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A COMPARATIVE ANALYSIS OF GLASGOW COMA SCALE SCORE WITH FULL OUTLINE OF UNRESPONSIVENESS SCORE IN ASSESSMENT OF PATIENTS WITH TRAUMATIC HEAD INJURY IN INTENSIVE CARE UNIT: A TERTIARY CARE CENTRE STUDY

G. K. Vishwas, Bojja Paul Shravan Kumar, Ubaid Zaheer Siddiqui and B. R. Kiran *

Department of Anesthesiology and Critical Care, S. S. Institute of Medical Sciences, Davangere - 577005, Karnataka, India.

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Correspondence to Author:
Dr. B. R. Kiran

Associate Professor,
Department of Anesthesiology and Critical Care, S. S. Institute of Medical Sciences, Davangere - 577005, Karnataka, India.

E-mail: drkiranbr@gmail.com

ABSTRACT: Background: Neurological assessment of traumatic brain injury patients is of prime importance as it affects the therapeutic and prognostic decisions. GCS (Glasgow Coma Scale), a well recognised and often used scoring system in such cases has some drawbacks. We compared FOUR score (Full Outline of Unresponsiveness) with GCS with an objective to test its validity as an alternative to assess the severity of traumatic brain injury. **Methods:** This was a descriptive study, conducted on 70 patients admitted to the neurosurgical ICU of a tertiary hospital of a Medical college in Karnataka, India. In these patients, FOUR score and GCS were assessed at the time of presentation and serially thereafter up to a week. The predictive value and the correlation between full outline of unresponsiveness score and Glasgow Coma Scale was studied. **Results:** Most of the patients presenting with traumatic brain injury were males (84%) and belonged to younger age group of 18 to 30 years (48.6%). A statistically significant correlation was found between Full outline of unresponsiveness score and Glasgow Coma Scale in estimating the severity of head injury. FOUR score also furnished better details about the neurological status of these patients. **Conclusion:** Full outline of unresponsiveness score can be used as an ideal replacement to GCS in evaluation of patients with traumatic head injury.

INTRODUCTION: Traumatic brain injury (TBI) is one of the leading causes of trauma related morbidity and mortality in the world. The victims of TBI have varying degrees of insults to the brain ranging from mild injuries to vegetative state. The need of therapeutic interventions and prognostication of such patients requires continuous and reliable neurological assessment by the expert medical professionals.

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The clinical findings keep fluctuating in such patients due to the possible secondary injury to the brain during the stay in intensive care unit. So, repeated, simple yet meticulous monitoring of these patients can be done with various neurological scoring systems. One such scoring is GCS-Glassgow Coma Scale which is been used with widespread recognition since many years since it is easy to use and reproduce [1].

GCS although reliable is not without drawbacks like misinterpretation of verbal response in intubated or aphasic patients, and an inconsistent interobserver reliability and predictive validity [2]. The recently developed FOUR score has four components - eye response, motor response, brainstem reflexes and respiration pattern [3].

It is not reliant on the verbal response. GCS is also criticized for not including brainstem reflexes which indicate the activity of brainstem arousal systems. Although GCS is being widely used to assess patients with head injury across the world, some degree of errors are reported when the GCS is assessed by medical care providers.

FOUR score has been developed to overcome such shortcomings of GCS. It is simple to use, provides information regarding neurological condition of the patient and includes the minimal necessity components of neurological testing in impaired consciousness. It includes the estimation of brain stem reflexes, determination of eye opening, a broad spectrum of motor responses, and the presence of anomalous breath rhythms and a respiratory drive [4]. So, we framed our study with a primary objective to evaluate the correlation between GCS and FOUR score in the assessment of level of consciousness in patients presenting with traumatic brain injury.

MATERIALS AND METHODS: This study was carried out at a tertiary hospital of a Medical college in Karnataka, India which caters to a large number of patients with major traumatic head injuries. Institutional Ethics Committee approval was obtained (IERB NO: 538-2022). The study was done as a Descriptive study done from June 2021 to July 2022. Patients aged 18- 80 years, who were admitted at the Neurosurgical ICU within 24 hours of radiologically documented traumatic brain injury, were included in the study. We excluded Patients with non-traumatic brain injuries from the study. The sample size was set at 70 based on values available from similar studies.

On admission, the patients' history was noted. Data was collected using a structured proforma, after obtaining consent from the immediate relatives. After the primary survey, patients were managed according to the ATLS protocol. Subsequently, they underwent definitive evaluation and managed with antiepileptics, antibiotics, sedatives and in some cases mechanical ventilation or neurosurgical procedures at the Neurosurgical ICU. At the time of admission, the patients were assessed for their GCS and FOUR scores. The assessment was done by the same person to reduce observer variation and a standard scheme of testing was followed. This was repeated at 1 hour and 6 hours after admission and on a daily basis till discharge or death of the patient. Regular follow-up was done to continue the neurological monitoring. Daily assessment of clinical, biochemical and radiological parameters was also done during the ICU stay of the patients. SPSS ver. 20.0 (SPSS Inc., USA) was used for statistical analyses and the level of statistical significance was set at $p < 0.05$. Data was analysed by Pearson coefficient correlation to find out the statistical correlation between GCS and FOUR scores.

