

Prediction of Return to Work after Mild Traumatic Brain Injury by Different Assessment Scales

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Abstract

Background: Mild Traumatic Brain Injury (m-TBI) based on a score of 15 on the Glasgow Coma Scale; a score of 13 or 14 is due to confusion and will be associated with a long duration of posttraumatic amnesia. Identifying factors that increase the risk of m-TBI is necessary to develop public health programs and reduce the risk of being unable to return to work. Therefore, early detection of disability and intervention training is a very important treatment strategy to enable the injured patients to return to their works.

Aim of Study: Is to predict disability effect on Return to Work (RTW) by assessment scales for patients with mild traumatic brain injury during hospital stay and eight to twelve weeks follow-up.

Material and Methods: Different assessment scales including: Glasgow Coma Scale (GCS), the Montreal Cognitive Assessment (MOCA) Arabic Version, Disability Rating Scale (DRS) and Post Traumatic Amnesia Time (PTAT) were reported a detailed understanding of patients temporally changes in physical and mental statuses and its impact on successful RTW and community integration. A prospective cohort study of sixty-one patients with mild traumatic brain injury (m-TBI) admitted consecutively to Neurotrauma Departments at Emergency Hospital, in El-Kasr El-Aini Hospital.

Results: The results revealed that return to work and recovery from m-TBI occurred after hospital discharging between eight to twelve weeks in 6 patients (9.8%), six to eight weeks in 28 patients (45.9%), two to four weeks in 9 patients (14.8%) and one week in 18 patients (29.5%) and this was supported by using GCS, MOCA [highly predicted (94.86%)] and DRS [highly predicted (96.03%)] scales to predict and develop a suitable work plan according to patient disability.

Conclusion: Return to work and recovery from mild traumatic brain injury occurred mainly between six and eight weeks and were followed for twelve weeks post-traumatic, indicating a high rate of predictability using GCS, MOCA,

DRS and PTAT and helped to develop a remedial plan suitable for disability reasons.

Key Words: Mild traumatic brain injury – The glasgow coma scale (GCS) – Disability rating scale – Montreal cognitive assessment – Post traumatic amnesia time.

Introduction

MILD traumatic brain injury is a common form of head injury, affecting about 600 per 100,000 persons at least per year globally, road traffic accidents account for most of the traumatic brain injuries. Most m-TBI patients return to previous work independently despite some patients may have mild cognitive disability [1,2].

Employment is participating in difficult aspects of life. Working people with head injury report better mental statuses, social integrity and better life quality than people without employment [5-8].

The National Institute on Disability and Rehabilitation Research (NIDRR) and Traumatic Brain Injury Model Systems (TBIMS) stated that only 22% of TBI patients had return to work during first year after injury [3]. Fifteen different research studies found that, eighty to ninety of unemployment cases were reported during rehabilitation period after acute brain injury [4].

Abbreviations:

m-TBI : Mild Traumatic Brain Injury.
GCS : Glasgow Coma Scale.
PTAT : Post Traumatic Amnesia Time.
MOCA : Montreal Cognitive Assessment.
RTW : Return to Work.
DRS : Disability Rating Scale.

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The Glasgow Coma Scale (GCS) is widely used by neurosurgeons to evaluate conscious level of traumatic brain patient [9], while Disability Rating Scale (DRS) intend to measure general functional changes over the course of recovery [10]. The Montreal Cognitive Assessment (MOCA) is screening tool for cognitive impairment with very good sensitivity [11].

The purpose of this study was the relation between these assessment scales and return to work in patients with m-TBI in terms of prediction and time needed to return to work.

Material and Methods

A prospective cohort study was done on sixty-one patients of m-TBI who were admitted to Neurotrauma Unit, Faculty of Medicine, Al-Kasr Al-Aini Hospital during period from September 2018 to February 2019 during hospital stay.

