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Sensitivity and Specificity of Full Outline of Unresponsiveness Score and Glasgow Coma Scale towards Patients' Outcomes at the Intensive Care Units

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Abstract :

Study Objective: Glasgow Coma Scale (GCS) is an instrument which is generally used to assess the patients' level of consciousness. However, in certain patients, the GCS cannot function properly to assess the patients' verbal responses. To enhance this instrument, the Full Outline of unresponsiveness (FOUR) score was therefore developed. This study aimed to determine the sensitivity and specificity of the FOUR score and the GCS in assessing the level of consciousness towards the outcomes of the patients in the ICUs.

Design: observational study.

Method and Measurement: The population was all patients admitted to the ICUs. The samples were 74 patients and 2 nurse observers who were selected using a consecutive sampling technique. The data were statistically analyzed using the Receiver Operating Characteristics (ROC) and the 2x2 table.

Result: The results of the GCS test showed that the scores of sensitivity and specificity were 0.722 and 0.737 consecutively. Meanwhile, the FOUR showed a score of sensitivity and specificity of 0.861 and 0.816. The Area Under Cover (AUC) scores of the GCS and the FOUR were 0.859 and 0.893 consecutively towards the outcomes of the patients in the ICUs. Value of the sensitivity and specificity of the FOUR score higher than the GCS and sensitivity FOUR score higher than specificity.

Conclusion: The scores of sensitivity and specificity of the FOUR were higher than the GCS. The FOUR instrument can be used as an replace of the GCS to assess the level of consciousness towards the patients' outcomes in the ICUs.

Keywords: FOUR score, GCS, sensitivity, specificity

I. Introduction

Intensive care unit is an independent part of a hospital with particular staff and equipments.¹ A critically ill patient who is treated in ICU ward has high level of morbidity and mortality caused by various diseases.² General clinical symptoms which are usually found in ICU ward are critically ill patients with tachypnea, tachycardia, hypotension, and disorder of conscious (such as lethargy, confusion, agitation or decreased level of consciousness).³ Level of consciousness is a sensitive indicator of neurological function, therefore an assessment on level of consciousness is needed.⁴ Glasgow Coma Scale (GCS) is an instrument which is broadly used to discover the level of brain injury and the level of coma of a patient with head injury.⁵ The GCS instrument has been tested for its validity and reliability which result was good and it has good correlation on the result of patients' outcome in forms of the number of mortality in Intensive Care Unit.^{6,7} This GCS instrument is simple, practical, standardized, has three assessment components including eyes response, verbal response, and motoric response in which each component has different score.⁸

The assessment using GCS has not completely facilitated the level of consciousness assessment, particularly on the patients with the decrease of consciousness who are intubated, the verbal component on GCS is difficult to assess. GCS components were unable to facilitate the assessment on patients with locked syndrome.^{9,10} A new instrument was made to complete the GCS instrument which still has some shortcomings, and it is called *Unresponsiveness Score* (FOUR score).¹¹ FOUR score instrument has four assessment components consist of eyes response, brainstem response, motoric response and respiratory response. Each component is valued 0 – 4.¹¹ This instrument does not include verbal response so that the patients who are either intubated or unintubated are able to be assessed. The result of the study showed different sensitivity and specificity scores with different cut off score as well.^{9,11,12} An alternative instrument to assess level of consciousness is needed in order to fill the limitations of GCS components. The instrument needed is an instrument that is able to provide detail neurological information, accessible, and its interpretation can be used to predict the patient's outcome in ICU.

II. Material and Method

This study was an observational research conducted to the respondents who were hospitalized in ICU of RSUD Dr. Moewardi, Surakarta. The research was conducted from August to October 2016. The inclusion criteria were adult patients aged minimum ≥ 18 -year-old who experienced decrease of consciousness level. The patients did not receive sedative drug or neuro blocker. The exclusion criteria were the patients who had the history of hearing and visual impairment. The patients who had *compos mentis* consciousness were not willing to be the respondents of the study. The instrument had undergone face validity test by clinic, academic and language experts. The researcher conducted uniformity perception to the candidate of observers and both of the observers agreed not to talk and show the result of the assessment. Both examiners were tested on their assessing reliability using Kappa test. There were 74 respondents whose level of consciousness were measured qualitatively by the observers which then the assessments were continued using GCS and FOUR score by two observers in the morning shift, which then the patients' progresses were monitored for the next 7 days in order to discover the patients' prognosis. The result of assessment was analyzed using ROC and 2x2 table. The respondents' distributions based on age, gender, medical diagnosis, medical treatment, clinical consciousness and outcome are as follows:

Table 1. Respondents characteristics

Variable	N	%
Age		
18-40-year-old	21	28,4
41-60-year-old	41	55,4
≥ 60 year-old	12	16,2
Gender		
Male	32	43,2
Female	42	56,8
Medical diagnose		
Neurological disorder	36	48,6
Pulmonary disorder	6	8,1
Gastrointestinal disorder	4	5,4
Musculoskeletal disorder	11	14,9
Infection	8	10,8
Metabolism and endocrinal disorders	2	2,7
Kidney disorder	1	1,4
Gynecology disorder	6	8,1
Medical treatment		
Intubated	28	37,8
Unintubated	42	56,8
Tracheostomy	4	5,4
Clinical Consciousness		
Apathic	23	31,1
Somnolent	7	9,5
Sopor	19	25,7
Coma	25	33,8
Outcome		
Alive	36	48,6
Death	38	51,4

