ABCS HEALTH SCIENCES

ORIGINAL ARTICLE

OPEN ACCESS

Early mobilization in victims of traumatic brain injury

Cintia Freire Carniel[1], José Carlos Molero Junior[1], Beatriz da Costa Aguiar Alves[1], Laura Beatriz Mesiano Maifrino[2], David Feder[1], Fernando Luiz Affonso Fonseca[1,3]

[1]Centro Universitário FMABC (FMABC) - Santo André (SP), Brazil
[2]Universidade São Judas Tadeu (USJT) - São Paulo (SP), Brazil
[3]Instituto de Ciências Químicas, Ambientais e Farmacêuticas, Universidade Federal de São Paulo (UNIFESP) – Diadema (SP), Brazil

ABSTRACT

Introduction: Several studies have shown that early mobilization is safe and beneficial for patients admitted to the intensive care units (ICUs), especially for those with mechanical ventilation (MV). **Objective:** To investigate the benefits of early mobilization physiotherapeutic techniques applied to patients who suffered craniocerebral trauma (CCT). **Methods:** This is an experimental study that evaluated clinical data from 27 patients. In sedated patients, mobilization and passive stretching were performed on the upper and lower limbs; in those without sedation, active-assisted, free and resisted exercises were included. **Results:** The experimental group was composed of 51.8% of the participants and the control group by 48.2%, the majority being male (81.5%) with a median age of 43 years. The patients in the experimental group had an average of 9.5 days (2.2-14.7) of mechanical ventilation (MV), and those belonging to the control group, of 17 days (7-21.7) with MV (p=0.154). The patients in the experimental group had an average of 13.5 days in the ICU, against an average of 17 days in the control group (p=0.331), and an average of 20.5 days in hospital against 24 days in the control group (p=0.356). **Conclusion:** Early mobilization should be applied to critically ill patients as it can decrease the length of stay in the ICU and the hospital.

Keywords: Physical Therapy Department, hospital; early ambulation; Intensive Care Units; Brain Injuries, Traumatic.

How to cite this article: Carniel et al. Early mobilization in victims of traumatic brain injury. ABCS Health Sci. 2022;47:e022207 https://doi.org/10.7322/abcshs.2019114.1372

Received: Nov 8, 2019
Revised: Oct 1, 2020
Approved: Mar 11, 2021

Corresponding author: Fernando Luiz Affonso Fonseca - Centro Universitário FMABC - Avenida Lauro Gomes, 2000 – CEP: 06090-870 – Santo André (SP), Brazil
E-mail: profferfonseca@gmail.com

Declaration of interests: nothing to declare

INTRODUCTION

Craniocerebral trauma (CCT) has a high incidence worldwide and is classified from a mild diffuse injury to extensive or focal injury[1]. The general care to be adopted in CCT depends on the severity and aims to optimize cerebral perfusion, tissue oxygenation, ventilatory support, sedation, prevention of hypoventilation and hypoxemia, as well as the increase of intracranial pressure and hypoxemia[2].

In the past, it was believed that bed rest was beneficial to the clinical needs of the CCT patient in an intensive care unit (ICUs)[1]. With the scientific advances in medicine, technology, and staff employed within an ICU, the survival of these patients has increased; it was also concluded that immobility would bring more harm to these patients admitted to an ICU, and could cause other severe dysfunctions of the musculoskeletal, gastrointestinal, urinary, cardiovascular, respiratory, and skin systems[1,3]. Thus, early mobilization of these patients can mitigate this effects[4]. Several studies have shown that early mobilization is safe and beneficial for ICUs patients, especially for those on mechanical ventilation[5-7].

Early intervention strategies include progressive therapeutic activities that aim to maintain muscle characteristics so that the risk inherent to rest and immobility is reduced[8]. In this context of CCT victims with its aggravating complexity and associated morbidities, early mobilization may be an option to reduce the adverse effects of immobilization, consequently reducing mechanical ventilation time as well as ICU stay and hospital stay, with consequent reduction of comorbidities acquired during hospitalization and mortality[9].

According to the above, this study was aimed to investigate the benefits early mobilization physiotherapy techniques can bring when applied to patients who have suffered TBI and are admitted to ICUs.

