Study of Quality of Life in Traumatic Brain Injury

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Abstract

Objective To assess quality of life (QOL) in individuals with mild and moderate traumatic brain injury (TBI) and their relationship with demographic, posttraumatic insomnia, and injury-related factors.

Method The present study was a cross-sectional study conducted at Sawai Man Singh Medical College and group of hospitals over a period of 6 months from January 2013 to June 2013. The groups studied consists of 204 patients of mild and moderate TBI between 14 days and 1 year postinjury and equal number of controls by recruiting close relatives of the patients for comparison. Patients were assessed on semistructured sociodemographic proforma along with WHOQOL BREF, insomnia severity index, and GCS to assess QOL, insomnia, and severity of TBI, respectively.

Result The number of participants included was 204. Mean age was 33.34 years. QOL was found impaired in all four domains of patients with TBI as compared with control group. The most unsatisfying domain among all was environmental health. None of the sociodemographic variables were associated with impaired QOL in TBI except duration and severity of head injury. Patients with longer duration (time since injury) of TBI and higher GCS had better QOL. Patients with insomnia had significantly poor QOL compared with those with TBI without insomnia.

Conclusion QOL is an important aspect to be considered while management of TBI is performed especially during follow-ups. Impact of severity and the duration of injury with associated sleep problems have significant bearing on QOL.

Keywords
- quality of life
- insomnia
- traumatic brain injury

Introduction

Traumatic brain injury (TBI) is a major cause of disability. Assessment and treatment of TBI typically focus on physical and cognitive impairments, yet psychological and social impairments represent significant causes of disability and affect quality of life (QOL) in trauma victims. QOL has gained importance and has become a primary objective of health care system intervention.[1] World health organization defines QOL as an individual's perception of their position in life in the context of their cultural and value system in which they live and in relation to their goals, expectation, standards, and concerns.[2] This definition reflects the view that QOL refers to a subjective evaluation, which is embedded in a cultural, social, and environmental context, and this is approach taken in the present study.

Researcher agrees that QOL is a multidimensional construct comprising physical/medical, psychological, and social factors. Berger et al[3] focused on the areas of life included in studies of the QOL of people with TBI. They noted that four functioning domains were frequently used: physical (including pain), psychological (e.g., affective disorders, personality changes), social (especially vocational status and relationship with family and friends), and cognitive.

TBI-afflicted individuals are more prone to have sleep problems as well. Insomnia after TBI is well documented in literature. The frequency of insomnia has been reported to

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range between 40%[4] and as high as 84%.[5] Coexisting insomnia in TBI may lead to several negative outcomes, including daytime fatigue,[4,5] tiredness, difficulty functioning, impaired performance at work, greater functional disability, reduced participation in activities of daily living, less social and recreational activity, less employment potential,[5,6] increased caregiver burden, greater sexual dysfunction, and also lower ratings of health, poor subjective well-being. These negative consequences can hamper a person's reintegration into the community, adjustment after injury, and overall QOL.[6]

More elaborative studies may prove more informative and credible in recognition of QOL in TBI. Hence, the present study is designed to investigate the QOL in TBI and its correlation with sociodemographic and injury characteristics.

Material and Method

Study Design

The present study was a cross-sectional study conducted at Sawai Man Singh Medical College and group of hospitals (SMSH) over a period of 6 months from January 2013 to June 2013. The institutional ethical committee approved the study protocol.

Participants

The group studied consists of 204 patients of mild and moderate TBI between 14 days and 1 year postinjury (►**Fig. 1**). Sample was recruited through the follow-up in neurosurgery OPD and Indoor of SMSH. SMSH is a tertiary care superspecialty treatment center. Being the largest medical institute in the state of Rajasthan, it caters the health needs of entire state as well as neighboring states. Equal numbers of controls were also enrolled to make comparison group by recruiting close relatives of the patients. Definition of mild TBI was adopted as developed by the Mild Traumatic Brain Injury Committee of the Head Injury (Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine).[7] Mild TBI was defined as "a person who has had a traumatically induced physiological disruption of brain function, as manifested by one or more of the following: (1) any period of loss of consciousness for up to 30 minutes; (2) any loss of memory for events immediately before or after the accident for as much as 24 hours; (3) any alteration of mental state at the time of the accident (e.g., feeling dazed, disoriented, or confused); and (4) focal neurological deficit(s) that may or may not be transient." Moderate head injury was classified as if the lowest postresuscitation GCS score was 9 ± 12 with or without evidence of lesion on CT.

