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Early patients' illness perception as a predictor of post-traumatic stress disorder and quality of life one month after mild traumatic brain injury: a prospective study

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ABSTRACT

Introduction: The illness perception of mild Traumatic Brain Injury (mTBI) patients before discharge from the hospital tends to be inappropriate. Apart from that, post-injury symptoms such as post-traumatic stress disorder (PTSD) are often experienced by patients, which can affect their quality of life. However, research linking patient perceptions with post-traumatic stress and quality of life remains scarce. This study aimed to examine patient's illness perceptions and their relationship with PTSD and HRQOL.

Methods: This study employed a prospective survey. Illness perceptions were measured before hospital discharge, and a follow-up of post-traumatic stress and health-related quality of life using an online survey was conducted one month later. The survey was administered from July to October 2023 at two hospitals, with a sample size of 72 mTBI patients.

Results: mTBI patients with older age (p= .001), negative emotional perceptions (p = < .001), more consequence (p = .045), more concern about their injury (p = < .001) are significantly related to more symptoms of post-traumatic stress. Patients with mTBI who felt more identity symptoms of IR (p = .001), worsened personal control (p = .041), and worsened treatment control (p = .011) are significantly related to deteriorated quality of life one month after injury.

Conclusions: This study produces evidence that mTBI patients' perceptions before leaving the hospital tend to be inappropriate and are related to post-traumatic stress and quality of life one month later. Based on these results, it is crucial for trauma nurses to identify patients' illness perceptions and initiate appropriate interventions to reduce PTSD symptoms and improve patients' quality of life.

Keywords: illness perceptions, post-traumatic stress disorder, quality of life, traumatic brain injury

Introduction

Mild traumatic brain injury (mTBI) is the most prevalent among Traumatic Brain Injury cases; an estimated 42 million people worldwide suffer from mTBI, and it is reported that around 302 people per 100,000 populations are hospitalized (Gardner and Yaffe, 2015; Skandsen *et al.*, 2019). Approximately 11.9%–44% of these cases worldwide, including the European and American continents and Indonesia, were related to traffic collisions (Dunne *et al.*, 2020; Majdan *et al.*, 2013; Ministry of Health, 2018). Studies showed that about 42 million people worldwide suffer from mTBI every year (Gardner and Yaffe, 2015; Skandsen *et al.*, 2019). However, literature reported that in the post-

hospitalization period, when patients are discharged from the hospital to home, they experience vulnerability to symptoms following injury, impairments in cognitive and neurological functioning, and quality of life (Hiploylee *et al.*, 2016; Theadom *et al.*, 2016; van der Naalt *et al.*, 2017; Voormolen *et al.*, 2019). Patients with mTBI who experience symptoms after an injury have an increased risk of developing posttraumatic stress disorder (PTSD) (Stein *et al.*, 2019) and considerably lower health-related quality of life (HRQOL) (Fikriyanti, Kitrungrote and Songwathana, 2014; Voormolen *et al.*, 2019). Therefore, both physical and psychological problems and their relationship to quality of life in the early stages after discharge from the hospital should be given significant consideration to be followed up.

HRQOL is a crucial outcome metric for individuals with mTBI. A study found that, in comparison to their contemporaries who were not injured, older persons with mTBI had worse quality of life for up to six months after the injury (Hume *et al.*, 2023). Patients who simultaneously experienced somatic and cognitive postconcussion symptoms (PCS) had a lower HRQOL six months after injury (Voormolen *et al.*, 2019; Yousefzadeh-Chabok, Kapourchali and Ramezani, 2021). Another study reported that patients with mTBI experienced a decrease in quality of life at one year after mTBI (Theadom *et al.*, 2016). Furthermore, a detailed study reported that mTBI patients said they had problems in work/daily activities due to physical health (Voormolen *et al.*, 2019).

