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Research Article

Early Diagnosis of Cognitive Impairment in Mild TBI

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Abstract

Background: Traumatic brain injury (TBI) is the first cause of death and disability in the young and active population. In the context of TBI, Mild Traumatic brain Injury (m-TBI) is frequent and it is often associated with transient cognitive disorders.

Aim: The aim of this study was to promote the early diagnosis of cognitive and behavioral disorders in patients with m-TBI and to prevent under-diagnosed and long-term symptoms, reducing the risk of a decline in patient's quality life.

Design: A Longitudinal observational study was conducted on subjects who received diagnosis of mTBI in emergency department along a period of time between October 2018 and June 2021.

Setting: Patients were primarily evaluated in Emergency Department of the Buccheri La Ferla Hospital in Palermo. Rehabilitation and follow-ups were conducted in Rehabilitation Medicine Complex Operative Unit of the same medical center.

Population: 520 patients were registered with a diagnosis of Head Trauma in Emergency Rooms during the observational period. 65 patients (12,5%) had a diagnosis of non-commotional head injury and therefore the possibility of being part of the study. 49 patients were included, 9 patients were excluded, 4 patients refused to be part of the study. The average age was 46,7 years.

Methods: a first neuro-psychological evaluation of the patient with m-TBI was conducted within 48 hours of the event. Anamnestic data were collected and standardized neuro-psychological screening tests were administered.Patients were followed up by a team of doctors and neuro-psychologists for a period of 12 months in order to monitor cognitive and behavioral condition. Patients with a cognitive deficit underwent to neuro-psychological rehabilitation.

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Results: 41% of the patients showed cognitive deficits, especially in executive functions. Patients who underwent to neuro-psychological rehabilitation obtained a normal profile at subsequent follow-up evaluations.

Conclusions: m-TBI can cause different clinical manifestations. Therefore, a multidisciplinary intervention is important in order to recognize the patients most at risk of developing long-term cognitive symptoms that can compromise social and occupational functioning.

Clinical Rehabilitative Impact: Post-trauma neuropsychological evaluation allows for early recognition of cognitive disorders. Neuro-psychological rehabilitation improves the quality of life of patients and reduces healthcare cost.

Introduction

The costs for treatment and loss of productivity due to brain trauma are enormous especially if severe [1]. Traumatic Brain Injury (TBI) is the leading cause of death and disability in the young and active population. [2, 3] In the contest of TBI, mild-Traumatic Brain Injury (m-TBI) is the most common and it is often associated with transient cognitive disorders. In fact, even mild injuries can cause persistent cognitive and/or behavioral deterioration. [4] According to the A.C.R.M.; patients with minor head injury have physiological disruption of brain function trauma-induced. Patient with diagnosis of m-TBI can show one of the following symptoms: loss of consciousness; memory loss for events immediately preceding or following the accident; change in mental status at the time of the accident (e.g. disoriented or confused); focal neuro-logic deficits that can be transient. Generally the severity of injury does not exceed unconsciousness of 30 minutes or less; a Glasgow Coma Scale (GCS) of 13-15 points after 30 minutes; post-traumatic amnesia (PTA) not exceeding 24 hours. [5-9] The aim of the trial was to build a protocol for the early diagnosis of cognitive and / or behavioral deficits in patients with m-TBI in the hours following the event. The cognitive assessment protocol was tested on a sample of patients from the hospital emergency room. The study has been conducted in order to promote early diagnosis and secondary prevention of underdiagnosed or later onset symptoms and to reduce the risk of a decline of the patient's quality of social, work and family life.

Materials and Methods

Preliminary analysis was obtained on expected results (expected results/research objective), characteristics of the context (opportunities and limits), roles and resources available (higher work experience, availability, financial resources, time, etc.). Possible actions, resources, times have been identified. Subsequently, the team structured the project deciding its specific objectives and structuring patient's evaluation protocol. Research sample was recruited within 24/48 hours from the patient's arrival at the emergency room. Patients with subnormal test results started neuropsychological rehabilitation treatment and subsequent follow-up for all patients. The two-year

trial took place as follows: 1st year: patient recruitment, cognitive assessment and eventual rehabilitation; quarterly follow-up. 2nd year: quarterly follow-up, reporting. The assessment of cognitive-behavioral deficits was made by the team of neuropsychologists using a battery of cognitive tests in association with a general screening test for the presence of any psychiatric symptoms at the emergency room. From October 2018 to November 2019, 520 patients were registered with a diagnosis of head injury in the emergency room of our hospital. Only 12.5% had a diagnosis of non-commotional head trauma and therefore the possibility of being part of the study. Among the 65 patients considered: 9 patients were excluded based on the established criteria, 4 patients refused to participate in the research project. The remaining 75.39% of patients were recruited and subjected to neuropsychological evaluation. 49 patients (32 men and 17 women) were recruited. Criteria for inclusion in the research project: non-commotional TBI-m;

- TBI-m loss of consciousness less than 24h.

- Age from 16 to 79. Exclusion criteria instead: dementia pathology.

- Psychiatric pathology.

- Neurodegenerative diseases.
Intellectual disabilities.