Inclusion and Exclusion Criteria

To be included in the study, participants had to be 18 years or older, and be able to comprehend or answer verbal or written questionnaires. Participants were excluded from the study if they were known to have (1) a serious medical

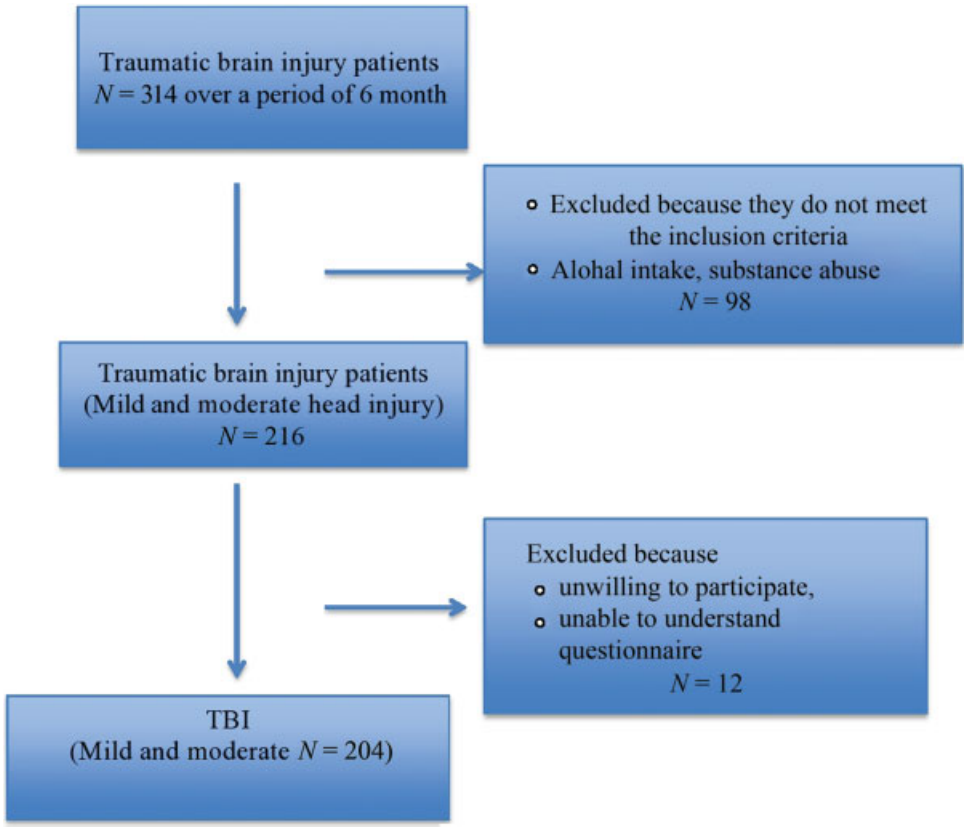

Fig. 1 Study design.

illness, (2) a current substance abuse disorder using DSM-IV criteria, and (3) a history of current or past psychosis or mania or any other mental disorder, as these factors can affect outcome independently.

Procedure and Measures

The nature and purpose of the study was explained to the participants and written informed consent was obtained. Demographic characteristics of the participants and controls were recorded on a self-designed semistructured proforma. Injury characteristics of cases were also recorded by interviewing the participants and exploring the medical records and neuroradiologic investigations. Their preinjury history of psychiatric disorder and substance abuse, if any, was also taken into account from the participant or their next of kin. In this cross-sectional study, the interview was focused on assessment of severity of TBI, insomnia, and QOL using GCS, Insomnia Severity Index (ISI), and WHOQOL-BREF, respectively.

GCS[8] is an extensively used clinical scale for assessing the depth and duration of impaired consciousness and coma. Three aspects of behavior are independently measured—motor responsiveness, verbal performance, and eye opening. These can be evaluated consistently by doctors and nurses and recorded on a simple chart, which has proved practical both in a neurosurgical unit and in a general hospital. The scale facilitates consultations between general and special units in cases of recent brain damage, and is useful also in defining the duration of prolonged coma.

