obtained p value of 0.087 indicating that there was no association between age with clinical output (GOS) within 30 days after the onset of hemorrhagic stroke (table 2).Based on the result of gender, there was 67.5% of male patients and 75.0% of female patients with poor clinical outcomes (GOS ≤ 3). The results of chi square test obtained p value of 0.525 indicating that there was no correlation between sex with clinical output (GOS) within 30 days after onset of hemorrhagic stroke (table 3) .

Clinical Data

The clinical data of the study includes increased systolic blood pressure, elevated body temperature, hyperglycemia, bleeding sites, hemorrhage volume, intraventricular hemorrhage, hydrocephalus, and severe awareness. The result of exact fisher or chi square test showed that there was a correlation between clinical output with the variables of severe reduced consciousness, increased body temperature, increased blood pressure, bleeding

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

volume, and intraventricular hemorrhage. Meanwhile, the other variables such as hyperglycemia, bleeding sites, and hydrocephalus did not make a significant difference in clinical outcome after 30 days of onset (Table 4).

The Association between Confounding Variables with Clinical Output (GOS) during 30 Days after Onset of Hemorrhagic Stroke

In this study, a total of 64 subjects were found to be 45 patients (70.3%) who had poor clinical outcome (GOS $\leq$ 3) while the remaining 19 patients (29.7%) had good clinical outcome (GOS> 3). The confounding variables that were presumed to affect clinical outcomes of hemorrhagic stroke on day 30 after the onset were electrolyte balance disorders, acute renal failure, and seizures.

The Association between Electrolyte Balance Disorder and Clinical Output (GOS)

The result of analysis in the association between electrolyte disturbances with clinical output (GOS) showed that the number of patients with disturbance of balance and electrolyte who have bad clinical outcome (GOS $\leq$ 3) was 18 (85.7%) and the number of patients without electrolyte equilibrium disturbance that had bad clinical outcome (GOS $\leq$ 3) was 27 (62.8%). Chi square test showed that there was no statistically significant difference with p value of 0.061 (> 0,05) (CI 0.904-13.898). This indicated that there was no statistically significant or clinical association between electrolyte balance disturbance and clinical outcome (GOS) of hemorrhagic stroke patients on day 30 after onset. The relative risk value (RR) was recorded at 1.018, which showed that patients with electrolyte balance disorder had a risk for a poor clinical outcome (GOS) of 1.018 times compared to patients without electrolyte balance (Table 5).

The Association between Seizures and Clinical Output (GOS)

The number of patients with seizures with poor clinical outcome (GOS $\leq$ 3) was 4 (80.0%) and the number of patients without seizures with poor clinical outcome (GOS $\leq$ 3) was 41 (69.5%). Chi square test showed that there was no statistically significant correlation between seizure and clinical outcome with p value of 0.682 (> 0.05). The RR value was recorded at 1.151, which meant that patients who experienced seizures at risk for poor clinical outcome (GOS) were 1.756 times compared to those without seizures (Table 6).

The Correlation between FOUR Score and Clinical Output (GOS)

In a group with a poor clinical outcome (GOS $\leq$ 3), subjects with FOUR Score $\leq$ 10 were 30 (96.8%) and subjects with FOUR Score > 10 (15.5%). These results indicated that there was a statistically significant and clinical relationship between the results of the FOUR Score and Clinical Outcomes (GOS) results of patients with acute intracerebral hemorrhage with p value of 0.000 (<0.05). The RR value was 2.129, which meant that patients with FOUR Score of $\leq$10 at risk of getting a poor clinical outcome 2.129 times higher compared to patients with FOUR Score >10 (table 7).

IV. DISCUSSION

The study showed that there was a correlation between the initial Full Outline of Unresponsiveness (FOUR) Score and clinical outcomes of acute intracerebral hemorrhage in 30 days of onset.44 subjects (68.75%) with the GOS result of $\leq$3 obtained poor clinical outcomes until the 30th day or death within 30 days after the onset of hemorrhagic stroke and 20 subjects (31.25%) with the GOS result of >3 obtained good clinical outcomes until the 30th day after the onset of hemorrhagic stroke.This is in accordance with previous studies which suggest that the mortality and morbidity of hemorrhagic strokes is very high. This type of stroke is more common in Asia, with a high average fatality rate of

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

40% in the first month and 54% in 1 year(16). In this study, there was no difference in clinical outcome (GOS) within 30 days after the onset of hemorrhagic stroke in gender by p 0.525 which was in accordance with a subsequent study which suggested that gender was not a significant predictive factor for mortality in patients with hemorrhagic stroke in 30 days(17). Almost all of the research on predictors of clinical outcomes of stroke patients included GCS as an independent predictor of prognosis. Similar to our study, GCS was one of the variables in clinical data that had a statistically significant association with clinical outcomes of hemorrhagic stroke at the onset of day 30 with p value of 0.000 1 (17).

