



Health-related quality of life after 6 months post-injury on severe traumatic brain injury: A cohort study in two Malaysian hospitals[☆]



Salizar Mohamed Ludin*, Nor'ain Abdul Rashid

Critical Care Nursing Department, Kulliyah of Nursing (Faculty), International Islamic University Malaysia, Pahang, Malaysia

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Abstract

Objective: Severe traumatic brain injury (TBI) survivors show physical and functional improvement but remain with the cognitive and psycho-social problem through our recovery. This study aims to measure the health-related quality of life of TBI survivors within 6 months post-injury. **Method:** A cohort study was conducted where 33 severe TBI survivors recruited at two tertiary hospitals. The health-related quality of life was measured using the Quality of Life after Brain Injury (QOLIBRI) tool.

Results: Participants mean age was 31.79 years old. The impaired range of health-related quality of life on 6 months post-injury seen, but an improvement occurs within 3–6 months post-injury.

Conclusions: Age and ventilation duration showed a moderate negative correlation in all domains and length of hospital stay showed a moderate negative correlation to social, daily life and self-domains. Nevertheless, small sample size and time constraint were the limitations of this study.

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* Corresponding author.

E-mail address: msalizar@iium.edu.my (S.M. Ludin).

Introduction

Traumatic brain injury (TBI) is a change in the brain function due to forces that happen in the brain, for example, a motor vehicle crashes falls and sports injuries are among the most common causes.¹ TBI is a major medical and socioeconomic problem and is the leading cause of death in children and young adult. The productive life was lost, and many people have to suffer years of disability post-TBI² showed a significant difference in the Quality of Life after Brain Injury (QOLIBRI) scores between participants and GOSE scores at 12 months post-injury. Severe TBI survivors showed 6.7% limited motor function and 20% limited cognitive tasks at 12 months post-injury. This study suggested that the rehabilitation unit plays an important role to help the severe TBI survivors in improving their quality of life. The same group showed that the result is consistent when focused on the QOLIBRI score.³ The results showed that after 12 months post-injury, HRQOL of the severe TBI was improved, especially in self and emotion sub-scale.

A cohort study⁴ highlighted on the health-related quality of life (HRQL) two years post-injury with participants from moderate to severe TBI survivors. The result showed that HRQL was stable from one to two years post-injury. However, there was not much improvement in all of the SF-36 subscales. Whereas, a study on moderate to severe TBI reported improved HRQL from one to two years after discharge from a trauma centre.⁵ This study showed that age of more than 31 years old has a significantly lower score for limitation due to physical health. On the other hand, patients with more than 12 years of education period were reported to have a better physical function.

In Malaysia, most of the studies were based on a clinical trial. A study finding in Sarawak, Malaysia⁶ suggested that the severe TBI survivors outcome to be measured using GOSE and also highlighted that the quality of life measurement is needed in severe TBI survivors population in Malaysia. Nevertheless, despite various findings from international studies, to date, the status of quality of life of the severe TBI survivors in Malaysia after discharge is still unknown. Thus, this study aims to obtain an understanding of the health-related quality of life of the severe TBI survivors' during their recovery period.

Method

A cohort study was conducted at two tertiary hospitals in the east coast of Malaysia from January to August 2016. The follow-up visits to the survivors' homes were done at three and six months post-injury.

Participants

The participants were purposively recruited due to a limited number of severe TBI cases and survivors. The inclusion criteria are (1) diagnosed with severe TBI and admitted to the ICU between October 2015 and February 2016, (2) aged 16 years old and above, (3) understands Malay and/or English. While those severe TBI survivors with an underlying history of senile or mental retardation prior to the injury,

experienced a cardiac arrest upon admission (2), died within 90 days of admission (3), and (4) foreigners were excluded.

Instrument

The Quality of Life after Brain Injury (QOLIBRI) questionnaire⁷ was used. It consists of 37 items covering six dimensions of health-related quality of life (HRQOL) (cognitive, self, daily life and autonomy, social relationship, emotional, and physical problems) and are assessed using Likert scale 0–5. The raw scores were transformed into a score range of 0–100; 0 = the worst possible quality of life, 100 = the best possible quality of life.⁷ The score range was interpreted into four ranges (>82 = 'above average'; 67–82 = 'normal', 60–66 = 'borderline' and <60 = 'impaired').⁸ This questionnaire was translated back to back into the Malay language prior to pilot testing. The overall Cronbach Alpha score for the Quality of Life after Brain Injury (QOLIBRI) scale was 0.989.