RESULTS: In this study of 70 patients, 11(7.7%) females and 59(84.3%) males were included. Most of the patients presenting with head injury were between the age group of 18 to 30 years (48.6%) followed by age group of 30 to 45 years (30%). Road traffic accidents contributed to the majority of head injuries (83% in all subjects studied and 90% in severe head injuries). Falls from a height seconds the list. (12% in all subjects and 6% in severe head injuries).

TABLE 1: DEMOGRAPHIC DATA OF PATIENTS

Age (Years)	Male	Female	Total
18-30	32	02	34(48.6%)
31-45	17	04	21(30%)
46-60	08	01	09(12.8%)
60-80	05	01	06(8.6%)
Total	62 (84%)	08(16%)	70(100%)

When the whole of study population is taken, the highest GCS score of 15 was found in 9 patients (20%), GCS of 6 in 10 patients and GCS of 3 seen in 9 patients **Fig. 1**. 11 patients in the study group had a full FOUR score of 16 **Fig. 2**. A FOUR score of 10 or less was found in 32 patients. Among patients with severe traumatic brain injury, the FOUR score values had a wider range of distribution. The Correlation between GCS and FOUR score at presentation on Day 1, day 2 and day 3 has been represented in **Fig. 3, Fig. 4** and **Fig. 5** respectively.