The age variable was not statistically significant in assessing the clinical outcomes of patients with hemorrhagic stroke on day 30 of onset (p 0.087). In previous studies, the association between age ranges and clinical outcomes of hemorrhagic stroke patients varied greatly, but most studies included ≥65 years or ≥80 years of age as a significant predictor of mortality rates for hemorrhagic stroke. In this study, we used the age limit of ≥65 years old which more accurately represents the pathophysiological changes of aging caused by hemorrhagic strokes(17). The mean age of patients with IH in this study was 54 ± 8.77 years, according to previous studies stating that the risk of stroke will increase along with the aging process(18).

Patients who experience an increase in body temperature ≥ 37.5 in the first 7 days are considered as independent factor for a poor prognosis(19). The presence of heat can aggravate the prognosis because it is associated with hematoma expansion(3,20)'. This is in accordance with the result of the study that there is a difference of clinical output to a statistically significant increase in body temperature with p value of 0.029.

From the 64 subjects, 35 patients (54.7%) had hemorrhagic stroke with systolic blood pressure of ≥ 180 mmHg and 29 patients (45.3%) had systolic blood pressure of <180 mmhg. This is in accordance with the Update Review on Intracerebral Hemorrhage that systolic blood pressure of > 180 will increase the risk of hemorrhagic stroke by 28.8 times compared with that of normotension(21). According to previous studies, high systolic blood pressure (mean 181.6 with SD : 34.86) and Mean Arterial Pressure (MAP) during hospitalization was associated with clinical outcome, whereas diastolic blood pressure at hospital admission was associated with large bleeding volume(22). The study was in line with our study which after tested with Chi square, it obtained statistically significant correlation between increased systolic blood pressure with clinical outcome of hemorrhagic stroke patient after 30 days of onset (p 0.003).

Hyperglycemia (mean 205.0 ± 50.3) during hospitalization can increase the risk of death in patients with hemorrhagic strokes(23). This is because hyperglycemia can increase cerebral edema and peri-tombomal cell death in hemorrhagic strokes(24). However, it did not occur in the present study, the presence of hyperglycemia did not give a difference in clinical outcome in hemorrhagic strokes after 30 days of onset with p value of 1.000. This is due to the fact that based on the management of stroke Perdossi 2011, the guidebook of clinical neurology (PPK) in 2016, and Guideline for the management of spontaneous intracerebral hemorrhage AHA/ASA 2015, hyperglycemia that occurs at the onset of acute stroke must be reduced immediately(3).Therefore, when patients come to ER and suffer from hyperglycemia, it will soon be regulated.

The location of bleeding is one predictor of clinical outcomes or mortality in patients with hemorrhagic strokes after the onset of day 30(17). In our study, there was no statistically significance association between the bleeding sites (supratentorial and infratentorial) with clinical outcome assessed with GOS. This is due to the unbalanced

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

distribution of research subjects between the stroke patients in the supratentorial which was 55 subjects (86%) and the location of the stroke in infratentorial which was 9 patients (14%). This is consistent with previous studies in which there was no significant differences between bleeding sites in predicting mortality within 30 days after the onset of bleeding(1). In addition, AHA/ASA recommendations 2015 on hematoma evacuation action on cerebellar hemorrhage (grade 1, level of evidence B) can also be one of the reasons why in this study the location of bleeding became meaningless(3).The volume of hemorrhage and intraventricular hemorrhage are also variables in clinical data which in many studies can serve as predictors for clinical outcomes such as GCS 23. There was a correlation between volume of bleeding and intraventricular hemorrhage with clinical outcome of hemorrhagic stroke patients at day 30 of onset with p value of 0.003 and p 0.002.

