

An observational study on the efficacy of Glasgow coma scale (GCS) in predicting the prognosis in patients with head injury with GCS score of 12 and less

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Abstract

Background: Traumatic brain injury is a major public health issue in India. Outcome prediction after moderate to severe traumatic brain injury is of great clinical importance especially for countries like India for better targeting of limited healthcare resources. Present study was aimed to evaluate the efficacy of Glasgow coma scale in predicting the prognosis in moderate to severe traumatic brain injury patients (i.e. with GCS 12 or less). **Material and Methods:** Present study was tertiary hospital-based prospective, descriptive and observational study conducted in patients of age 19-70 years, either gender, had isolated head injury with GCS 12 or less admitted to our hospital. The GCS of patients were monitored according to the NICE guidelines. **Results:** Mean age was 36.6 years old. Majority of patients who had come were of male gender (90%), Male to Female ratio was 9:1. 47(39%) patients were classified as SEVERE head injury according to GCS scoring system i.e. GCS score of 8 or less (44 died and only 3 survived that too with severe disability). The remaining 73(61%) patients were of Moderate brain injury i.e. GCS score between 9- 12 (46 had good recovery and 23 had moderate disability). The patients with Favourable outcome i.e. Good recovery and Moderate Disablement were 69(57%), and patients with Unfavourable outcome i.e. severely disabled and who died during treatment were 51(43%). Patients with GCS score between 9- 12 did not require intubation as they maintained SpO₂ levels above 90% on admission. The patients with Favourable outcome i.e. Good recovery and Moderate Disablement were 69, and patients with Unfavourable outcome i.e. severely disabled and who died during treatment were 51. **Conclusion:** Initial Glasgow coma scale score is a very efficient predictor of prognosis in head injury patients and it has a very good corroboration with Glasgow outcome scale.

Keywords: Glasgow coma scale, head injury, Glasgow outcome score, prognosis

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INTRODUCTION

Traumatic brain injury is a major public health issue in India. Head injury results in injuries, death and disabilities in all age groups but more in the young working and hence productive population.¹ In India, 1 out of 6 trauma victims succumb to death, every year more than 100,000 lives are lost.² Fifty percent of those who die from traumatic brain injury do so within the first two hours of injury. Ninety five percent of trauma patients in India do not receive the required care during the “Golden Hour” period after an injury is sustained.² The Glasgow Coma Scale has been widely accepted and practiced internationally by emergency medical service providers, doctors and nurses.³

The Glasgow Coma Scale is a quantifiable determination of neurologic function that is useful for Triage, treatment and prognosis determination of a head injury patient.^{4,5} Outcome prediction after moderate to severe traumatic brain injury is of great clinical importance especially for countries like India for better targeting of limited healthcare resources. Present study was aimed to evaluate the efficacy of Glasgow coma scale in predicting the prognosis in moderate to severe traumatic brain injury patients (i.e. with GCS 12 or less).

MATERIAL AND METHODS

Present study was tertiary hospital-based prospective, descriptive and observational study which has been carried out in the department of general surgery of our Institute during the period of 1st January 2018 to 31st August 2019. Study was approved by institutional ethical committee.

Inclusion criteria: Patients of age 19-70 years, either gender, had isolated head injury with GCS 12 or less admitted to our hospital.

Exclusion criteria: On evaluation GCS more than 12. Patients /Close relatives declining written informed consent.

Study was explained and written informed consents from patient’s close relatives was taken. Demographic data, detailed medical history, information about operative

intervention, investigations, outcome, etc obtained from patients was entered in a pre-designed case record form.

The patients were examined clinically, GCS score was assessed on admission, initial GCS assessment were made upon arrival to the casualty and 6 hours after patient had been admitted in surgical intensive care unit, once the patients were resuscitated and stabilized, then CT scan was done and findings correlated. Neurosurgeon's consultation was taken and the necessity of conservative/operative intervention was decided. In cases requiring operative intervention, mode of surgery was decided on individual patient profile. The GCS of patients were monitored according to the NICE guidelines.⁶ All Head injury patients were finally scored with regards to their outcome after medical/surgical management.

According to Glasgow outcome scale different levels of outcome were assessed. - Favourable (Good recovery, moderately disabled) and Unfavourable (Severely disabled, Vegetative and Death).

Mode of Injury, requirement of intubation, CT scan findings, management strategy whether conservative/operative, and their outcome based on the Glasgow Outcome scale was assessed during discharge and follow up.

Data was collected and compiled using Microsoft Excel, analysed descriptively. Frequency, percentage was calculated for the continuous variables.

RESULTS

Out of the 120 patients majority were from the age group of 18-40 years (66%). Others were 41- 50 years (20%), 51- 60 years (12 %) and 61- 70 years (2 %). the Mean age was 36.6 years old. Majority of patients who had come were of male gender (90%), Male to Female ratio was 9:1.

