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Evaluation of Glasgow Coma Outcome Scale at Hospital Discharge as a Prognostic Index in Patients With Brain Injury

KEYWORDS: Brain Injuries, Glasgow coma scale, Glasgow coma outcome scale

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ABSTRACT *Objective: To evaluate the Glasgow Coma Outcome Scale (GCOS) at hospital discharge as a prognostic indicator in patients with brain injury*

Method: Retrospective data were collected of 45 patients, with Glasgow coma scale ≤8, age 30±10 years, 36 men and 9 women from medical records. Later, at home visit, two measures were scored GCOS at hospital discharge (according to information from family members) and GCOS - LATE (10 months after brain injury).

Results: At discharge, the ERG showed: Vegetative State (VS) in 2 (4%), Severe Disability (SD) in 27 (60%), Moderate Disability (MD) in 15 (33%) and Good Recovery (GR) in 1 (2%). After 10 months: Death in 5 (11%), VS in 1 (2%), SD in 7 (16%), MD in 9 (20%) and GR in 23 (51%). Variables associated with poor outcome were: worse GOS at hospital discharge (p=0.03), neurosurgical procedures (p=0.008) and the kind of brain injury (p=0.009).

Conclusion: The GCOS hospital discharge was indicator of prognosis in patients with brain injury.

INTRODUCTION

Brain injury (BI) has been increasing in civilian population in a direct relationship to technological development, especially due to the great number of motor vehicle accidents and urban violence. Nowadays it represents a serious public health problem, carrying high levels of morbidity and mortality and expressive social-economic impacts.

BI comes with a huge personal and social cost, resulting in more deaths in young adults than any other cause. For those who survive, the lifelong consequences can often be devastating. It is a growing problem in low-and middle-income countries – in India one person dies every 10 minutes due to BI, and this will treble by 2020.

Prevention and clinical care for patients– interventions that can make a real and substantial impact on the incidence and outcome of head injury

The early identification of brain injury severity is extremely important in BI patients since many secondary damages can be prevented or minimized by applying correct therapeutic maneuvers, reducing, in this way, their adverse effects in the final patient outcome1,6.

For an adequate pre-hospital management, emergency medical services has been extensively improved, not only by incorporation of new technologies, but also by training and continuous education of health care professionals, according to national and international advanced trauma life support guidelines

At hospital admission in the emergency room, besides application of Glasgow coma scale (GCS), these patients must be routinely evaluated by means of an extensive and careful clinical neurological examination and subsidiary tests that can guide their correct management, thus avoiding critical and irreversible lesions7,8. However, notwithstanding the most careful management of these victims, from pre-hospital care to post-hospital discharge rehabilitation, it has been observed that BI is responsible for serious sequelae, and this fact justifies more detailed researches to investigate their long-term outcome with the aim to prevent or mitigate them.

In this way, the Glasgow outcome scale (GOS), described by Jennett and Bond9 in 1975, has been extensively employed to outcome evaluation of BI patients take into consideration their physical, social and cognitive sequelae10-13. Despite some controversies regarding GOS reliability, it is widespread used to evaluate long-term outcome of severe brain injured patients14.

In the international medical literature some investigations that have applied the GOS to evaluate BI patients' outcome are found15-20. However, in Brazil, reports in this field are scarce. In addition, to our knowledge, there was not a single investigation that has employed GOS at hospital discharge (GOS-HD) as a tool to estimate long-term prognosis in severe BI patients.

In this way, the main objective of the present study was to evaluate if GOS-HD can be employed as a long-term prognostic index in severe BI patients.

METHODS

The investigation was carried out in two phases: the first one, retrospective, at various Hospital and Clinics with patients' selection from our intensive care unit (ICU) data bank and getting information from their medical records and the second one, prospective, including an interview with patients and/or their relatives and performing a detailed clinical neurological evaluation of those who stayed alive.

Forty five severe BI patients admitted to our ICU were selected from our data bank, according to the following inclusion criteria: age ≥30 years, both genders, GCS ≤8 at hospital admission, survival to hospital discharge and an elapsed time ≥10 month from the BI at the second phase (prospective one). Exclusion criteria included those lost for late clinical neurological evaluation and those who denied

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their informed consent to take part in the clinical investigation.

GOS was applied as a tool for neurological evaluation of the BI patients, both retrospectively, at hospital discharge (GOS-HD), and prospectively, at least one year after BI (GOS-LATE). According to GOS, BI patients were classified as: Dead (D), Vegetative State (VS), Severe Disability (SD), Moderate Disability (MD) and Good Recovery (GR).

It is highlighted that GOS was evaluated at both moments (hospital discharge and later) only by one person (the main investigator), as suggested by Anderson.