According to some studies, the presence of hydrocephalus is an independent predictor of adverse clinical outcomes in patients with hemorrhagic strokes but it is stated in those studies that surgical action at the onset of IVH will provide less benefit(25–27). There was no association between hydrocephalus and clinical outcome (p 0.09), which can be caused by surgery while the patient was in ER. It is in accordance with previous studies which suggested that the external ventricular drainage response was better conducted earlier(28).

In this study, the presence of balance and electrolyte disorders was not associated with clinical outcome in patients with hemorrhagic stroke with p value of 0.061 (RR 1.018; 95% CI 0.619 - 1.675). Based on SUSPEKT scores, the presence of electrolyte imbalance (serum potassium level) is a predictor of mortality in 30 days of hemorrhagic stroke(29). However, it did not occur in this study, caused by the correction of electrolyte balance disorder performed in ER or inpatient room.

From the 64 subjects, 5 patients (7.8%) had seizures and 59 patients without (92.2%) seizures. There was no association between seizure and clinical outcome of hemorrhagic stroke patients after 30 days of onset with p 0.682 (RR 1.151; 95% CI 0.720 - 1.841). This is consistent with previous studies suggesting that there was no significant association between seizures in hemorrhagic strokes and mortality compared with non-seizures (OR 2.1 95% CI 0.48-9.4) and no significant difference of good prognosis between patients with and without the seizures(30).Seizures are not associated with neurologic or mortality outcomes(3). However, several journals stated that seizures within the first 7 days can increase the risk of epilepsy within 3 years (31).

According to several studies, the level of awareness during hospitalization is a strong predictor of fatal prognosis within 30 days and the first 1 year after hemorrhagic stroke (32). In this study, FOUR Score was the main variable in relation to predictors of prognosis through measurement at the level of consciousness during hospitalization replacing GCS due to several limitations. The results of this study showed a statistically significant association between FOUR Score and clinical outcomes assessed with GOS on day 30 onset with p value of 0.000 (RR 2.129; 95% CI 1.457 - 3.111). Patients with low FOUR Score (≤ 10) will most likely have a poor clinical outcome after 30 days of onset. Meanwhile, patients with high FOUR Score (> 10) will most likely have a good clinical outcome after 30 days of onset. The RR value was recorded at 2.129 which meant that patients with low FOUR Score likely obtain a poor clinical outcome were 2,129 times compared with patients with high FOUR Score. This result is in line with previous studies that FOUR Score ≤ 10 increased the risk of mortality (RR 4.10, 95% CI 2.43-6.91) and poor functional outcome (RR 1.60, 95% CI 1.27-2.02) in the first 30 days after hemorrhagic stroke(33).Fabregas MJ et al also mentioned that FOUR Score ≤ 10 was one of the independent predictors of mortality in intraventricular hemorrhage

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

(OR 4.25; CI 1.97-9.56, p 0.0005)(34). Zeiler et al mentioned that FOUR Score during hospitalization had a significant association (p 0.05) in 1 month between mortality and clinical outcome and 6 months after subarachnoid hemorrhage(35). FOUR Score is a valid instrument (p 0.92, $\propto$ 0.86-0.87) and reliable (kappa coefficient >0.82 CI 0.77-0.88)(12). It is proved also in this research that FOUR Score is a reliable and valid instrument in measuring interatter reliability with coefficient value of Kappa 1.00. The result of product moment Pearson correlation test obtained smaller p value than the significance level of 5% (p 0.000, correlation coefficient 0.773-0.918).

V. Conclusion

There was a correlation between the initial Full Outline of Unresponsiveness (FOUR) Score and clinical outcomes of acute intracerebral hemorrhage in 30 days of onset.

REFERENCES

[1] Ferrete-Araujo AM, Egea-Guerrero JJ, Vilches-Arenas Á, Godoy DA, Murillo-Cabezas F. Predictors of mortality and poor functional outcome in severe spontaneous intracerebral hemorrhage: a prospective observational study. Med Intensiva (English Ed. 2015;39(7):422–32.

[2] Rost NS, Smith EE, Chang Y, Snider RW, Chanderraj R, Schwab K, et al. Prediction of functional outcome in patients with primary intracerebral hemorrhage: the FUNC score. Stroke. 2008;39(8):2304–9.

