Med. J. Cairo Univ., Vol. 93, No. 1, Accepted 22/1/2025
DOI: 10.22608/MJCU. 473-479, March 2025
www.medicaljournalofcairouniversity.net

Early Rehabilitation Impact on Traumatic Brain Injury Patients Recoveries

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Abstract

Background: Traumatic brain injury (TBI) is the commonest type of cerebral damage resulting in serious impairment and neurological deficits among young and middle-aged cases.

Aim of Study: To examine the effect of early rehabilitation affects TBI patients' recoveries.

Patients and Methods: This was a prospective research study including sixty cases. Traumatic brain injury to examine the effect of early rehabilitation on traumatic brain injury patients' recoveries. This study was done at Al-Azhar University from June 2023 to December 2023.

Results: There was no statistically significant distinction among GOS at three and six months, *p* more than 0.05. Regarding functional status at three and six months post-injury, there was a statistically significant distinction among alone meal preparation and alone housework at three and six months after injury (*p* below 0.05), while there was no statistically significant distinction among alone shopping, housework, meal preparation, and shopping with support at three and six months after injury (*p* more than 0.05).

Conclusion: Consequently, we found that there was no significant distinction among GOS at three and six months after injury. However, there was a significant distinction between alone meal preparation and alone housework at three and six months post-injury, but no significant distinction has been found between meal preparation, alone shopping, shopping with support, and housework. Therefore, we concluded that early rehabilitation may enhance neurological activity and daily life activities in cases with TBI.

Key Words: *Early rehabilitation – Traumatic brain injury – Impact – Recovery.*

Introduction

ANNUALLY, more than ten million individuals globally suffer from TBI **[1]**.

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Traumatic brain injury represents the most prevalent type of brain damage, leading to significant debility and neurological damage among young and middle-aged populations **[2]**. In the last decade, the rate of death associated with TBI has decreased due to advancements in medical care **[3]**.

Traumatic brain injuries result from direct traumas to the head that induce neuronal damages or dysfunctions. These occurrences are primarily attributed to falls from different elevations, vehicular accidents, sports accidents, and acts of hostility by humans or animals **[4]**. The degree and mechanism of these forces differ, resulting in distinct brain lesions. TBI are typically categorized into mild, moderate, or severe classifications **[5]**. For cases recovering from traumatic brain injury, any therapeutic intervention that enhances their prognosis may significantly minimize the social and caregiver burden associated with traumatic brain injury. Early intense rehabilitation therapy post-stroke is widely recognized to be associated with improved outcomes and may facilitate recovery **[3,6]**. There has been a heightened concentration on the results of traumatic brain injury cases and the effectiveness of rehabilitation therapy in enhancing physical, psychological, functional, and cognitive outcomes **[7]**.

The aim of rehabilitation is to facilitate spontaneous recovery, reduce the possibility of problems, and enhance the brain's inherent rehabilitative ability and plasticity **[8]**.

Limited research has examined the impact of early rehabilitation on the functional recovery of cases with traumatic brain injury. Despite the recognition that early rehabilitation is advantageous for cases with traumatic brain injury, there is less

knowledge regarding the optimal timing and intensity of rehabilitation interventions [9].

Limited studies have assessed the impact of modifying the time or intensity of rehabilitation therapy administered to cases healing from brain injury [10].

This investigation aimed to examine the effect of early rehabilitation on Traumatic brain injury cases 'recoveries.

Patients and Methods

This was a prospective study performed on 60 cases with TBI to examine the effect of early rehabilitation on TBI patients' recoveries. This study was done at Al-Azhar University from June 2023 to December 2023.

Inclusion criteria:

Cases with initial traumatic brain injury, impaired limb motor function, a Glasgow Coma Scale score among nine and twelve, aged among eighteen and sixty years, who exhibited hemodynamic stability, experienced unintentional trauma, tolerated evaluations and interventions, and survived the first six months post-injury.

Criteria for exclusion:

Any further significant concomitant harm, linked spinal cord harm, serious preexisting medical conditions, prior neurological disorders, psychological and/or substance use problems, thrombosis of deep vein, and purposeful trauma.

Methods:

All patients were subjected to the following:

Rehabilitation management:

Rehabilitation management was established by the rehabilitation service at our institution, including neurologic intensive care specialists, a neurosurgeon, neurologists, nurses, and physiotherapists. The rehabilitative training involved correct limb position and care, passive, assessed, and active movements, strength exercises, and functional activity practice. Cases in group one got early and intensive rehabilitation management (seven days post-injury, seven days a week, four times daily, and one hour per session) for four weeks. Cases in group two got standard rehabilitation management (fourteen days after injury, five days per week, two times per day, and one hour per session) for four weeks. Once the cases' primary medical problems have been adequately stabilized, they have been transmitted directly to the rehabilitation therapy center of our hospital to get their rehabilitative treatment.