TABLE 1: Age and gender in relation to head injury

Characteristic	Number of patients	Percentage
Age group (years)		
18-20	10	8%
21-30	34	28%
31-40	36	30%
41-50	24	20%
51-60	14	12%
61-70	2	2%
Gender		
Male	108	90%
Female	12	10%

47(39%) patients were classified as SEVERE head injury according to GCS scoring system i.e. GCS score of 8 or less (44 died and only 3 survived that too with severe disability). The remaining 73(61%) patients were of Moderate brain injury i.e. GCS score between 9- 12 (46 had good recovery and 23 had moderate disability).

Table 2: Severity of head injury based on Glasgow coma scale.

Severity of head injury	Number of patients (n=120)	Percentage
Moderate (GCS-9-12)	73	61%
Severe (GCS 8 and less)	47	39%

The patients with Favourable outcome i.e. Good recovery and Moderate Disablement were 69(57%), and patients

with Unfavourable outcome i.e. severely disabled and who died during treatment were 51(43%).

Table 3: Percentage of outcome based on Glasgow outcome scale.

Glasgow Outcome Scale.	Number of Patients.	Percentage.
Good Recovery/Moderate Disability (Favourable)	69	57%
Severe Disability/Dead (Unfavourable)	51	43%

It was observed that those patients whose Glasgow coma score on admission was 8 or less (severe head injury) required intubation and hence were intubated. All patients of severe head injury criteria were intubated in our study. Patients with GCS score between 9- 12 did not require intubation as they maintained SpO2 levels above 90% on admission.

Table 4: Patients intubated.

Intubated	No Of Patients	Percentage
Yes	47	39%
No	73	61%

In our study EDH and SDH were the most common findings on non-contrast brain CT scan. EDH comprising of 27% and SDH comprising of 26% making the majority 53% of the population. SAH was the third highest finding making up 18% of the population, followed by haemorrhagic contusion (11%) and intra-parenchymal haemorrhage (7%). In 11% of the head injured population CT scan could not be done as they were not in a stable condition. We found out that mortality was least with EDH, none of the patients who was diagnosed with EDH on CT scan imaging died in our study, whereas SDH had the highest mortality as 13 patients out of 44 died due to SDH, SAH and Intra-parenchymal haemorrhage comprised of 7 each mortality and Haemorrhagic contusion resulted only in 3 mortality out of 44. All patients whose CT was not done died eventually as they had severe head injuries.

Table 5: Intracranial findings on CT scan.

CT SCAN FINDINGS	NO OF PATIENTS	PERCENTAGE
EDH	32	27%
SDH	31	26%
SAH	22	18%
HC	13	11%
IPH	9	7%
CT NOT DONE	13	11%

99 patients (82%) were managed conservatively with monitoring in the surgical intensive care unit without the requirement of operative intervention. Operative interventions were required only in 21(18%) patients which included Craniotomy (7 patients) and Burr Hole (14 patients).

Table 6: Mode of management

Mode Of Management	Number Of Patients	Percentage
Conservative	99	82%
Operative	21	18%

The patients with Favourable outcome i.e. Good recovery and Moderate Disablement were 69, and patients with Unfavourable outcome i.e. severely disabled and who died during treatment were 51. Out of the 108 Male population 63 (58%) had good recovery/moderate disability and 45 (42%) had severe disability/died. Whereas the female population had 6 (50%) favourable outcome and 6 (50%) unfavourable outcome.

Table 7: Gender in relation to outcome.

Sex	Good recovery/ Moderate disability	Severely disabled/Died	Total
Male	63	45	108
Female	6	6	12
Total	69 (57%)	51 (43%)	110

DISCUSSION

Since the 1970s, when Teasdale and Jennett⁷ established the Glasgow Coma Scale, the scale has been the subject for numerous papers. The identification of variables in the acute stage of head injury that could provide insight into patient outcomes is of great interest to healthcare providers and researchers. The GCS score is one such variable.

Numerous researchers have investigated the use of the GCS score in predicting outcomes in head injury patients. In a study by Haroon S. *et al.*, 79.2% cases belonged to the first four decades of life, the maximum number of patients were in the age group of 21 to 30 years (25.3%).⁸ Similar observations have also been made by Tandon *et al.*⁹ who reported the mean age of 25.87 years in a series of 681

