Original Research Article

Recovery Degree in Pediatric Patients with Antecedent Severe Traumatic Brain Injury in Mexico

ABSTRACT

Aims: To determine the recovery degree in pediatric patients with antecedent severe traumatic brain injury.
Study design: Prospective, analytical and relational.
Place and Duration of Study: Pediatrics Intensive Care Area of the "Hospital para el Niño Poblano" from March 2014 to February 2015.
Methodology: Patients aged 2 to 192 months, both sexes, with antecedent severe traumatic brain injury. The degree of recovery was determined with the Glasgow Outcome Score (GOS) at hospital discharge and one year after. Descriptive and inferential statistics were used data analysis.
Results: The study consisted of 23 patients, of which 69.56% were men. The mean age was 73.17±50.33 months. The predominant age group was middle childhood (34.78%). The main mechanism of injury was run over by a vehicle (39.13%). The group of toddler remained hospitalized for 17.50±8.58 days. Moreover, GOS at hospital discharge (p=0.391) and at one year (p=0.789) was not associated with sex. Additionally, an association of GOS at hospital discharge was found with GOS at one year of care (p=0.003), with greater improvement being observed, in those cases with less initial damage brain.
Conclusion: The degree of recovery at one year after hospital discharge in pediatric patients with antecedent severe traumatic brain injury is associated with the degree of recovery at hospital discharge. Middle childhood, being the group at greatest risk. The complications can reduce the recovery of the patient. Rehabilitation therapy provided by the public health services and the family is of vital importance.

Keywords: critical care, Glasgow Outcome Scale, GOS, head injury, neurotrauma

1. INTRODUCTION

Traumatic brain injury is defined, as any physical injury or functional impairment of the cranial content secondary to a sudden exchange of mechanical energy [1] or as physical injuries produced on brain tissue that temporarily or permanently alter brain function [2]. The categorization is established from the Glasgow Coma Scale as mild (13-15), moderate (9-12) and severe (3-8) [3]. In recent years, traumatic brain injury has become a major public health problem [4] as it represents, the leading cause of death and disability worldwide among all trauma-related injuries [5].

In the United States, there are 500-800 estimated cases of traumatic brain injury per 100,000 people [6]. In Mexico, mortality related to traumatic brain injury is 38.8 per 100,000 people, especially in population, aged 15-45 years. The most frequent cause, is traffic accidents (75%) [7]. Traumatic brain injury in pediatric patients, is common in Emergency

Department, which represents a high risk of presenting sequels [8]. Despite this, in the general population, it is the leading cause of mortality and disability in children older than 12 months in high-income countries, estimating that about 10% of the children under 18 years of age will suffer some type of head trauma during this stage, with a mortality rate twice as high in children under 12 months [9].

Traumatic brain injury can cause cell death, neurotoxicity mediated by alteration in neurotransmission, cerebral edema, vasospam and compromised angiogenesis, causing secondary lesions with potential irreversibility and neurological disability [10]. Glasgow Outcome Scale (GOS) is recommended, as an instrument to measure the degree of recovery from traumatic brain injury. It is simple to apply and has reliability, validity and stability in its results [11], categorizing patients in death, neurovegetative status, severe disability, moderate disability and good recovery [12]. The objective of this paper, is to determine the recovery degree in pediatric patients with antecedent severe traumatic brain injury.

2. METHODOLOGY

Prospective, analytical and relational study in Pediatrics Intensive Care Area of the "Hospital para el Niño Poblano" during the period March 2014 to February 2015 with patients, aged 2 to 192 months, both sexes, with severe traumatic brain antecedent injury, regarding Glasgow Coma Scale. Patients with previous neurological pathology, were excluded. Patients were classified in: infancy (28 days-12 months), toddler (13-24 months), early childhood (25-71 months), middle childhood (72-132 months) and early adolescence (133-198 months) [13].

The variables studied were: age, sex, hospital stay and injury mechanisms (run over by vehicle, fall at the same level, fall at different levels, car accident, other). The degree of recovery was obtained by Glasgow Outcome Score (death (1); neurovegetative state (2); severely disabled (3); moderately disabled (4); and good recovery (5); at hospital discharge and one year after [14]. All patients received rehabilitation for one year by the institution (once a moth) and supplemented by their families (Every day of the week). Rehabilitation was oriented to physical, neurological and sensoperception therapy. Improvement with rehabilitation after one year was evaluated using the Glasgow Outcome Score. Descriptive and inferential (Mann-Whitney U test, Kruskal-Wallis test, Chi square, V Cramer, Wilcoxon test) statistics were used data analysis, with a confidence interval 95%, using the statistical program SPSS Ver. 25.

3. RESULTS

The study was carried out with 23 patients, of which 16 (69.56%) were males. The median age did not present, a statistical difference between the sexes ($p = 0.109$), being higher in males (84.94±55.39 months; median: 82.5 months) than in females (46.29±20.12 months; median: 48 months) (Table 1). The predominant age group, were middle childhood (34.78%) with a mean age of 91.13 ± 22.16 months, followed by early childhood (21.74%) (Table 2).

The principal injury mechanisms, were run over by vehicle (39.13%), fall at the same level (13.39%), fall at different levels (13.04%) and car accident (8.34%). The length of hospital stay respecting gender did not display significant differences ($p = 0.867$), with a median of 12 days (Table 3).

The toddler group stayed longer (17.50±8.58 days; median: 17.50 days), followed by middle childhood (12.13±4.26 days; median: 12.5 days) ($p = 0.464$) (Table 4). Glasgow Outcome

Scale (GOS) at hospital discharge, was not associated with sex (p = 0.391). Males in this stage showed lower values than females, with 56.25% they found in GOS 2 and GOS 3 (Table 5).