Subjects:

Sixty-one patients finished our complete study assessment and follow-up, while nineteen patients refused to continue follow-up and one patient die

two weeks after discharge from non-trauma related cause, suspected sudden cardiac arrest. Fifty-eight patients (95.1%) were males while only three females (4.9%). Age of the majority (72.1%) of our cases ranged between twenty-one to forty years (44 patients). Fifty-one patients (83.6%) were educated (Technical Education) while only ten patients (16.4%) were illiterate. Thirty-six patients (59%) were manual workers (driver and hand crafts) while twenty-five patients (41%) were employed in non manual works (lawyers, social workers and security). Patients included in the study were required to have recent traumatic brain injury with GCS score [13-15] and age is more than 21 years. As in (Table 1).

Procedures:

The physiotherapist conducted clinical assessment by The Glasgow Coma Scale (GCS) Fig. (1), Post Traumatic Amnesia Time (PTAT) Fig. (2), the Montreal Cognitive Assessment (MOCA) Figs. (3,4) and Disability Rating Scale (DRS) Fig. (5) based on the medical files, clinical interviews of patients and by phone calls during eight to twelve weeks were the patients asked to recall events retrospectives.

Glasgow Coma Scale						
	1	2	3	4	5	6
Eye	Does not open eyes	Opens eyes in response to painful stimuli	Opens eyes in response to voice	Opens eyes spontaneously	N/A	N/A
Verbal	Makes no sounds	Incomprehensible sounds	Utters inappropriate words	Confused, disoriented	Oriented, converses normally	N/A
Motor	Makes no movements	Extension to painful stimuli (decerebrate response)	Abnormal flexion to painful stimuli (decorticate response)	Flexion / withdrawal to painful stimuli	Localizes painful stimuli	Obeys commands

Fig. (1): Glasgow coma scale. Brain injury is classified as: (A) Severe, with GCS <9. (B.C) Moderate, GCS 9 minor, GCS >=13.

Duration of PTA	Severity
<5 minutes	Very mild
5-60 minutes	Mild
1-24 hours	Moderate
1-7 days	Severe
1-4 weeks	Very severe
>4 weeks	Extremely severe

Fig. (2): Severity of post Traumatic Amnesia Time. PTAT include assess orientation, questions, together with questions that a response time measure, a visual acknowledgment test and a speed of response.

The Disability Rating Scale (DRS) is primarily used to assess impairment based on the Glasgow coma Scale. Disability assesses the cognitive ability of the individual after assessment by Montreal Cognitive Assessment (MOCA) Arabic version which submitted by patient his/her own and handicap of an individual.

All tests were performed in an inpatient rehabilitation setting to predict ability to return to employment based on admission and discharge". The intent of the scales was to measure the general functional changes of the patient throughout the course of recovery.

Fig. (3): Montreal Cognitive Assessment (MOCA) Arabic version. Scores range from zero to 30, with a score of 26 and higher generally considered normal.



Fig. (4): Mild Traumatic Brain Injury Patient is submitting Montreal Cognitive Assessment (MOCA) Arabic version.

Patient Name _____
 Rater _____
 Date Completed _____

Diability Rating Scale (DRS)

Arousability, Awareness, & Responsivity

Eye Opening U 0 Spontaneous U 1 To Speech U 2 To Pain U 3 None	Communication Ability U 0 Oriented U 1 Confused U 2 Inappropriate U 3 Incomprehensible U 4 None	Motor Response U 0 Obeying U 1 Localizing U 2 Withdrawing U 3 Flexing U 4 Extending U 5 None
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Cognitive Ability for Self Care Activities
Knows how and when to feed, toilet or groom self