patients, whereas the mean age of the patients studied by Turazzi; *et al.*,¹⁰ was 34 years. The Mean age in our study was 36.6 years, which was similar to the findings of other studies mentioned here. The Male to female ratio was 9:1. Different Indian authors noted similar findings, such as Sambasivan M¹¹ (15:1), Bharti P¹² (5.6:1) and Haroon S *et al.*,¹⁰ (3.5:1). Out of the 120 patients participating in our study, 47(39%) patients were classified as severe head injury on admission according to the GCS score i.e. with GCS 8 and less, out of 47 patients who were classified as severe head injury 44 died and only 3 survived that too with severe disability. All patients who had an initial GCS score in the range of severe head injury (3-8) had an unfavourable Glasgow outcome score i.e. they were either severely disabled or died during treatment. Mittal B *et al.* observed 47.5% mortality in patients with the score of 3-7 and 10.7% deaths in those having the score ranging from 8 to 13 while only 7% cases with the score of 14-15 died.¹³ Mishra HB *et al.* found mortality figures of 62% in those having score of 3-7 while 12.8% and 2.2% died who had Glasgow Coma Score of 8-14 and 15 respectively.¹⁴ Present study confirms the prognostic value of Glasgow Coma Score. A number of the studies included in this review used descriptive analyses in reporting the relationship between specific GCS scores and certain outcome categories.¹⁵⁻¹⁸ Most studies reported positive outcomes in patients who presented with high initial GCS scores. Young *et al.*,¹⁵ found that 72 of the 76 patients with initial GCS scores of 8-15 had a good recovery or moderate disability, as measured by the GOS. Similarly, 99% of patients with GCS scores of 13- 15 had good recovery (Pal *et al.*,¹⁶), while 89%-96% of patients with a GCS score of 8 or above (Bishara *et al.*,¹⁷) and 75% of patients with GCS score 6 and above (Changaris *et al.*,¹⁸) also had good recovery or moderate disability outcomes. It was observed in our study that patients who had a GCS of 3, did not survive, showing similar findings as Demetriades study.¹⁹ Bansal S *et al.*,²⁰ noted that the highest accuracy rate was seen for Glasgow Coma Scale (i.e. 84.3%). GCS had a good predictive power and had good discriminative ability between survivors and non-survivors, GCS had the added advantage of being simple and practical.⁹⁰ Choi *et al.*,²¹ and Narayan *et al.*,²² created the outcome categories of good or favourable outcome and poor or unfavourable outcome. The category of good outcome was composed of patients who had good recovery or moderate disability, while the poor outcome category included patients who had severe disability, persistent vegetative state, or death. By creating these broad outcome categories, the researchers were able to demonstrate better accuracy in their outcome predictions. Choi *et al.*,²¹ and Narayan *et al.*,²² reported accurate outcome predictions as high as 80% when using early GCS scores and these outcome categories. Poon,

Zhu, Ng, and Wong²³ reported a 71% accuracy prediction rate of the GCS using similar outcome categories of moderate/severe disability and good recovery. Thus, the use of broad outcome categories increased the ability of the GCS score to predict patient outcomes. A relationship between assessments of the GCS and the outcome was shown clearly by Gennarelli *et al.*,²⁴ who demonstrated the existence of a continuous, progressive association between increasing mortality after a head injury and decreases in GCS score from 15 to 3. The NICE Guideline CG176 (2014, updated 2019) Head injury⁶: assessment and early management states that “Intubate and ventilate all patients with GCS 8 or less requiring transfer to a neuroscience unit, and any patients with the indication detailed below- Intubate and ventilate the patient immediately in the following circumstances:

1. Coma-not obeying commands, not speaking, not eye opening (i.e. GCS 8 or less).
2. Loss of protective laryngeal reflexes.
3. Ventilatory insufficiency as judged by blood gases: hypoxemia (PaO₂ <13 k Pa on oxygen) or Hypercarbia (PaCO₂ >6 k Pa).
4. Spontaneous hyperventilation causing PaCO₂ < 4 k Pa.
5. Irregular respirations.

Knowledge about the potential outcomes for head-injured patients based on these early GCS scores can prove to be invaluable to the families, and to healthcare professionals who care for and support these patients and their loved ones throughout the recovery process. By having information about the potential outcomes in head-injured patients, health care providers may facilitate earlier consultation of these services, which could improve outcomes for the head-injured patient. Many factors in head injury patients have been assessed and analysed, however, now is the time to expand our use of clinical knowledge beyond the Glasgow Coma scale, and create new scoring systems that take other variables like pupillary reactivity into account for establishing prognosis of head injury patients. Regardless of how many people perceive the Glasgow coma scale and its assessment of prognosis through the Glasgow outcome scale, it has proven to be widely used, easy form of examination that can help in predicting patient's future with or without disability. As long as its purpose and its benefits are appreciated, it can have an essential role in predicting outcome of patients with head injury in the future for many more years to come.

CONCLUSION

Initial Glasgow coma scale score is a very efficient predictor of prognosis in head injury patients and it has a very good corroboration with Glasgow outcome scale. Patients who had an initial GCS score in the range of severe

head injury (3-8) had an unfavourable Glasgow outcome score i.e. they were either severely disabled or died during treatment. Glasgow Coma Scale score can be validated as an excellent assessment for monitoring and predicting the prognosis in patients with head injury.

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