The group of patients evaluated had an average age of 46.7 years; the average age of the male sample is 43.66 years and the female one is 53.35 years. Furthermore, the sample has a low level of education (average 8.73); specifically, the average schooling of the male sample is 8.81 and the female one is 8.82. The causes of m-TBI were road accidents (25 cases), domestic accidents (15 cases), scuffle (3 cases), workplace accident (2 cases), other (4 cases). Within the first 48 hours of accessing the emergency room, the patients were administered tests for the neuropsychological and behavioral assessment. The neuropsychologists evaluated the possibility of starting a cognitive rehabilitation process based on the scores obtained on the cognitive tests tools administered. Every intervention focused on rehabilitation of cognitive functions that were found to be deficient. A database of patients in excel format has been prepared, kept using passwords, to protect of privacy. An informed consent form and an explanatory guide on the risks of m-TBI were prepared for emergency room patients. Team meetings were held to monitor the progress of the project. Cognitive tools used informed consent.

- Information guide for the patient on m-TBI with a list of possible symptoms that may show up later, both cognitive, physical and psychological symptoms, suggesting the patient to go to the emergency room in the in case he noticed any of these symptoms.

- Symptom Checklist-90-Revised, SCL 90R (Prunas A. and Derogatis LR, 2011), used only if the neuropsychologist wants to investigate behavioral functioning.

- Questionnaire for anamnestic data.

- Galveston Orientation and Amnesia Test, GOAT (Levin et al.; Crovitz, 1987; MacMillan et al.).

- Neuropsychological Screening Test 15-79 years: Mini Mental State Examination, MMSE (Measso G., Cavarzeran F., Zappalà G. et al.); E same neuropsychological breve 2, ENB2 (Mondini, Mapelli, Vestri, Arcara e Bisiacchi, 2011); Frontal Assessment Battery, FAB (Apollonio I, et al.). Telephone interview.

Results

41% of the 49 patients at T0 (first evaluation carried out in the emergency room) presented deficient scores for some of the cognitive functions evaluated. Raw analysis of patients evaluation showed the presence of: deficit of executive functions (measured by the Frontal Assessment Battery test) in 34.7% of the patients evaluated;

Deficits in auditory-verbal short and long-term memory (m. deferred prose), divided attention (Trial B) and understanding (Token test) in 31% of cases; Deficit of abstraction in 14% of cases.

Deficient results in the sub-test of "cognitive estimates in 29% of the patients evaluated". Differences in deficits were also found between subjects with high and low educational attainment. Patients with low schooling present with greater frequent deficits regarding cognitive functions of memory, understanding and praxis skills. None of the patients exhibited behavioral deficits. Among patients with cognitive impairment, the 30% accepted the proposal to undergo a neuropsychological rehabilitation treatment. They did one hour of therapy at week with the neuropsychologist, member of the research project team. An evaluation follow-up was carried out every three months to evaluate the cognitive functioning of the patients. The rehabilitation process was interrupted when the result was normal. During the months of intervention, a dropout percentage was detected at the various follow-up phases. 20% of patients did not deem it necessary to carry out subsequent neuropsychological assessments, stating that they do not have cognitive disorders or do not want to go to hospital due to the restrictions derived from the covid-19 health emergency. In the months of March, April, May 2020 the project was suspended due to the Covid-19 health emergency. In recent months, many patients should have had a follow-up one year after the event. From June 2020, a follow-up neuropsychological evaluation was offered to the patients, but they refused to follow up for fear of hospitals during the COVID-19 pandemic. During the first half of the year 2021, the work team contacted the patients by telephone to obtain information on their psychophysical health. The data collected by neuropsychologists by telephone from patients (49 pcs): 51% not reported any disturbances in the year following the traumatic event:

- 18% of patients described depressive behavioral symptoms.

- 16% said of attention and memory difficulties.

- 8% did not want to answer the telephone interview.

- 6% of patients were not tracked.

Discussion

Head trauma is a heterogeneous pathology. Syndromes post m-TBI are difficult to recognize and treat. Early evaluation of these patients allows recognizing if there are temporary and reversible alterations of brain functions. However, a 20% drop out was recorded during the trial. Patients, in fact, were not motivated to return to the hospital for a follow-up evaluation if they did not find cognitive-behavioral changes. Furthermore, COVID-19 emergency has negatively influenced. [10-13] Cognitive-behavioral recovery can be expected in most patients with m-TBI, but research highlights subgroups with persistent somatic, cognitive, emotional, and/or behavioral problems, generally referred to post-concussion syndrome (PCS). [14-17] Traumatic brain injury (TBI) is a public health problem. After a brain injury, treatment and degree of recovery vary between patients based on

the severity of the trauma. Psychological factors such as emotional distress, maladaptive coping strategies and mental health problems experienced soon after TBI are predictive of a bad outcome. In cases of m-TBI, early intervention by the neuropsychologist makes it possible to pre- vent cognitive and/or behavioral effects, secondary to the trauma. Research shows that both single and multiple m-TBI induce pathophysiological changes in the brain, but the high degree of heterogeneity in the results supports the need to define the m-TBI classification systems. Some patients do not realize or admit the extent of their symptoms until their psychosocial functioning is compromised. We need trials to address challenges in studying post-concussion symptoms, multidimensional longitudinal and large-scale prospective, as they would allow subgroup analyzes. The goal should be to identify patients at risk of developing persistent symptom, and to allow an accurate diagnosis and management of the different manifestations of m-TBI, considering the overall incidence of the disorder (42 million people every year all over the world) and the different therapeutic implications.

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