Insomnia was assessed on ISI.[9] ISI is one of the most commonly used disease-specific measures for self-perceived insomnia severity. It has seven items describing insomnia-related health impairments. Each item is rated on a 5-point Likert scale with scores ranging from 0 to 4, indicting "none," "mild," "moderate," "severe," and "very severe" sleep problems, respectively. The total ISI score is calculated by summing the scores from the seven items, and range from a minimum of 0 to a maximum of 28, with higher scores reflecting more severe sleep problems. In clinical assessments, the ISI total summary score falls into 1 of 4 ISI categories; with scores 0–7, 8–14, 15–21, and 22–28 indicating no clinically significant insomnia, subthreshold insomnia, moderate insomnia, and clinically severe insomnia, respectively. We used Hindi version of the ISI[10] that has a reliability of 0.91 and a corrected item correlation range of 0.56–0.87.Hindi version of the ISI is a valid and reliable tool for the measurement of severity of insomnia. A clinical cutoff score of 8 on the ISI is associated with optimal sensitivity and specificity for the detection of sleep difficulties.[11]

WHOQOL-BREF was used to measure QOL in both cases and control. The WHOQOL-BREF was developed by the World Health Organization Quality of Life Group, in 15 international field centers.[12] It is a self-report questionnaire that contains 26 items, and each item represents one facet. Among the 26 items, 24 make up the four domains of physical health (seven items), psychological health (six items), social relationships (three items), and environment (eight items). The other two items measure overall QOL and general health. In this study Hindi version[13] was used. The scale has been shown to have good discriminant validity, sound content validity, and good test-retest reliability at several international WHOQOL centers. Despite the heterogeneity of facets included within domains, all domains display excellent internal consistency. Domain scores were calculated by multiplying the mean of all facet scores included in each domain by a factor of 4, with a possible range of each raw domain score of 4 to 20. Each raw domain score was then transformed to a scale ranging from 0 to 100, with a higher score indicating a higher QOL. The WHOQOL-BREF-Hindi has been tested for its psychometric properties in a large population, and it was discovered that this brief version is shorter, simpler, and more convenient to be used in community survey and has better comprehensibility.[13] Therefore, using the WHOQOL-BREF-Hindi questionnaire in this study was suitable due to limited patient's time and busy clinical environments.

Statistical Analyses

Data were analyzed using SPSS version 22, with a two-tailed α level of 5%. Analysis included basic description of the TBI and control group, descriptive analysis of independent and dependent variables, univariate analysis for outcome variables of QOL, demographic profile, and insomnia. Independent *t*-test and ANOVA analyses were performed. The criterion for statistical significance was set at $p < 0.05$ and for statistical trend at $p < 0.10$.

Results

Sociodemographic Profile of Participants and Controls

Distributions of sociodemographic and injury-related characteristics are shown in ►**Table 1**. Total 204 patients and equal numbers of controls were included in study. Mean ages of patients and controls were 33.34 (standard deviation [SD] 12.89) and 34.9 (SD 13.97) years, respectively. In case group, 77.9% were males ($n = 159$ and 22.1% ($n = 45$) were females. In control group, males and females constituted 75.34% ($n = 154$) and 24.65% ($n = 50$), respectively. While 40.16% of the patients had moderate head injury (GCS 9–13), 59.88% had mild head injury (GCS 14–15). Mean time of follow-up after injury was 88.2 days (SD 102.1). Motor vehicle accidents were the most common cause (52.9%, $n = 108$) of TBI, followed by falls and assaults each accounting for 19.6% ($n = 40$) and 21.1% ($n = 43$), respectively.

Mean QOL Score in TBI and Control Groups

►**Table 2** shows mean value of QOL related to all four domains in cases and controls as measured on WHOQOL-BREF. Patients with TBI scored significantly lower than the controls in all the four domains, including physical health (58.00 vs. 81.65%), psychological health (61.01 vs. 78.97%), social relationship (60.16 vs. 79.36%), and environmental health (56.70 vs. 84.59%).