Functional assessment and follow-up:

Motor function was examined using the Fugl-Meyer Assessment (FMA), and activities of daily living have been measured with the Barthel Index (BI) before treatment, three months post-brain injury, and six months post-brain injury by an assessor unaware of randomization and interventions. All necessary details have been systematically recorded on a specific form.

Evaluation of outcomes:

The degree of traumatic brain damage was classified depending on the Glasgow Coma Scale (GCS) score. Mild traumatic brain injury is defined by a score of 13-15, moderate traumatic brain injury by a score of 9-12, and severe traumatic brain injury by a score of 3-8 [11].

Statistical examination:

Statistical analyses have been conducted with SPSS 13.5 (SPSS Inc., Chicago, Illinois, USA). The *t*-tests have been utilized to evaluate the distinctions among variables prior to and following management in the two groups. All quantitative data are presented as mean ± standard deviation (SD). p less than 0.05 was considered statistically significant, and p less than 0.01 was regarded as very significant.

Results

The mean age of cases was 33±10.7, and thirty-five (58.3 percent) of cases were men, while 25 (41.7 percent) of cases were women. (Table 1).

16 (26.7%) of patients had fallen on the ground, 10 (16.7%) of patients had Fallen downwards, 14 (23.3%) of patients had blown, 13 (21.7%) of patients had road traffic accident and 7 (11.6%) of patients had other causes. (Table 2).

There was 15 (25%) of patients had pneumonia, 11 (18.3%) had anemia, 10 (16.7%) had urinary tract infection, 7 (11.7%) had sepsis, 6 (10%) had seizures, 4 (6.7%) had congestive heart failure, 2 (3.3%) were decubiti, 2 (3.3%) had contracture, 2 (3.3%) had cardiac arrest/severe hypoxia and 1 (1.7%) had deep venous thrombosis. (Table 3).

There was no statistically significant distinction among Glasgow outcome scores at three and six months p more than 0.05. (Table 4).

There was a statistically significant distinction among alone meal preparation and alone housework at three and six months after injury (p less than 0.05), while there was no statistically significant distinction among meal preparation, alone shopping, shopping with support, and housework at three and six months post-injury (p more than 0.05). (Table 5).

Table (1): Distribution of baseline characteristic in the studied group.

	Examined group (Number=60)	
	Mean	Standard deviation
Age (years)	33	10.7
Sex:	N	%
Male	35	58.3
Female	25	41.7

Table (2): Distribution of accident type in the studied group.

	Studied group (N=60)	
	N	%
Accident type:		
Fall on the ground	16	26.7
Fall downwards	10	16.7
Blow	14	23.3
Road traffic accident	13	21.7
Others	7	11.6

Table (3): Distribution of complications in the studied group.

	Studied group (N=60)	
	N	%
Pneumonia	15	25
Anemia	11	18.3
UTI	10	16.7
Sepsis	7	11.7
Seizures	6	10
Congestive heart failure	4	6.7
Decubiti	2	3.3
Contracture	2	3.3
Cardiac arrest / severe hypoxia	2	3.3
Thrombosis of deep venous	1	1.7

Table (4): Spread of GOS at three and six months in the studied group.

	Studied group (N=60)		*p*-value
	Three months n (%)	Six months n (%)	
Good recovery	33 (55%)	31 (51.7%)	0.98
Moderate disability	17 (28.3%)	18 (30%)	
Severe disability	8 (13.3%)	9 (15%)	
Vegetative	2 (3.3%)	2 (3.3%)	

p-value more than 0.05: Not significant.
p-value less than 0.05 is statistically significant.
p less than 0.001 is highly significant.