METHODS

This is quasi-experimental research conducted at Hospital Estadual Mário Covas (HEMC), located in Santo André, SP, Brazil. This study was authorized by the clinical director of the hospital and approved by the Ethics and Research Committee (CEP) of the Faculdade de Medicina do ABC (FMABC) under number 535.819 on 19/02/14. Patients were included after their legal guardians signed the consent forms (CFs). The study subjects were divided into experimental groups and control groups randomly and systematically by order of admission, with the first admitted to the unit directed to the experimental group, the second directed to the control group, and so on.

The patients in the experimental group were seen by the physiotherapy team (usual treatment) and by the students of the supervised internship of the Physiotherapy course of the Faculdade de Medicina do ABC (FMABC), always with a responsible teacher, for the early mobilization approach. These patients had been admitted to the hospital service 48 hours before their inclusion in the study. After this period, the approaches would no longer be considered early. This research was conducted 3 times a week, with a therapy time of approximately 40 minutes per session. The sessions were held during the patient's stay in the ICU until discharge. The control group patients were also assisted by ICU physiotherapists in their routines, which did not suffer interference from the research protocol (no early mobilization). The research protocol also did not interfere in the ventilatory and/or ventilatory weaning strategies of both groups.

Patient Selection

For this study, the patients that were included had not been hospitalized for more than 48 hours in the institution, with age greater than or equal to 18 years, maintenance of ICP less than 20 mmHg or without intracranial hypertension (IH) diagnosed by the attending physician, absence of associated fractures, and absence of chest trauma with pulmonary contusion. Among the 35 patients admitted to the ICU in the period February 2019 to 2018November 2019 and who passed the inclusion criteria and underwent randomization, 27 were included in this study and 08 excluded due to death (06) or transfer of hospital unit (02). Of these 27 patients, 14 (51.8%) were from the experimental group and 13 (48.2%) were from the control group (Figure 1).

Protocol for a patient under sedation

In patients under sedation (maintained between levels 5 and 6 of the RAMSAY scale), passive muscle mobilization and stretching were performed for 20 seconds in the upper and lower limbs with a minimum of 10 and a maximum of 20 repetitions in each joint, followed by functional positioning, maintenance of decubitus above 30º, and co-contraction performed manually by the physical therapist.

Protocol for a patient without sedation

In patients without sedation, using oxygen therapy (nasal oxygen catheter up to 3 liters per minute) after assessing clinical and neurological stability, with Glasgow Coma Scale (GCS) levels from 12 to 15 and Kendall's manual muscle strength test at least 3, in addition to the exercises described in the protocol for sedated patients, active-assisted, free and resistance exercises were included, aiming at functional activities such as sedestation in bed and the bedside, orthostasis, and sedestation in an armchair, according to the muscle strength assessed during the care. The protocol would be terminated if the patient presented signs of respiratory distress (dyspnea/tachypnea/desaturation <90%), hemodynamic instability (heart rate >125bpm and mean arterial pressure ≤ 90mmHg or decrease/increase >40 mmHg in systolic blood pressure), dizziness, intense sweating, or darkening of vision.

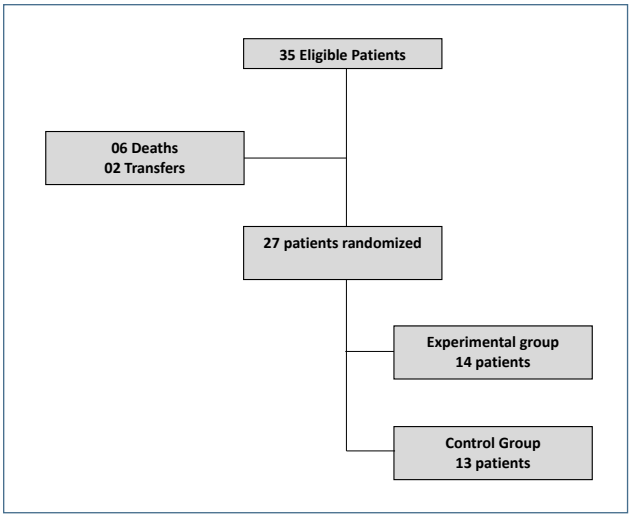

Figure 1: Flowchart of inclusion and exclusion of patients.

