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A Study of Post-concussion Symptoms in Mild Traumatic Brain Injury Patients

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Abstract

Objective: Patients with mild traumatic brain injury account for 80% of all traumatic brain injury cases. Patients with symptoms were found to occur following traumatic brain injury. The purpose of this study was to post-concussion symptoms and post-traumatic amnesia.

Method: This prospective observational study was conducted in the Emergency Department (ED) of two tertiary care hospitals in Thailand's Khon Kaen Province. Patients with mild traumatic brain injuries had phone interviews for the first 24 hours, first week, second week, and fourth week after the injury to assess post-concussion symptoms and post-traumatic amnesia.

Results: 166 patients completed the follow-up assessment four times. The mean severity of RPQ-3 symptoms was significantly reduced (p <.01). RPQ-13. The mean severity score of symptoms increased statistically significantly (p< .01). Amnesia, on the other hand, was discovered in 11.40 percent of patients within the first 24 hours.

Conclusion: Post-concussion symptoms, there was the occurrence of symptoms and their severity for each group, the time difference. Amnesia appears within 24 hours of trauma. These results could be used in discharge planning and referral care for continuing cares.

Keywords:

Mild traumatic brain injury; Post-concussion symptoms; Post-traumatic amnesia.

Introduction

Traumatic Brain Injury (TBI) is a major public health concern around the world, including in Thailand. Brain injuries affect an estimated 69 million people worldwide each year. It is found primarily in Southeast Asia and the Western Pacific [1]. Traffic is the leading cause of brain injury, particularly in developing countries. However, 2.8 million people with traumatic brain injury have been reported in emergency departments in the United States [2]. The Glasgow Coma Score (GCS) is a tool used to categorize brain injury severity into three levels: 1) mild traumatic brain injury (GCS 13-15), 2) moderate traumatic brain injury (GCS 9-12), and 3) severe traumatic brain injury (GCS 3-8), [3] with mild traumatic brain injury being the most common, accounting for approximately 80% of traumatic brain injury[1,4]. Mild TBI is classified into three levels based on risk factors: low risk, moderate risk, and high risk. Low-risk groups do not to be admitted to the hospital to observe symptoms [5].

Moderate-risk groups may need hospitalization or brain computed tomography. When the patient's symptoms have stabilized, they will be discharged. Patients with mild TBI, according to guidelines developed by the Royal College of Surgeons of Thailand and the College of Neurological Surgeons of Thailand. However, even if the injury is not severe, there is a risk of brain haemorrhage in patients with mild traumatic brain injury. There is also a risk of post-concussion symptoms, [6] which are caused by brain injury and result in abnormalities in brain function, as well as patients with neurological impairments such as unconsciousness and amnesia [7]. Post-traumatic amnesia can be caused by both retrograde and anterograde amnesia [8]. It may occur over a period of hours, days, months, or even years and is a predictor of function following a brain injury, [9] which may affect perception and lower the patient's quality of life. Moreover, it was discovered that there were signs of traumatic brain injury, such as headache, insomnia, irritability, forgetfulness, hyperactivity, and double vision. The symptoms can be divided into 1) physical symptoms, 2) behavioral and emotional symptoms, and) cognitive symptoms [10,11]. According to research, 85% of symptoms following traumatic brain injury appeared within the first week. The most frequent symptoms were headaches, forgetfulness, drowsiness, fatigue, and dizziness [7]. Typically, the symptoms appeared and disappeared within 7 to 14 days [12]. 10-25% of people [13] had symptoms that lasted between three months and a year. It is a problem with lifestyle. Work and obligations prevent patients from participating in activities with others, which typically lowers their quality of life [14].

Caring for patients with mild traumatic brain injuries (moderate and high-risk groups) who were admitted from the emergency room to the trauma ward for observation and close monitoring until discharge, as well as follow-up treatment for two weeks to one month after the patient is discharged and returned to school or work, some people still experience varying degrees of symptoms after a traumatic brain injury, which has an impact on the patient's way of life. Therefore, the researcher is interested in research to understand the symptoms. In patients with mild traumatic brain injury, the severity of post-injury symptoms and post-traumatic amnesia were assessed during the first 24 hours, first week, second weeks, and fourth weeks after the injury. The study's findings will help healthcare providers

understand the symptoms and progression of the disease. To prepare, discharge plan, and refer patients in the context of continuity of care.

Methods

Participants

Patients with mild traumatic brain injury were conducted in the emergency department and transferred to the trauma ward. The inclusion criteria were patients with mTBI, moderate risk, and high-risk GCS score of 13 – 15, aged 18-60 years old, having a phone for telephone interviews, having no psychiatric diagnosis before the injury, and having no alcohol withdrawal syndrome. The researcher has calculated the sample size was determined according to the program G* Power version 3.1.9.7 [15], using an effect size of .25, a power of the test of 0.80, and a level of significance (alpha level) of 0.05, the sample size was 158, adjusting the dropout rate of 10% [16], the total sample size was 174.

