

Novel Modification of Four To Four-P Score: A Comparative Analysis with GCS in Head Injury Patients with Poly Trauma

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Abstract

Overview: Head injuries are among the leading cause of morbidity and mortality across the world. Adequate, expeditious assessment and early intervention is of utmost importance for favorable outcome in patients with head injury. GCS and FOUR score are the widely accepted tool to quickly assess the severity in head injury patients and prognosticate, albeit with limitations. The objective of this study was to test the adequacy of FOUR-P score, as an alternative tool, to assess the severity and prognosticate the patients with head injury in poly trauma patients. **Methods and Materials:** This was a comparative study, conducted on 100 patients of poly trauma admitted to the trauma ward of Madras Medical College, Chennai. For all these patients, FOUR and FOUR-P score and GCS were calculated at the time of presentation and at 1st hour, 6th hour, 24th hour. The predictive value of FOUR-P score as well as its correlation with FOUR score and GCS was studied. **Results:** A statistically significant assessment and prognostication could be made using FOUR-P score when compared to FOUR score and GCS. Also FOUR-P was able to furnish better details about the neurological status of poly trauma patients. **Conclusion:** As per the results, it can be concluded that the FOUR-P score can be applied as an ideal tool for initial evaluation and prognostication in patients with poly trauma. It can be used as the ideal replacement for FOUR score and GCS. Further studies needed.

Keywords: FOUR and FOUR-P score; GCS; Poly trauma; Head injury.

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Introduction

Traumatic brain injury (TBI) is one of the serious causes of mortality and disability worldwide.¹ In India, it is estimated that nearly 1 million people get injured, 200,000 people die and another 1 million require rehabilitation services every year due to TBI.²

The Glasgow coma scale (GCS) was the result of two parallel international studies on coma and

prognosis of severe head injuries, which were funded by the National Institutes of Health. In 1974, Teasdale and Jennett published 'assessment of coma and impaired consciousness: A practical scale'.³

The GCS was designed mainly to improve the communication between physicians and nurses when describing the state consciousness and to avoid ambiguous terminologies such as "somnolence" and "unresponsiveness".⁴ GCS is being widely used to assess patients with head injury across the world. With no serious challenges raised in the last 15 years, it has certainly withstood the test of time.

Scoring in intubated patients also has been an Achilles' heel of GCS for too long. When intubated, some trauma centers give 1 point for verbal component, some give points for total GCS, while some others give 15 points for total GCS and a few assigned a "T" for the verbal component. Some authors mention the pseudo-scoring technique, i.e.

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replacing missing values with an average value of the testable score or assigning a score of ⁵ if patients seem able to talk, of ³ if there is questionable ability to talk and of ¹ if patients are generally unresponsive.⁵ With such approaches, the significance of verbal portion to the predictive value of GCS is reduced and may account for the disparity in mortality rates between different centers.⁶ Teasdale and Jennett themselves reported a high degree of consistency in eliciting responses by different assessors. But some degree of errors are reported when the GCS is assessed by both experienced and inexperienced medical care providers.⁷

By using appropriate tools for measuring the level of consciousness to evaluate the severity of the injury in head trauma patients, nurses will be able to prepare for taking critical measures for the injury in the shortest time and in the best possible way and reduce the disability and mortality of trauma patients.⁸⁻¹⁶

Many scoring models have been proposed to evaluate level of consciousness in patients who are affected with traumatic brain injuries, the most famous of which is Glasgow coma scale. This scale has some limitations such as its low efficiency in intubated patients, its poor use in cases of language differences, and not being able to evaluate the reflexes of brainstem.¹⁷⁻¹⁸

It was in 2005 that Wijdicks and his associates published a new coma scale, the FOUR score.¹⁹ FOUR score appears to be an easier tool to use and it provides a more comprehensive neurological assessment.²⁰

Aims and Objectives

To evaluate the effectiveness of assessment of trauma patients by addition of associated other injuries to the FOUR score in the form of P, making it a FOUR-P score. To assess if FOUR- P score is comparable to and has an advantage over FOUR score and GCS

Material and Method

It is a prospective study with a sample size of 100, aged 14-70 years. All poly trauma patients with associated head injury were included in the study. Study population included TBI with poly trauma patients arriving at MMC and RGGGH trauma ward. Patients with non-traumatic insults to the brain, alcoholics and pediatric population were excluded from the study.

FOUR -P scoring system

Component Tested	Score
<i>Eye Response</i>	
Eye lids open or opened, tracking or blinking to command	4
Eye lids open but not tracking	3
Eye lids closed but open to loud voice	2
Eye lids closed but open to pain	1
Eye lids remain closed to pain	0
<i>Motor Response</i>	
Thumbs up or fist or peace sign	4
Localizing to pain	3
Flexion response to pain	2
Extension response to pain	1
No response or generalized myoclonus status	0
<i>Brainstem Reflexes</i>	
Pupil and corneal reflexes present	4
One pupil wide and fixed	3
Pupil or corneal reflexes absent	2
Pupil and corneal reflexes absent	1
Absent pupil, corneal and cough reflex	0
<i>Respiration</i>	
Not intubated regular breathing patterns	4
Not intubated cheyne stokes breathing pattern	3
Not intubated, irregular breathing	2
Breathes above ventilator rate	1
Breathes at ventilator rate or apnea	0
<i>Poly-trauma</i>	
No associated injuries	4
All injuries requiring conservative treatment	3
Extremity injuries requiring intervention or thoracic injuries requiring ICD insertion without hypotension	2
Abdomen, thoracic or vascular injuries leading to hypotension	1
Patient on inotropes at admission	0