Data analysis

Qualitative variables were presented by absolute and relative frequency and quantitative variables by a median, 25th, and 75th percentiles, and 95% confidence interval of the median (Shapiro-Wilk test, p<0.05). The Chi-square test and the Mann-Whitney test were used to analyze the associations between the variables according to the group. The confidence level adopted was 95%. Statistical analysis was performed using the statistical software Stata version 11.0.

RESULTS

The distribution according to the sex and age of these individuals is described in Table 1. It is noted that these characteristics did not interfere in the application of the protocol. Treatment according to the group are described in Table 2. The groups did not show statistically significant differences, except concerning the surgical procedure (p<0.031).

The association between length of stay in ICU, hospital stay, and mechanical ventilation according to the group is described in Table 3. It was found that the intervention group had shorter MV time, shorter ICU stay, and hospital stay, with a difference of 7.5, 3, 5and 3.5 days, respectively, when compared to the intervention group. The data were presented with intention-to-treat analysis due to the important clinical change.

The main trauma mechanisms of the patients in the study were motorcycle accident (n=9 - 31.3%), hit by a car (n=6 - 25.0%), fall from heights (n=6 - 25.0%), physical assault (n=4 - 12.5%) and car accident (n=2 - 6.2%).

In the present study, 76.9% of the control group patients underwent orotracheal intubation (OTI) while in the experimental group it was 85.7%. Patients in the control group spent less time under sedation than those in the experimental group.

No patient included in this study had a change in the intracranial pressure that prevented the continuation of the study, which demonstrates that an early mobilization is a safe approach.

Table 1: Characteristics of the study sample according to gender and age, obtained in the ICU of Hospital Mário Covas, Santo André, Brazil

Variables	Experimental	Control	*p**
	n (%)		
Genre			
Male	12 (54.6)	10 (45.4)	0.557*
Female	2 (40)	3 (60)	
	Median (CI95%)		
Age (year)	45,0 (29.1–48.5)	37.0 (20.8–58.7)	0.197**

*Chi-square test. ***Mann-Whitney* test.

Table 2: Treatment according to the groups included in the study.

Variables	Experimental	Control	*p**
	n (%)		
Orotracheal intubation			
Yes	12 (85.7)	10 (76.9)	0.557
No	2 (14.3)	3 (23.1)	
Tracheostomy			
Yes	2 (14.3)	4 (30.8)	0.303
No	12 (85.7)	9(69.2)	
Extubation			
Yes	12 (85.7)	10 (76.9)	0.557
No	2 (14.3)	3 (23.1)	
Extubation failure			
Yes	1 (7.1)	2 (15.4)	0.496
No	13 (92.9)	11 (84.6)	
Surgical Procedure			
Yes	9 (64.3)	5 (35.7)	0.031
No	3 (23.1)	10 (76.9)	
Intercurrence			
Yes	2 (14.3)	0 (0)	0.157
No	12 (85.7)	13 (100.0)	

*Chi-square test.

DISCUSSION

Our early mobilization program influenced the meantime on mechanical ventilation. In this study, patients in the experimental group had a shorter stay (9.5 days) compared to the control group (17 days), with a delta of variation of approximately 08 days. Our results are similar to those described by Malkoç et al.[10] in which they evaluated the dependence on mechanical ventilation and length of stay in the intensive care unit. According to the authors, the patients in the intervention group (n=227) who participated in the respiratory physiotherapy, bed exercises, and mobilization program, stayed on average 6 and 10 days less respectively on MV in which they evaluated the dependence on mechanical ventilation and length of stay in the intensive care unit. According to the authors, the patients in the intervention group (n=227) who participated in the respiratory physiotherapy, bed exercises, and mobilization program, stayed on average 6 and 10 days less respectively.