[3] Morgenstern LB, Hemphill III JC, Anderson C, Becker K, Broderick JP, Connolly Jr ES, et al. Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2010;41(9):2108–29.

[4] Shi Q, Presutti R, Selchen D, Saposnik G. Delirium in acute stroke: a systematic review and meta-analysis. Stroke. 2012;43(3):645–9.

[5] Al Fauzi A, Sumorejo P, Suroto NS, Parenrengi MA, Wahyuhadi J, Turchan A, et al. Clinical Outcomes of Repeated Intraventricular Transplantation of Autologous Bone Marrow Mesenchymal Stem Cells in Chronic Haemorrhagic Stroke. A One-Year Follow Up. Open Neurol J. 2017;11:74.

[6] Rahma ON, Wijaya SK, Prawito, Badri C. Electroencephalogram analysis with extreme learning machine as a supporting tool for classifying acute ischemic stroke severity. In Biomedical Engineering, Department of Physic, Universitas Airlangga, Surabaya, Indonesia: Institute of Electrical and Electronics Engineers Inc.; 2017. p. 180–6. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85043448686&doi=10.1109%2FISSIMM.2017.8124287&partnerID=40&md5=06a92fcd6d08db9d56bb4778c45731cb

[7] Adrianto Y, Susilo H. COMPARISON OF FUNCTIONAL IMPROVEMENT SCALE (NIHSS) DEGREE BETWEEN ACUTE INTRACEREBRAL HEMORRHAGE STROKE PATIENTS RECEIVING STANDARD TREATMENT AND THOSE RECEIVING STANDARD TREATMENT PLUS CELECOXIB. Folia Medica Indones. 2014;50(4):234.

[8] Amaheka BJ, Machfoed MH, Putra ST. Examination of OXLDL Serum Level as The Prognosis of Acute Thrombotic Ischemic Stroke. Folia Medica Indones. 2007;43(1):23–7.

[9] Clarke JL, Johnston SC, Farrant M, Bernstein R, Tong D, Hemphill JC. External validation of the ICH score. Neurocrit Care. 2004;1(1):53–60.

[10] Wijdicks EFM, Bamlet WR, Maramattom B V, Manno EM, McClelland RL. Validation of a new coma scale: the FOUR score. Ann Neurol Off J Am Neurol Assoc Child Neurol Soc. 2005;58(4):585–93.

[11] Kocak Y, Ozturk S, Ege F, Ekmekci AH. A useful new coma scale in acute stroke patients: FOUR score. Anaesth Intensive Care. 2012;40(1):131–6.

[12] Stead LG, Wijdicks EFM, Bhagra A, Kashyap R, Bellolio MF, Nash DL, et al. Validation of a new coma scale, the FOUR score, in the emergency department. Neurocrit Care. 2009;10(1):50.

[13] Saika A, Bansal S, Philip M, Devi BI, Shukla DP. Prognostic value of FOUR and GCS scores in determining mortality in patients with traumatic brain injury. Acta Neurochir (Wien). 2015;157(8):1323–8.

[14] Idrovo L, Fuentes B, Medina J, Gabaldón L, Ruiz-Ares G, Abenza MJ, et al. Validation of the FOUR Score (Spanish Version) in acute stroke: an interobserver variability study. Eur Neurol. 2010;63(6):364–9.

[15] Weir J, Steyerberg EW, Butcher I, Lu J, Lingsma HF, McHugh GS, et al. Does the extended Glasgow Outcome Scale add value to the conventional Glasgow Outcome Scale? J Neurotrauma. 2012;29(1):53–8.