Data analysis

The data were analyzed using the Statistical Package for Social Science (SPSS) Software version 22 for the descriptive and inferential analysis.

Ethical consideration

The data collection process commenced following approvals from the university (IREC 564), Ministry of Health and the Director of both hospitals (NMRR-16-121-28870 (IIR)). The purpose of this study was explained, and the consent form was signed by the participant or the caregiver. All personal details of the participants and caregivers were kept anonymous.

Results

A total of 57 severe TBI patients admitted to the ICU in both hospitals from October 2015 until February 2016 (5 months). However, 10 participants died in the hospital, and 9 participants died within 90 days after discharge from the hospitals. As a result, the 90 days mortality is 33.3%. From the 57 participants, only 38 are eligible to participate in this study, 5 of them were unable to be reached, leaving 33 participants to join in this study and have met the inclusion criteria. This represents 86.8% of the expected population.

Participants' characteristics

Table 1 summarizes the socio-demographic characteristics of the 33 severe TBI participants. The participants' mean age was 31.79 (SD = 2.90) years old. Most of the participants from young teenagers ($n = 14$, 42.4%) (ages 16–24 years old). The majority were male ($n = 27$, 81.82%) and mostly Malay ($n = 31$, 93.94%), with primary level of education ($n = 5$, 15.15%), secondary level of education ($n = 15$, 45.45%) and 13 (39.40%) with higher education level. Majority of them were single ($n = 24$, 72.73%).

Table 1 The demographic characteristics of severe TBI.

Variables	Frequency (n)	Percent (%)	Mean	SD
<i>Age</i>			31.79	2.9
16–24 year old	14	42.4		
25–34 year old	9	27.3		
35–44 year old	2	6.1		
>45 years old	8	24.2		
<i>Gender</i>				
Male	27	81.82		
Female	6	18.18		
<i>Race</i>				
Malay	31	93.94		
Chinese	2	6.06		
<i>Marital status</i>				
Single	24	72.73		
Married	6	18.18		
Widow	3	9.09		
<i>Educational status</i>				
Primary	5	15.15		
Secondary	15	45.45		
Tertiary education	13	39.40		

For the clinical characteristics (Table 2), the most participants ($n = 32$, 96.97%) sustained severe TBI through a motor vehicle accident (MVA) and with no comorbid disease ($n = 30$, 90.91%), whereas, only one (3.03%) participant with diabetes mellitus (DM), hypertension (HTN) and chronic lung disease. 11 of the participants had a cardiovascular failure, and three of the participants had respiratory failure. The median (IQR) of the length of stay (LOS) in the intensive care unit (ICU) was 5 (5) days, with a range between 2 and 37 days. Furthermore, for the LOS in the hospital (median (IQR) = 9 (7) days), with a range between 5 and 58 days. The majority of the participants had experienced being on the mechanical ventilator (median (IQR) = 4 (5) days), with a range between 0 and 31 days. The mean score for the sequential of the organ failure (SOFA) was 7.15 (SD = 0.55) and simplified acute physiology score II (SAPS II) score, 36.73 (SD = 1.55).

Quality of Life after Brain Injury (QOLIBRI) score

The mean score for QOLIBRI, at 3 months post-injury was 28.87 (SD = 18.31). The highest mean for the sub-scale was emotion ($M = 38.48$, $SD = 25.60$), physical ($M = 6.36$, $SD = 20.96$), social relationship ($M = 34.2$, $SD = 20.49$), daily life and autonomy ($M = 25.32$, $SD = 18.02$), the self ($M = 5.32$, $SD = 18.02$) and cognitive scale ($M = 23.92$, $SD = 20.35$).

Table 2 The distribution of severe TBI clinical characteristics.