Feeding U 0.0 Complete U 0.5 U 1.0 Partial U 1.5 U 2.0 Minimal U 2.5 U 3.0 None	Toileting U 0.0 Complete U 0.5 U 1.0 Partial U 1.5 U 2.0 Minimal U 2.5 U 3.0 None	Grooming U 0.0 Complete U 0.5 U 1.0 Partial U 1.5 U 2.0 Minimal U 2.5 U 3.0 None
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Dependence on Others Level of Functioning <i>Physical & cognitive disability</i> U 0.0 Completely Independent U 0.5 U 1.0 Independent in special environment U 1.5 U 2.0 Mildly Dependent-Limited assistance <i>Non-resident helper</i> U 2.5 U 3.0 Moderately Dependent-moderate assist <i>Person in home</i> U 3.5 U 4.0 Markedly Dependent <i>Assistance with all major activities, all times</i> U 4.5 J 5.0 Totally Dependent <i>24 hour nursing care</i>	Psychosocial Adaptability Employability <i>As full time worker, homemaker, student</i> U 0.0 Not Restricted U 0.5 U 1.0 Selected jobs, competitive U 1.5 U 2.0 Sheltered workshop, Noncompet. U 2.5 U 3.0 Not Employable
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Total Score (sum all scores) _____

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Fig. (5): The Disability Rating Scale (DRS).

Total DRS score	Level of disability
0	None
1	Mild
2-3	Partial
4-6	Moderate
7-11	Moderately severe
12-16	Severe
17-21	Extremely severe
22-24	Vegetative state
25-29	Extreme vegetative state
30	Death

Fig. (6): Disability categories, total DRS score, level of disability. The maximum score a patient can obtain on the DRS is 29 (extreme vegetative state). A person without disability would score zero.

Abbreviation: DRS: Disability Rating Scale.

Statistical analysis:

The statistical analysis was conducted by using statistical SPSS Package program Version 20 for Windows (SPSS, Inc., Chicago, IL). The following statistical procedures were conducted:

Descriptive statistics: Including the number and percentage for all variables.

- *Chi-square test:* Used to compare between during hospital stay and after discharge for scales. Also, to compare between patients returned to work and those had not returned to work within prediction and actually returned to work for scales.

- *Spearman rank correlation:* For prediction between scales and returned to work.

- *Significant level:* All statistical analyses were significant at $p < 0.05$.

Results

Sixty-one patients finished our complete study assessment and follow-up, while nineteen patients refused to continue follow-up and one patient die two weeks after discharge from non-trauma related cause, suspected sudden cardiac arrest. Fifty-eight patients (95.1%) were males while only three females (4.9%). Age of the majority (72%) of our cases ranged between twenty-one to forty years (44 patients). Fifty-one patients (83.6%) were educated (Technical Education) while only ten patients (16.4%) were illiterate. Thirty-six patients (59%) were manual workers (driving and hand crafts) while twenty-five patients (41%) were employed in non manual works (lawyers, social workers and security).

Different modes of trauma were encountered in our study including; road traffic collusions in twenty-eight patients (45.9%), fights in fourteen patients (22.9%), falling from height in twelve patients (19.7%) and work related injury in seven patients (11.5%) as shown in (Table 1).

Glasgow Coma Scale (GCS) during hospital stay were 15 in forty-seven patients (77%), 14 in eight patients (13.1%) and 13 in six patients (9.8%). While all patients were discharged within three days fully conscious (GCS 15). Patients with very mild grade Post Traumatic Amnesia (PTAT) were thirty-seven (60.7%) and very sever grade were in one patients (1.6%) as shown in (Table 2).

The Montreal Cognitive Assessment (MOCA) scale revealed that during hospital stay, two patients (3.3%) had cognitive impairment and only one of them improved two weeks after leaving the hospital and the rest of patients (fifty-nine patients)

didn't experience any cognitive impairment during hospital stay or follow-up period as shown in (Table 2).

Table (1): Demographic data.

Variables	Items	Number	Percentage
Sex:	Male	58	95.1%
	Female	3	4.9%
Age:	21-40 year	44	72.1%
	40-50 year	8	13.1%
	50-65 year	9	14.8%
Education:	Educated	51	83.6%
	Illiterate	10	16.4%
Employed category:	Non manual works	25	41%
	Manual works (hand crafts, driving)	36	59%
Smoking:	Yes	39	63.9%
	No	22	36.1%
Drug abuse:	Yes	4	6.6%
	No	57	93.4%
Cause of injury:	Road traffic collision	28	45.9%
	Fights	14	22.9%
	Falling from height	12	19.7%
	Work related injury	7	11.5%

Table (2): Comparison of scales between during hospital stay and recovery after discharge.

