

## **Correlation Between Full Outline Unresponsiveness Score and Glasgow Coma Scale for Severe Head Injury Patients at Prof. dr. R. D. Kandou General Hospital, Manado-Indonesia**

*Jusuf, W. R. A., Prasetyo, E., and Oley, M. C.*

Department of Neurosurgery School of Medicine, Sam Ratulangi University, Manado-Indonesia

**Objective:** Glasgow Coma Scale (GCS) has been widely used to assess level of consciousness related to trauma, however, its use have a limitation especially in intubated patients. Full Outline Unresponsiveness Score (FOUR) consists of four components (eye, motor, brainstem, and respiration) and each component has a maximal score of 4 and total score 17. This study aims to evaluate correlation between FOUR score and GCS to evaluate level of consciousness in severe head injury patients. **Methods:** This is a prospective study with correlation approach. We prospectively studied all severe head injury patients at surgical emergency department Kandou Hospital, Manado from March to May 2010. Level of consciousness was assessed using GCS and FOUR score. Data were analysed with Pearson correlation coefficient. **Results:** From March to May 2010 at surgical emergency department there were 27 severe head injury patients (24 males and 3 females) with average range of age 10-20 years old (29,6%). The highest distribution of GCS in severe head injury patients were GCS 8 (33.3%) and GCS 3 (22.2%) while in FOUR score were 8 (33.3%) and 7 (14.8%). **Conclusions:** we concluded that FOUR score can be used as important tools to assess level of consciousness of severe head injury patents. FOUR score provides greater neurological detail than GCS which can assess brainstem reflexes, breathing pattern, and herniation.

**Key words:** GCS, FOUR score, level of consciousness, severe head injury

### **INTRODUCTION**

Head trauma is one of the leading causes of death in traffic accidents. In the UK each year approximately 100,000 patients visit to hospital due to head trauma which 20% were hospitalized.<sup>1</sup> In the United States, the incidence of head injuries each year reached 500,000 cases. Of these, 10% of patients die before arriving at the hospital. In developing countries such as Indonesia, the economic and industrial growth impact to the increasing incidence of head injury.<sup>2,3</sup> GCS is a method that has been used extensively for evaluation of trauma-related awareness. However, GCS has some limitations when applied to intubated patients. In addition, GCS also did not assess brain stem reflexes. Wijdicks et al. (2005) was then presented a new FOUR score as an alternative to the GCS to evaluate the awareness of patients with severe brain damage.<sup>1,2</sup>

There are four components that are valued in FOUR score, i.e. eyes, motor, brainstem, and respiration, which each component valued at a maximum of 4.<sup>3,4</sup> Low FOUR scores were associated with increased mortality and morbidity of acute brain injury patients. FOUR score is a more detailed neurological examination to assess brain stem reflexes and eye movements.

**Correspondence:** Jusuf, W. R. A

**Address:** Department of Neurosurgery School of Medicine, Sam Ratulangi University, Manado-Indonesia.

Unlike the GCS, FOUR score can identify uncal herniation, locked in syndrome, and the beginning of the vegetative state, when one of the three components of the GCS, i.e. verbal component can not be used in intubated patients.<sup>3,5</sup>

### **METHOD**

This is a prospective study with correlative approach. The study was conducted at the Installation of Emergency Surgery Unit Prof. dr. RD Kandou General Hospital Manado and carried out in March through May 2010. Inclusion criteria was patient with severe head injury. Mild and moderate head injury were excluded.

Severe head injury is unable to follow simple commands because of consciousness disturbance with a GCS  $\leq$  8. A number of 24 patients were recruited in this study based on sample amount calculation.

Patient consciousness was evaluated on the basis of FOUR and GCS score. Data were statistically analysis by applying Pearson coefficient correlation.

### **RESULTS**

There were 27 severe head injury patients following the study during March until May 2010 at Surgery Intensive Care Unit, Prof dr. R.D Kandou General Hospital, Manado-Indonesia. Of them 24 were male and 3 female. The younger age is 2 year and the oldest age is 70 year. The most age range is 10-20 year (29.6%).

The most severe head injury GCS distribution was within 33.3% of GCS-8 score and 22.2% of GCS-3 score. The distribution was presented in Figure 1. Meanwhile, severe head injury by applying FOUR score, we found the most within score-8 for 33.3% followed by score-7 around 14.8%. For more detail, the data was pictured in Figure 2.

