

The Effect of Early Rehabilitation Intervention on Functional Outcome in Patients with Traumatic Brain Injury: A Systematic Review Protocol

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Protocol

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Abstract

Introduction: Traumatic Brain Injury (TBI) is a serious health problem which is considered as a silent epidemic. Early rehabilitation interventions are among significant factors affecting the functional improvement, reduction of disability and impairment in patients. Initial observations indicate evidence for the effectiveness of such interventions; however, there is no related systematic review study conducted so far. The main objective of the present study is to investigate the prevalence of the interventions and to determine the effectiveness of such interventions on functional outcomes for patients with TBI.

Methodology: In order to find related studies, several data bases such as Embase, Medline, Scopus, PubMed and Web of Science and also Gray Literature are observed. Inclusion and exclusion criteria are designed and modified by a team of experts. Observation of the content of the titles and abstracts will be done by two reviewers and then the data will be extracted and evaluated. All the studies published in English between 1990 and 2019 were included. Primary outcomes include the frequency of early rehabilitation interventions and the effects of such interventions on functional outcomes. If possible, meta-analysis will be conducted as well. **Discussion:** The results of this systematic review study will contribute to identification and clarification of different types of rehabilitation interventions and the effects of such interventions on TBI patients' functional outcomes.

Background

Traumatic Brain injury (TBI) which is often referred to as the “silent epidemic” is one of the most important health problems in the world, resulting in increased need for emergency medical care, rehabilitation, long-term social and psychological support (1-3). According to the reports from World Health Organization, brain injuries will be leading the main cause of death and disability in the world by 2020(4). It is estimated that the direct and indirect costs caused by brain injuries in the United States of America will be between 60/4 to 221 billion dollars(5).

TBI is divided into three main categories of mild, moderate and severe injuries; mild TBI accounts for 81%, moderate TBI for 11% and severe TBI for 8% of the aggregate reported traumatic brain injuries around the world. Most patients with brain injuries ranges between 15 to 45 years of age (6, 7). In addition, Motor vehicle accidents are the most common cause of TBI-related death, usually associated with ejection from the vehicle (5).

The number of surviving patients with severe TBI has increased. However, the sensory-motor and neurological movement deficit has created challenges for rehabilitation medicine (8). 40% of the patients admitted to hospital with TBI, have disorders that lead to long-term disability (9). According to statistics, about 2 percent of people in America live with disabilities caused by brain injury (5).

Since brain injuries involve young people and develop permanent nerve damage, and also because of the nature of the damage to several organs (nerve, muscle, cognitive, etc.), it results in devastating outcomes (10). TBI leads to disabilities that affect their quality of life, ability to perform tasks and social

interactions of individuals at risk (11). Also recently rehabilitation after brain injury has been taken into account by policy makers, doctors, patients and the media as an important health issue in the United States of America (12).

In patients with TBI, rehabilitation process consists of three stages: early rehabilitation phase on a regional trauma hospitals level 1, specialized rehabilitation for inpatients in acute phase and community-based rehabilitation after acute phase (13). Consistent early rehabilitation interventions are designed to repair and improve brain function as well as to help return the individual to community and work (8). Any possibility of participating in activities or obtaining performance and quality of life are greatly in need of early, interdisciplinary and specialized rehabilitation interventions to this group of patients (14). Early rehabilitation is an interdisciplinary and integrated therapy that starts in early admission to the hospital and its objectives include: a guide for prognosis and reduction of complications of immobility, joint contractures, and bladder and bowel dysfunction, skin and sleep problems (5, 8). Early rehabilitation can improve nerve functioning and consequently functional outcomes (15). In fact, patients with severe brain injuries who had received early rehabilitation interventions during the acute phase, will have shorter length of stay and will have fewer remaining disorders and a better outcome at discharge (15, 16).

Early rehabilitation interventions for the next period of rehabilitation are vital and necessary for patients. Any possibility of patient participation in activities or obtaining performance and quality of life greatly reduced in these patients in case early, interdisciplinary and specialized rehabilitation interventions to the affected cases are done (14). Early rehabilitation strategies including exercise, mobility in bed, moved to chair, walking and activities of daily living. As well as for patients with severe cognitive functional limitations and problems of other activities such as exercise in scope, brace and neuromuscular electrical stimulation (5). Barriers to early rehabilitation of patients with brain injuries include concerns about intracranial pressure, cerebral blood flow, and cerebral perfusion pressure. However, early rehabilitation can have many benefits for patients in critical conditions (4, 5).

The results of the systematic review study indicate that early rehabilitation was investigated in intensive care unit (ICU). The findings show that early rehabilitation interventions leads to reduction of hospitalization period, especially in ICU, and also leads to an increase in patients' movements and their independence. The study was conducted on all the patients in intensive care unit (18).

However, there is a little information about the different types of early rehabilitation interventions and the effects of such interventions on TBI patients' functional outcomes. Moreover, there is little comprehensive evidence on the effectiveness of early rehabilitation interventions on reduction of hospitalization period. It is assumed that early rehabilitation interventions increase the improvement of performance among patients with TBI; nevertheless, there are no systematic review studies evaluating the frequency of early rehabilitation intervention on such patients in the literature.

