



Comparison between FOUR score and GCS in assessing patients with traumatic brain injury

A. Ramya¹, C.M. Santhosham^{2*}, P. Saravana Kumar³

¹MEM/CCT-EM Resident, Kauvery Hospital, Cantonment, Trichy, Tamil Nadu

²Critical Care Specialist, Kauvery Hospital, Cantonment, Trichy, Tamil Nadu

³HOD Critical Care, Kauvery Hospital, Cantonment, Trichy, Tamil Nadu

*Correspondence

Abstract

Background: Head injuries are a major cause of morbidity and mortality across the world. To ensure the maximum favourable outcome, effective initial assessment and early intervention is of importance in patients with traumatic brain injury. Distinctive approaches to determining severity early after injury include neuroimaging, assessing the presence of an altered consciousness or loss of consciousness, assessing the presence of posttraumatic amnesia, and applying the various traumatic severity assessing scores like Glasgow Coma Scale score. The Glasgow Coma Scale is a clinical tool designed to assess coma and impaired consciousness and is one of the most commonly used TBI severity scoring systems. The “Full Outline of Unresponsiveness (FOUR) score,” a novel scale created to provide a more thorough assessment. The FOUR score offers extra details that the GCS cannot estimate, such as brainstem reflexes, visual tracking, breathing patterns, and respiratory drive.

Keywords: GCS; FOUR score; Brain injury

Aim: To evaluate the efficacy of FOUR score in comparison with GCS score on the day of arrival, Day 1 and Day 2 of traumatic head injury patients.

Materials & Methods: This is a prospective observational study conducted in the Emergency medicine department of Kauvery speciality hospital, Trichy. Patients primarily presenting to ER with head injury are included in the study. Glasgow Coma scale and FOUR score are recorded for all the head injury patients on the day of admission, on Day 1 and Day 2 with their demographic details. Data will be noted in proforma and calculated using SPSS.

Results: In our study population majority belonged to above 40 years of age and majority were male patients. The correlation between FOUR score for all 3 days were strong with GCS for all 3 days.

Citation: A. Ramya, C.M. Santhosham, P. Saravana Kumar. Comparison between FOUR score and GCS in assessing patients with traumatic brain injury. *Kauverian Med J.* 2026;3(3):62-78

Academic Editor: Dr. Venkita S. Suresh

ISSN: 2584-1572 (Online)



Copyright: © 2026 by the authors. Submitted for possible open access publication under the terms and conditions.

Conclusion: Our results shows that FOUR score have better ways to predict the neurological implications for brain stem reflexes at a early period than GCS

1. Introduction

Brain Injury Definition and its assessment types:

Traumatic Brain injury is defined as an insult to the brain from an external force that leads to temporary or permanent impairment of cognitive, physical, or psychosocial function. TBI is a form of acquired brain injury, and it may be open (penetrating) or closed (non-penetrating) and can be categorized as mild, moderate, or severe, depending on the clinical presentation. A traumatic brain injury, can occur due to various circumstances which can result in physiologic or structural brain damage. The circumstances may be blunt, non-penetrating TBI injury; penetrating injury; and blast injury.^{1,2}

Blunt, Non-Penetrating TBI: Brain injury from this mechanism has two phases. The first phase occurs as a direct result of the initiating traumatic event; the second involves a cascade of several neuropathologic processes continuing for weeks to months after the initial injury. The first phase can cause death immediately. The secondary injury phase begins immediately after the primary phase and involves a progression of axonal injury, with shifts in ionic flux leading to axonal swelling, a loss of axonal transport, and altered neurotransmission.³

Penetrating TBI: A TBI may be open (penetrating) or closed (non-penetrating). A penetrating TBI occurs when physical, external forces disturb the brain and an object enters the brain tissue. A non-penetrating (closed) head injury is caused by an external force that produces movement of the brain within the skull. Bullet injuries, such as gunshot wounds, are a common cause of TBI, and are classified as either penetrating or perforating depending on how the bullet traverses the head. In penetrating injuries, the object enters and lodges within the cranial cavity. Perforating injuries occur when the object traverses the cranial cavity and leaves through an exit wound. The extent of damage is governed by the shape and mass of the missile and by its direction.⁴

2. Assessment of TBI using various scales like GCS, GCS-P, FOUR Score, etc

Distinctive approaches to determining severity early after injury include neuroimaging, assessing the presence of an altered consciousness or loss of consciousness, assessing the presence of posttraumatic amnesia, and applying the Glasgow Coma Scale score. That score has been the gold standard of neurologic assessment of trauma patients since its development by Teasdale and Jennett. The Glasgow Coma Scale is a clinical tool designed to assess coma and impaired consciousness and is one of the most commonly used TBI severity scoring systems. Other TBI severity-classification systems grade single indicators, such as loss of consciousness and the duration of posttraumatic amnesia. The predictive value of those measures has been demonstrated but each may be influenced by factors unrelated to or only indirectly related to the severity of TBI (e.g., intoxication). The severity of a TBI might range from mild to severe. All are similar in that those individuals with TBI experience just a brief loss of consciousness or even an alteration of consciousness without complete loss. However, GCS is widely used across the world, there are few drawbacks including inability of understanding of verbal component in intubated patients, inability to evaluate brain stem reflexes and incapacity to

grade breathing pattern. Adding these declared components to GCS could provide better data about prognosis.

2.1 Four score and its application on brain injury

The “Full Outline of Unresponsiveness (FOUR) score,” a novel scale created to provide a more thorough assessment. The FOUR score offers extra details that the GCS cannot estimate, such as brainstem reflexes, visual tracking, breathing patterns, and respiratory drive. As it does not depend on a judgement of the vocal response, it is also more useful for assessing severely ill intubated cases. The FOUR score assesses four factors – Eye reaction, Motor response, Brain stem reflexes, and Respiratory pattern – each of which is given a maximum value of four.