Variables	Frequency (n)	Percent (%)	Mean	SD
<i>Type of injury</i>				
Fall	1	3.03		
MVA	32	96.97		
<i>Comorbid disease</i>				
DM	1	3.03		
HTN	1	3.03		
Chronic lung disease	1	3.03		
NKMI	30	90.91		
<i>Secondary organ failure</i>				
No organ failure	19	57.58		
Respiratory	3	9.09		
Cardiovascular	11	33.33		
<i>LOS in ICU (days)</i>	–	–	5	5.00 ^a
<i>LOS in hospital (days)</i>	–	–	9	7.00 ^a
<i>Duration on ventilator (days)</i>	–	–	4	5.00 ^a
<i>SOFA score</i>	–	–	7.15	0.55
Respiratory score	–	–	1.00	2.00 ^a
Haematology score	–	–	0.00	1.00 ^a
Hepatology score	–	–	0.00	1.00 ^a
Cardiovascular score	–	–	1.82	1.93
Central nervous system score	–	–	3.15	0.44
Renal score	–	–	0.00	0.00 ^a
<i>SOFA score excluded CNS</i>	–	–	4.09	2.99
<i>SAPS II score</i>	–	–	36.73	1.55

LOS: length of stay; ICU: intensive care unit; SOFA: sequential organ failure score; SAPS II: simplified acute physiology II score; DM: diabetes mellitus; HTN: hypertension; NKMI: no known medical illness.

^a Median (IQR).

Table 3 The descriptive of Quality of Life after Brain Injury (QOLIBRI) mean scores.

	3 months score Mean (SD)	6 months score Mean (SD)
Cognition	23.92 (20.35)	51.84 (32.64)
Self	25.32 (18.02)	49.57 (29.34)
Daily life and autonomy	25.32 (18.02)	50.32 (31.08)
Social relationship	34.21 (20.49)	55.56 (30.68)
Emotion	38.48 (25.60)	60.30 (31.45)
Physical	36.36 (20.96)	53.48 (28.82)
Total score	28.87 (18.31)	53.09 (29.46)

Table 4 Relationship between socio-demographic characteristics and emotional domain at 6 month post-injury.

Variable	Mean (SD)	F statistic (df)	p value
<i>Marital status</i>			
Single	68.13 (27.10)	3.238 (2)	0.053*
Married	35.83 (36.93)		
Widow	46.67 (34.03)		
<i>Educational level</i>			
Primary	30.00 (31.82)	4.807 (2)	0.015*
Secondary	57.33 (29.39)		
Tertiary	75.38 (25.53)		
<i>Household income</i>			
<RM 1500	61.25 (33.45)	1.533 (2)	0.232
RM 1501–3000	51.43 (26.42)		
>RM 3001	76.43 (34.97)		
<i>Comorbid disease</i>			
Yes	25.00 (22.91)	4.630 (1)	0.039*
No	63.83 (30.22)		

Post hoc analysis: single vs married = p value 0.057; primary vs tertiary = p value 0.013.

Bold values mean significant value.

* $p = 0.05$.

The 6 months result showed an improvement in all scales. The total mean score for the 6 months was 53.09 (SD=29.46). The highest mean score was emotion ($M = 60.30$, $SD = 31.45$), followed by social relationship ($M = 55.56$, $SD = 30.68$), physical ($M = 53.48$, $SD = 28.82$), cognition ($M = 51.84$, $SD = 32.64$), daily life and autonomy ($M = 50.32$, $SD = 31.08$) and self ($M = 49.57$, $SD = 29.34$). Table 3 explains the detail of the QOLIBRI results at 3 and 6 months post-injury.

Despite both finding (3 and 6 months of QOLIBRI score) were still in the impaired range (less than 60 mean scores), there are increments of the total score of three months to the total score of six months indicating improvement occurred within 6 months. The highest increment occurs at the cognitive scale ($M = 23.92$) in 3 months increases to $M = 51.84$ in six months result). Followed by the daily life and autonomy scale with an increment ($M = 25.32 - 50.32$), self ($M = 25.32 - 49.57$). On the other hand, emotion scale increased ($M = 38.48 - 60.30$), the social relationship scale increased ($M = 34.21 - 55.56$) and physical scale increased ($M = 36.36$ to 53.48).