Table 2. Examiner reliability with GCS and FOUR score using Kappa test

	FOUR score	GCS
Kappa	0.891	0.973

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Table 3. Sensitivity and specificity of FOUR score and GCS

FOUR score	Outcome 7 day
Sensitivity	0,861
Specificity	0,816
Positive Predictive Value	0,816
Negative predictive value	0,861
Accuracy	0,838
AUC	0,893
GCS	Outcome 7 day
Sensitivity	0,722
Specificity	0,737
Positive predictive value	0,772
Negative predictive value	0,737
Accuracy	0,729
AUC	0,859

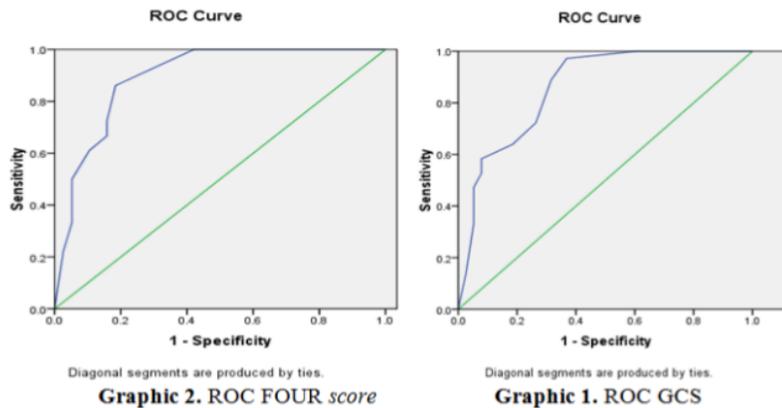


Table 4. Crosstabulation FOUR score

	Outcome	Total	
		Alive	Died
FOUR score >6	31	7	43
FOUR score ≤6	5	31	31
Total	36	38	74

Table 5. Crosstabulation GCS

	Outcome	Total	
		Alive	Died
GCS >5	28	8	36
GCS ≤5	8	30	38
Total	36	38	74

III. Discussion

The result of the study showed that the sensitivity and specificity of FOUR score with the patients' outcome in ICU and cut off value of 6 were 0.861;0.816 respectively. While the sensitivity and specificity of GCS with cut off value of 5 were 0.722; 0.737 respectively. The result showed that of the sensitivity and specificity of the FOUR score higher than the GCS. The result of the study was supported with a research conducted by Baratloo on patients with head injuries when they entered the hospital gained sensitivity and specificity values for GCS instrument were 0.842; 0.886 respectively, while the values gained for FOUR score were 0.869;0.884 respectively.¹³ In general, the higher cut off resulted in better outcome. The AUC score of GCS and FOUR score showed very good results of 0.859 and 0.893 respectively. A good AUC score showed that the mortality probability to occur in the lowest total score of FOUR score and GCS was very high. The high AUC score of this study was also supported by other studies which showed AUC score for GCS was 0.815, while the AUC for FOUR score was 0.834.¹⁴ Another study gained a very high score for AUC GCS on patients' mortality on their initial entrance to the hospital of 0.9116 while FOUR score was 0.9272.¹³

GCS instrument has been used for a long time. However, there are some shortcomings of this instrument such as its inability to assess verbal response of intubated patients and its inability to assess vegetative condition of a patient experiences locked syndrome. GCS instrument does not have clinical indicators to assess the brainstem death and the changes of respiratory patterns which are used to discover the development of severity coma.^{10,11,15} However, there were numerous studies which have been conducted to assess the level of consciousness which have established good result for both validity and reliability scores of patients' mortality outcome in intensive care unit. Generally, this instrument is considered as simple and accessible to assess the level of consciousness.^{6,7} FOUR instrument was made to ease and accelerate the assessment of patients' level of consciousness in which GCS does not contain neurological components needed. The scores in GCS components have different total score in each response; eye scores 1 – 4, motoric score 1 – 6, and verbal score 1 – 5, while FOUR score has similar score on each score of 0 – 4. Hence, the assessment for FOUR score is easy to remember.¹¹ Level of consciousness is a measurement of a person's attitude and response toward him/herself and the environment.¹⁶ Arousal component and awaken situation are determined by the function of cerebral hemisphere and reticular activating system (RAS) interaction in the brainstem. Therefore, when there is a dysfunction in this channel then the patient's consciousness will be disturbed. ARAS information channel will activate hypothalamus and limbic system in cortical in arranging the emotion and attitude response such as the response of sick and loud sound.¹⁷

FOUR instrument has similar score on each component in which the maximal score is 4 and the minimal is 0, so it eases the observer to memorize. The verbal response is not included in this instrument so that it can be used to assess the level of consciousness on patients either incubated or not.¹¹ The assessment on level of consciousness with precise result will help the family and health workers to give medication, monitor the

condition and development of the patients' health, give comfort and administration easiness as well as reduce the treatment cost.¹⁵ The researcher confirmed that GCS can be used to assess the level of consciousness instead of its shortcomings, while FOUR score can be used to assess the level of consciousness which was proven with the high level of sensitivity and specificity scores. The researcher still needs to gain a larger sample in order to prove that this instrument will be able to be used for all patients in general and accessible for all health workers.

4 IV. Conclusion

The result of the study showed that value of the sensitivity and specificity of the FOUR score higher than the GCS. Therefore, FOUR score instrument can be used as an alternative instrument to replace GCS in assessing the level of patients' consciousness in ICU with patients' outcome at 7 day in ICU.

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