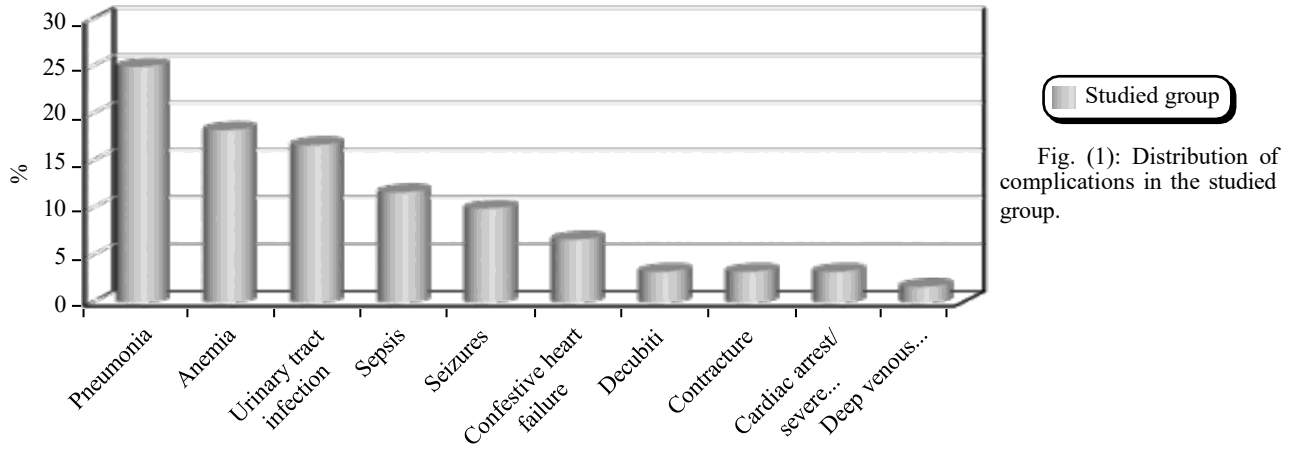

Fig. (1): Distribution of complications in the studied group.

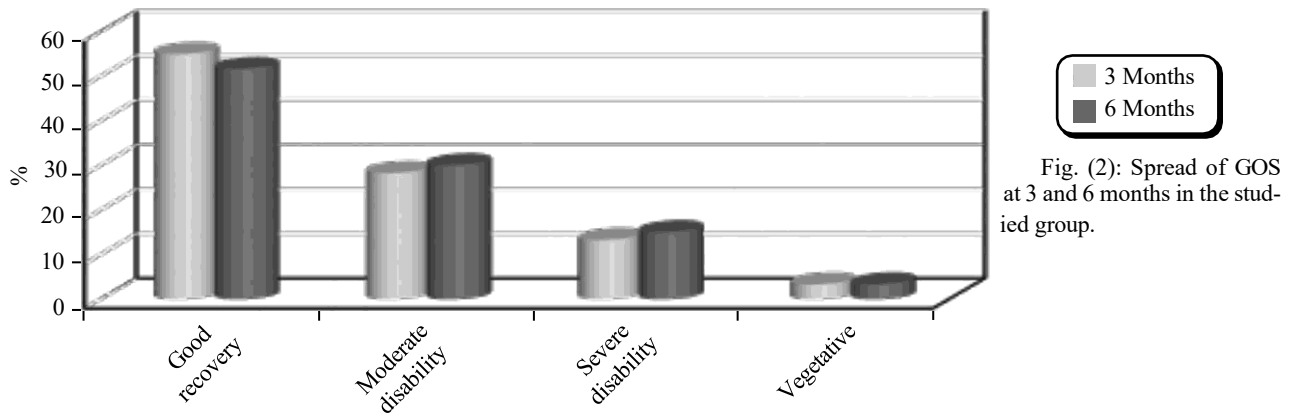

Fig. (2): Spread of GOS at 3 and 6 months in the studied group.

Table (5): Distribution of Functional status at 3 and 6months post-injury in the studied group.

	Studied group (N=60)		*p*-value
	Three months n (%)	Six months n (%)	
Alone:			
Meal preparation	21 (35%)	32 (53.3%)	0.04
Housework	24 (40%)	35 (58.3%)	0.044
Shopping	15 (25%)	21 (35%)	0.23
With help:			
Meal preparation	15 (25%)	8 (13.3%)	0.104
Housework	17 (28.3%)	10 (16.7%)	0.12
Shopping	20 (33.3%)	13 (21.7%)	0.15

p-value more than 0.05: Not significant.
p-value less than 0.05 is statistically significant.
p less than 0.001 is highly significant.

Discussion

Traumatic brain injury (TBI) is a primary cause of morbidity, disability, and mortality across all age groups, placing significant demands on healthcare systems. Annually, almost fifty million cases worldwide suffer from a brain injury **[12]**.

Traumatic brain injury is classified depending on the mechanism of injury, the anatomical location, and the extent of the injury. The Glasgow Coma Scale (GCS) is predominantly utilized upon admission to assess TBI severity. Brain injuries are classified as mild (GCS equal to thirteen or more), moderate (GCS 9–12), and severe (GCS less than nine) based on this scale **[13]**.