Relationship between socio-demographic characteristics and Quality of Life after Brain Injury (QOLIBRI) score

In the QOLIBRI score, there are six domains that measure the HRQOL. There are no significant differences in all domains except for emotional domain. For education level, participants were divided into three categories, which are primary, secondary and tertiary education. In that case, educational level has a statistically significant difference with $p < 0.05$, and in the emotional domain: $F(2, 33) = 1.533$, $p = 0.015$. The effect size was classified as 0.01 as a small effect, 0.06 as a medium effect and 0.14 as a large effect.⁹ Thus, the actual difference in the mean scores between the groups was large, as calculated using the eta square, which was 0.24. Post hoc comparisons using Turkey HSD test indicated that the mean score for the primary group ($M = 30$, $SD = 31.82$) was significantly different from the tertiary group ($M = 75.38$, $SD = 25.53$). It showed that the participants with tertiary education have a good score in HRQOL in terms of emotional

domains. Besides that, the comorbid disease also has a significant difference to the emotional domains in the HRQOL: $F(1, 33) = 3.238, p = 0.039$. The actual difference in the mean score between the groups was medium as the eta square was 0.13. Table 4 explains the result of the one-way ANOVA.

The relationship between age, duration on the mechanical ventilator, LOS in the hospital, SOFA score and SAPS II score with the HRQOL were investigated using a correlation coefficient test. A statistical significance was observed in the test related to age and duration on the mechanical ventilator to all domains in the QOLIBRI. Furthermore, the LOS in a hospital gives a significant difference in self-domain, daily lifestyle domain, and social domain. All correlation that reached significance level was negative. The strength of the correlation was between moderate ($r > 0.30$) and strong ($r > 0.50$).⁹ Table 5 shows the result of the relationship between the socio-demographic characteristics and the domains in the QOLIBRI scale at six months post-injury.

For age, moderate negative correlation with cognitive domain ($r = -0.381$), self-domain ($r = -0.463$), daily lifestyle domain ($r = -0.429$), social domain ($r = -0.436$), emotion domain ($r = -0.484$), a physical domain ($r = -0.357$) seen. The duration on ventilator also showed the same result, with moderate negative correlation in all domains. The result for cognitive domain was ($r = -0.436$), self-domain ($r = -0.603$), daily lifestyle domain ($r = -0.566$), social domain ($r = -0.525$), emotion domain ($r = -0.363$), a physical domain ($r = -0.441$). Furthermore, the LOS in a hospital gives a moderate negative correlation in self-domain ($r = -0.466$), daily lifestyle domain ($r = -0.404$) and social domain ($r = -0.407$).

Discussion

Socio-demographic and clinical characteristics

The result shows that the majority of the participants were male whereas the common cause of injury was motor vehicle accident (MVA). The finding from this study was similar to other studies whereby most of their participants were male and causes of injury were MVA.^{6,10-13} Furthermore, study findings showed that majority of the participants were young teenagers ranging from 16 to 24 year old. This result is similar to a study¹⁴ showed that male and age between 16 and 30 years old are the majority group that involved in accidental brain injury. Consistently, the National Trauma Database¹⁵ showed that the majority of trauma patients were male and 74.3% cases are from road traffic accidents.

The result also showed that the mortality rate was 33.3% in this study due to the one-third of the participants were death within 90 days after admission to the ICU. This result is similar to the data from the National Trauma Database¹⁶ in which the death outcome of ICU admission due to major trauma cases was 30.24%. In this study, the death outcome specific for severe TBI cases was revealed.

Health-related quality of life after severe traumatic brain injury (TBI)

Even though the result of the QOLIBRI within six months post-injury was still under impaired range, but in all scales of the

Table 5 Correlation between socio-demographic characteristics and QOLIBRI scale at 6 months post-injury.