In addition, some symptoms following mTBI, including PCS and PTSD, contributed to a decrease in the patient's QOL after hospital discharge (Fikriyanti, Kitrungrote and Songwathana, 2014; Haagsma *et al.*, 2014; Yousefzadeh-Chabok, Kapourchali and Ramezani, 2021). For example, PCS was related to a decrease in QOL six months after discharge (van der Vlegel *et al.*, 2021; Voormolen *et al.*, 2019) and up to 15 months after discharge (Fikriyanti, Kitrungrote and Songwathana, 2014). Meanwhile, PTSD was associated with lower quality of life six months after injury (van der Vlegel *et al.*, 2021). However, most studies do not examine how these variables influence each other to influence quality of life immediately after discharge from the hospital.

PTSD is one of the psychological consequences for patients suffering from different traumatic injuries. Evidence reported that 8.8%-13.5% of head-injured individuals met the diagnostic criteria for PTSD (Lagarde *et al.*, 2014; Van Praag *et al.*, 2019). A study reported that PTSD complaints were experienced up to six months' post-injury (Stein *et al.*, 2019). Another study reported that patients with mTBI having PTSD tended to have higher pain intensity, maladaptive coping, and more PCS symptoms (Aase *et al.*, 2018). Furthermore, PTSD symptoms were significantly associated with consequences and emotions of illness perception components (Bahraini *et al.*, 2018).

The patient's illness perceptions or illness representations is a part of Leventhal's Common-Sense Model of Illness Representation (CSMIR) and plays a vital role in the early recovery of trauma patients (Mulyadi *et al.*, 2023; Tonapa *et al.*, 2022). This model proposes that individuals develop self-regulation and coping processes when faced with illness, symptoms, or situations threatening health (Diefenbach and Leventhal, 1996; Tonapa *et al.*, 2023). However, studies of trauma injury reported that patients' illness perceptions change over time and relate to their QOL (Chen, Yang and Lee, 2021). Specifically, in mTBI, a previous study reported a relationship between illness perceptions (IP) and QOL (War and Rajeswaren, 2013). Furthermore, a systematic review of mTBI patients reported that some dimensions of illness perception were found to have relationships to post-traumatic stress disorder and the quality of life of mild traumatic brain injury patients (Mulyadi, Tonapa, *et al.*, 2023). The phrases "illness perceptions" and "illness representations," which refer to people's perspectives when they come across health risks, are frequently used synonymously (Diefenbach and Leventhal, 1996; Tonapa *et al.*, 2023). Therefore, IP should be considered an essential variable in examining the relationship between PTSD and HRQOL post-mTBI.

Previous studies reported that trauma patients find it difficult to embrace the new reality of their changing capacities during transitional care and lack the expertise or experience to comprehend or manage their injuries (Goldsmith, McCloughen and Curtis, 2018). A recent study on extremity injuries in Indonesia emphasized the importance of illness perceptions in the early phase after being discharged from the hospital (Tonapa *et al.*, 2023). Considering the occurrence of post-traumatic syndrome and changes in quality of life in the early phase after discharge from the hospital, as well as the limited research on mTBI, this study proposes the following research questions: (a) what is the illness perception before hospital discharge? (b) what is the relationship of illness perceptions and PTSD and HRQOL one month after hospital discharge? Thus, this study aimed to determine patient perceptions of their illness and its relationship with PTSD and HRQOL.

Materials and Methods

Research Design

This study employed a predictive correlational design with a prospective survey. IPs was measured before hospital discharge (T0), and a follow-up of PTSD and HRQOL using an online survey was conducted one month (T1).

Participants

Data were collected from July to October 2023 at two hospitals in Manado, North Sulawesi. The inclusion criteria were patients with mTBI, 18 years old or older, and able to communicate using Indonesian. Patients having a history of significant medical conditions (often) or trauma-related injuries, hearing impairment, or deafness were excluded.

A power analysis was performed using software to estimate whether the present sample size achieved sufficient power (Faul *et al.*, 2009). Given that the present study produces a large effect size on the multiple linear regression, the number of predictors, the power, and the alpha value of .73, 12, .80, and .05, respectively, the sample size of 72 participants was deemed adequate.