2.2 Rationale for the study

Based on GCS deficiencies and difference of opinion to predict the outcome, a recalibration of study needs to be done to demonstrate a similar test performance with a better outcome. Therefore, the present study was undertaken to evaluate the efficacy of FOUR score in comparison with GCS score on the day of arrival, Day 1 and Day 2 of traumatic head injury patients.

3. Objectives

- To evaluate the efficacy of FOUR score in comparison with GCS score on the day of arrival, Day 1 and Day 2 of traumatic head injury patients.
- To find the correlation between FOUR score and GCS score on the day of arrival, Day 1 and Day 2 of traumatic head injury patients.

4. Materials and Methods

Study Design: A prospective observational study which was carried out in our tertiary care centre over a period of one year

Population and Criteria of selection: The selected population was 80. All traumatic head injury patients who primarily presented to Emergency Medicine Department (ED) of Kauvery speciality Hospital, Trichy.

The inclusion criteria were

- Traumatic head injury
- Age group of 18 to 60 years
- The exclusion criteria were
- Intoxicated patient
- Known psychiatric disorder
- Patients transferred from elsewhere- post-stabilisation
- Duration of injury more than 24 hr on arrival

- Associated Polytrauma

4.1 Collection of Data

Patients were assessed by trained emergency medicine residents. A specially designed proforma was filled for each patient which includes demographic data, mode of injury, duration of trauma, vital parameters, GCS and FOUR scores. The GCS was interpreted using the sum of the scores for these three components, with a maximum score of 15 and a minimum score of three. Similar to this, the FOUR score components – Eye response, Motor response, Brainstem reflexes, and Respiratory pattern – were assessed. Each category was scored from zero to four, with zero being the worst and four being the best. The lower the value in both scoring systems, the poorer is the prognosis.

4.2 Analysis of Data

The comparison between GCS and FOUR score was done. Thus, the better scale in the prediction of better outcome is assessed. Complete record of the case was entered in the standardised data collection form (proforma of the study). All statistical analysis was done by using SPSS software with version 26.0. Quantitative variable was represented by descriptive statistics and qualitative variable were represented by frequency and percentages. Chi-square test and Fisher's exact test was used to find out association between the categorical variables. Correlation coefficient test was used to find out Degree of relationship between the variables. Independent 't'-test was used to find the significance difference between groups. $P < 0.05$ was considered as statistically significant. The Bayesian Method was used to find the in ROC Curve and Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Diagnostic Accuracy.

5. Review of Literature

- In 2023 Study by Sandeep Singh et al., conducted on 70 patients presented to emergency surgery ward with traumatic head injury. The correlation between FOUR score and GCS was calculated for each patients. They concluded that both scoring systems have good and comparable prediction values to each other, but the four score has added benefit of assessing brainstem reflexes and respiration and does not have a dependence on verbal response.
- In 2023 Nishanth Agarwal et al., conducted a study that included 50 TBI patients admitted in the ICU and assessed GCS, GCS-P and FOUR score to predict outcome among patients with traumatic brain injury. they concluded that gold standard GCS score compared to the GCS-P and FOUR score shows the best correlation with outcome in patients with mild to moderate TBI. Above scores are excellent predictors with strong positive linear correlation with final outcome prediction. In particular the GCS score has the best correlation with final outcome.
- In 2023 Sri keerthi et al conducted a study on 125 patients with traumatic head injury. The GCS and FOUR scores were determined for each of these instances on the day of arrival at the emergency department (ED), and GCOS was used to score the results. Next, the correlation between each of the three scores was determined and study revealed a significant correlation was found in FOUR Score when compared with GCS and concluded that FOUR score is a better tool for prognostication.

- In 2019 Jamileh Ramazani et al conducted a study in 300 patients admitted in MICU. The FOUR Score and GCS were calculated in the first admission 24hrs.it was concluded that both scores are valuable scales for predicting outcome however the FOUR score showed better discrimination and calibration than GCS, so FOUR Score is superior to GCS in predicting outcomes of patients.
- In 2016 Sarath S.Nair et al conducted a study in 69 patients admitted to the general surgical and neurosurgical wards with traumatic head injury. FOUR Score and GCS were calculated at the time of presentation and serially thereafter for all these patients.it was concluded there was a statistically significant correlation was found between these scores and also FOUR was able to furnish better details about the neurological status of trauma patients.
- In 2016 Amrit saika et al conducted a study in 138 patients admitted with TBI.FOUR Score and GCS were calculated at time of admission and were aimed to compare the predictability for early mortality after moderate and severe TBI. It was concluded that the predictive value of the FOUR Score on admission of patients with TBI is no better than the GCS Score.

6. Evaluation

Level of consciousness (LOC), altered mental status (AMS), post-traumatic amnesia (PTA), and Glasgow coma scale (GCS) are used in the evaluation of the severity of the TBI (see table 1).

Moreover, recent studies recommend the implementation of the portable cognitive assessment tools at the time of the incidence of the TBI as a potential indicator for the long-term effects. Canadian CT head rule, Revised Trauma scale, Circulation, Respiration, Abdomen, Motor and Speech(CRAMS) scale, Trauma grading system, Ranko scale, Rador scale, FOUR score, GCS are some of the scales used to find the severity of the patients.

7. Classification of Severity of TBI

The relationship between the GCS Score and outcome is the basis for a common classification of acute traumatic brain injury:

- Severe, GCS 3 to 8
- Moderate, GCS 9 to 12
- Mild, GCS 13 to 15

8. Results

Demographics



Fig (1): Age wise distribution of study population

Among the 80 study participants 5(6.3%) belonged to <20 years of age group, 15(18.8%) belonged to 21- 30 years of age, 14(17.5%) belonged to 31-40 years of age, 23(28.7%) belonged to 41-50 years of age, 23(28.7%) belonged to >50 years of age group as seen in Fig.1.