In the first phase of the study, the patients were selected based on our ICU data bank as previously reported, For those patients who fulfilled inclusion criteria, additional data were obtained from their hospital medical records and registered in a specific form, including: patient's identification, BI cause, admission GCS, type of brain lesion according to CT scan and hospital outcome. GOS-HD was estimated according to patient's neurological status at hospital discharge.

The patients selected in the first phase of the study (and/or their relatives) were then contacted and invited to participate in the second phase of the investigation, either in hospital dependences or at their homes, as feasible.

In this second phase (prospective one), as long as the patients or their relatives have given their informed consent, a second specific form was filled with data obtained by means of a structured interview and a clinical neurological evaluation were performed by the author. The patients were then classified according to GOS, now denominated GOS-LATE.

Statistical Analysis

Statistical analysis was performed using of a computational program and the descriptive analysis was done by constructing frequency tables for categorical variables and position and dispersion measures for continuous variables. To verify the existence of associations or to compare proportions between selected variables, $\chi 2$, McNemar, or Fisher's exact tests were employed as fitted. To verify the most important factors that have influenced patients' outcome, logistic regression analysis was employed. Mann-Whitney test was employed to compare continuous or ordered variables between two groups, and Kruskal-Wallis test to compare them between three groups. The results were considered statistically significant when $p<0.05$.

RESULTS

Forty-five patients composed the study population with 36 men (80%) and 9 women (20%), aging 24.6±10.4 years (mean±SD; median=20 years), and 65% of them were single.

The main BI causes were: motorcycle accidents (50%), car accidents (25%), accidental falls (10%), and automobile accident (15%).

GCOS at hospital admission, the type of acute brain lesion at CT scan (focal or diffuse), the need for neurosurgical interventions, and patients' classification according to GCOS at hospital discharge (GCOS-HD) and at later evaluation (GCOS-LATE) are shown in Table 1.

GCS at hospital admission versus GCOS-LATE

There was no association between categorical GCS at hospital admission (3–5 versus 6–8) and worst outcome according to GOS-LATE (Fisher exact test; p=0.2747). GCS at hospital admission were also not indicative of worst prognosis by univariate logistic regression analysis (p=0.1088) (Table 2).

GOS-HD versus GOS-LATE

From 64% (29/45) of patients initially classified by GOS-HD as VE and SD, 41% (12/29) remained within this classification by GOS-LATE. However, amongst patients classified as MD or GR (15 and 1, respectively) by GOS-HD, significant improvement was observed, and GOS-LATE has shown GR in 75% of them (12/16). There was a positive and significantly association between GOS-HD and GOS-LATE ($\chi 2$ test; p=0.0274). As well, the univariate logistic regression analysis has shown that a worst classification by the GOS-HD was significantly indicative of pour late outcome (p=0.0319) (Table 3)

Multivariate logistic regression analysis

By the application of multivariate logistic regression analysis, as shown in Table 4, it was found that patients classified as MD and GR by GOS-HD have had a greater chance of better outcome according to GOS-LATE when compared to patients initially classified as VS or SD (OR=12.049; 95%IC 1.252–15.989; p=0.0312).

DISCUSSION

International epidemiological data have shown that BI mainly affects young and male healthy people19,23,24. Indeed, in the present investigation, accordingly to these reports, BI was seen more frequently in young males in a 4:1 proportion in relation to females. The mean patients' age was 24 years, corresponding to their most potentially productive life phase, as emphasized by Brandt et al.23. In accordance with another clinical reports, the main cause of BI was motor vehicle accidents (50-% of the cases) 18, 24, 25

Table 1

Glasgow coma scale at hospital admission, type of brain lesion at computerized tomography, need for neurosurgical intervention, and classification according to Glasgow outcome scale at hospital discharge and at least one year after traumatic brain injury, in severe traumatic brain injury patients.

Variable	Frequency
GCS	
3–5	16 (35.6%)
6–8	29 (64.4%)
Type of lesion Focal	22 (48.9%)
Diffuse Neurosurgical intervention	23 (51.1%)

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Yes	20 (44.4%)
No	25 (55.6%)
GOS-HD	
Death	–
Vegetative state	2 (4.4%)
Severe disability	27 (60.0%)
Moderate disability	15 (33.3%)
Good recovery	1 (2.2%)
GOS-LATE	
Death	5 (11.1%)
Vegetative state	1 (2.2%)
Severe disability	7 (15.6%)
Moderate disability	9 (20.0%)
Good recovery	23 (51.1%)

GCS: Glasgow coma scale; GCOS: Glasgow outcome scale; GOS-HD: Glasgow outcome scale at hospital discharge.

Table 2
Factors related to the worst outcome, according to univariate logistic regression analysis in severe brain injury patients.