Studies indicate that the early initiation of mobilization in patients under mechanical ventilation positively impacts the return to functional independence[1,11]. According to Sanders *et al.*[12], the patients submitted to early rehabilitation had a decrease in ICU and hospital stay days when compared to the control group, averaging 5.5 and 11.2 days (respectively) for the experimental and 6.9 and 14.5 for the control group. A randomized study presented by Mundy *et al.*[13] with 458 patients who acquired pneumonia in the ICU used an early mobilization protocol and observed a decrease in ICU length of stay. Feliciano *et al.*[14], performed a quality-quantitative, prospective, controlled, and randomized clinical trial, and observed that patients with early mobilization had a mean total time in MV days, length of ICU stay in days, length of hospital stay in days, and length of hospital stay shorter than the control group.

Table 3: Association between duration of mechanical ventilation, length of stay in the Intensive Care Unit of Hospital Mário Covas (Santo André, Brazil) and length of hospital stay according to the group.

Variables	Control	Experimental	p*
	Median (CI95%)		
Mechanical ventilation time (days)	17 (7.0–21.7)	9.5 (2.2–14.7)	0.154
Length of stay in ICU (days)	17 (9.8–26.3)	13.5 (3.8–22.5)	0.331
Length of hospital stay (days)	24 (14.4–42.8)	20.5 (11.3–35.2)	0.356

ICU: Intensive Care Unit. CI95%: 95% confidence interval. **Mann-Whitney* test.

A study showed that patients submitted to early rehabilitation presented a decrease in ICU and hospital stay days when compared to the control group, with a mean of 5.5 and 11.2 days (respectively) for the experimental group, and 6.9 and 14.5 for the control group. A randomized study presented by Mundy *et al.*[13] with 458 patients who acquired pneumonia in the ICU, used an early mobilization protocol and observed a decrease in ICU length of stay. Similarly, Feliciano *et al.*[14] performed a quali-quantitative, prospective, controlled, and randomized clinical trial with 14 patients in both groups and observed that the early mobilization group had a mean of 10.86±9.63 in total time in days of MV, 19.86±11,67 time in days of ICU stay and 32.21±16.44 time in days of hospital stay when compared with the control group that presented 13.25±13.51 time in MV days, 21.43±17.14 time in ICU days and 39.71±17.57 time in days of hospital stay.

The weaning and extubation process of patients diagnosed with CCT is of great importance for a satisfactory evolution and should be considered as a primary goal, and early mobilization can favor this process[2,10].

In the study by Borges *et al.*[15], the MV time was 10.2 days for the control group and 8.8 days for the experimental group. In this study, 76,9% of the patients in the control group and 85,7% of the subjects in the experimental group were submitted to OTI; patients in the control group stayed less time under sedation compared to those in the experimental group. In the same study by Borges *et al.*, [15] 76.9% of patients in the control group underwent OTI, while in the experimental group 85.7% underwent, and patients in the control group spent less time under sedation compared to those in the experimental group.

However, despite the evidence cited here that early mobilization in critically ill patients promotes a decrease in deleterious effects and consequently reduces the length of hospital stay, some health professionals are still afraid to mobilize critically ill patients and those under MV, restricting these subjects to inactivity[3,16] in other words, it is still challenging to overcome the multiple barriers that prevent its widespread use.

The results of this study suggest that early mobilization performed in a systematic and protocolized way may lead to a decrease in MV time, ICU, and hospital stay, with consequent cost and morbidity reduction. However, further studies with a larger number of subjects are needed to evaluate this outcome.

Conclusion

The results of this study showed that early mobilization performed in a systematic and protocoled manner decreases the length of stay in the ICU and hospital, with a possible reduction of cost and morbidity, and mortality related to a prolonged hospital stay, which was not directly evaluated in this study; however, it is important to emphasize that the sample size of the groups did not allow us many stratifications and, thus, it is necessary to continue this research with a larger population for better conclusions.