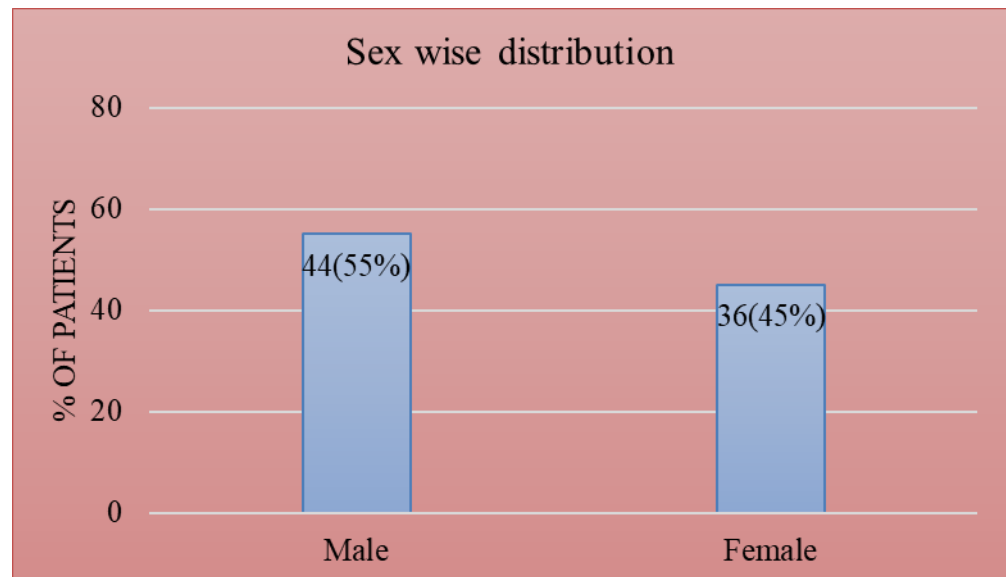


Fig (2): Sex wise distribution of study population

Among the 80 study participants 44(55%) were males and 36(45%) were females as shown in Fig 2.

Mode of Injury

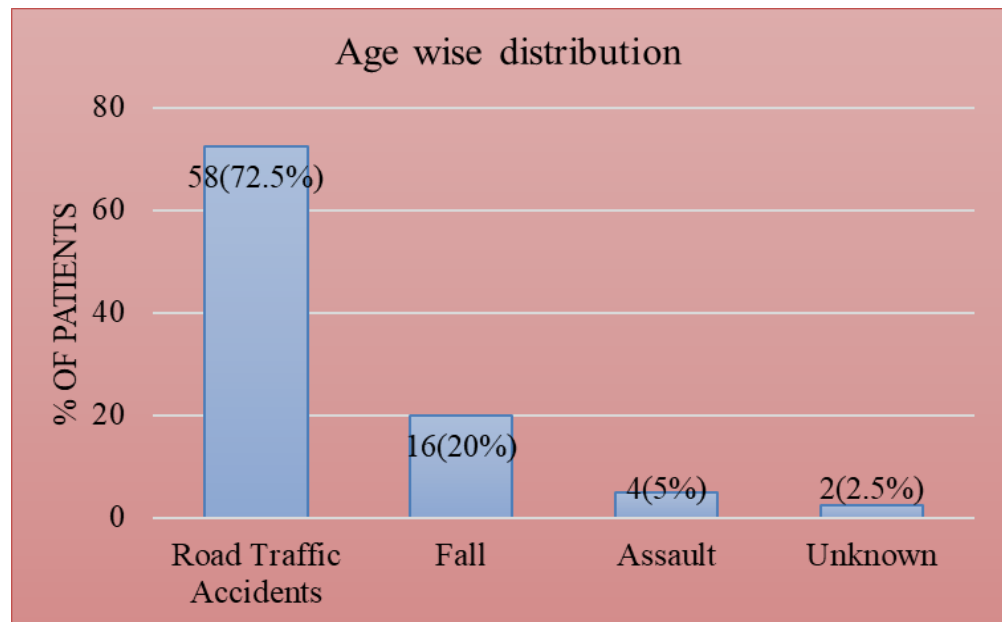


Fig (3): Mode of Injury

Among the 80 study participants 58(72.5%) met with road traffic accidents, 16(20%) had a fall, 4(5%) were involved in assault and 2(2.5%) were of unknown reasons figure.3.

