



ANALYSIS OF FOUR SCORE AND GCS SCORE ACCURACY IN PREDICTING THE FIRST SEVEN-DAY MORTALITY ON ADULT PATIENTS WITH HEAD INJURY IN dr. SAIFUL ANWAR GENERAL HOSPITAL, MALANG

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ABSTRACT

Background: Head injury is one of the most common causes of death recorded in intra hospitals. Head injuries can cause death, disability, reducing a person's productivity. Moreover, it involves the productive age group and becomes big socio-economic burdens. **Purpose:** To analyze the FOUR score and GCS score as mortality predictors of the first 7-days of adult patients at Regional General Hospital of Dr. Saiful Anwar, Malang. **Method:** This research is an analytic observational research using cross sectional approach. The population in this study is all adult patients with head injuries who came to Saiful Anwar's Emergency Room (IGD). Sample selection uses purposive sampling with the number of sample accounted as many as 75 respondents. Univariate analysis is used to determine the description of each variable, and testing coefficient of contingency is employed to determine the relation between variables. To know difference of effectiveness of GCS score and FOUR score in detecting the mortality of head injured patients, the analysis by ROC (Receiver Operator Characteristic) comparative method is then utilized to obtain the AUC (Area Under Curve) value determining cut-off point, sensitivity, and specificity on each GCS Score and FOUR Score. **Result:** The result of bivariate test identifies the relationship between GCS variable and mortality occurrence of $p = (0.000)$ with $r = 0.536$. The relationship between the FOUR Score variable and the mortality event was $p = 0.000$ with $r = 0.649$. The AUC score of the GCS Score is 0.683 (IK95% 0.541 – 0.825). Furthermore, the AUC value of the FOUR score is 0.785 (IK95% 0.639 -0.932). **Conclusion:** FOUR Score and GCS score can be predictors of mortality in adult patients with head injury after seven days, which statistically FOUR Score is better in predicting mortality event.

KEYWORDS: Head injury, FOUR Score, GCS Score.

INTRODUCTION

Head injury is one of the leading causes of death in intra-hospital (Talving, 2013). Head injury occurs due to direct or indirect mechanical trauma causing impaired neurological function of physical disturbance, cognitive, psychosocial function both temporary and permanent and cause changes in function or structure in brain tissue due to gain external mechanical strength in the form of blunt trauma or penetration (Wijdicks et al., 2012).

Head injuries can cause death, disability, reducing an individual's productive time as it involves productive age groups resulting in a large socio-economic burden. Costs incurred directly or indirectly from head injuries for victim care are over \$56 million per year (Hickisch & Holmfur, 2016). High mortality rate for head injury patients is related to the severity of head injury, disability

rate, and death. Therefore, knowing the prognosis of a head injury with an accurate preliminary assessment is extremely important as it can be utilized to provide information on disease travel and disease outcomes.

Scoring can be used as a predictor and management according to the patient's condition to make a decision to determine immediate actions, as well as to provide information to the patient's family about the condition and the worst possible possibilities related to the patients' condition (Yamamoto et al., 2016).

The preliminary research data was taken from the field by researchers on December 6, 2016 in the emergency room in the yellow zone to the head of the yellow zone team in Indonesia. Yombana found that the cut-off value of the first three-day death was eight, where all patients

who died had a total FOUR score of under eight. As for the cut-off value of each component the FOUR Score is 2, where the deceased patients have the value of each component of the FOUR Score below 2. To recent days, the FOUR Score has started to be widely used throughout the world, especially in the United States and Europe. In Asia, FOUR Score has been used in South Korea, Thailand and Indonesia (Purwanto, 2015) (Purwanto, 2015).

METHOD

This study is planned to use an observational design which compares the ability of FOUR Score and GCS Score in predicting death in the first 7 days in adult patients with head injury. The patients' status would be followed for the duration of 7 days in the inpatient unit (and after the outpatient if the patient's hospitalization is less than 7 days), after being assessed with FOUR Score and GCS Score.

The data collection was taken from August to September 2017, and this research was conducted in Emergency Department of Saiful Anwar hospital, Malang.

The population in this study is all adult patients with head injuries who came to the emergency room of Saiful Anwar hospital, Malang.

Sampling used is consecutive sampling. The number of samples studied in this study is accounted to 75 respondents.

- Subjects in this study have inclusion criteria as follows:
- a. Patients with head injuries aged over than 19 years old.
 - b. During onset and up to 12-hour duration.
 - c. Undergoing treatment at Saiful Anwar hospital, Malang.

RESEARCH RESULT

1. Characteristic Distribution of the Respondents

According to the research data processing, the research results are as follows:

Characteristics of Respondents		n	%
Sex	Male	49	65.3
	Female	26	34.7
Age	Adult	37	49.3
	Middle Age	36	48
	Aged	2	2.7

According to the characteristic description, male respondents are 49 respondents (65.3%) and female respondents are 26 respondents (34.7%); more than half

respondents aged from 18 to 40 years are 37 respondents (49.3%), and those aged >60 years old are as many as 2 respondents (2.7%).

2. Bivariate Analysis

Bivariate analysis is conducted to find out the relationship between independent variable with dependent variable. In this research, bivariate analysis used is coefficient of contingency.

Table 2.1: Characteristics of Mortality Event of the Respondents.

	Mortality Event		
	Alive	Dead	Total
Sex	38 (50.7%)	11 (14.7%)	49 (65.3%)
Male	19 (25.3%)	7 (9.3%)	26 (34.7%)
Female	57 (76%)	18 (24%)	75 (100%)
Total	38 (50.7%)	11 (14.7%)	49 (65.3%)

Source: Primary Data 2018.