Table 1 Demographic profile of patients with TBI and control groups

	Head injury		Control	
	n	Percentage	*n*	Percentage
1. Age				
18–24	54	26.5	56	27.42
25–34	67	32.80	62	30.19
35–44	43	21.1	45	21.88
45–54	19	9.3	17	8.03
55–64	17	8.3	19	9.41
≥65	4	2.0	5	2.71
2. Sex				
Male	159	77.90	154	75.34
Female	45	22.10	50.00	24.65
3. Mode of injury				
RTA	108	52.90	–	–
FFH	40	19.66	–	–
Assault	43	21.10	–	–
Other injury	13	6.40		
4. Income				
< 5,000	129	63.20	121	59.31
5,000–10,000	58	28.40	63	30.88
10,000–20,000	15	7.40	15	7.40
> 20,000	2	1.00	5	2.45
5. Education				
Primary	46	22.50	40	19.66
Secondary	55	27.00	46	22.43
Higher secondary	49	24.00	50	24.65
Graduate	23	11.30	29	14.12
Postgraduate	15	7.40	20	9.9
Nil	16	7.80	19	9.6
6. Marital status				
Married	158	77.50	150	73.61
Unmarried	46	22.50	54	26.31
7. Head injury				
Mild	122	59.80	–	–
Moderate	82	40.20	–	–
8. Duration of head injury (time: since injury)				
< 3 mo	103	50.41	–	–
3–6 mo	63	31.02	–	–
6 mo–1 y	38	18.55	–	–
9. Insomnia				
No	122	59.83	–	–
Yes	82	40.16	–	–

Abbreviations: FFH, fall from height; RTA, road traffic accident; TBI, traumatic brain injury.

Table 2 Mean QOL score in TBI and control group

Domain	TBI patients			Control group		
	n	Mean	SD	Mean	SD	
Physical health	204	58.26	19.47	81.65	11.41	$p < 0.03$, $t -14.91$, df 406
Psychological	204	61.01	19.30	78.97	14.97	$p < 0.02$, $t -10.70$, df 406
Social	204	60.16	20.74	79.36	13.20	$p < 0.031$, $t -11.41$, df 406
Environmental	204	56.70	19.27	84.59	9.6	$p < 0.021$, $t -18.81$, df 406

Abbreviations: QOL, quality of life; SD, standard deviation; TBI, traumatic brain injury.

Relationship of Sociodemographic Profile and Injury Characteristics with QOL in TBI

The relationships of demographic variables and injury characteristics to the QOL were also examined. None of the demographic variables were associated with altered QOL except severity and time since injury. Patient with moderate TBI scored lower than mild TBI cases in physical health (51.37 vs. 62.45, $p = 0.045$), psychological health (53.68 vs. 65.29, $p = 0.05$), social relationship (51.65 vs. 65.03, $p = 0.034$), and environmental health (50.47 vs. 60.41, $p = 0.021$) (►**Table 3**). This association was statistically significant for all the domains. Subjects with longer duration of head injury (>6 months) had better QOL in all domains compared with the subjects with lesser duration of head injury (<3 months). This association was again statistically significant for all the domains except for social domain (►**Table 3**).

Relationship between QOL and Insomnia in TBI

We also explored the association between QOL and insomnia. Insomnia was found in 82 (40.16%) patients as measured on ISI. Patient with insomnia scored lower than those without insomnia in all four domains of QOL, including physical health (49.09 vs. 63.98, $p < 0.0031$), psychological health (51.97 vs. 66.44, $p < 0.012$), social relationship (50.69 vs. 65.68, $p < 0.04$), and environmental health (48.58 vs. 61.68, $p < 0.011$). These findings were statistically significant for all domains (►**Table 4**).

Discussion

Our study population was implicitly closed to the age and sex distribution of TBI in general adult population. The age range was 18 to 70 years with a mean of 31.1 years and sex distribution was roughly 2:1, similar to general adult population with TBI as has been reported in earlier studies as well.[14] We incorporated equal number of controls as comparison group to assess the impact of TBI on QOL. The controls were recruited among the close friends and family members of the patients in respect of sociodemographic profile, thus maintaining the homogeneity of the sample group. The objective of this study was the participant perspective, which is the normal perspective in QOL studies. This perspective, however, relies on participants having sufficient cognitive awareness to provide insight into their own condition for making meaningful assessments.[15,16]

Our study shows QOL was found to be impaired in all four domains, including physical, social, environmental, and psychosocial as compared with control group. The most affected domain among all the domains was environmental health in TBI patients. Many factors may be hold accountable for lower QOL in these patients. This includes poor physical functioning, fatigability,[4] sleep disturbances,[4,14] pain, and depression.[16] It is suggested that QOL is associated with levels of perceived available social support and contact. TBI results in weakening of existing friendship that is further added by incapability of forming new contacts because of reduced motility and poor interaction, thus losing opportunity to meet potential new friends.[4] TBI also affects employment, a major determinant of QOL that may affect many other factors determining QOL, such as standard of living, financial security, and opportunity to meet different individuals. Studies have also reported that people with moderate to severe TBI not only lose their jobs[17] but also tend to have lower quality of leisure activities after injury.[17,18] This all may cumulatively ensue a poor QOL.

