Section: General Surgery

Original Research Article

TO DETERMINE THE OUTCOMES OF VARIOUS SEVERITY OF HEAD INJURY USING GLASGOW OUTCOME SCORES

Paritosh Kumar[1], Sayed Adil Husain A.H[2], Mrunal Dharamdas Bhad[3]

[1]Assistant Professor, Department of General Surgery, ESIC Medical College & Hospital, Faridabad, Haryana, India
[2]Senior Resident, Department of General Surgery, ESIC Medical College & Hospital, Faridabad, Haryana, India
[3]Assistant Professor, Department of Anaesthesia, ESIC Medical College & Hospital, Faridabad, Haryana, India

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Corresponding Author:
Dr. Paritosh Kumar,
Email: docparitosh@gmail.com

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Abstract
The primary objective of this study was to assess the consequences of different severity levels of head injury using Glasgow outcome scores. The research was conducted at Fortis Hospitals Limited in Faridabad from February 2018 to April 2019. The study included patients aged 10 or older who were admitted to the hospital's Departments of Surgery and Neurosurgery due to head injuries. The study lasted for 13 months and focused on demographic data, admission clinical data, and Glasgow Outcome Scale (GOS) at three and twelve months. A poor outcome, defined as GOS 1-3 measured 12 months after injury, was determined using multivariate logistic regression. The patient population was predominantly male (78%) and the median age was 31 years. The GOS at 3 months was found to be the most accurate predictor of 12-month outcomes. Patients with a GOS of 2 had an 88.6% risk of a poor outcome, while those with a GOS of 5 had a 0.26% chance. The study found that fixed and dilated pupils, prolonged hypotension, and DAI were independent predictors of poor prognosis.

INTRODUCTION

The Glasgow Outcome Scale (GOS) is widely used to assess patient outcomes following head injury.[1] Developed by Jennett and Bond in 1975, the GOS evaluates the level of assistance required for individuals recovering from traumatic brain injury (TBI) and their capacity to perform daily activities. While various scales have been developed to assess TBI outcomes,[2-5] the GOS remains the most commonly used tool for assessing TBI in both acute care and rehabilitation settings.[6]
Accurate prognosis of long-term outcomes following severe TBI would be highly beneficial from a socioeconomic perspective. Patients and their families are eager to know the prognosis for recovery. As a result, it is crucial to concentrate the most intensive and expensive rehabilitation and acute care resources on individuals who are most likely to achieve a significant recovery. Previous studies,[6-10] have demonstrated that both patient characteristics and acute data contain prognostic value, such as age, pupillary abnormalities, initial Glasgow Coma Score, imaging findings, and length of hospitalization. However, research on the application of post-acute data and prognosis for recovery from TBI is limited.[6] In this study, we aimed to determine the outcomes of various severities of head injury using Glasgow outcome scores. Specifically, we investigated the prognostic significance of the 3-month GOS, an intermediate outcome, in predicting sustained functional recovery after TBI.[7] By doing so, we hope to provide valuable insights into the prognosis of TBI recovery and inform the allocation of rehabilitation and acute care resources. The study's objective was to determine the outcomes of different severity of head injury using Glasgow outcome scores.

MATERIALS AND METHODS

The current trial is planned to occur at ESIC Medical College & Hospital, Faridabad, with a starting date in February 2018 and a completion date in April 2019. The research was focused on individuals aged 10 or above who have been admitted to the hospital's Departments of Surgery and Neurosurgery and have sustained head injuries. This study represented a prospective, observational, hospital-based research endeavor that will span a period of 13 months. The study included 120 patients who were admitted to the hospital due to head trauma, without exception who were fulfilling our inclusion criteria. Patients with significant additional injuries to their abdomens, thorax, or bones were excluded, as these injuries may significantly impact the outcome scores. Furthermore, patients with significant pre-existing medical conditions were excluded if these conditions could potentially affect the outcome scores, such as Parkinson's disease, stroke, degenerative diseases, or cancer.

The following are the components of the history that should be taken into account: the mechanism of injury, any primary and secondary injuries, coexisting medical conditions or comorbidities, preexisting disabilities, general and systemic examinations, evaluation of head injury through Glasgow Coma Scale (GCS), assessment of pupils, neurological deficits, examination of cranial nerves, complete blood count, kidney function tests, blood sugar levels, arterial blood gas analysis, imaging tests such as X-rays, chest X-rays based on trauma protocol, non-contrast computed tomography (NCCT) head scans on admission and as needed, and additional tests based on suspected injuries. The patients will be managed according to standard protocols, and any need for ventilator, transfusion, or dialysis will be noted. Changes in GCS or investigations will also be recorded. Any surgical intervention and its findings, as well as post-operative events, will be documented.