Scales	During hospital stay (1-3 days) (n=61)	After discharge (1-12 weeks) (n=61)	x ² -value	p-value
GCS:				
• 13	6 (9.8%)	0 (0%)	15.815	0.0001
• 14	8 (13.1%)	0 (0%)		
• 15	47 (77.0%)	61 (100%)		
PTAT:				
• (Very mild) none	37 (60.7%)			
• (Mild) <5 minutes	4 (6.6%)			
• (Moderate) 5-60 minutes	15 (24.6%)			
• (Sever) 1-24 hours	4 (6.6%)			
• (Very sever) 1-4 weeks	1 (1.5%)			
MOCA:				
• Normal control (>26)	59 (96.7%)	60 (98.4%)	0.342	0.559
• Cognitive impairment (<26)	2 (3.3%)	1 (1.6%)		
DRS:				
• None	51 (83.6%)	39 (63.9%)	32.679	0.0001
• Mild	4 (6.6%)	4 (6.6%)		
• Partial	3 (4.9%)	15 (24.6%)		
• Moderate	2 (3.3%)	2 (3.3%)		
• Moderately sever	1 (1.6%)	1 (1.6%)		

The disability rating scale scores during hospital stay was successfully able to predict that thirty-nine patients (63.9%) will be able to return to work after discharge, ten patients (16.4%) were correctly unable to return to work according to DRS scores due to different forms of physical disabilities as shown in (Table 3).

Twelve patients (19.7%) did not return to work although DRS during their hospital stay was suggesting their smooth return to work but in these cases it was related to other causes than head trauma (social isolation, orthopedic fractures, work related social problems) as shown in (Tables 3,4).

The statistical analysis revealed that there were significant differences ($p=0.0001$; $p<0.05$) in scales (GCS and DRS) while no significant difference ($p=0.559$; $p>0.05$) in MOCA scale between patients during hospital stay and recovery after discharge to returned to work.

Table (3): Prediction versus actually returned to work within returned and not returned to work.

Scales	Returned to work		Not returned to work	
	Prediction	Actually	Prediction	Actually
<i>Return to work:</i>	51 (83.6%)	39 (63.9%)	10 (16.4%)	22 (36.1%)
• χ^2 -value	10.588		5.697	
• <i>p</i> -value	0.005		0.034	
<i>MOCA:</i>				
• Normal control (>26)	59 (96.7%)	60 (98.4%)	0 (0%)	0 (0%)
• Cognitive impairment (≤ 26)	1 (1.6%)	0 (0.0%)	1 (1.6%)	1 (1.6%)
• χ^2 -value	0.992		0.000	
• <i>p</i> -value	0.319		1.000	
<i>DRS:</i>				
• None	39 (100%)	39 (100%)	10 (0%)	10 (0%)
• Independent in special environment	0 (0%)	0 (0%)	4 (100%)	4 (100%)
• Selected jobs	0 (0%)	0 (0%)	2 (100%)	2 (100%)
• Mildly dependent	0 (0%)	0 (0%)	1 (100%)	1 (100%)
• Markedly dependent	0 (0%)	0 (0%)	2 (100%)	2 (100%)
• Totally dependent with inappropriate response	0 (0%)	0 (0%)	1 (10.0%)	1 (10.0%)
• χ^2 -value	0.000		0.000	
• <i>p</i> -value	1.000		1.000	

Table (4): Causes related to not return to work and time of return to work after injury.

Items	Number (%)	χ^2 -value	<i>p</i> -value
<i>Causes related to not return to work (n=22):</i>			
Work related disability	3 (13.6%)	7.928	0.041
Work related psychological cause	6 (27.3%)		
Orthopedic fracture injury	8 (36.4%)		
Persistence PCS	5 (22.7%)		

For those 39 cases who returned to work, the relation between Post Traumatic Amnesia Time and time to return to work was documented in (Table 5) showing that 23 patients (59%) returned to work with 6-8 weeks with very mild grade of amnesia (fourteen patients) and moderate grade of amnesia (nine cases). Only three cases (7.7%) with sever grade of amnesia and returned to work within 8-12 weeks. And the rest of patients (13 cases) returned to work within 1-4 weeks as shown in (Table 5).