Factors associated with QOL were investigated in this study. None of the sociodemographic variables were associated with impaired QOL in TBI. This finding has been supported by earlier observations made by Reddy et al,[19] who did not find any correlation between age and QOL; according to the study both younger and older adults experience poorer QOL post-TBI. Similarly marital status and education did not have any bearing on QOL in our study, as has been found in previous research as well.[20] However Reddy et al[19] reported years of education become protective factor, which increases the QOL following TBI.

This study has shown that the patients with longer duration of head injury (>6 months) have better QOL in all domains compared with those with lesser duration. Physical domains are most affected with shorter duration of head injury whereas psychological domain tends to be affected much with longer duration of TBI. In a study of Dikmen et al[21] 30% of 31 patients with TBI suffered from continuing physical disability affecting ambulation. It was shown that patients with TBI initially feel more severely impaired by physical dysfunctions such as pareses than by psychological or social problems. During the following 2 years the somatic symptoms decrease, while the psychological and social problems remain and become the most impairing factor in the patients' life. In another study by van Balen et al,[22] 45% of the patients with TBI and 56% of the family members

Table 3 Mean, SD and statistical analysis of demographic profile with QOL in TBI

	Physical	Psychological	Social	Environmental
1. Age[a]				
18–24	60.66(19.01)	58.98(18.85)	58.88(22.26)	56.68(19.06)
25–34	56.92(19.73)	61.88(19.30)	60.65(20.40)	56.01(19.01)
35–44	55.25(21.01)	59.86(20.78)	59.76(22.30)	56.34(20.03)
45–54	53.73(17.72)	54.78(17.50)	52.84(18.98)	51.94(20.08)
55–64	62.52(17.09)	66.82(16.88)	63.76(15.50)	60.82(19.09)
65 or older	70.5(19.330)	71.50(25.30)	67.00(17.06)	63.00(16.99)
	p <0.355, F 1.11, df 5	*p <0.360, F 1.103, df 5*	*p <0.685, F 0.685, df 5*	*p <0.793, F 0.477, df 5*
2. Sex[b]				
Male	58.29(19.81)	60.28(19.24)	59.53(21.37)	55.71(19.47)
Female	56.95(18.41)	61.82(19.67)	60.08(18.56)	58.93(18.50)
	p <0.685, t 0.407, df 202	*p <0.639, t −0.469, df 202*	*p <0.875, t −0.158, df 202*	*p <0.323, t −0.990, df 202*
3. Mode of injury[a]				
RTA	57.27(20.16)	60.26(20.13)	60.37(21.69)	55.34(19.84)
FFH	60.55(18.86)	61.97(18.17)	59.72(17.29)	57.92(17.77)
Assault	56.76(18.41)	59.15(19.01)	58.53(20.32)	56.88(18.79)
Other injury	59.76(20.36)	63.15(17.93)	57.23(25.44)	59.23(21.92)
	p <0.785, F 0.355, df 3	*p <0.898, F 0.197, df 3*	*p <0.935, F 0.142, df 3*	*p <0.832, F 0.291, df 3*
4. Income[a]				
< 5,000	56.20(19.00)	58.84(18.78)	57.89(19.60)	54.63(18.21)
5,000–10,000	58.72(20.06)	61.51(20.68)	60.36(23.02)	58.34(21.46)
10,000–20,000	70.80(18.62)	71.80(16.21)	72.06(18.90)	64.40(19.08)
> 2,0000	56.50(9.19)	66.00(4.24)	59.50(20.74)	56.00(0.000)
	p <0.052, F 2.6, df 3	*p <0.093, F 2.1, df 3*	*p <0.094, F 2.1, df 3*	*p <0.236, F 1.4, df 3*
5. Education[a]				
Primary	54.19(19.26)	61.78(19.39)	57.52(20.87)	53.91(19.59)
Secondary	57.12(19.56)	57.98(19.17)	55.85(19.79)	55.67(20.63)
Higher secondary	58.71(18.01)	59.95(18.93)	61.69(21.04)	55.89(19.07)
Graduate	59.56(21.18)	60.52(18.21)	62.26(19.89)	56.30(17.70)
Post graduate	66.66(21.18)	64.26(21.49)	63.80(26.67)	60.93(20.11)
Nil	59.37(18.95)	65.18(21.26)	65.00(17.45)	63.75(15.46)
p Value	*p < 0.403, F 1.02, df 5*	*p < 0.753, F 0.530, df 5*	*p < 0.440, F 0.965, df 5*	*p < 0.549, F 0.803, df 5*
6. Marital status[b]				
Married	57.18(19.73)	60.82(19.88)	60.08(20.00)	56.84(19.36)
Unmarried	60.78(18.50)	59.93(17.34)	58.17(23.27)	54.97(19.07)
	p <0.272, t −1.102, df 202	*p <0.767, t 0.276, df 202*	*p <0.583, t 0.550, df 202*	*p <0.565, t 0.576, df 202*
7. Severity of head injury[b]				
Mild	62.45(18.74)	65.29(18.91)	65.03(19.91)	60.41(18.70)
Moderate	51.37(18.74)	53.68(17.83)	51.65(19.43)	50.47(18.66)
	p <0.045, t 4.1, df 202	*p <0.05, t 4.3, df 202*	*p <0.034, t 4.7, df 202*	*p <0.021, t 3.7, df 202*
8. Duration of head injury[a]				
< 3 mo	52.80(18.82)	57.44(16.81)	56.93(21.71)	52.83(19.85)
3–6 mo	61.76(18.42)	61.92(21.47)	62.55(18.66)	59.92(17.76)
6 mo–1 y	65.84(19.32)	67.10(20.43)	63.23(20.85)	60.34(18.69)
p Value	*p <0.001, F 4.2, df 2*	*p <0.024, F 3.7, df 2*	*p <0.166, F 1.812, df 2*	*p <0.023, F 3.705, df 2*