Co-morbidities

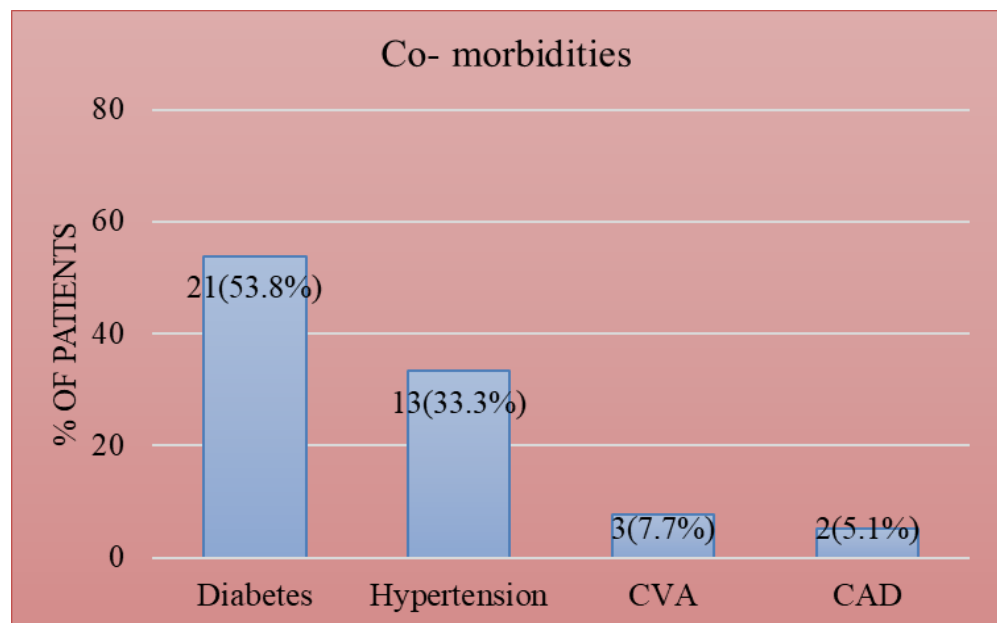


Fig (4): Co-morbidity status of study population

Among the 80 study participants 21(53.8%) had previous history of Diabetes Mellitus, while 13(33.3%) had previous history of hypertension, 3(7.7%) had previous history of cerebrovascular accident and 2(5.1%) had previous history of Coronary Artery Disease as seen in Fig.4.

Diagnosis

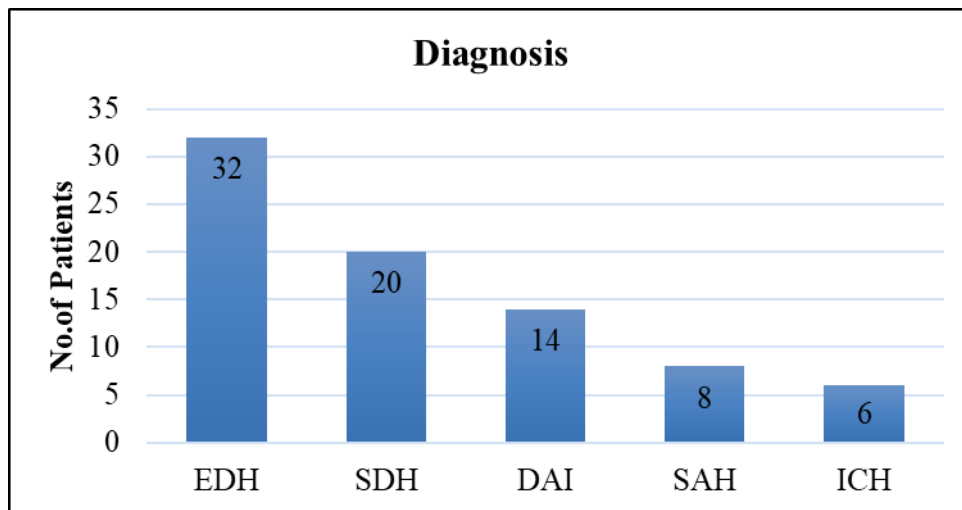


Fig (5): Diagnosis of study population

Among the 80 study participants, 32(40%) had extradural hematoma,20(20%) had subdural hematoma,14(17.5%) had diffuse axonal injury,8(10%) had subarachnoid hematoma,6(7.5%) had intracerebral hematoma.

Table. 1: Age vs Outcome of the patient

Outcome		Mean	SD	P-Value
Age	Alive	40.7	12.5	0.061 NS
	Death	49.4	11.7	

In our study it was found that the mean and standard deviation of alive patients was found to be 40.7± 12.5 while among the dead patients mean and standard deviation was found to be 49.4± 11.7, it was also found that there is no significant association between Age and `outcome of the patient as seen in Table. 1.

Table. 2. Sex vs Outcome of the patient

Parameter	Outcome		Total	P-Value	
	Alive	Death			
Sex	Male	40	4	44	0.499 NS
		56.3%	44.4%	55.0%	
Female	31	5	36		
		43.7%	55.6%	45.0%	
Total	71	9	80		
	100.0%	100.0%	100.0%		

In our study it was found that out of the 44 patients 40(56.3%) of the patients were alive and 4(44.4%) were dead, out of 36 female patients 31(43.7%) were alive and

5(55.6%) were dead and it was also found that there is no significant association between the Sex of the patient and the outcome of the patient as seen in Table.2

Table.3 GCS vs FOUR scores on each day

Parameter		Day 0 n(%)	Day 1 n(%)	Day 2 n(%)
FOUR Score	<8	13(16.3)	34(42.5)	30(38.5)
	9 – 12	21(26.3)	34(42.5)	20(25.6)
	13 - 16	46(57.5)	12(15.0)	28(35.9)
GCS	<8	17(21.3)	42(53.8)	44(56.4)
	9 – 12	16(20.0)	20(25.6)	9(11.5)
	13 - 15	47(58.8)	16(20.5)	25(32.1)

In our study on admission 46(57.5%) patients were having a FOUR score of 13-16, while 47(58.8%) patients were having GCS of 13-15. As the day progressed majority of the patients GCS and FOUR score deteriorated as seen in Table. 3.

Table.4: Correlation between GCS vs FOUR Score

Parameter		Four Score D0	Four Score D1	Four Score D2	GCS D0	GCS D1	GCS D2
Four Score D0	Pearson Correlation	1	.532**	.488**	.821**	.500**	.544**
	Sig.(2-tailed)		.000	.000	.000	.000	.000
Four Score D1	Pearson Correlation	.532**	1	.812**	.517**	.877**	.702**
	Sig.(2-tailed)	.000		.000	.000	.000	.000
Four Score D2	Pearson Correlation	.488**	.812**	1	.494**	.853**	.917**
	Sig.(2-tailed)	.000	.000		.000	.000	.000
GCS D0	Pearson Correlation	.821**	.517**	.494**	1	.517**	.575**
	Sig.(2-tailed)	.000	.000	.000		.000	.000
GCS D1	Pearson Correlation	.500**	.877**	.853**	.517**	1	.872**
	Sig.(2-tailed)	.000	.000	.000	.000		.000
GCS D2	Pearson Correlation	.544**	.702**	.917**	.575**	.872**	1

	Sig.(2-tailed)	.000	.000	.000	.000	.000	
**. Correlation is significant at the 0.01 level (2-tailed).							