The severity of head injury is classified using the GCS, where the motor score is the best predictor of neurological outcome. For minor head injury, the GCS score is 15 with no loss of consciousness. For mild head injury, the score is 14 or 15 with loss of consciousness. For moderate head injury, the score ranges from 9 to 13, and for severe head injury, the score ranges from 3 to 8 (with 7 being the most severe). The GCS was developed in the 1970s at the Institute of Neurological Sciences in Glasgow to assess the level of consciousness using three aspects of a patient's response: eye opening, verbal, and motor. It has since been widely adopted worldwide and is included in the Advanced Trauma Life Support course of the American College of Surgeons.

The Glasgow Outcome Scale (GOS) will be used to assess the outcomes of patients at the time of discharge, as well as at three- and six-months post-discharge. This measure evaluates functional outcomes, and the GOS categorizes patients' status into one of five categories: death, vegetative state, severe disability, moderate disability, or good recovery. The scoring system is as follows: 1 for death, 2 for persistent vegetative state (no obvious cortical function), 3 for severe disability (dependent on others for daily support due to mental or physical disability or both), 4 for moderate disability (independent but with varying degrees of dysphasia, hemiparesis, ataxia, intellectual and memory deficits, and personality changes), and 5 for good recovery (resumption of normal activities with minor neurological or psychological deficits).

Statistical Analysis

Continuous variables were analyzed using median, mean, standard deviation, and range values, and two-sample t-tests and Fisher's exact tests were applied to compare relationships between predictor variables. Paired t-tests were used to evaluate GOS assessments conducted at three- and twelve-months post-injury. The 2 tests for proportions were used to identify candidate variables associated with poor outcomes in the initial bivariate analysis. Variables with two-sided p-values less than 0.15 in the bivariate analysis were included in the multivariate logistic regression model, which aimed to identify independently associated variables with unfavorable outcomes. Statistical significance was set at $P < 0.05$.

RESULTS

The demographic and clinical characteristics of the 160 patients who satisfied the inclusion criteria for our analysis are as follows: 79% of the patients were male, with a median age of 32 years. Most of the patients had been involved in motor vehicle accidents. 16 patients (10%) had fixed and dilated pupils, while 29 patients (18%) had protracted hypotension. The median GCS admission score was 6, with scores ranging from 3 to 7. Initial CT scan findings indicated the presence of DAI in 40% of patients. In 36% of patients, emergency surgery was necessary to remove parenchymal, epidural, or subdural hematomas.

Hypothermia was administered to 57 patients (36%), while 54 patients (34%) constituted the control (non-hypothermic) group. A significant correlation was observed between the admission Glasgow coma score (GCS) and the 3-month GOS, both of which are indicators of neurologic functional status (Spearman's rho = 0.366, $p = 0.008$). The distribution of GOS evaluations at the 3- and 12-month follow-up is presented in a table. A statistically significant increase in mean GOS was observed between 3 and 12 months (4.3 ± 0.8 and 3.6 ± 0.5, respectively) after injury ($p < 0.05$). Notably, GOS changes significantly during the nine-month observation period (between 3 months to 12 months) ($p < 0.05$). In addition, most alterations occurred at higher levels of functioning: only six patients (4%) deteriorated, while 91 patients (57%) improved. Only four patients with a three-month GOS score of two perished.

Long-term outcomes were found to be unfavorable in individuals who underwent emergency surgery, sustained DAI (Diffuse Axonal Injury), exhibited dilated pupils upon admission, and obtained a GCS score at admission. The three-month assessment utilized the specified scale. The association between GOS and age or gender was not observed at 12 months. Table 4 presents the results of the multivariate logistic regression analysis. The most significant independent predictor of outcomes at 12

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months was GOS at 3 months, with an odds ratio (OR) of 16.4 and $p < 0.001$. Additionally, fixed and dilated pupils upon admission (OR=14.3, p = 0.044), prolonged hypotension (OR = 4.9, P = 0.039), and DAI (OR = 6.7, $p < 0.05$) were found to be significant independent predictors. The area under the receiver operating characteristic (ROC) curve for the final logistic model was 0.927 (95% confidence interval [CI]: 0.999, 0.888).