Variable	p-value	OR	95%CI
GCS (6-8 vs 3-5)	0.1088	2.981	0.784–11.332
GOS-HD (MD-GR vs VS-SD)	0.0319	10.588	1.227– 91.337

GOS-LATE: Glasgow coma outcome scale at one or more years after (GOS-LATE) showing death (D), vegetative state (VS) or severe disability (SD); CI: confidence interval; GCS: Glasgow coma scale; GOS-HD: Glasgow coma outcome scale at hospital discharge; GR: good recovery; MD: moderate disability; OR: Odds Ratio.

Table 3
Association between GOS-HD and GOS-LATE in BI patients

GOS-LATE

GOS-HD		D-VS-SD	MD	GR	Total
VS-SD	n	12	6	11	29
	%	26.67	13.33	24.44	64.44
		41.38	20.69	37.93	
		92.31	66.67	47.83	
MD-GR	n	1	3	12	16
	%	2.22	6.67	26.67	35.56
		6.25	18.75	75.00	
		7.69	33.33	52.17	
TOTAL	n	13	9	23	45
	%	28.89	20.00	51.11	100.00

Table 4
Multivariate logistic regression analysis showing Odds Ratio of late good neurological outcome according to Glasgow outcome scale at hospital discharge classification of traumatic brain injury patients (n=45).

Variable	Estimative	Standard	p-value	OR	95%CI
Intercept GOS-HD	1.8625	0.6264	0.0029	-	-
MD-GR vs VS-GR	1.2445	0.5777	0.0312	12.049	1.252–15.989

The socioeconomic impact of BI was also very impressive, as long as in the present investigation it was observed that almost 50% of the injured patients have shown some

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degree of long-term neurological sequelae or have been dead according to GOS-LATE.

GOS has been widespread used due to its practicality, simplicity and sensibility, and has been recommended by many experts as a tool to uniformize data and to allow adequate comparisons between results obtained during long-term evaluation of BI patients.

In the investigation carried by Wilson, Pettigrew, including 135 patients, GOS applied at hospital discharge has offered evidence that 97.8% of the patients have shown some degree of neurological disability, with relevant social and economical impact, as long as 40.4% of the patients remained classified as VS or SD one year after the initial BI. In the present investigation, every patient has shown some degree of neurological disability at hospital discharge. Surprisingly, at least one year later, 71.1% of them have improved, and were classified as MD or GR by GOS-LATE, indicating a substantially better neurological condition than that reported by Wilson, Pettigrew.

In the literature, many authors have applied GOS to evaluate long-term outcome of BI patients. Amongst them, it's highlighted the investigation of Jiang et al.28, that evaluated 846 patients with GCS ≤8 at hospital admission one year after BI, and found 31.6% of GR, 14.1% MD, 24.3% SD, 0.6% VS and 29.4% dead by GOS classification.

In the present investigation, when the results obtained by GOS-HD were correlated with those measured by GOS-LATE, it was observed a better neurological improvement in patients classified as MD and GR by GOS-HD when compared to those that were graded as VS and SD at the same time (GOS has remained unchanged in 41.4% of them). However, it wasn't possible to estimate the real time needed for patients to accomplish this improvement, as long as they were evaluated by GOS-LATE in many different times elapsed from the initial brain injury.

In addition, Heiden et al.29 were more systematic in their follow-up of BI patients. These authors, in a prospective study, have evaluated 213 patients one, six and twelve months after BI applying GOS. They reported the most prevalent GOS classification found at the end of the first month after BI was SD, and that 16% of the patients were in VS. After six months, 68% of them have shown some neurological improvement (MD and GR were prevalent). At one year after BI, GOS has shown that 35% of the patients were in MD-GR, 13% in SD- VS and 52% were dead.

Although in the medical literature it could be found many studies that have employed GOS for the long-term follow-up of BI patients' outcome24,25,28-30, the correlation between GOS-HD and GOS-LATE is scarcely reported.

As a prognostic index tool, GOS-HD has shown to be highly useful in this investigation, indicating a possibility of later neurological outcome improvement 12 times higher in those patients classified as MD and GR when compared to those that have shown VS and SD (p=0.0312). This is an important finding as it opens some doors for the development of rehabilitation programs aiming to limit or minimize the serious sequelae that are often seen after BI, condition that has been more and more frequently found in civilian life. Unhappily, this line of investigation has scarcely been reported or discussed worldwide.

STUDY LIMITATIONS

Amongst many important limitations of the present investigation that could be responsible for some findings' bias, two of them must be highlighted. First, a retrospective method was employed for patients' selection, and only 20% of BI victims admitted to our ICU during the period selected for data gathering were found for prospectively evaluation. Second, no reliable recordings could be retrieved to clearly known if the selected patients have been undergoing or not to a systematic neurological rehabilitation program just after hospital discharge.

In conclusion, in these severe BI patients GOS-Hospital Discharge has shown to be a useful long-term prognostic index. Additionally, factors like the type of brain lesion, the need for neurosurgical interventions, the presence of pneumonia and increasing age had also been associated with poor long-term outcome

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