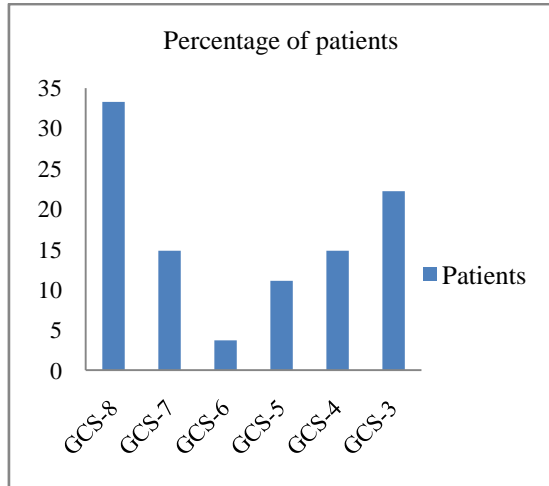


Figure 1  
 Distribution of Severe Head Injury Patients Based on GCS-Score

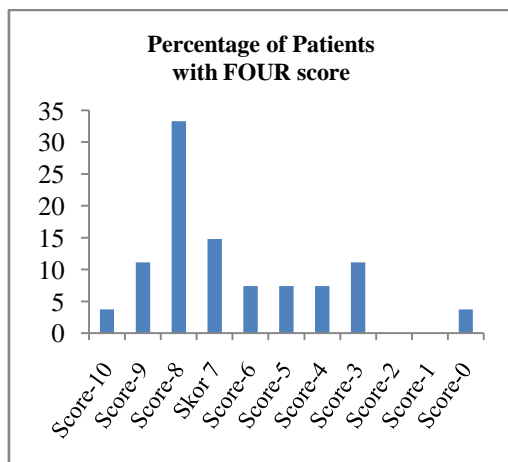


Figure 2  
 Distribution of Severe Head Injury Patients Based on FOUR-Score

**DISCUSSION**

FOUR score for the first time was reported by Wijdicks, et al. (2006) as an alternative of GCS score for evaluating consciousness of severe head injury patient.<sup>2</sup> GCS is a method that has been used extensively for evaluating level of severe head injury consciousness patients, this method has a limitation when applied to intubated patients and could not be used to assess brain stem reflexes. It is different from GCS score, in FOUR score, verbal response was replaced with assessment of

stembrain and respiration components. For FOUR score, the assessor applying 0-4 score for each functional category, i.e. eye response, motor, brainstem reflexes, and respiration. The detail of the FOUR score and GCS score are listed in Table 1.

Table 1  
 Comparison of the FOUR score with GCS

FOUR-Score	GCS-Scale
<b>Eye Response</b>	
4 = eyelids open or opened, tracking, or blinking to command	4 = eyes open spontaneously.
3 = eyelids open but not tracking	3 = eye opening to verbal command
2 = eyelids closed but open to loud voice	2 = eye opening to pain
1 = eyelids closed but open to pain	1 = no eye opening
0 = eyelids remain closed with pain	
<b>Motor Response</b>	
4 = thumbs-up, fist, or peace sign	6 = obeys commands
3 = localizing to pain	5 = localizing pain
2 = flexion response to pain	4 = withdrawal from pain
1 = extension response to pain	3 = flexion response to pain
0 = no response to pain or generalized myoclonus status	2 = extension response to pain
	1 = no motor response
<b>Brainstem Reflexes</b>	
4 = pupil and corneal reflexes present	5 = oriented
3 = one pupil wide and fixed	4 = confused
2 = pupil or corneal reflexes absent	3 = inappropriate words
1 = pupil and corneal reflexes absent	2 = incomprehensible sounds
0 = absent pupil, corneal, and cough reflex	1 = no verbal response
<b>Respiration</b>	
4 = not intubated, regular breathing pattern	
3 = not intubated, Cheyne–Stokes breathing pattern	
2 = not intubated, irregular breathing	
1 = breathes above ventilator rate	
0 = breathes at ventilator rate or apnea	

FOUR score has an ability to identify lock-in syndrome, uncal herniation, brainstem death, vegetative status, MCS (minimally conscious state), and to evaluate level of intubated patient's consciousness. The whole of decrease consciousness of patients' evaluation are the help for initial decision, to evaluate the needs of addition neurological consultation, more effective triage to ICU, neuroradiology, or surgery room. Inpatients probability is higher in low FOUR score compare to low GCS.<sup>1,3,5-7</sup> FOUR score classification are for the range of 0-7 means high mortality rate, 8-14 means middle mortality rate, and 15-16 indicates low mortality rate.<sup>7</sup>

In this correlative prospective study, 27 of severe head injury patients were evaluated by applying GCS and FOUR score to determine their level of consciousness. The correlation of these two score was then evaluated. In this study, we obtained that the higher the consciousness level based on GCS score the higher also the levels obtained by FOUR score and vice versa. The correlation graph is pictured on Figure 3. The figure reveals, that the FOUR score is positively correlated to GCS score in which increase of FOUR score in line with increase of GCS score.

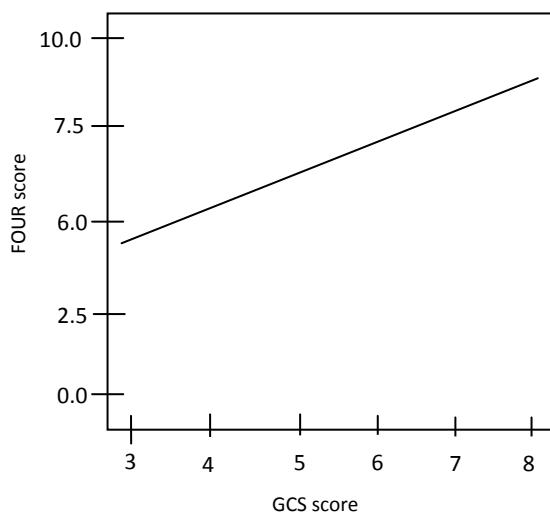


Figure 3  
The Correlation Graph of FOUR score and GCS Score.

In this study, it was obtained that the Pearson correlation coefficient is 0.627 with  $p < 0.05$ . This indicates that there was a positive correlation between FOUR score and GCS score in the severe head injury cases. This results proven the hypothesis of positive correlation between the two scores. This research also supported the finding of Wijdicks, et al. (2005).<sup>1</sup>

## CONCLUSION

Based on the research results, therefore, it can be concluded that the FOUR score can be applied

as a reference to evaluate consciousness patients' status in management of head injury, especially severe head injury. The FOUR score was also more practical, therefore, can be adopted by many clinicians, resident, physician, and can be applied in intensive care unit.

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