Results indicated that Montreal Cognitive Assessment (MOCA) ($p=0.891$; $p>0.05$) and Disability Rating (DRS) ($p=0.902$; $p>0.05$) scales could be significantly predicted from assessing the cognitive status and ability to track an individual from coma to community as shown in (Table 6).

Table (5): Post Traumatic Amnesia Time (PTAT) grades and time of return to work after injury.

PTAT	Very mild (none)	Mild	Moderate	Sever	Very sever
1 week	3 (7.7%)				
2-4 weeks	6 (15.4%)	4 (10.2%)			
6-8 weeks	14 (35.9%)		9 (23.1%)		
8-12 weeks				3 (7.7%)	0 (0.0%)

Table (6): Overall prediction of scales related to mild Traumatic Brain Injury (m-TBI).

Item	Scales	
	MOCA	DRS
Prediction	94.86%	96.03%
<i>p</i> -value	0.891	0.902
Significant	NS*	NS*

*: Non significant difference.

Discussion

Return to work is an essential result proportion of TBI. It has been underlined as a key part for assessing result in the World Health Organization's International Classification of Functioning, Disability and Health. Unsuccessful RTW can have significant negative financial and psychosocial ramifications for TBI patients and their families [12].

Returning to work will depend on how patients are feeling, associated injury related disability and the type of job that they do. As the symptoms may impede carrying out the responsibility at work. So the issue of the present study is to predict disability (during hospital stay) versus ability of return to work (during recovery after discharge) by assessment scales for patients with mild traumatic brain

injury to be taken into consideration when evaluating future occupational rehabilitation.

It was very noticeable in this study that the increase in the number of males than the number of females in m-TBI injury cases, which was consistent with the studies that examined the population of m-BTI found that the risk of TBI among males is twice the risk among females. The real reasons for m-TBI are: Car collision, violence, particularly suicidal behavior and assaults involving firearms—the main source of death associated with TBI is located the main source of TBI among the older. While others found that TBI rates were high and equal for both sexes in young age, while adult males are the group most at risk [13,14].

Glasgow Coma Scale and PTAT were measured and monitored during the period of stay in the hospital (GCS 13, 14, 15) and achieving the significant differences in the improving all participants conscious state to reaching GCS 15. It also indicates that the GCS score at emergency admission has a prognostic estimate [15] and that it is a vital factor in each diagnostic score [16].

Cognitive measurement and identification requires a degree of awareness of measurement and reassessment during the recovery period. There was no significant change in the proportion of patients with normal cognitive control at admission and during hospital stay. However, there was an improvement of cognitive impairment patients due to m-TBI during recovery period. It is clear from literature [17-19] that the neuropsychological test results, as proportions of cognitive ability, have been found to associate essentially with practical result measures (e.g DRS).

As The Montreal Cognitive Assessment (MOCA) was measured twice post injury and there is no significant change in the proportion of patients with cognitive impairment. As they only participant patient who presented with mild cognitive impairment was detected with more than 24 hours of post traumatic amnesia at the second time of m-TBI (Arachnoid Cyst on the left temporal lobe) within 12 days of the first time (left temporal concussion) of m-TBI due to vertigo, the patient falling from height and cause second TBI.

We could have excluded this patient from our study, but he was among the participants in the included criteria when he was first injured. This indicates that minor head trauma can cause a cyst damage as a complications of arachnoids cysts [20]. Which can cause the fluid within a cyst to leak into other areas (e.g., subarachnoid space).

To develop a detailed understanding of temporal change at the individual level, regarding ability of return to work, disability rating scale prediction measurement and actual status after post injury recovery was comparable and resulted in a high proportion of the two standards which is consistent with the finds of Brooks and coworkers [21].