Objectives

Primary Objectives:

1. Evaluation of the prevalence of early rehabilitation interventions in patients with TBI.
2. Evaluation of the effectiveness of early rehabilitation interventions on TBI patients' functional independence measurement.

Secondary Objectives:

1. Evaluation of the effectiveness of early rehabilitation interventions on Glasgow Coma Scale among patients with TBI.
2. Evaluation of the effectiveness of early rehabilitation interventions on Glasgow Outcome Scale among patients with TBI.
3. Evaluation of the effectiveness of early rehabilitation interventions on Community Integration Questionnaire among patients with TBI.
4. Evaluation of the effectiveness of early rehabilitation interventions on hospitalization period.

Methods

The Cochrane Handbook was used to decide over the methodological approach in the present study (17), and the findings will be reported using the recommended methods and checklist of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (18). The protocol is formed according to the guidelines of PRISMA (21). In order to improve the validity of the results and also to decrease the inconsistencies in the process, the protocol is then registered as PROSPERO (International Prospective Register of Systematic Reviews).

Eligibility criteria

The following criteria will be used in order to include or exclude initial studies.

Types of studies:

In this systematic review, we will include studies only if they address the effect of early rehabilitation or early inpatient rehabilitation or early comprehensive rehabilitation in traumatic brain injury in randomized clinical trials (RCTs) and controlled clinical trials (CCTs; quasi-randomized and quasi-experimental designs with comparative controls – controlled before and after studies, experimental, before and after studies), prospective and retrospective cohort studies, and case control studies which are published in English. We will also exclude the following studies: qualitative, mixed method, descriptive, cross-sectional studies, editorial, case report, and anecdotal report.

Types of Participants:

We will include patients (both male and female) with mild to severe TBI who are older than 16 years of age and patient who have received early rehabilitation interventions in hospital.

We will exclude studies if: patients are admitted to hospital due to neurological conditions (e.g., stroke, multiple sclerosis, amyotrophic lateral sclerosis, brain tumor, spinal cord injury, neuromuscular diseases, substance abuse disorders), or trauma that could limit rehabilitation (e.g., major trauma, fractures, joint replacement) and studies on community or home rehabilitation, and outpatients.

Intervention group includes all the patients whose early rehabilitation interventions procedure begins within the first 35 days after hospitalization in ICU or Neurological Ward. Such early rehabilitation interventions should start after the stability of vital signs, intracranial pressure, and cerebral perfusion pressure and should last for at least one hour a day. The rehabilitation team consists of at least two experts including nurses, physiotherapists, occupational therapists, speech therapists, dieticians, and medical social workers. Such interventions should take at least half an hour per day based on the patients' needs.

Patients in the control group receive routine care or any interventions except for early rehabilitation interventions. Besides, the types of control groups will be included in the data extraction section.

Searching strategy in the PubMed database is as follows:

(rehabilitation[ti] OR habilitation[ti] OR "Early intervention*" OR "Early mobili*" OR "Early therap*" OR "Early ambulation" OR vertical OR "early exercis*" OR "tilt table" OR "out of bed")AND ("brain injury" OR (injur* AND brain) OR ("brain injury" AND diffuse[ti]) OR "diffuse brain injury"[ti] OR (injury[ti] AND "diffuse Brain" [ti]) OR ("brain injury"[ti] AND focal[ti]) OR "focal brain injury"[ti] OR (injury[ti] AND "focal brain"[ti]) OR "focal brain injuries"[ti] OR ("brain injury"[ti] AND "trauma*" [ti]) OR (injury[ti] AND "traumatic brain"[ti]) OR (injury[ti] AND brain[ti] AND traumatic[ti]) OR "traumatic encephalopathy"[ti] OR (trauma[ti] AND brain[ti]) OR "brain trauma"[ti] OR "traumatic brain injury"[ti] OR (encephalopathy[ti] AND traumatic[ti]) OR "traumatic encephalopathies"[ti] OR TBI[ti] OR "brain laceration"[ti] OR (laceration[ti] AND brain[ti]) OR "brain contusion"[ti] OR (contusion[ti] AND brain[ti]) OR "cortical contusion"[ti] OR (contusion[ti] AND cortical[ti]) OR (encephalopathy[ti] AND "post-concussive"[ti]) OR (encephalopathy[ti] AND "post concussive"[ti]) OR "post-concussive encephalopathy"[ti] OR "post concussive encephalopathy"[ti] OR (encephalopathy[ti] AND post-traumatic[ti]) OR (encephalopathy[ti] AND "post traumatic"[ti]) OR "post-traumatic encephalopathy"[ti] OR "post traumatic encephalopathy"[ti] OR "Acute Brain Injury"[ti] OR ("Brain Injury"[ti] AND Acute[ti]) OR (injury[ti] AND "acute brain"[ti]) OR "mild traumatic brain injury"[ti] OR (injury[ti] AND brain[ti] AND "traumatic mild"[ti])) AND (1990/01/01:2019/12/31[dp]).