The main results of this study were as follows:

In the current study, the mean age of cases was 33±10.7, and thirty-five (58.3 percent) of patients were males, while twenty-five (41.7 percent) of cases were women.

Corresponding with our findings, DOMBOVY ML et al., **[14]** who aimed To investigate if functional, social, and neuropsychological outcomes at three and six months in cases hospitalized after traumatic brain injury could be evaluated through follow-up and to analyze the utilization of rehabilitation services in these cases. They found that the mean age was 39.2 years, with a median of 28.5. Regarding gender, the male frequency was preponderant at 70.3 percent.

As well, Fan MC et al., **[15]** who aimed to examine the impact of initial intensive rehabilitation therapy on the motor function recovery and daily living activities in cases with moderate TBI. Eighty-seven cases (age range eighteen to sixty-five) with TBI who achieved the enrollment criteria have been randomly classified into 2 groups. Group one had early and high-intensity rehabilitation therapy (from seven days after injury, seven days per week, four sessions per day, one hour per session) for four weeks; group two had regular rehabilitation therapy (from fourteen days after injury, five days per week, two sessions per day, one hour per session) for four weeks. Also, the male (n = 45) was more frequent than the female (n = 36).

Concerning accident type, our study found that 16 (26.7%) of patients had fallen on the ground, 10 (16.7%) of patients had fallen downwards, 14 (23.3%) of patients had blown, 13 (21.7%) of patients had road traffic accidents, and 7 (11.6%) of patients had other causes.

Corresponding with our findings, Elgmark Andersson E et al., **[16]**. They found that regarding the accident type, in the intervention group, it was road traffic accident in 63 (24%), fall downwards in 48 (18%), fall on the ground in 70 (27%), blow in 66 (25%), and unknown in 17 (6%). While in the control group, it was road traffic accident in 33 (25%), fall downwards in 26 (20%), fall on the ground in 32 (24%), blow 66 in 33 (25%), and unknown in 7 (6%).Our results showed that regarding complications, there were 15 (25%) of patients who had pneumonia, 11 (18.3%) had anemia, 10 (16.7%) had urinary tract infection, 7 (11.7%) had sepsis, 6 (10%) had seizures, 4 (6.7%) had congestive heart failure, 2 (3.3%) were decubiti, 2 (3.3%) had contracture, 2 (3.3%) had cardiac arrest/severe hypoxia, and 1 (1.7%) had deep venous thrombosis.

Corresponding with our results, DOMBOVY ML et al., **[14]** they found that The primary hospital complications were pneumonia, anemia (hemoglobin less than eight), urinary tract infection, sepsis, and seizures have been reported in. 25.7 %, 18.9%, 16.2%, 10.8% and 9.5% respectively.

In our findings, in term of Glasgow outcome scores at three and six months in the examined group, there was no statistically significant distinction among Glasgow outcome scores at three and six months.

Corresponding withour findings, DOMBOVY ML et al., **[14]** to ensure that the cases available for monitoring at three and six months were representative of the first group of seventy-four subjects, the researchers compared the admission GCS of the whole group with those available for monitoring at three and six months, finding no significant changes. Furthermore, the acute hospital discharge GOS

was examined among the sixty-seven survivors and those available for monitoring at three and six months, revealing no significant distinction.

Also, Fan MC et al., **[15]** they reported that there were no significant distinction among group in GCS score (*p* more than 0.05). In addition, three months following rehabilitation treatment, no significant distinction among group have been found in the GOS score (*p* more than 0.05).

As well, Andelic N et al., **[7]** They revealed that at twelve months after injury, the mean GOSE in the investigation was 5.4 (standard deviation 1.3), with a median of six and a range of two to eight. Among the cases, 16.4 percent attained favorable recovery levels (GOSE 7–8), sixty-four percent experienced moderate disability (GOSE 5–6), eighteen percent suffered from severe disability (GOSE 3–4), and 1.6 percent were in a vegetative state (GOSE 2). Group A exhibited improved global functioning, as measured by GOSE (*p* equal 0.03). Seventy-one percent of cases in the initial rehabilitation group (Group A) achieved an ideal outcome (GOSE 6–8). With respect to functional status at three and six months after injury in our examined group, there was a statistically significant distinction among alone meal preparation and alone housework at three and six months post-injury, while there was no statistically significant distinction among alone shopping, housework, meal preparation, and shopping with support at three and six months after injury.