In our study by using 2-tailed T test FOUR score for Day 0 and GCS score for Day 0 were strongly correlated with a pearson correlation value of 0.821, FOUR score for Day 1 and GCS score for Day 1 were strongly correlated with a pearson correlation value of 0.877 and FOUR score for Day 2 and GCS score for Day 2 were strongly correlated with a pearson correlation value of 0.917 as shown in table 4.

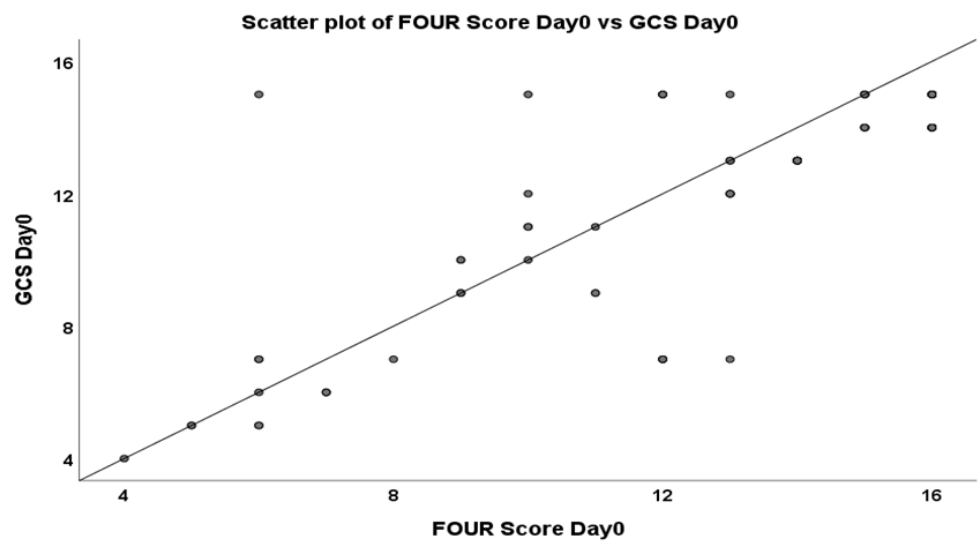


Fig (6): Scatter plot of GCS Day 0 vs FOUR score Day 0

The scatter diagram for GCS Day 0 vs FOUR score Day 0 also proves that all the variables are strongly correlated as the reference line is formed as a straight line as shown in Figure 6

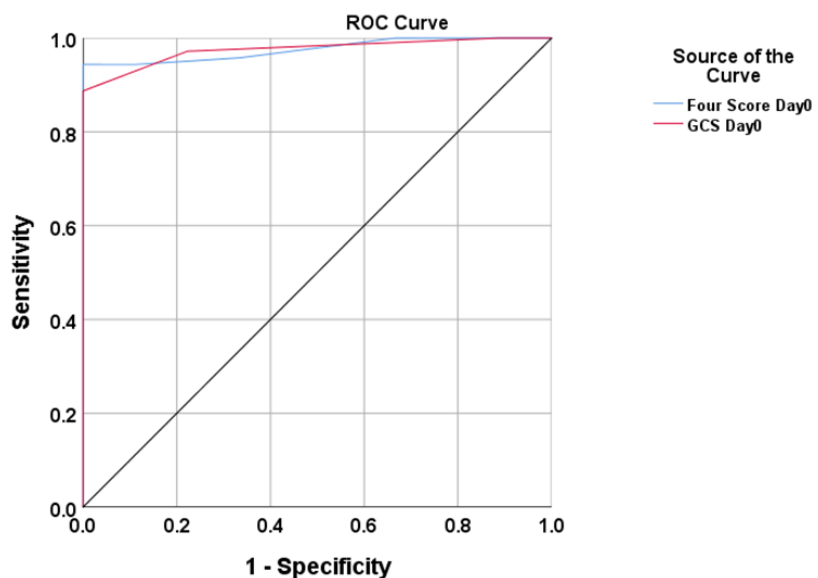


Fig (7): ROC curve for GCS Day 0 and FOUR score Day 0

Table.5: Area under the curve for GCS Day 0 and FOUR score Day 0

Area Under the Curve	Area	Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
Four Score Day0	.976	.000	.946	1.000
GCS Day0	.975	.000	.944	1.000

Table.6. Diagnostic value of GCS Day 0 and FOUR score Day 0

Parameter	FOUR Score Day0	GCS Day0
Sensitivity	100%	100%
Specificity	80.28%	88.73%
Positive Predictive Value	39.13%	52.94%
Negative Predictive Value	100%	100%
Diagnostic Accuracy	82.50%	90%

In our study the area under the curve for Four Score Day0 is 0.976 in which the lower bound value and upper bound value for 95% Confidence Interval is 0.946 and 1.00 respectively and the area under the curve for GCS Day 0 is 0.975 in which the lower bound value and upper bound value for 95% Confidence Interval is 0.944 and 1.00 respectively as seen in Figure 7 and Table 5.