Sources of Primary Research:

We will search the following electronic databases using a strategy developed by the researchers based on the medical subject headings pertaining to each database. PubMed, EMBASE, CINAHL, AMED, Psych INFO, the Cochrane Library, Scopus, Web of Science, Clinical trials.gov, WHO International Clinical Trials Registry Platform (ICTRP), IFPMA Clinical Trials Portal, Current Controlled Trials, Scielo and LILACS, ProQuest dissertations and theses are used to retrieve primary studies published from 1990 to 2019. Gray Literature was identified by additional hand-searching of the reference lists of the review articles on early

rehabilitation in TBI patient. This ensured that the literature review was relevant and comprehensive. We will search Gray Literatures such as conference paper based on Scopus and thesis in ProQuest dissertations. We will conduct hand-searching 2 key journals based on Scopus.

Methods of the review

Selection of studies:

The initial screening of titles will be performed by two independent reviewers (RB and ME). Disagreements will be resolved by consensus. The citations are classified as eligible, uncertain about eligibility, or excluded and stored in an Excel spreadsheet. Abstracts of references considered relevant based on the title will then be checked by two independent reviewers (RB and ME). The full text articles of eligible and uncertain about eligibility citations are retrieved and reviewed. If, after reviewing the full text version of the article, eligibility is not clear or there is missing information, the authors will be contacted by email. When there is no response, a reminder email is sent at two week intervals. After three unsuccessful attempts at contact, the decision will be made based on the information available.

In a second selection phase, two independent reviewers (RB, ME) will confirm the eligibility of the studies by reviewing the full text of the selected studies. A third party (HK) will consider all discrepancies not resolved by discussion in the course of the two selection phases and make a final decision about eligibility. A kappa statistic and the percent agreement will be used to calculate inter-rater agreement in both selection phases.

Data extraction:

The data will be extracted by two reviewers in a standardized way and according to the general information, the features of the study, the primary and secondary outcomes and also the results. Disagreements will be resolved by consensus. Otherwise, another researcher will be asked to make the final decision. The data points will be obtained using Get Data Graph Digitizer following the data extraction from the graph (www.getdata-graph-digitizer.com).

Risk of biased assessment:

The PEDro scale is used to assess the methodological quality of randomized clinical trial on the included studies (19). The new castle Ottawa will be used to assess risks of bias in non-randomized studies (20). A risk of bias table will be generated with the principal biases and the methodological quality of the studies.

Data analysis

At first, the frequency of all types of early rehabilitation interventions for TBI patients will be listed. And then, the number and percentage of each frequency will be provided. All the studies included in this

systematic review will be reported within a form referring to the study characteristics and the types of the studies.

Initially, a narrative synthesis method will be used in order to evaluate the effectiveness of such intervention on functional outcomes so as to describe the results of the present study. Then, all the included studies will be reported in a narrative form and a table of specifications for key features of these studies (study characteristics, interventions, starting time and intervention time, the sample size, sampling method, study setting, statistical methods, expected outcomes and other necessary information) will be presented as well.

Afterwards, meta-analysis will be conducted when possible. The tau-squared and I^2 will be used to measure the statistical heterogeneity among the studies. Where $P < 0.10$ and also I^2 is larger than 50%, the results show a high level of statistical heterogeneity. If the homogeneity of the features of the studies is approved, they will be categorized into different groups and meta-analysis of the pooled data will be performed as well. All analyses will be conducted using STATA software. In the end, two independent experts will assess the quality of the present systematic review according to the Preferred Reporting Items for Systematic Reviews and using Meta-Analyses (PRISMA) guidelines.

Discussion

The results of this systematic review study clearly explain the frequency of the different types of early rehabilitation interventions for hospitalized patients with traumatic brain injury. Moreover, the effectiveness of such interventions on the improvement of functional outcomes among those patients will be obtained. The results of this study can contribute to providing early rehabilitation interventions by a team of inter-disciplinary experts for patients with TBI. Furthermore, the results can propose a set of beneficial early rehabilitation interventions to be applied by the rehabilitation team for patients in the acute phase of injury.

Abbreviations

TBI: Traumatic Brain Injury; EMBASE: Excerpta Medica database; PRISMA: the Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PROSPERO: International Prospective Register of Systematic Reviews; RCT: randomized clinical trials; CCT: controlled clinical trials; ICU: intensive care unit; CINAHL: Cumulative Index to Nursing and Allied Health Literature; AMED: Allied and Complementary Medicine Database; PsycInfo: Psychological Information Database; WHO: world health organization; PEDro: Physiotherapy Evidence Database.

Declarations

Ethics approval and consent to participate

No ethics approval is required given that this is a systematic review.

Consent for publication

Not applicable.

Availability of supporting data

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

ME was the main investigator, carried out the study, and wrote the first draft. HKH supervised the study and contributed to writing process. SAH and VRM was the study advisor. HKH helped with the preparation of the manuscript and critical revision of the draft. SAH and VRM contributed to editing the articles.

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