Poor outcome was not independently linked to age, gender, GCS at admission, or emergency surgery. Consequently, adjusted predicted 12-month GOS outcomes were generated for each 3-month GOS score using the model. At 12 months following TBI, the likelihood of an unfavorable outcome ranged from 88.6% (95% CI: 84.8, 94.5%) for GOS 2 at 3 months to 0.23% (95% CI: 0.01, 0.26%) for GOS 5 at 3 months.

To better understand the significance of functional data obtained three months after an injury, an additional logistic model was fitted using only early clinical and demographic data (excluding GOS at three months). Independent predictors of GOS at 12 months included admission GCS (OR=2.63, $p < 0.05$), prolonged hypotension (OR=6.57, $p < 0.05$), DAI (7.76, $p < 0.05$), and fixed and dilated pupils (OR=15.90, $p < 0.05$) in this second model. The area under the ROC curve for the second model was 0.953, which was outside the 95% CI of the first model. This indicates that the model incorporating GOS at 3 months has a significantly higher predictive value ($p < 0.05$).

DISCUSSION

Serious TBI patients frequently have a precarious prognosis that is difficult to forecast. Accurate prognostication for clinicians and family members regarding formation. Using early data and 3-month GOS, the primary objective of this study was to forecast long-term functional outcomes in a cohort of TBI survivors who received consistent, protocol-driven acute care. The strongest predictor of 12-month outcomes was determined to be 3-month GOS. Additionally, pupillary dilation, protracted hypotension, and DAI were all significant independent predictors. Recovery is highly probable even three months following a traumatic brain injury; 57 % of patients experienced a one to two-point increase in GOS levels between the three- and twelve-month evaluations.

Numerous organizations have documented the prognostic factors associated with TBI recovery. In 2009, Jacobsson et al,[11] examined 88 patients who were undergoing rehabilitation due to severe traumatic brain injuries. They were able to determine the prognostic value of age, duration of coma, and duration of posttraumatic amnesia on overall recovery by employing the GOS as a functional recovery measure. In their retrospective assessment, A study,[12] examined the prognoses of elderly patients who had suffered severe closed head injuries. The researchers employed multivariate statistical techniques to examine the relationships between functional outcome, mortality, heart rate, pupillary reactivity, GCS, and mechanism of injury; they discovered that both pupillary reactivity and GCS were predictive variables. The results of a prospective, multicenter trial conducted by Frankel et al. (2006) were presented.[13] The objective of the trial was to assess the impact of age on both the recovery process from traumatic brain injury and the financial burden of associated medical expenses. Individuals aged 55 years or older who were matched by gender and injury severity (n = 273 patients) exhibited considerably prolonged hospital stays, considerably elevated rehabilitation costs, and considerably diminished progress on functional outcome scales. In 39 TBI patients, Garcia and colleagues documented the poor prognoses associated with acute subdural hematomas.[14] A mortality rate of 58 % and a functional recovery rate of 22 % were recorded by the cohort. The most influential predictive factors were the presenting GCS and CT results, specifically a midline displacement of less than 5 mm. Additional variables, such as the mechanism of injury and the timing of operative intervention, were not identified as reliable predictors of outcome.

In the same way, 116 patients with extensive head injuries were subjected to clinical and electroencephalographic (EEG) evaluations by Fan et al.[15] The researchers employed a multivariate regression analysis model to establish a correlation between EEG findings one week after the trauma and functional outcomes at six months. The group concluded, an early-stage quantitative EEG-R marker was independently associated with awakening and 3-month level of consciousness in patients with severe brain injury. This promising marker based on functional connectivity will need external validation before potential integration into a multimodal prognostic model.

CONCLUSION

GOS for assessing the severity of brain injuries have provided important information on the results for patients. The results of this study highlight the value of GOS in evaluating and forecasting outcomes for different types of head trauma. It is easier for patients with minor injuries to rehabilitate and avoid handicap, while those with moderate to severe injuries have a more difficult time doing so. GOS improves the standard of care for patients with brain injuries by assisting physicians with prognosis, treatment planning, and resource allocation. It also stresses the need for interventions and preventative efforts to lessen the frequency and impact of head trauma.

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