Corresponding with our findings, DOMBOVY ML et al., **[15]** they found that the occurrence of physical debility, as assessed by the Functional Independence Measure (FIM) in cases during monitoring, was minimal. At three months, the mean was 108, and the median level was 122, out of a total potential of 126. At six months, the mean was 113, and the median was 123. The categories of the Functional Independence Measure (FIM) that exhibited the fewest cases achieving scores of six or seven include bathing, dressing (upper body, limited to three months), tub transfers, stairs, memory (limited to three months), and problem-solving (limited to three months). Concerning the employment status at baseline and subsequent evaluation. A significant decline occurred in the percentage of cases worked full-time, accompanied by a corresponding rise in the percentage of those who are disabled or retired. Their investigation indicated the proportion of respondents performing shopping, meal preparation, household finances independently, and housework, with support, or not at all (another person) at both monitoring intervals. Between three and six months, there is a slight tendency for cases in the 'with-help' group to transition to the 'alone' category for shopping, in addition to a more pronounced trend towards independence in meal preparation and household tasks.

Moreover, Zhu XL et al., **[17]** who aimed to evaluate The impact of heightened rehabilitation intensity on the functional outcomes of cases with traumatic brain injury. Sixty-eight cases with moderate to severe traumatic brain injury has been involved. Cases were randomly assigned to high (four hours per day) or control (two hours per day) intensity rehabilitation regimens approximately twenty days after injury. The programs concluded when cases attained independence in daily activities or when six months had elapsed. The mean Functional Independence Measure total scores of cases in the intensive group enhanced from forty-six (standard deviation = twenty-eight) at admission to 115 (standard deviation = twenty-seven) at six months and to 116 (standard deviation = twenty-seven) after twelve months. The scores of cases in the control group exhibited an increase from fifty-two (standard deviation = thirty-two) at admission to 117 (standard deviation = sixteen) at the sixth month, and further to 119 (standard deviation = eleven) at the 12th month.

Conclusion:

Consequently, we found that there was no significant distinction among GOS at three and six months post-injury. However, there was a significant distinction among alone meal preparation and alone housework at three and six months post-injury, but no significant distinction was found between meal preparation, housework, alone shopping, and shopping with support. Therefore, we concluded that early rehabilitation may enhance neurological activity and daily life activities in cases with traumatic brain injury.

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تأثير إعادة التأهيل المبكر على حالات التعافى من إصابات الدماغ الناتجة عن الصدمة

الخلفية : إصابات الدماغ الرضحية (TBI) هى أكثر أنواع الأضرار الدماغية شيوعًا وتسبب تدهورًا كبيرًا فى الوظائف العصبية لدى الحالات الشابة ومتوسطى العمر.

الهدف: دراسة تأثير إعادة التأهيل المبكر على تعافى المرضى المصابين بإصابات الدماغ الرضحية.

المرضى والطرق: كانت هذه دراسة بحثية مستقبلية شملت ستين حالة من مرضى إصابات الدماغ الرضحية لدراسة تأثير إعادة التأهيل المبكر على تعافى المرضى المصابين بتلك الإصابات. أجريت هذه الدراسة فى جامعة الأزهر من يونيو 2023 حتى ديسمبر 2023.

النتائج: لم يكن هناك فرق ذو دلالة إحصائية بين مقياس النتيجة العامة (GOS) في الثلاثة أشهر وستة أشهر، حيث كانت القيمة الاحتمالية أكبر من 0.05. أما بالنسبة للحالة الوظيفية بعد ثلاثة وستة أشهر من الإصابة، فقد كان هناك فرق ذو دلالة إحصائية فى تحضير الطعام بمفردهم والأعمال المنزلية بمفردهم فى الثلاثة أشهر وستة أشهر بعد الإصابة (p أقل من 0.05)، بينما لم يكن هناك فرق ذو دلالة إحصائية بين التسوق بمفردهم، والأعمال المنزلية، وتحضير الطعام، والتسوق مع الدعم فى الثلاثة أشهر وستة أشهر بعد الإصابة (p أكبر من 0.05).

الخلاصة: :وبناءً على ذلك، وجدنا أنه لا يوجد فرق ذو دلالة إحصائية بين مقياس النتيجة العامة (GOS) فى الثلاثة أشهر وستة أشهر بعد الإصابة. ومع ذلك، كان هناك فرق ذو دلالة إحصائية بين تحضير الطعام بمفردهم والأعمال المنزلية بمفردهم بعد ثلاثة وستة أشهر من الإصابة، لكن لم يتم العثور على فرق ذو دلالة إحصائية بين تحضير الطعام، والتسوق بمفردهم، والتسوق مع الدعم، والأعمال المنزلية. لذلك، نستنتج أن إعادة التأهيل المبكر قد تعزز النشاط العصبى والأنشطة اليومية فى حالات إصابات الدماغ الرضحية.