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

[16] An SJ, Kim TJ, Yoon B-W. Epidemiology, risk factors, and clinical features of intracerebral hemorrhage: an update. J stroke. 2017;19(1):3.
[17] Hemphill JC, Bonovich DC, Besmertis L, Manley GT, Johnston SC. The ICH score. Stroke. 2001;32(4):891–7.
[18] Caplan LR. Caplan's stroke. Cambridge University Press; 2016.
[19] Azzimondi G, Bassein L, Nonino F, Fiorani L, Vignatelli L, Re G, et al. Fever in acute stroke worsens prognosis: a prospective study. Stroke. 1995;26(11):2040–3.
[20] Schlunk F, Greenberg SM. The pathophysiology of intracerebral hemorrhage formation and expansion. Transl Stroke Res. 2015;6(4):257–63.
[21] Aguilar MI, Brott TG. Update in intracerebral hemorrhage. The Neurohospitalist. 2011;1(3):148–59.
[22] Gupta M, Verma R, Parihar A, Garg RK, Singh MK, Malhotra HS. Perihematomal edema as predictor of outcome in spontaneous intracerebral hemorrhage. J Neurosci Rural Pract. 2014;5(1):48.
[23] Kimura K, Iguchi Y, Inoue T, Shibazaki K, Matsumoto N, Kobayashi K, et al. Hyperglycemia independently increases the risk of early death in acute spontaneous intracerebral hemorrhage. J Neurol Sci. 2007;255(1–2):90–4.
[24] Song E-C, Chu K, Jeong S-W, Jung K-H, Kim S-H, Kim M, et al. Hyperglycemia exacerbates brain edema and perihematomal cell death after intracerebral hemorrhage. Stroke. 2003;34(9):2215–20.
[25] Bhattathiri PS, Gregson B, Prasad KSM, Mendelow AD. Intraventricular hemorrhage and hydrocephalus after spontaneous intracerebral hemorrhage: results from the STICH trial. In: Brain Edema XIII. Springer; 2006. p. 65–8.
[26] Diringer MN, Edwards DF, Zazulia AR. Hydrocephalus: a previously unrecognized predictor of poor outcome from supratentorial intracerebral hemorrhage. Stroke. 1998;29(7):1352–7.
[27] Phan TG, Koh M, Vierkant RA, Wijdicks EFM. Hydrocephalus is a determinant of early mortality in putaminal hemorrhage. Stroke. 2000;31(9):2157–62.
[28] Liliang P-C, Liang C-L, Lu C-H, Chang H-W, Cheng C-H, Lee T-C, et al. Hypertensive caudate hemorrhage prognostic predictor, outcome, and role of external ventricular drainage. Stroke. 2001;32(5):1195–200.
[29] Szepesi R, Széll IK, Hortobágyi T, Kardos L, Nagy K, Lánczi LI, et al. New prognostic score for the prediction of 30-day outcome in spontaneous supratentorial cerebral haemorrhage. Biomed Res Int. 2015;2015.
[30] Vespa PM, O'phelan K, Shah M, Mirabelli J, Starkman S, Kidwell C, et al. Acute seizures after intracerebral hemorrhage: a factor in progressive midline shift and outcome. Neurology. 2003;60(9):1441–6.
[31] Haapaniemi E, Strbian D, Rossi C, Putaala J, Sipi T, Mustanoja S, et al. The CAVE score for predicting late seizures after intracerebral hemorrhage. Stroke. 2014;45(7):1971–6.
[32] Nilsson OG, Lindgren A, Brandt L, Säveland H. Prediction of death in patients with primary intracerebral hemorrhage: a prospective study of a defined population. J Neurosurg. 2002;97(3):531–6.
[33] Mittal MK, Lele A. Predictors of poor outcome at hospital discharge following a spontaneous intracerebral hemorrhage. Int J Neurosci. 2011;121(5):267–70.
[34] Martí-Fàbregas J, Piles S, Guardia E, Martí-Vilalta J-L. Spontaneous primary intraventricular hemorrhage: clinical data, etiology and outcome. J Neurol. 1999;246(4):287–91.
[35] Zeiler FA, Lo BWY, Akoth E, Silvaggio J, Kaufmann AM, Teitelbaum J, et al. Predicting outcome in subarachnoid hemorrhage (SAH) utilizing the Full Outline of UnResponsiveness (FOUR) score. Neurocrit Care. 2017;27(3):381–91.
[36] Thamarai, P., Adalarasu, K. An effective method to remove noise in EEG signal using wavelet packet transform(2018) International Journal of Pharmaceutical Research, 10 (4), pp. 793-799. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85062401962&partnerID=40&md5=4364f50cfe8fa13d7c6f428ce119748b
[37] Shivshankar r. Mane (2019) advances of hydrazone linker in polymeric drug delivery. Journal of Critical Reviews, 6 (2), 1-4. doi:10.22159/jcr.2019v6i2.31833
[38] Vekaria A, Gigani Y, Belemkar S. "Cardiovascular Indications and Complications of Recombinant Human Erythropoietin." Systematic Reviews in Pharmacy 2.1 (2011), 43-47. Print. doi:10.4103/0975-8453.83438