GOS one year after hospital discharge, was not associated with gender (p = 0.789). An association of GOS at discharge was found with GOS, one year after hospital discharge (p = 0.003). The most frequent hospital discharge was GOS 4 (52.17%), followed by GOS 3 (39.13%) and GOS 1 (8.7%). One year after hospital discharge, those that predominated were, GOS 5 (56.52%) and GOS 4 (34.78%). Furthermore, it observed an significant increase in the score (p=0.000) of the patients under study (Table 6).

Table 1. Age in months with respect to the sex of the patients.

Sex	p value	N	Median	Mean	Standard deviation	Minimum value	Maximum value
Males	0.109	16	82.5	84.94	55.39	2	168
Females		7	48	46.29	20.12	24	80
Total		23	12	73.17	50.33	2	168

Table 2. Classification of patients respect age stage.

Classification	N	Median	Mean	Standard deviation	Minimum value	Maximum value
Infancy	2	6	6.00	5.66	2	10
Toddler	4	19	18.75	6.08	13	24
Early childhood	5	55	51.00	9.35	36	59
Middle childhood	8	86.5	91.13	22.16	71	132
Early adolescence	4	150	153.00	11.49	144	168
Total	23	71	73.17	50.33	2	168

Table 3. Hospital stay in days respect to sex.

Sex	p value	N	Median	Mean	Standard deviation	Minimum value	Maximum value
Males	0.867	16	12	12.00	4.00	5	20
Females		7	9	13.57	8.60	5	28
Total		23	12	12.48	5.62	5	28

Table 4. Hospital stay in days respect to age stage.

Classification	p value	N	Median	Mean	Standard deviation	Minimum value	Maximum value
Infancy	0.464	2	10.5	10.50	2.12	9	12
Toddler		4	17.5	17.50	8.58	7	28
Early childhood		5	8	10.00	6.32	5	21
Middle childhood		8	12.5	12.13	4.26	5	20
Early adolescence		4	12	12.25	3.77	8	17

Total	23	12	12.48	5.62	5	28

Table 5. Glasgow Outcome Scale (GOS) in hospital discharge and one year after, respect to sex.

Sex	GOS hospital discharge						GOS one year after hospital discharge					
	1	2	3	4	5	Total	1	2	3	4	5	Total
Males	-	2	7	7	-	16	-	-	1	6	9	16
Females	-	-	2	5	-	7	-	-	1	2	4	7
Total	-	2	9	12	-	23	-	-	2	8	13	23

Table 6. Glasgow Outcome Scale (GOS) in hospital discharge and one year after, respect to age stage.

Classification	GOS hospital discharge						GOS one year after hospital discharge					
	1	2	3	4	5	Total	1	2	3	4	5	Total
Infancy	-	-	2	-	-	2	-	-	-	1	1	2
Toddler	-	-	2	2	-	4	-	-	1	1	2	4
Early childhood	-	-	2	3	-	5	-	-	-	2	3	5
Middle childhood	-	1	1	6	-	8	-	-	-	2	6	8
Early adolescence	-	1	2	1	-	4	-	-	1	2	1	4
Total	-	2	9	12	-	23	-	-	2	8	13	23

4. DISCUSSION

The number of males, included in this study was higher than the number of females, coinciding with other investigations carried out in Mexico and other countries [6,7]. Regarding the average age of the patients studied, it was similar to reported by another investigations [15,16]. However, it should be emphasized that the level of medical care of each institution, affected this variable.

The predominant age groups were, middle childhood and early childhood, similar data to those recorded in other investigations. [16,17] This is due to the fact that, the minor begins increasing the risk of suffering accidents without an appropriate care.

The foregoing is related to being run over by vehicle, as the main mechanism of injury found in this research and other authors ratified [7,18,19]. The longest hospital stay was, in the toddler group, which is similar to the data reported, in another investigation carried out in Mexico [7]. Nevertheless, it differs from other investigations, probably due to the availability of resources and the complications that each patient presents [20].

The Glasgow Outcome Scale (GOS) recorded, at hospital discharge the male presented, the lowest values (GOS 2 and GOS 3) and they are consistent with other studies [16,17,21,22] it found an association of sex patients with the mechanisms of injury, the level of severity and the length of hospital stay. Besides, GOS one year after hospital discharge was similar to the

reported by other studies [21,22] that indicated a pathophysiological response of the brain to trauma which was higher in children and young people.

5. LIMITATIONS

The results generated in this study, they are still insufficient to establish a strong management criteria, regarding the recovery of pediatric patients with antecedents of severe traumatic brain injury, mainly due to the lack of resources allocated to the development of research, medical follow-up and rehabilitation. The experience resulting, in this study should be considered, as an opportunity to improve the quality of medical care and the educational and training processes, within the institution.

6. CONCLUSION

The degree of recovery at one year after hospital discharge, in pediatric patients with antecedent severe traumatic brain injury is associated with the degree of recovery at hospital discharge. Middle childhood was the group at greatest risk. Rehabilitation therapy provided by the public health services and the family are of great importance. Nonetheless, due to the prevailing social and economic characteristics in Mexico and access to health services it is difficult to achieve this and above all related to rehabilitation. Therefore, it is important to carry out educational actions about accident prevention, in pediatric patients will reduce this type of injuries and their possible consequences, in the medium and long term. Therefore, it is recommended continue with research related to the subject, in order to propose management alternatives.

CONSENT

All authors declare that written informed consent was obtained, from the parents of patients for publication of this paper.

ETHICAL APPROVAL

The research work was examined and approved by the hospital research and ethics committee.

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