The sensitivity of Four score and GCS score on admission was found to be 100% respectively, the specificity for FOUR score on admission was 80.28% and GCS score on admission was 88.73%, the positive predictive value on admission was 39.13% and GCS on admission was 52.94%, negative predictive value for both Four score and GCS score on admission was found to be 100% respectively and the diagnostic accuracy for FOUR score on admission was found to be 82.50% and GCS score on admission was found to be 90% as seen in Table.6

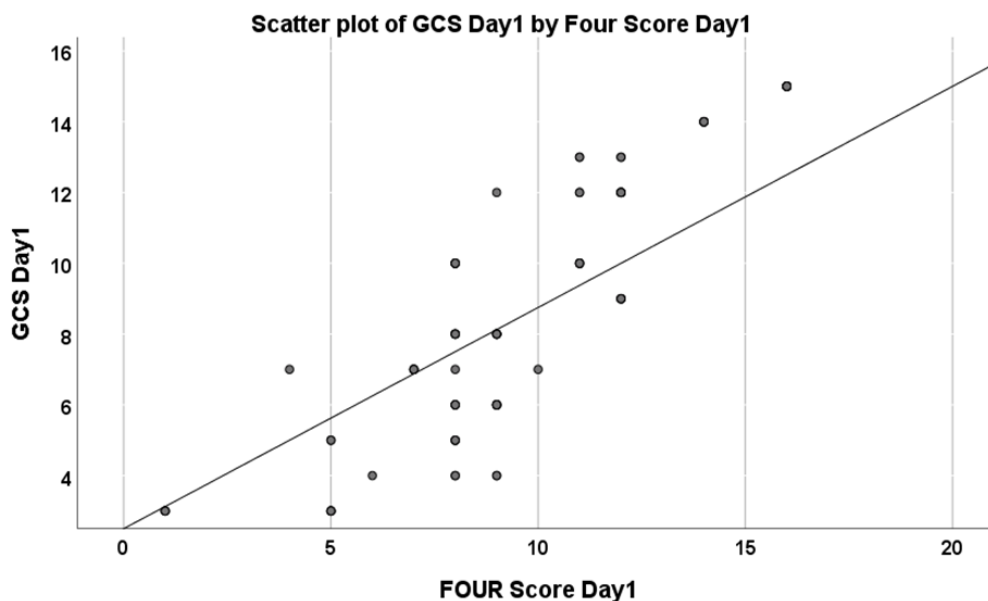


Fig (8): Scatter plot for GCS Day 1 and FOUR score Day 1

The scatter diagram for GCS Day 1 vs FOUR score Day 1 also proves that all the variables are strongly correlated as the reference line is formed as a straight line as shown in Figure 8.

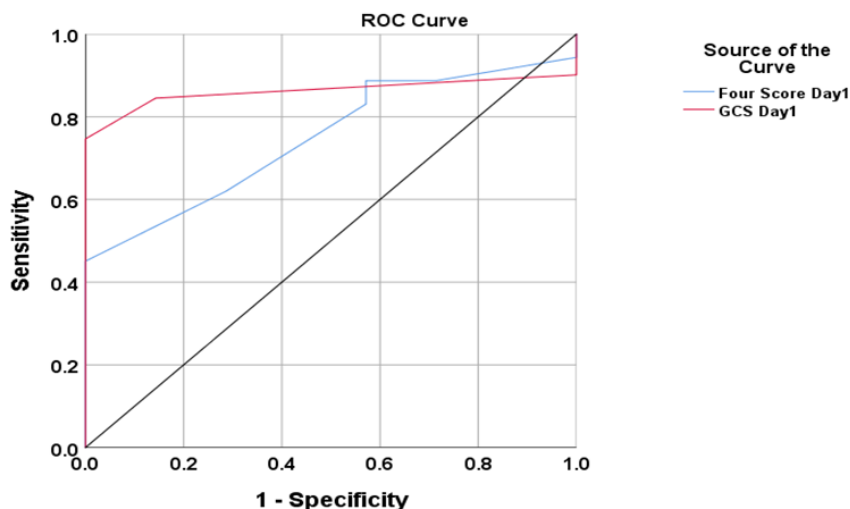


Fig (9): ROC curve for GCS Day 1 and FOUR score Day 1

Table.7: Area under the curve for GCS Day 1 and FOUR score Day 1

Area Under the Curve	Area	Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
Four Score Day1	.748	.031	.607	.890
GCS Day1	.862	.002	.783	.941

Table.8. Diagnostic value of GCS Day 1 and FOUR score Day 1

Parameter	FOUR Score Day1	GCS Day1
Sensitivity	100%	100%
Specificity	43.66%	64.79%
Positive Predictive Value	18.37%	21.88%
Negative Predictive Value	100%	100%
Diagnostic Accuracy	50%	67.95%

In our study the area under the curve for Four Score Day1 is 0.748 in which the lower bound value and upper bound value for 95% Confidence Interval is 0.607 and 0.890 respectively and the area under the curve for GCS Day 1 is 0.862 in which the lower bound value and upper bound value for 95% Confidence Interval is 0.783 and 0.941 respectively as seen in Figure 9 and Table 7.

The sensitivity of Four score and GCS score on Day 1 was found to be 100% respectively, the specificity for FOUR score on Day 1 was 43.66% and GCS score on Day 1 was 64.79%, the positive predictive value on Day 1 was 18.37% and GCS on Day 1 was

21.88%, negative predictive value for both Four score and GCS score on Day 1 was found to be 100% respectively and the diagnostic accuracy for FOUR score on Day 1 was found to be 50% and GCS score on Day 1 was found to be 67.95% as seen in Table.8