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

TABLES

Table 1: The Validity and Inter-rater Reliability of FOUR Score

Response	Resident in training D	Resident in training A
	r *pearson* (p-value)	r *pearson* (p-value)
Eye response	0.901 (0.000)	0.905 (0.000)
Motor response	0.910 (0.000)	0.918 (0.000)
Brainstem response	0.856 (0.000)	0.854 (0.000)
Respiratory response	0.773 (0.000)	0.778 (0.000)
Kappa	1.000 (0.000)	

Table 2: The subject characteristics based on age

Variable	GOS ≤ 3	GOS > 3	Total	P
Age				
< 65 years old	12 (92.3%)	1 (7.7%)	13 (100%)	0.087
≥ 65 years old	33 (64.7%)	18 (35.3%)	51 (100%)	
Total	45	19	64	

Table 3: The subject characteristics based on gender

Variables	GOS ≤ 3	GOS > 3	Total	P
Gender				
Male	27 (67.5%)	13 (32.5%)	40 (100%)	0.525
Female	18 (75.0%)	6 (25.0%)	24 (100%)	
Total	45	19	64	

Table 4: The characteristics of clinical data

Variables		GOS ≤ 3	GOS > 3	Total	P
Severe consciousness	decreased				0.000

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

GCS ≤ 8	31(96.9%)	1(9.5%)	32 (100%)	
GCS > 8	14 (43.8%)	18(56.3%)	32 (100%)	
Increased body temperature				
≥ 37.9^{o}C	17 (89.5%)	2 (10.5%)	19 (100%)	0.029
< 37.9^{o}C	28 (62.2%)	17 (37.8%)	45 (100%)	
Increased blood pressure				
Systolic ≥ 180 mmHg	30 (85.7%)	5 (14.3%)	35 (100%)	0.003
Systolic < 180 mmHg	15 (51.7%)	14 (48.3%)	29 (100%)	
Hiperglikemia				
GDA > 150 mg/dL	5 (71.4%)	2 (28.6%)	7 (100%)	1.000
GDA ≤ 150 mg/dL	40 (70.2%)	17 (29.8%)	57 (100%)	
Hemorrhage sites				
Infratentorial	8 (88.9%)	1 (11.1%)	9 (100%)	0.260
Supratentorial	37(67.3%)	18 (29.4%)	55 (100%)	
Hemorrhage volume				
≥ 30 cc	26 (89.7%)	3 (10.3%)	29 (100%)	0.002
< 30 cc	19 (29.7%)	16 (25.0%)	35 (100%)	
Intraventricle hemorrhage				
Occur	28 (87.5%)	4 (12.5%)	32 (100%)	0.003
None	17 (53.1%)	15 (46.9%)	32 (100%)	
Hydrocephalus				
Occur	11 (91.7%)	1 (8.3%)	12 (100%)	0.090
None	34 (65.4%)	18 (34.6%)	52 (100%)	

Table 5: The association between electrolyte balance disorder and clinical outcomes (GOS)

Variables	GOS ≤ 3	GOS > 3	Total	P	RR (IK)
Electrolyte balance disorder					
Occur	18 (85.7%)	3 (14.3%)	21 (100%)	0.061	1.018 (0.619 – 1.675)
None	27 (62.8%)	16 (37.2%)	43 (100%)		

Table 6: The association between seizure and clinical outcome (GOS)

Variables	GOS ≤ 3	GOS > 3	Total	P	RR

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020

					(IK 95%)
Seizure					
Yes	4 (80.0%)	1 (20.0%)	5 (100%)	0.682	1.151
No	41(69.5%)	18 (30.5%)	59 (100%)		(0.720 – 1.841)

Table 7: The association between FOUR Score and clinical outcome (GOS)

Variables	GOS ≤ 3	GOS > 3	Total	P	RR (IK 95%)
FOUR *Score*					
≤ 10	30 (96.8%)	1 (3.2%)	31 (100%)	0.000	2.129 (1.457-3.111)
> 10	15 (45.5%)	18 (54.5%)	33 (100%)		

DOI: 10.37200/IJPR/V24I2/PR200742
Received: 05 Jan 2020 | Revised: 20 Jan 2020 | Accepted: 30 Jan 2020