Accordingly, most patients were able to return to their work after 6-8 weeks after injury, while only a few returned after two weeks which were the least severity of injury. On the other hand, the patient expected the possibility of returning to work, but did not return for reasons that like social isolation, orthopedic deficits and aging associated with post concussion symptoms. This is consistent with some previous studies that have reported that a mild traumatic brain injury is a unique injury that affects everyone differently. Recovery times may vary but the majority of people will notice that their symptoms are gone after a few days. however, some patient may experience prolonged recovery and take longer to return to work [22-24].

Finally, in this study, there were five patients who did not return to work despite the expectation of their return through the DRS, which were not accurate in predicting the symptoms of persistence concussion and this is what is taken on this scale in his ability to predict long-term disability in m-TBI patients. Some sources reported that the DRS has a few disadvantages as the inter-rater reliability need to be well established [25], while others found a high variability [26].

Conclusions:

Return to work and recovery from mild traumatic brain injury occurred mainly between six and eight weeks and were followed for twelve weeks post-traumatic, indicating a high rate of predictability using GCS, MOCA (94.86%), DRS (96.03%) and PTAT and helped to develop a remedial plan suitable for disability reasons. Thus these findings should be taken into consideration when evaluating future occupational rehabilitation.

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التنبؤ بالعودة إلى العمل بعد الإصابة بالدمغ الرضى الخفيف بإستخدام مقاييس تقييم مختلف

الأهداف وطرق البحث: هدفت الدراسة إلى التنبؤ بتأثير العجز على "العودة إلى العمل" من خلال مقاييس التقييم للمرضى الذين يعانون من إصابات رضية خفيفة فى الدماغ وذلك أثناء الإقامة فى المستشفى ومتابعة ثلاثة أشهر بعد الخروج من المستشفى.

الأشخاص والطريقة: تم مشاركة واحد وستين مريضاً يعانون من إصابات رضية خفيفة فى الدماغ فى قسم جراحة المخ والأعصاب فى مستشفى الطوارئ، فى مستشفى القصر العينى. تم إخضاعهم لجدول تقييم مختلفة بما فى ذلك، مقياس غلاسكو للغيوبية GCS، مقياس التقييم المعرفى فى مونتريال للنسخة العربية MOCA، مقياس تقييم الإعاقة وفقدان الذاكرة ما بعد الصدمة DRS، فهم مفصل للتغيرات المؤقتة للمرضى فى التماثل الجسدية والعقلية وتأثيرها على العودة الناجحة إلى العمل والتكامل.

النتائج: كشفت النتائج أن العودة إلى العمل والشفاء من الإصابات الرضية الخفيفة فى الدماغ حدثت بعد الخروج من المستشفى من ثمانية إلى إثنى عشر إسبوعاً فى ٦ مرضى (٩٠.٨٪)، ستة إلى ثمانية أسابيع فى ٢٨ مريضاً (٤٥.٩٪)، إسبوعان إلى أربعة أسابيع فى ٩ المرضى (١٤.٨٪) وإسبوع واحد فى ١٨ مريضاً (٢٩.٥٪) وهذا كان مدعوماً بإستخدام، مقياس غلاسكو للغيوبية، مقياس التقييم المعرفى فى مونتريال للنسخة العربية تنبؤ عالى الدرجة (٩٤.٨٦٪) ومقياس تقييم الإعاقة وفقدان الذاكرة ما بعد الصدمة تنبؤ عالى الدرجة (٩٦.٠٢٪) للتنبؤ وتطوير عمل خطة مناسبة وفقاً لإعاقة المريض.

الإستنتاج: ثبت أنه العودة إلى العمل والشفاء من إصابة خفيفة فى الدماغ بشكل رئيسى تحدث بين ستة وثمانية أسابيع وتم متابعتها لمدة ١٢ إسبوعاً بعد الصدمة، مما يشير إلى إرتفاع معدل القدرة على التنبؤ بإستخدام مقياس غلاسكو للغيوبية GCS، مقياس التقييم المعرفى فى مونتريال للنسخة العربية MOCA، مقياس تقييم الإعاقة وفقدان الذاكرة ما بعد الصدمة DRS، وساعد فى تطوير خطة علاجية مناسبة لأسباب العجز.