On admission, patients were managed according to the ATLS protocol, later the detailed history was noted and data collected using a structured pre-format. At the time of admission, the patients were assessed to chart out their GCS, FOUR and Four P scores. This was done by the same person to reduce observer variation and a standard scheme of testing was followed. FOUR and FOUR-P score and GCS were calculated at the time of presentation and at 1st hour, 6th hour, 24th hour. The level of

statistical significance was set at $p < 0.05$. Data was statistically analyzed by applying Pearson coefficient correlation. P in FOUR-P score Stand for poly trauma which includes other associated injuries which are graded from 0-4 based on the severity.

After admission, X rays, CT brain and USG were done as per requirement. Appropriate treatment protocols have been followed during the study. Surgical management or conservative treatment options were considered based on patient's clinical and radiological findings. Adequate ventilator, neuro-critical care and appropriate management of other associated injuries done after taking opinion from concerned specialty.

Results

The collected data were analyzed with IBM. SPSS statistics software 23.0 version. To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean and S.D were used for continuous variables. To assess the relationship between the variables Pearson's Correlation was used. To predict the agreement of comparability between the tools the Bland Altman plot was used. In all the above statistical tools the probability value .05 is considered as significant level

Discussion

GCS and FOUR score are existing established scoring systems to assess the level of consciousness in TBI patients.²¹ Several studies have showed FOUR score to be more comprehensive than GCS in assessing TBI patients. We sensed the importance of adequate management of associated systemic and general injuries in TBI patients. This was a descriptive study undertaken to find whether FOUR-P score can be an effective tool in assessing head injury patients with associated poly-trauma.

Most common age group of 20-50 years (Fig. 1 and 3) and mode of injury in most cases was motor vehicle accidents (Fig. 2 and 4). Most common associated injuries were lung and thorax related followed by abdominal and long bone injuries (Fig. 4). The FOUR score hovered around the maximum of 16 in many of the studied patients and so was corresponding FOUR-P score to 20. When the GCS score improved over a period of time, a similar improvement in FOUR score was also noted

but FOUR-P score varied depending upon the associated injuries. It was quite evident that the FOUR score could furnish out more details about the neurological status of the patients.

Our results concurred with the findings from similar studies which compared FOUR score with GCS. A research conducted in 2014 on head injury patients, revealed that FOUR is an applicable tool for high predictive power of outcomes in discharge time for patients with TBI.²² The authors suggested that FOUR score could be used in the first 24 hours of admission of patients with TBI. By including associated injuries along with FOUR score it was more easy to categorize the patients and prioritize the treatment plans. Another study found that the inter-rater agreement of FOUR score results was excellent among medical intensivists.²³

The Pearson correlation coefficient between FOUR, FOUR-P score and GCS were calculated to be (0.980 & 0.964), (0.974 & 0.958), (0.988 & 0.980) and (0.989 & 0.983) respectively at the time of presentation, after 1 hour and after 6 hours and at 24 hours (Fig. 5-8). As derived from the graphs, there is excellent correlation between the two. In all cases the p values were calculated to be less than 0.05, which shows that the correlation is not due to chance, but is of statistical significance.

The Bland-Altman plot (Bland & Altman, 1986 and 1999), or difference plot, is a graphical method to compare two measurements techniques. In this graphical method the differences (or alternatively the ratios) between the two techniques are plotted against the averages of the two techniques. The presentation of the 95% limits of agreement is for visual judgment of how well two methods of measurement agree. The smaller the range between these two limits the better the agreement is (Fig. 9-16).

In line with our study, the results of the study by Sahin et al. (2015) in evaluation of 105 patients also showed that GCS and FOUR score have similar value in prediction of patient mortality and can be used interchangeably.²⁴ The findings of Gujjar et al. study showed that FOUR score is a better scale compared to GCS for evaluation of changes in level of consciousness in medical wards.²⁵ In contrast to these findings, the results of the study by Nair et al. (2017) showed that there is a statistically significant difference between FOUR score and GCS in estimating the severity of injury in head traumas. They reported that FOUR score is a better index for evaluating the level of consciousness in patients with head trauma.²⁶

As per the study results of our study, FOUR and FOUR-P scores show comparable results with GCS in the assessment of patients with Traumatic Brain Injury, with added advantage of including poly-trauma patients in FOUR-P score. There is excellent statistical correlation between the scoring systems. Additionally, FOUR score furnishes better details regarding the neurological status of the patient, so does the FOUR-P score by being more comprehensive in giving information about associated injuries

Study Limitations

Small sample size, associated facial injuries being very common not categorized in the score. Extremes of age excluded. Short duration of the study and study did not include the treatment.

Conclusion

The FOUR-P score can be applied as an effective reference to evaluate consciousness status and associated injuries in management of TBI with poly-trauma patients. It can be a good guide for clinician in detecting and stratifying patients of TBI with poly-trauma in emergency ward.

Abbreviations: FS-Four score, FSP-Four-P score, GCS- Glasgow coma scale, TBI- Traumatic brain injury.

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