Data Collection

Data were collected in the Emergency Department. After patients received primary treatment for their health problems, they were asked for their consent to participate in the study, and if they agreed, they were asked to complete a questionnaire. One month following their release, patients were phoned, and a verbal agreement was taken over the phone. One month following discharge, a survey was conducted regarding PTSD and HRQOL via a link (Google Link), and the author evaluated or checked the results via Google Drive.

Measures

Demographic and characteristics data

Data regarding age, gender, education level, and employment status, IP, PTSD, and HRQOL were gathered via self-administered questionnaires and were sent together in a link.

The Brief Illness Perception Questionnaire (BIPQ)

The patients' perceptions of their illnesses were evaluated using an eight-item BIPQ (Broadbent *et al.*, 2006). A timeline showed how long it would take them to recover from the injury, with personal control representing their capacity for self-control, treatment control representing the medical intervention/therapy that could control their injury, identity representing the number of symptoms following their mTBI, concern representing the patient's concern for their mTBI, coherence representing the patient's understanding of their injury, and emotional perceptions representing the person's adverse reaction to the injury were all included in the questionnaire. This instrument uses a rating scale of 0 to 10 to evaluate each dimension; a higher score indicates more serious damage that could be fatal.

The Post-Traumatic Stress Disorder Checklist (civilian version) (PCL-5)

A popular tool for measuring PTSD symptoms is the PCL-5. The 20 DSM-5 symptoms of PTSD can be evaluated using the 20 items on the PCL-5. It uses a 5-point scale in the range of 0 to 80 (Blevins *et al.*, 2015), with scores of 33 or above indicating experienced PTSD. (0 = "Not at all" to 4 = "Extremely") (Stein *et al.*, 2019; van der Vlegel *et al.*, 2021).

The Quality of Life after Traumatic Brain Injury Overall Scale (QOLIBRI-OS)

The QOLIBRI-OS was developed by von Steinbuechel *et al.*, (2012). It consists of six physical conditions: cognition, emotions, daily life, personal and social life, and current situation and prospect. A five-point Likert scale, with one representing "not at all satisfied" and five representing "very satisfied," was used to evaluate it. The scale means are transformed into a 0-100 scale by subtracting one from the mean and multiplying by 25, yielding scale scores of 0 to 100 representing the poorest and best QOL, respectively (Steinbuechel *et al.*, 2012).

Ethical Consideration

The study protocol was approved by the hospital's research ethics committee of RSUP Prof. Dr. R. D. Kandou Manado (No.109/EC/KEPK-KANDOU/VII/2023). Participant rights during the study were considered, their responses were protected, and a signed informed consent form was obtained from all participants.

Data Analysis

Data analyses were conducted with computer software. Descriptive analysis and simultaneous multiple regression were used in this study's analyses. Mean and standard deviation values were calculated for descriptive statistics measured as continuous variables, while frequencies were obtained for categorical variables. The force-entered multiple regression analyses were used to identify whether the demographic and IP domains could predict PTSD and HRQOL at one-month post-discharge. Statistical significance level was established at $p \leq 0.05$ for all tests.

Validity, Reliability, and Rigor

The BIPQ, PCLC-5, and QOLIBRI-OS instruments were chosen and used in this research because they are appropriate to the research context and meet validity, reliability, and rigor. The BIPQ has been examined for test-retest reliability and is reliable and valid (Broadbent *et al.*, 2006). The internal consistency and the test-retest reliability of the measurements were examined in Indonesia for patients with extremity injuries. The internal consistency of the BIPQ resulted in a Cronbach's alpha score of .85 and test-retest reliability with an intra-class correlation (ICC) of .84 (Tonapa *et al.*, 2021). Related to PCLC-5, the content validity index of the questionnaire used in Indonesia is 0.96, and Cronbach's alpha for the reliability test was 0.87 (Arnika, 2017). In the mTBI population, the PCLC-5 was re-examined for reliability (internal consistency), resulting in Cronbach's alpha 0.91 (Mulyadi, Harianto et al., 2023). In mTBI patients, the Indonesian version of QOLIBRI-OS' internal consistency reliability was examined, and Cronbach's alpha coefficient was 0.91 (Fikriyanti et al., 2014). In the present study, the Cronbach's alpha coefficient for BIPQ, PCLC-5, and QOLIBRI-OS were 0.84, 0.93, and 0.82, respectively.