Procedures

After the human ethics committee's approval, the data collection, the ward nurses initially screened the data from the qualifying sample. The researcher welcomes the sample population. Clarify the study's goals and specifics when the sampling agrees to participate by informed consent obtained in written form before data collection begins. The tools used to collect sample data consisted of three parts as follows:

1. General information and clinical information forms
2. The River mead Post-Concussion Symptom Questionnaire
3. The Galveston Orientation and Amnesia Test (GOAT)

Participants were interviewed by phone to follow up after a traumatic brain injury.

The Rivermead Post-Concussion Symptom Questionnaire (RPQ) and the Galveston Orientation and Amnesia Test (GOAT) are the interviewing tools used in the first 24 hours, first week, second weeks, and fourth weeks after injury. (**Figure 1**) The researcher explains to the sample how to understand the questions in the assessment form to clarify any misunderstandings. The interview lasts 15 to 20 minutes, and scheduling a time and date that work for the patient must be done before calling the patient for an interview. The information was gathered between June and August 2022.

Measures

The tool used to collect sample data and for analyzed of this study as follows: 1) The River mead Post-Concussion Symptom Questionnaire (RPQ) is an instrument developed by King et al. (1995) [17] and modified scoring version by Eyres et al. (2005) [18], The assessment consisted of 16 symptom questions and two open-ended questions, divided into two groups: RPQ-3 and RPQ-13. There are Likert scale five levels of 0-4 of the score. (0 = not experienced at all, 1 = no more of a problem, 2 = a mild problem, 3 = a moderate problem, and 4 = a severe problem). The RPQ-3 consists of the first three items; the score is potentially 0–12. The RPQ-13 comprises the next 13 items, the score is potentially 0–52, and the total score in RPQ is 0 – 64.

2) The Galveston Orientation and Amnesia Test (GOAT) is an instrument developed by Levin, O'Donnell & Grossman (1979) [19]. There are a total of 10 questions, and a score of less than 75 points is a patient with memory loss after traumatic brain injury, and a score greater than 75 points means the patient has no memory loss after traumatic brain injury.

Data analysis

Analysis was performed using IBM SPSS for Windows computer programs. The general and clinical information of The Galveston

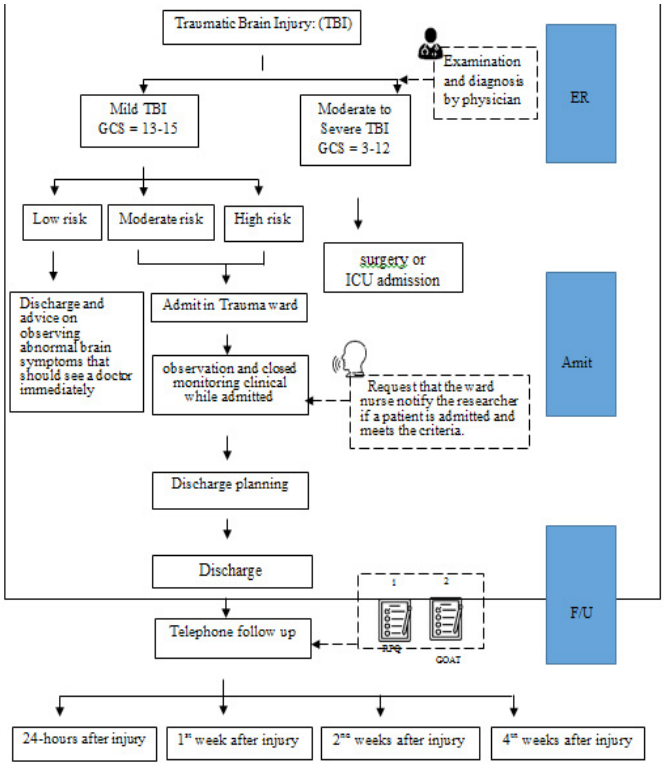

Figure 1: Overview study diagram.

Orientation and Amnesia Test (GOAT) was analyzed by frequency, percentage, mean, and standard deviation. The River mead Post-Concussion Symptom Questionnaire (RPQ) was analyzed using repeated measures ANOVA to compare symptoms, onset, and severity after traumatic brain injury during the first 24 hours, first week, second weeks, and fourth weeks. Before the analysis, statistical assumptions were tested. The results of Mauchly's Test of Sphericity were found to be significant. This is not in accordance with the preliminary agreement that the analytical results can be read by the Sphericity calculation method. Therefore, the analytical results are reported using Greenhouse-Geisser.