Male respondents of 38 respondents (50.7%) and female respondents of 19 (25.3%) suffered from head injury survived after the first 7 days. Meanwhile, male respondents of 11 respondents (14,7%) and female respondents of 7 respondents (9,3%) with head injury could not survive after their first 7 days at the hospital.

Table 2.2: Characteristics of Mortality Event Based on Age.

Age	Mortality Event		
	Alive	Dead	Total
Adult	30 (40%)	7 (9.3%)	37 (49.3%)
Middle Age	27 (36%)	9 (12%)	36 (48%)
Aged	1 (1.3%)	1 (1.3%)	2 (2.7%)
Total	58 (77.3%)	17 (22.7%)	75 (100%)

Source: Primary Data 2018.

Adult respondents of 7 respondents (9,3%) died, and 30 respondents (40%) did not experience death. In middle age group, 27 respondents (36%) were alive, and 9 respondents (12%) died. Aged patient of 1 respondent (1.3%) was alive, and 1 respondent (1.3%) died.

Table 2.3: Test Analysis of Age T-Test with Mortality Event.

	Mortality	Mean	SD	P-Value
Age	Alive	60.09	± 11.222	0.379
	Dead	56.50	± 14.300	

Source: Primary Data 2018.

Based on Table 2.3, p-value of 0.379 is obtained which means there is no age difference between living patients and those experiencing mortality.

Table 2.4: Correlation of GCS Score with Mortality Event.

		Mortality Event		r	p
		No	Yes		
GCS	GCS Score \geq 8	52 (91.2%)	5 (8.8%)	0.536	0.000
	GCS Score \leq 7	5 (27.8%)	13 (72.2%)		
	Total	57 (76%)	18 (24%)		

Table 2.4 shows the significance value (p) of 0.000, meaning there is a significant correlation between GCS Score and mortality (p < 0.05). The coefficient correlation

(r) 0.536 indicates that the correlation strength of GCS Score with the incidence of mortality on the respondent is weak.

Table 2.5 Correlation of FOUR Score with Mortality Event.

		Mortality Event		r	p
		No	Yes		
FOUR	FOUR Score \geq 10	55 (96.5%)	2 (3,5%)	0.649	0.000
	FOUR Score \leq 7	2 (11.1%)	16 (88.9%)		
	Total	57 (76%)	18 (24%)		

Table 2.5 shows the significance value (p) of 0.000, meaning there is a significant correlation between the FOUR Score and the respondents' worsening condition (p < 0.05). The correlation coefficient (r) of 0.649 indicates that the correlation strength of FOUR Score with worsening of respondents' condition is moderate.

The study with ER setting and the same diagnosis with this research was conducted by Kasprovic et al., (2016), but this study found no significant difference between total FOUR Score and total GCS Score in predicting mortality. This is due to an uneven distribution of clinical head injuries and a small mortality rate of 7.8%. In the current study, the mortality rate was 18 cases (24%).

DISCUSSION

Analysis of the Correlation of FOUR Score and GCS Score with the Accuracy of Mortality Prediction on the first 7 days

On this analysis stage, the Glasgow Coma Scale shows a value of p value = 0.000, where this value implies that GCS can be used as a predictor to determine the accuracy of the first 7-day mortality prediction to patients with head injury. The value of R in this analysis is 0.536 which means GCS has a chance of 53.6% to be used as a parameter that can predict the first 7-day mortality. However, this result when compared with the FOUR Score is still below the FOUR Score as one of the tools to predict mortality in the first 7-day head injury treatment. The results of this study indicate that a low total FOUR Score has a relative risk for experiencing 7-day post-head injury deaths, being higher than that of with a low total GCS Score.

The results of this study are consistent with the research conducted by Wijdicks et al., (2012). This first study on validating the FOUR score showed that an increase of 1 point FOUR Score lowered the mean of death by 16% compared to that of GCS Score with 1 point decreasing odds of death by 26%.

In addition, in the scatter plot analysis with local regression, Wijdicks found the probability of in-hospital mortality was higher in the lowest total FOUR Score compared to the lowest total GCS Score. However, the weaknesses of Wijdicks et al., (2012) study used the ICU setting and diagnosis of various research subjects covering trauma and non-trauma.

As viewed from the ROC curve, the AUC score obtained in the GCS score is 68.3% (95% IK 54.1% - 82.5%), where statistically this result is still weak (60% - 70%). Although this means that if GCS score is used to predict death after 7 days for patients with head injured, GCS Score on 100 people will be able to predict exactly on people as much as 68 people.

Moreover, from the ROC curve, the AUC score obtained in the FOUR score is 78.5% (95% IK 63.9% - 93.2%) where statistically this result is categorized in moderate strength (70% - 80%). This proves that the FOUR Score is more appropriately used in predicting mortality in head injured patients after 7 days. This AUC value means that if there are 100 people who want to predict the mortality on the next 7 days, then the FOUR Score can accurately predict on 78 people.

IMPLICATIONS OF THE RESEARCH RESULTS

Conducting better mortality prediction will improve survival skills so that treatment in patients with high mortality predictions will be enhanced. In addition, FOUR Score as one of mortality predictors for patients with head injury can also be conducted routinely in order to improve its outcomes.

RESEARCH LIMITATION

The drawback of this study is the subject uneven distribution, most of whom had FOUR Scores and high GCS Scores and a relatively small proportion of head

injuries, which are not ideal for multivariate analysis (logistic regression) to determine the prediction models..

CONCLUSION

There is a correlation between FOUR Score with incidence of mortality in Saiful Anwar hospital, Malang. Therefore, the FOUR Score can be used as a predictor to predict the mortality on the first 7-day treatment to patients with head injury.

There is a difference in the effectiveness of GCS and FOUR Scores in predicting mortality after 7-day treatment in head injured patients in Saiful Anwar hospital, Malang.

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