Results

Descriptive Statistics of Participants

Participants in this study were 72 mTBI patients who were treated in the emergency department and followed up for up to one month after discharge from the hospital. The ages of participants were average 31.53 (SD 12.14) years, ranging from 18 to 56 years, with 60 (83.30%) males. Related to educational background, the majority received education over nine years (75.0%) and were not employed (52.40%) (Table 1)**.** On average, participants had a negative perception of their condition (5.02 ± 1.95) before being discharged from the hospital.

Table 1 Demographic data of the sample (n=72)

Demographic data	n (%)	Mean ±SD
Age		31.53±12.14
Gender		
Male	60 (83.30)	
Female	12 (16.70)	
Education		
> 9 years	54 (75.0)	
≤ 9 years	18 (25.0)	
Employment status		
Not employed	37 (51.40)	
Employed	35 (48.60)	

Note: M= Mean; SD= standard deviation

Table 2 Descriptive statistics of illness perceptions, post-traumatic stress disorder, and health-related quality of life (N=72).

Variables	Hospital discharge Mean (SD)	1 month after discharge Mean (SD)
Illness Perceptions†		
Consequence	4.54 (1.73)	
Timeline	4.83 (1.42)	
Personal control	5.69 (2.34)	
Treatment control	5.65 (2.08)	
Identity	5.83 (2.49)	
Concern	4.15 (2.05)	
Coherence	4.57 (1.72)	
Emotional representation	4.88 (2.62)	
PTSD score†		25.65 (21.47)
Quality of life overall ‡		62.63 (19.88)

Note: SD= standard deviation; PTSD= post-traumatic stress disorder; HRQOL= health related quality of life
† higher score indicates worst while lower best;
‡ higher score indicates best while lower worst;

Some of the participants reported the presence of PTSD (25.65 ± 21.47) and reported HRQOL within the good range (62.63 ± 19.88) one month after discharged.

Predictors of Post-traumatic Stress Disorder

This study used simultaneous multiple regression to identify the significant predictors of PTSD one month after discharge from the hospital. There were no multicollinearity problems at any step of the regression analysis, as shown in Table 3. Four predictors were

Table 3 Predictors of PTSD at one month following mTBI (n=72)

Variables	1 month after hospital discharge				
	β	SE	95% CI	t-statistic	p-value
Demographic					
Age	0.53	0.15	[0.23,0.83]	3.49	.001*
Gender	0.31	4.98	[-9.65,10.28]	0.06	.950
Years of education	-7.63	4.01	[-15.66,0.41]	-1.90	.062
Employment	3.50	3.76	[-4.02,11.01]	0.93	.355
Illness Perceptions					
Identity	0.33	1.72	[-3.12, 3.77]	0.19	.851
Personal control	-0.51	1.75	[-4.00, 2.99]	-0.29	.773
Treatment control	-1.99	1.51	[-5.01, -1.04]	-1.32	.193
Emotional representation	3.41	0.81	[1.79, 5.03]	4.21	<.001*
Coherence	-1.02	1.06	[-3.15, 1.11]	-0.96	.342
Consequence	2.25	1.10	[0.05, 4.44]	2.05	.045*
Timeline	-1.50	1.22	[-3.95, 0.95]	-1.22	.227
Concern	5.39	0.95	[3.48, 7.30]	5.65	<.001*
R2 0.73					
Adjusted R2 0.68					

Note: SE=standard error; CI=confidence interval; PTSD= post-traumatic stress disorder
* p <.05;

Table 4 Predictors of HRQOL at one month following mTBI (n=72)