Results

A post-traumatic brain injury and post-traumatic amnesia study were conducted on patients with mTBI, moderate-risk, and high-risk, and patients were followed up for the first 24 hours, first week, second weeks, and fourth weeks after injury. Because eight samples were not collected from the 174 samples collected, therefore, this study included 166 samples.

The sample was mostly male (60.20%) with a mean age of 32.66 years, and it was found that most had road accident victims protection 60.20% of the health welfare. 76.50% of the samples occasionally wear a helmet or use a seat belt while driving. Traffic accidents were the leading cause of brain injury for 87.30%, by motorcycles accounted for 96.56% of the total traffic accidents. It was discovered 54.20% had consumed alcohol prior to the accident. Most of the samples had a GCS 15 at admission, 74.70%, who had received computed tomography of the brain, 48.20%, the length of stay for 24-48 hours, and 54.20%.

The River mead Post-Concussion Symptom Questionnaire (RPQ) is divided into two groups, RPQ-3 and RPQ-13. RPQ-3 symptoms and severity decreased in the fourth week after post-brain injury. RPQ-13, the most symptoms were found in the second and fourth weeks, indicating a tendency to increase symptoms (**Table 1**). Memory loss and amnesia were found in the first 24 hours of 19 samples, representing a percentage of 11.40. However, no samples with amnesia were found in the first, second, or fourth weeks (**Table 2**).

Table 1. Post-concussion symptoms are classified according to the time since the brain injury.

Symptom	Duration of symptoms after a traumatic brain injury							
	24 hrs.		1st week		2nd week		4th week	
	N	%	N	%	N	%	N	%
RPQ-3								
1. Headaches	166	100.00	151	91.00	124	74.70	105	63.25
2. Feelings of dizziness	133	80.12	129	77.70	116	69.90	105	63.25
3. Nausea or vomiting	44	26.50	0	0	0	0	0	0
RPQ-13								
4. Noise sensitivity	0	0	1	0.60	2	1.20	2	1.20
5. Sleep disturbance	9	5.42	77	46.38	128	77.10	123	71.10
6. Fatigue	119	71.68	112	67.46	112	67.50	99	59.60
7. Irritable	0	0	1	0.60	2	1.20	0	0
8. Depressed	0	0	0	0	0	0	0	0
9. Frustrated or impatient	34	20.50	4	2.40	2	1.20	5	3.00
10. Forgetfulness	1	0.60	2	1.20	14	8.40	72	43.40
11. Poor concentration	1	0.60	1	0.60	7	4.20	65	39.20
12. longer to think	1	0.60	1	0.60	8	4.80	26	15.70
13. Blurred vision	1	0.60	0	0	0	0	0	0
14. Light sensitivity	0	0	0	0	0	0	0	0
15. Double vision	0	0	0	0	0	0	0	0
16. Restlessness	0	0	0	0	0	0	0	0
RPQ-3 Scoring								
Mean (S.D.)	4.71 (±2.00)		3.11 (±1.33)		2.05 (±1.27)		1.67 (±1.26)	
Min - Max	1 - 11		0 - 6		0 - 4		0 - 4	
RPQ-13 Scoring								
Mean (S.D.)	1.94 (±1.50)		2.19 (±1.75)		2.16 (±1.64)		2.77 (±2.04)	
Min - Max	0 - 7		0 - 6		0 - 9		0 - 9	

Table 2. Post traumatic amnesia.

Post traumatic amnesia	Duration after traumatic brain injury							
	24 hrs.		1st week		2nd weeks		4th weeks	
	N	%	N	%	N	%	N	%
amnesia	19	11.40	0	0	0	0	0	0
Mean (S.D.)	68.05 (±4.90)		0 (0)		0 (0)		0 (0)	
No amnesia	147	88.60	166	100.00	166	100.00	166	100.00
Mean (S.D.)	88.61 (±7.78)		98.07 (±4.21)		98.89 (±3.45)		98.95 (±3.34)	

Table 3. Repeated measure ANOVA of mean severity scores, RPQ-3 and RPQ-13 in first 24 hours, first week, second week, and fourth week after injury (N=166).

Source	Sum of Squares	df	Mean Square	F	*p*-value
RPQ-3					
Time	921.084	1.726	533.648	364.969	<.001*
Error time	416.416	284.793	1.462		
RPQ-13					
Time	61.861	2.647	23.374	16.580	<.001*
Error time	615.639	436.680	1.410		

df = degree of freedom, F= Repeated Measure ANOVA

Discussion

A study of mTBI patients with moderate and high risk was conducted in the emergency department and transferred to the trauma ward until discharged. The following are post-concussion symptoms and post-traumatic amnesia. After four weeks, the RPQ-3 group had decreased mean score of symptom severity, while the RPQ-13 group had increased mean score of symptom severity. Post-traumatic amnesia was observed within the first 24 hours and was not shown in the later periods (**Table 1**).