REFERENCES

1. Mota CM, Silva VG. A segurança da mobilização precoce em pacientes críticos: uma revisão de literatura. Interfaces Cient Saude Ambiente. 2012;1(1):83-91. http://doi.org/10.17564/2316-3798.2012v1n1p83-91
2. Prieto R, Gutiérrez-González R, Pascual JM, Roda JM, Cerdán S, Matias-Guiu J, *et al.* Modelos experimentales de traumatismo craneocefálico. Neurocirurgia. 2009;20:225-44.
3. Dantas CM, Silva PFS, Siqueira FHT, Pinto RMF, Matias S, Maciel C, ***et al***. Influência da mobilização precoce na forca muscular periférica e respiratória em pacientes críticos. Rev Bras Ter Intensiva. 2012;24(2):173-8. http://dx.doi.org/10.1590/S0103-507X2012000200013
4. Aquim EE, Bernardo WM, Buzzini RF, Azeredo NSG, Cunha LS, Damasceno MCP *et al.* Brazilian Guidelines for Early Mobilization in Intensive Care Unit. Rev Bras Ter Intensiva. 2019;31(4):434-43. http://dx.doi.org/10.5935/0103-507x.20190084
5. Fontela PC, Lisboa TC, Forgiarini-Júnior LA, Friedman G. Early mobilization practices of mechanically ventilated patients: a 1-day point-prevalence study in southern Brazil. Clinics. 2018;73:e241. http://dx.doi.org/10.6061/clinics/2018/e241
6. Li Z, Peng X, Zhu B, Zhang Y, Xi X. Active mobilization for mechanically ventilated patients: a systematic review. Arch Phys Med Rehabil. 2013;94(3):551-61. http://dx.doi.org/10.1016/j.apmr.2012.10.023
7. Adler J, Malone D. Early mobilization in the intensive care unit: a systematic review. Cardiopulm Phys Ther J. 2012;23(1):5-13.
8. Koizumi MS, Lebrao ML, Mello-Jorge MHP, Primerano V. Morbimortalidade por Traumatismo Crânio-encefálico no município de São Paulo, 1997. Arq Neuropsiquiatr. 2000;58(1):81-8. http://dx.doi.org/10.1590/S0004-282X2000000100013

9. Nozawa E, Sarmento GJV, Vega JM, Costa D, Silva JEP, Feltrim MIZ. Perfil de fisioterapeutas brasileiros que atuam em unidades de terapia intensiva. Fisioter Pesqui. 2008;15(2):177-82. http://dx.doi.org/10.1590/S1809-29502008000200011

10. Malkoç M, Karadibak D, Yildirim Y. The effect of physiotherapy on ventilatory dependency and the length of stay in an intensive care unit. Int J Rehabil Rev. 2009;32(1):85-8. http://doi.org/10.1097/MRR.0b013e3282fc0fce

11. Toledo C, Garrido C, Troncoso E, Lobo SM. Efeitos da fisioterapia respiratória na pressão intracraniana e pressão de perfusão cerebral no traumatismo cranioencefálico grave. Rev Bras Ter Intensiva. 2008;20(4):339-43. http://dx.doi.org/10.1590/S0103-507X2008000400004

12. Sanders C, Oliveira F, Souza G, Medrado M. Mobilização precoce na UTI: uma atualização. Fisioscience. 2010;55-68.

13. Mundy LM, Leet TL, Darst K, Schnitzler MA, Dunagan WC. Early mobilization of patients hospitalized with Community-Acquired Pneumonia. Chest. 2003;124(3):883-9. https://doi.org/10.1378/chest.124.3.883

14. Feliciano VA, Albuquerque CG, Andrade FMD, Dantas CM, Lopez A, Ramos FF, *et al.* A influência da mobilização precoce no tempo de internamento na unidade de terapia intensiva. Assobrafir Cienc. 2012;3(2):31-42. http://dx.doi.org/10.47066/2177-9333/ac.11702

15. Borges VM, Oliveira LRC, Peixoto E, Carvalho NAA. Fisioterapia motora em pacientes adultos em terapia intensiva. Rev Bras Ter Intensiva. 2009;21(4):446-52. http://dx.doi.org/10.1590/S0103-507X2009000400016

16. Feitoza CL, Jesus PKS, Novais RO, Gardenghi G. Eficácia da fisioterapia motora em unidades de terapia intensiva, com ênfase na mobilização precoce. Rev Eletron Saude Cienc. 2014;4(1):19-27.