Variables	1 month after hospital discharge				
	β	SE	95% CI	t-statistic	p-value
Demographic					
Age	0.06	0.10	[-0.13,0.25]	0.61	.546
Gender	1.12	3.12	[-5.13,7.37]	0.36	.720
Years of education	2.88	2.52	[-2.16,7.92]	1.14	.258
Employment	1.74	2.36	[-2.97,6.45]	0.74	.463
Illness Perceptions					
Identity	-3.79	1.08	[-5.95, -1.63]	-351	.001*
Personal control	-2.28	1.10	[-4.48, -0.09]	-2.09	.041*
Treatment control	-2.48	0.95	[-4.37, -0.58]	-2.61	.011*
Emotional representation	0.04	0.51	[-0.98, -1.05]	0.08	.938
Coherence	-0.57	0.67	[-1.91, 0.76]	-0.86	.395
Consequence	0.00	0.69	[-1.38, 1.37]	0.00	.966
Timeline	0.68	0.77	[-0.86, 2.22]	0.88	.380
Concern	0.77	0.60	[-0.43, 1.96]	1.28	.008
R2 0.88					
Adjusted R2 0.85					

Note: SE=standard error; CI=confidence interval; PTSD= post-traumatic stress disorder
* p <.05;

found statistically significant related to PTSD one month after injury. mTBI patients' age significantly predicted PTSD (β = 0.53, *p* .001). This indicates that, on average, a one-unit increase in age will increase the PTSD score. Patients' emotional perceptions significantly predicted PTSD (β = 3.41, *p* =< .001), which indicates a one-unit increase in emotional perception will increase the PTSD score. Patients' perceptions about injury consequences significantly predicted PTSD (β = 2.25, *p* = .045), which indicates a one-unit increase in consequences will increase the PTSD score. Finally, patients' concern of their injury significantly predicted PTSD (β = 5.39, *p* =< .001), which indicates a one-unit increase in concern will increase the PTSD score.

Predictors of Health-related Quality of Life

There were no multicollinearity problems at any step of the regression analysis, as shown in Table 4**.** Three predictors were found statistically significant related to HRQOL one month after injury. mTBI patients' perception of identity symptoms significantly predicted HRQOL (β =-3.79, *p* = .001). This indicates that, on average, a one-unit increase in identity will decrease the HRQOL score. Patients' personal control significantly predicted HRQOL (β = -2.28, *p* = .041), which indicates a one-unit increase in personal control will decrease the HRQOL score. Patients treatment control significantly predicted HRQOL (β = -2.48, *p* = .011), which indicates a one-unit increase in treatment control will decrease the HRQOL score.

Discussions

This study aims to examine patient's illness perceptions and their relationship with PTSD and HRQOL. The results indicated that the average BIPQ results show a value more than or close to the median value; this represents the patient's mTBI perception, including more consequences, perceived long duration of their injury, worsened personal control, worsened treatment control, the concern of their injury, and negative emotional perceptions. The results of this study also showed that the IP domain is correlated with PTSD and QOL. Previous studies reported that, in the early phase after injury, patients' perception is important because it has been proven to be associated with health outcomes, including PTSD (Bahraini et al., 2018) and HRQOL (Mulyadi, Harianto, *et al.*, 2023). Therefore, nurses need to pay special attention to patient perceptions to reduce PTSD complaints and improve HRQOL.

Available evidence has reported that mTBI patients showed symptoms of PTSD before hospital discharge. Before leaving the hospital, patients with mTBI experience PTSD, and the PTSD lasts up to three months after leaving the hospital (Lagarde *et al.*, 2014; Mulyadi, Harianto, *et al.*, 2023). Another study in the United States even reported that PTSD symptoms continued to increase from three to six months among patients with mTBI (Stein *et al.*, 2019). A total of three domains of illness perception (emotional perception, consequence, concern) and age were predictors of PTSD.