Variable	QOLIBRI domain						Total score
	Cognitive	Self	Daily lifestyle	Social	Emotion	Physical	
Age	-0.381* ($p = 0.029$)	-0.463* ($p = 0.007$)	-0.429* ($p = 0.013$)	-0.436* ($p = 0.011$)	-0.484* ($p = 0.004$)	-0.357* ($p = 0.042$)	-0.426* ($p = 0.014$)
Ventilator (days)	-0.436* ($p = 0.011$)	-0.603* ($p = 0.001$)	-0.566* ($p = 0.001$)	-0.525* ($p = 0.002$)	-0.363* ($p = 0.038$)	-0.441* ($p = 0.010$)	-0.483* ($p = 0.004$)
LOS in hospital	-0.205 ($p = 0.252$)	-0.466* ($p = 0.006$)	-0.404* ($p = 0.020$)	-0.407* ($p = 0.019$)	-0.247 ($p = 0.166$)	-0.264 ($p = 0.138$)	-0.303 ($p = 0.086$)
SOFA score	-0.17 ($p = 0.343$)	-0.267 ($p = 0.133$)	-0.241 ($p = 0.177$)	-0.212 ($p = 0.237$)	-0.105 ($p = 0.561$)	-0.134 ($p = 0.458$)	-0.203 ($p = 0.258$)
SAPS II score	-0.141 ($p = 0.434$)	-0.235 ($p = 0.187$)	-0.202 ($p = 0.260$)	-0.214 ($p = 0.231$)	-0.201 ($p = 0.262$)	-0.213 ($p = 0.233$)	-0.208 ($p = 0.246$)

Bold values mean significant value.

* $p < 0.05$ (2-tailed).

** $p < 0.001$ (2-tailed).

Pearson correlation test.

QOLIBRI result, there was an improvement in the scoring between three and six months result. It showed that after six months post-injury, the participants showed an improvement in their HRQOL. The 'plateau' phase occurs within six to twelve months post-injury.¹⁶ Although the 'plateau' phase always related to the functional outcome, it also gives an effect on the HRQOL. In this study, functional outcome and HRQOL showed the same result, which has the 'plateau' phase after six months post-injury. Consistently, in another study¹⁷ it was found patients with less than a year of post-TBI showed a significantly higher quality of life. Besides, the general improvement in the quality of life will happen within 3–12 months after discharge from the ICU, but it will remain below norms population.¹⁸

Age

The finding showed a moderate negative correlation in all scales. For the cognitive scales, it explained that the younger age rated to have a high quality of life on the cognitive scale. This is supported by other authors¹⁹ in which they reported that younger age had a significant impact on the quality of life of the TBI survivors. Consistently, previous study⁴ reported that age more than 31 years old showed significantly lower scores for the role limitation due to physical health. This may be due to younger age have consistently associated with better functional outcome after TBI.²⁰ Also, younger age had higher determination to have a good recovery and wanted to return to normal life rapidly.

Duration on the mechanical ventilation and LOS in the hospital

QOLIBRI score also gives a moderate correlation with the duration on the mechanical ventilator where patients that have a shorter length of using the ventilator machine will have a better quality of life in all scales. A study²¹ reported that showed that patients ventilated more than 96 hours have a low quality of life. This explains that a shorter duration on the mechanical ventilation will give a higher quality of life. The duration on the ventilation and LOS in the ICU or hospital were closely related to the HRQOL of the ICU survivors. This statement was supported by the data that showed a consistent relationship across studies, which revealed that days of ventilation was related to the pulmonary impairment and LOS in the ICU or hospital was related to neuromuscular impairment.²² Both problems showed a consistent relationship to the ICU survivors' quality of life.

Education and comorbid

Both education and comorbid variables give a significant impact to the emotional domain in the QOLIBRI result. It showed that participants who have a high level of education and no comorbid disease score better in the emotional domain. Participants with a high level of education can control their emotion by accepting their condition. This is the same with the participants who do not have the comorbid disease by achieving a higher score in the emotional domain.

For future research, it is highly recommended to conduct further study throughout the whole Malaysia population. It should be conducted nationally to have clearer information about TBI survivor and their outcome. A larger result would assist in getting the finest findings, and it also can generalize the overall population and develop intensive research.

Conclusion

The HRQOL assessed by QOLIBRI was improved from three months to six months. There was a 'plateauing' of the recovery process within three and six months post-injury. Overall, this study may indicate the age and duration of the mechanical ventilation give a significant correlation to all scales in the HRQOL after TBI. But, the LOS in the hospital only gives a significant correlation to social, daily life and self-domains. Thus, support from the surrounding, for example, social, emotional, physical and others will give a positive outcome to the TBI survivors especially in their HRQOL. To conclude, TBI has a long-term recovery process that may be influenced by different factors and the outcome measure with more holistic assessment should be emphasized. Thus, it will have a more useful result and will be more beneficial in the longitudinal studies of TBI.

Conflict of interests

The authors declare no conflict of interest.

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