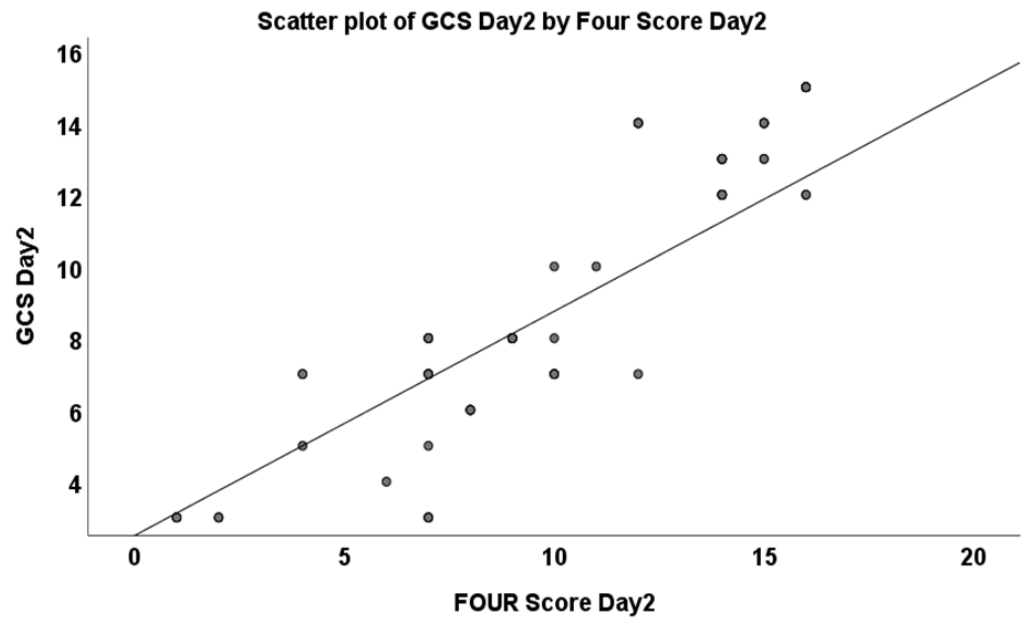


Fig (10): Scatter plot for GCS Day 2 and FOUR score Day 2

The scatter diagram for GCS Day 2 vs FOUR score Day 2 also proves that all the variables are strongly correlated as the reference line is formed as a straight line as shown in Figure 10

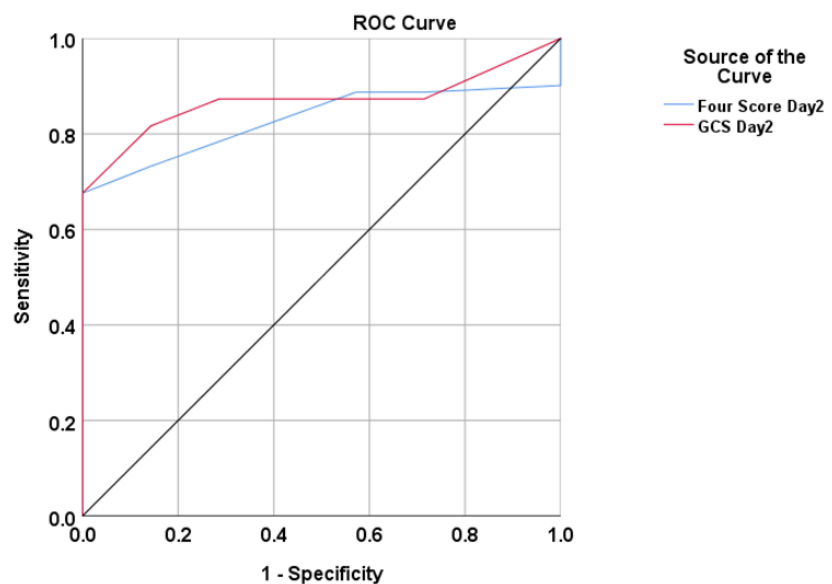


Fig (11): ROC curve for GCS Day 2 and FOUR score Day 2

Table.9: Area under the curve for GCS Day 2 and FOUR score Day 2

Area Under the Curve	Area	Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
Four Score Day2	.830	.004	.738	.922
GCS Day2	.869	.001	.786	.952

Table.10. Diagnostic value of GCS Day 2 and four score Day 2

Parameter	FOUR Score Day2	GCS Day2
Sensitivity	77.78%	100%
Specificity	47.89%	67.61%
Positive Predictive Value	15.91%	23.23%
Negative Predictive Value	94.44%	100%
Diagnostic Accuracy	51.26%	50.50%

In our study the area under the curve for Four Score Day 2 is 0.830 in which the lower bound value and upper bound value for 95% Confidence Interval is 0.738 and 0.922 respectively and the area under the curve for GCS Day 2 is 0.869 in which the lower bound value and upper bound value for 95% Confidence Interval is 0.786 and 0.952 respectively as seen in Figure 11 and Table 9.

The sensitivity of Four score and GCS score on Day 2 was found to be 77.78% and 100%, the specificity for FOUR score on Day 2 was 47.89% and GCS score on Day 2 was 67.61%, the positive predictive value on Day 2 was 15.91% and GCS on Day 2 was 23.23%, negative predictive value for both Four score and GCS score on Day 2 was found to be 94.44% and 100% and the diagnostic accuracy for FOUR score on Day 2 was found to be 51.26% and GCS score on Day 2 was found to be 50.50% as seen in Table. 10

9. Discussion

- To evaluate the efficacy of FOUR score in comparison with GCS score on the day of arrival, Day 1 and Day 2 of traumatic head injury patients.
- In this study the mean age group of patients were 40.7± 12.5 but a study done by H Yusuf et. al (7) found mean age to be 62± 13.7 which is having a mean age group higher than our study population.
- In this study the population of males (55%) was slightly on the higher side than the females (45%) which is similar to the study done by H Yusuf et. al (7). Another study done by Nishant Agrawa (8) had more number of males (74%) than females(26%). But a study done by Jamileh Ramazani (9) had more number of female patients (52.3%) and less number of male patients (47.7%)
- The mode of injury in our study had most patients with Road traffic accidents (37.5%) followed by fall (30%), assault (17.5%) and unknown reasons (15%) which is similar to a study done by Sharath S Nair (6) which had Road traffic accidents (82.6%) as a major occurrence followed by fall(14.5%). Another study done by Molly

Mcnett (10) found that Fall (47.1%) as the major reason for injury followed by Road traffic accidents (16.9%) and Assault (13.2%).