The mean age of this study was 31.53 years. The average age in this group is relatively young, which is in line with studies on epidemiology, which have typically shown that elderly persons have a lower prevalence of PTSD than younger adults (Lee, 2019). A study reported that the age of traumatization was a predictor of post-traumatic stress disorder in young women (Becker *et al.*, 2004). However, another study of TBI patients reported that it did not differ significantly with regard to age of people who had either not lost consciousness during the event or were unconscious for less than one hour (Glaesser *et al.*, 2004). Despite the mixed findings from past evidence, the present study identified that older age was a significant predictor of PTSD one month after hospital discharge among mTBI patients. Therefore, nurses should pay attention to older mTBI patients when

discharged from the hospital by providing them with precautions about the signs of PTSD and advising them to seek help from healthcare professionals when these signs appear.

Patients with mTBI who were relatively worried and concerned about their injury, their perception of the severity or negative influence of their injury, and their perception of negative emotions of their injury were predicted to have PTSD one month after injury. Considering that the increasing problem of post-injury depression is associated with a decrease in the recovery process (Kellezi *et al.*, 2017), nurses need to be aware of these psychological conditions, including PTSD. In this regard, existing predictor factors need special attention, including providing appropriate interventions.

Regarding HRQOL, mTBI patients with more identity symptoms of IP worsened personal control and worsened treatment control are significantly related to worsened HRQOL one month after injury. Patients with mTBI who felt many symptoms prior to hospital discharge had decreased QOL one month after. These results align with previous studies that identified identity as a predictor of QOL a month after injury of mTBI patients (Mulyadi, Harianto, *et al.*, 2023) and three months after injury of trauma extremity patients (Tonapa *et al.*, 2021). Patients with mTBI who thought they had little personal control over their injury reported decreased HRQOL one month later. These results corroborate previous mTBI research in India and extremity trauma research in Indonesia that found an association between personal control and HRQOL (Tonapa *et al.*, 2021; War and Rajeswaren, 2013). Patients with mTBI who felt that medical interventions or medications could not manage their injury tended to have lower HRQOL one month later. This is also supported by previous diabetes mellitus research conducted in Indonesia and France on lung cancer, which reported that patients perceived treatment control to be related to HRQOL (Masson *et al.*, 2020) (Perwitasari *et al.*, 2017). Given that injury symptoms encountered after mTBI are significant for postinjury quality of life, nurses may consider providing case management that covers symptom management approaches such as pre-discharge discussions to ease the symptom burden on patients in the early recovery phase (Hung *et al.*, 2023). In addition, nurses and other health professionals must empower patients to gain appropriate personal control and involve patients in the treatment plans.

This research has limitations. During the one-month follow-up period, there was still no information on patient visits after leaving the hospital, whether to hospital clinics or health centers or no visits. This allows them to obtain information and education linked to patient perceptions. In addition, the sample size of this study is quite limited; one of the reasons is that this study excluded mTBI patients who had several other cases of trauma that may have co-occurred with the event. So, further research can be recommended to continue identifying mTBI patients even though they have several other cases of trauma. Additionally, patients are categorized as having PTSD based on self-reported PCL-5 data, but the use of this survey is not sufficient to clinically diagnose patients with PTSD. This limitation can be overcome by providing a clear explanation regarding the self-reported PCL-5, ensuring that the filling is truly appropriate to the condition experienced by the patient. Early recognition of PTSD symptoms based on self-reported PCL-5 and appropriate interventions are expected to improve health outcomes of mTBI patients.

Conclusion

This study produces evidence that mTBI patients' perceptions before leaving the hospital tend to be inappropriate and are related to PTSD and HRQOL one month later. Patients with mTBI who were relatively worried and concerned about their injury, perception of the severity or negative influence of their injury, and perceived negative emotion of their injury were predicted to have PTSD one month after injury. In addition, mTBI patients, before going home, perceive more identity symptoms of IP, worsened personal control, and worsened treatment control, which are significantly related to worsened HRQOL. Based on these results, it is crucial for trauma nurses to identify patients' illness perceptions and initiate appropriate interventions to reduce PTSD symptoms and improve patients' quality of life. Potential developments in clinical practice are identifying patients' illness perceptions routinely (e.g. in outpatient clinics) and initiating follow-up trauma care programs for mTBI patients either in person or using communication media (e.g. digital, telehealth).

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Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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