Findings of a study on mild traumatic brain injury patients with post-traumatic brain injury. Amnesia and post-injury symptoms during the first 24 hours, first week, second week, and fourth week after trauma. The most common symptoms, according to the RPQ [17,18], were headache, dizziness, sleep disorders, fatigue, and frustration, which were consistent with previous studies [7,20]. The symptoms observed in the samples did not occur concurrently. In some cases, the symptoms can be found in the early stages after the injury, while in others, the symptoms worsen late stage after the injury. RPQ-3 symptoms included headache, dizziness, nausea, and vomiting, which were most common in the first 24 hours after injury [18]. However, symptoms will decrease over time. The analysis of the RPQ-3 severity comparison results revealed that there was a difference in each period. Until the fourth week, the severity of the onset of symptoms gradually decreased (**Table 3**). They are anxious, frustrated, and stressed about the situation because of the early stages of injury. They did not get enough rest while in the hospital. Over time, patients understand their health and are able to manage their problems, resulting in a decrease in the severity of their physical symptoms. It was also found that the decrease in physical symptoms was a self-recovery process [21]. We only found nausea and vomiting during the first 24-hour period, explaining that vomiting is a symptom that indicates the possibility of brain abnormalities [5, 4]. An increase in intracranial pressure indicates. For example, when nausea and vomiting occur more than twice, according to Monroe and Kelly's theory (Monroe-Kellie doctrine), when intracranial volume changes, increased intracranial pressure results. The vomiting center is activated when the Medulla oblongata of the brain is pressed [22]. 9% of vomit patients with mild traumatic brain injuries had abnormalities on computed tomography of the brain [5]. There were 34 samples with abnormal brain computed tomography results, indicating cerebral hemorrhage, and most of the samples noticed nausea and vomiting. When the cerebral hemorrhage was resolved or treated. As a result, there was no later nausea or vomiting. RPQ-13 is detected in the late stages of injury [18]. Most of the symptoms appeared after the second week after the injury and tended to increase in severity (**Table 3**). The samples perceived an increase in the severity of symptoms in the fourth week, such as sleep disorders, forgetfulness, poor concentration, longer thinking, and noise sensitivity. When the patient returns to normal life, such as returning to work or studying, those activities necessitate increased consciousness and concentration. The patients were aware of the severity of their symptoms, which is consistent with the adverse reaction theory of Lenz et al [23]. The influencing factor is the interaction of physiologic, psychological, and situational factors, which results in symptoms or syndromes. On the other hand, they have an impact on individual expression, which includes cognitive functioning, physically as well as socially. The study found that sleep disorders. It is a common symptom associated with traumatic brain injury. The sample had insomnia, which was consistent with the previous study. Insomnia was found in 50% of them [24]. However, the feeling of frustration or impatience, which was a symptom in the RPQ-13 group, was discovered within the first 24 hours of the injury and persisted throughout the fourth week. Patients have acknowledged their medical conditions, injuries, and treatment plans, including medical expenses. This results in the onset of ongoing symptoms following the injury.

According to the study, the following post-concussion symptoms were not found in the sample: depression, light sensitivity, double vision, and restlessness, which is consistent with previous research [20]. Only 11.40% of patients had post-traumatic amnesia in the first 24 hours after injury (**Table 1**). Amnesia has been reported in samples with mild traumatic brain injury following head trauma, with abnormal brain computed tomography results accounting for 3-13% [5]. So the first, second, and fourth weeks were when the sample returned home and stayed with relatives. The date, time, and location were obtained, and the memory of the accident was reviewed. Which recovered faster, which was consistent with a study in traumatic brain injury patients with post-traumatic amnesia? Being stimulated by a nurse's orientation to the date, time, and location reduced short-term memory more than the control group [25].

Limitations

According to the study, eight samples were not collected due to the assessment in the first 24 hours after injury. There were no signs of post-concussion symptoms and post-traumatic amnesia. The patients were inconvenienced by being given information and being able to return to their normal lives without experiencing any abnormal symptoms. As a result, no additional symptoms were reported. Because they were a follow-up in the following three times, it was impossible to collect complete data.

RPQ is a widely recognized measurement. There was also a limitation on depression symptoms in this study due to an assessment or symptom reporting by samples that were given but did not have symptoms. As a result, no symptoms were reported. Specific depressive assessment tools should be used in the future.

Conclusion

A study of mild traumatic brain injury patients from the ED admitted to the trauma ward and followed up on for the first 24

hours, first week, second weeks, and fourth weeks after injury. The incidence and severity of RPQ-3 and RPQ-13 were different for each group as well as the time after brain injury. Amnesia appears within 24 hours of a traumatic event. These findings could be used in discharge planning and continuing care referrals.

Acknowledgments

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