- In our study majority of the patients had diabetes mellitus (53.8%) followed by Hypertension (33.3%), and some of the patients had CVA (7.7%) and CAD (5.1%) as the co-morbidities while getting admitted in the emergency department.
- The study found strong correlation between FOUR score and GCS score with pearson correlation value of 0.82 which is also significant at the level of 0.01 which is similar to the study did by Umesh Pandwar (11) which also had pearson correlation value of 0.82 also significant at the level of 0.01.
- The sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of GCS score in our study was found to be 100%, 88.73%, 52.94%, 100%, 90% and for FOUR score it was 100%, 80.28%, 39.13%, 100%, 82.50% but a study did by Rostam Jalali (12) had sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of GCS score as 68.4%, 63.6%, 52.0%, 77.8%, 65.4% and for FOUR score it was 68.4%, 77.3%, 63.4%, 81.0%, 74.0%. Another study done by Jamileh Ramazani (8) had sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of GCS score as 79.76%, 68.98%, 50.00%, 89.76%, 72.00% and for FOUR score it was 78.31%, 78.24%, 58.04%, 90.37%, 78.26%. Another study did by Sri Keerthi et.al (28) found sensitivity and specificity of GCS to be 98.1% and 33.3% for FOUR score it was 96.2% and 6.7% respectively.
- The Area under the curve for GCS score in our study was found to be 0.975 with lower bound and upper bound as 0.944 and 1.000 respectively and for FOUR score it was 0.976 with lower bound and upper bound as 0.946 and 1.000, which is similar to the study did by Sri Keerthi et.al (13) which had Area under the curve for GCS score as 0.974 with lower bound and upper bound as 0.947 and 1.000 and for FOUR score it was 0.989 with lower bound and upper bound as 0.974 and 1.000.
- Another study did by Dr. Sandeep Singhet. al (14) had GCS and FOUR score analysed at admission, at 6 hours and 24 hours with Area under the curve value for GCS at admission as 0.931, at 6 hours as 0.988 and at 24 hours as 0.995 and for FOUR score at admission as 0.941, at 6 hours as 0.975, at 24 hours as 0.975 but our had a GCS and FOUR score checked at admission, at Day 1 and at Day 2.

10. Conclusion

Since the inception of GCS scale for more than 40 years GCS is the only scoring system used to evaluate the traumatic brain injury patients, the use of FOUR score has also helped the emergency physicians in assessing the neurological status among the intubated patients. Our results show that both GCS and FOUR score have better ways to predict the neurological implications for brain stem reflexes at an early period. we also recommend that health care personnel in emergency department need to be continuously trained.

References

- [1] Ng SY, Lee AYW. Traumatic Brain Injuries: Pathophysiology and potential therapeutic targets. *Front Neurosci.* 2019 Nov 27;13:528.
- [2] Jain S, Iverson LM. Glasgow Coma Scale. [Updated 2023 Apr 21] [Internet]. Vol. In: StatPearls [Internet]. Treasure Island (FL). Stat Pearls Publishing; 2022. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK513298>.
- [3] Laureys S, Piret S, Ledoux D. Quantifying consciousness. *Lancet Neurol.* 2005 Dec;4(12):789–90.
- [4] Teasdale G, Jennett B. Assessment of coma and impaired consciousness. *The Lancet.* 1974 Jul;304(7872):81–4.
- [5] Wijdicks EFM, Bamlet WR, Maramattom BV, Manno EM, McClelland RL. Validation of a new coma scale: The FOUR score. *Ann Neurol.* 2005 Oct;58(4):585–93.
- [6] Saika A, Bansal S, Philip M, Devi BI, Shukla DP. Prognostic value of FOUR and GCS scores in determining mortality in patients with traumatic brain injury. *Acta Neurochir (Wien).* 2015 Aug;157(8):1323–8.
- [7] H Yusuf et. al. Comparison of the glasgow coma scale vs four score in assessing conscious level in patients with non-traumatic neurological diseases. *Journal of the Neurological Sciences* 405S (2019) 105322.
- [8] Agrawal N, Iyer SS, Patil V, Kulkarni S, Shah JN, Jedge P. Comparison of admission GCS score to admission GCS-P and FOUR scores for prediction of outcomes among patients with traumatic brain injury in the intensive care unit in India. *Acute and Critical Care.* 2023 May;38(2):226.
- [9] Ramazani J, Hosseini M. Comparison of full outline of unresponsiveness score and Glasgow Coma Scale in Medical Intensive Care Unit. *Ann Card Anaesth* 2019;22:143-8.
- [10] McNett M, Amato S, Gianakis A, Grimm D, Philippbar SA, Belle J, Moran C. The FOUR score and GCS as predictors of outcome after traumatic brain injury. *Neurocritical care.* 2014 Aug;21:52-7.
- [11] Pandwar U, Navindana, Ramteke S, Motwani B, Agrawal A. Comparison of Full Outline of Unresponsiveness Score and Glasgow Coma Scale for Assessment of Consciousness in Children with Acute Encephalitis Syndrome. *Indian pediatrics.* 2022 Dec;59(12):933-5.
- [12] Jalali R, Rezaei M. A comparison of the Glasgow Coma Scale score with full outline of unresponsiveness scale to predict patients' traumatic brain injury outcomes in intensive care units. *Critical care research and practice.* 2014 Jun 10;2014.
- [13] Keerthi sri, Doshi A. Comparative analysis between GCS (Glasgow coma scale) and FOUR (Full Outline of Unresponsiveness) score in preliminary assessment and prognostication of traumatic brain injury. *NJNS.* 2023;20(1):32-38.
- [14] Sandeep Singh et. al. Comparison of GCS (Glasgow Coma Scale) Score and Four (Full Outline Of Unresponsiveness) Score In Traumatic Head Injury Patients. *Journal of Cardiovascular disease research.* Vol 14, ISSUE 2, 2023.