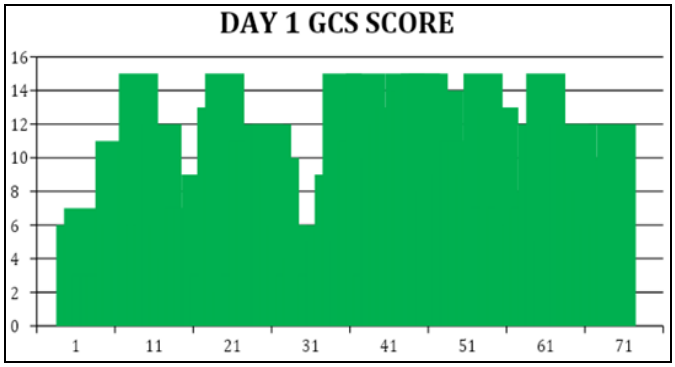

FIG. 1: GCS SCORE AT PRESENTATION ON DAY 1

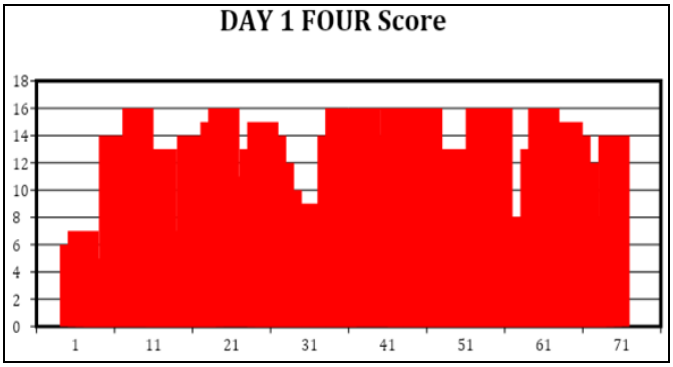

FIG. 2: FOUR SCORE AT PRESENTATION ON DAY 1

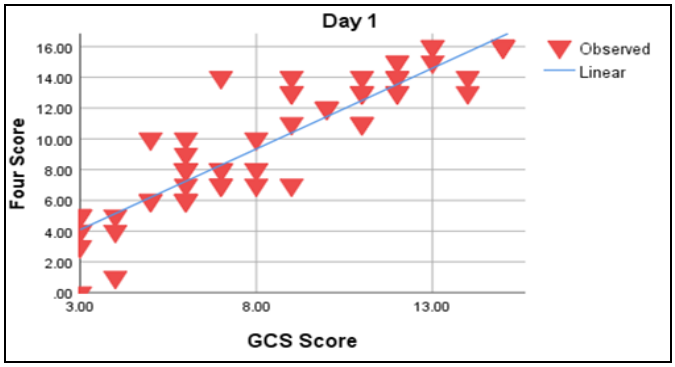

FIG. 3: CORRELATION BETWEEN GCS AND FOUR SCORE AT PRESENTATION ON DAY 1

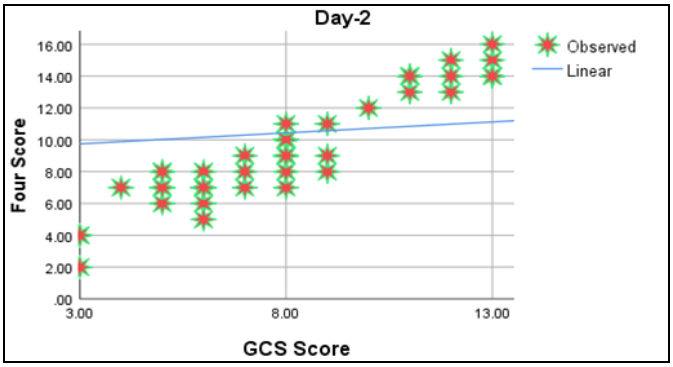

FIG. 4: CORRELATION BETWEEN GCS AND FOUR SCORE AT PRESENTATION ON DAY 2

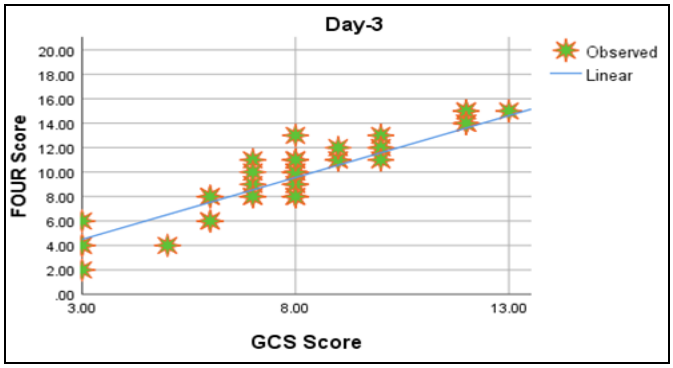

FIG. 5: CORRELATION BETWEEN GCS AND FOUR SCORE AT PRESENTATION ON DAY 3

TABLE 2: CORRELATION BETWEEN GCS SCORE & FOUR SCORE

Pearson correlation coefficient			
Time Interval	**r Value**	**P Value**	**N**
Day-1	0.928	P<0.001	70
Day-2	0.429	P<0.001	68
Day-3	0.956	P<0.001	54
Day-4	0.904	P<0.001	41
Day-5	0.963	P<0.001	26
Day-6	0.973	P<0.001	12

The Pearson correlation coefficient between FOUR score and GCS was calculated from day 1 to day 6 of stay in ICU. As per the values in **Table 2**, the p values were calculated to be less than 0.05 in all the cases which is statistically significant and hence there is an excellent correlation between the two scores.

DISCUSSION: This descriptive study was undertaken to assess the efficacy of FOUR score in assessing patients with head injury. FOUR score is easy to learn, has very good inter-rater reliability and provides a more accurate picture of, or in combination with the GCS [5]. FOUR score was developed for the assessment of the level of

consciousness in patients admitted to a neuro intensive care unit with a purpose of improving the standardised assessment of consciousness in patients who are intubated or have focal neurological deficits [6].

FOUR score had better prediction than previous scale for classifying and communicating impaired consciousness [7], in emergency department after cardiac arrest [8] and in intensive care units. This new score when compared to GCS does not require assessment of verbal response and also provides better neurological details by inclusion of brainstem reflexes and breathing patterns [9]. Another study concluded that the FOUR score appears to be an easier tool to use and it provides a more comprehensive neurological assessment [10].

FOUR score is more capable than GCS for prediction of discharge and mortality in patients admitted to the PICU [11]. Also, all components of the FOUR score could be rated even in intubated patients. In our study, most of the patients presenting with head injury were between the age group of 18-30 years which could be attributed to the motor vehicle accidents as the most common mechanism of head injury where in younger people are often involved. This association of head injuries with motor vehicle accidents also explains as to why males (84%) outnumber females (16%) by a large ratio. Kodliwadmath, H *et al* [12] also presented similar results where patients having brain injury were predominantly males (87.8%) with majority of the cases compromising the middle age group population.

These results were replicated by Gorji MA *et al* [13] with a mean age group of 33.80 ± 12.60 years and male predominance (79.2%) over females (20.8%). The FOUR score poised around the maximum of 16 in most of the studied patients. Among severe head injury patients with GCS 0f 8 or less, the FOUR score was found to be distributed in a wider range. It was found that patients with higher level of consciousness as per GCS score had higher FOUR score values and vice versa. When the GCS score improved over a period of time, a similar improvement in FOUR score was also noted. Also, it was noted that the FOUR score could furnish out more details about the neurological status of the patients and hence turned out to be more informative. Five cases went discharge against medical advice and hence could not be followed up for recovery or mortality. As derived from the table, there is excellent correlation between the two scores from Day 1 to day 6. In all cases the p values were calculated to be less than 0.05, which is of statistical significance. Our results are similar to the findings from previous studies which compared FOUR score with GCS. In a study by Keerthi Sri *et al* [14] there was a significant positive correlation found between GCOS, FOUR score and GCS in the study population. The comparable results to present study were found by Nair S *et al* [15] with strong association between FOUR score and GCS, reported at presentation, after one hour and after six hours in patients with mild, moderate and severe head injuries.

Jalali R *et al* [10] concluded that the FOUR score is a simpler tool to use and it offers a more thorough neurological assessment. As per the results of this study, GCS and FOUR scores show comparable results in the assessment of patients with Traumatic Brain Injury. There is an excellent statistical correlation between the two scoring systems. Additionally, FOUR score furnishes better details regarding the neurological status of the patient.

CONCLUSION: In patients with traumatic brain injury, FOUR score appears to be an appropriate tool to evaluate the level of consciousness and thus helps in the management of these patients. Hence it is can definitely be used as a ideal alternative to GCS in neurosurgical critical care units.

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