Abbreviations: FFH, fall from height; RTA, road traffic accident; QOL, quality of life; SD, standard deviation; TBI, traumatic brain injury.
[a]ANOVA analysis.
[b]*t*-test analysis.

Table 4 Mean, SD, and *t*-test analysis of QOL with insomnia in TBI

Insomnia	Physical	Psychological	Social	Environmental
No	63.98(18.47)	66.44(18.08)	65.68(20.46)	61.68(18.57)
Yes	49.09(17.51	51.97(17.84)	50.69(17.78)	48.58(17.64)
t-test analysis	$p < 0.031$, t 5.76, df 202	$p < 0.012$, t 5.6, df 202	$p < 0.04$, t 5.3, df 202	$p < 0.011$, t 5.04, df 202

Abbreviations: QOL, quality of life; SD, standard deviation; TBI, traumatic brain injury.

reported at least one behavioral or emotional disability; 10% of the patients and 15% of the family members mentioned mood disorders. Overall improvement in QOL with longer duration of injury may be explained by the fact that the recovery from physical impairment allows the patient to resume jobs and attain comparatively better social and recreational activities, thus imbibing a sense of independence and accomplishment resulting in improved QOL.

We also tried to understand the association between severity of TBI and QOL. Severity of trauma had inverse relation with QOL as moderate TBI patients scored lower on all domains of QOL than mild TBI patients. Our results are consistent with the studies reported that severity of TBI tends to influence QOL adversely, possibly because of the potential emotional distress of cognitive and physical handicaps.[23,24] Although another study has contrasted this finding by observing that higher level of injury severity was significantly related to higher perceived QOL.[25] This finding may be attributed to cognitive deficits experienced by individuals who sustained severe injuries, such as lack of insight in to post TBI difficulties. Moderate TBI often results in falling away of friendships, losing their jobs after injury,[17]and having a lower level and lower quality of leisure activities after injury,[17] which cumulatively leads to poor QOL in these patients after TBI.

Insomnia was observed in almost 40% of TBI sample in this study. Recent clinical trials have also reported similar frequency of insomnia.[6] Statistical analysis was performed to understand the relationship between domains of QOL and insomnia. Subjects with no posttraumatic insomnia report significantly higher QOL than subjects with insomnia. Our result are consistent with the findings of quelled et al[26] who studied 452 TBI cases and found that insomnia was associated with decrease concentration, attention, irritability, and anxiety that leads to decrease QOL in TBI.

Limitation

There are multiple limitations in the current investigation. Assessment of insomnia was based on subjective experience that may have resulted in underreporting or over-reporting of symptoms. It is recognized, however, that subjective experience provides only a partial, and sometimes inaccurate, portrayal of the nature and severity of disease process. Severe TBI cases were not included in our study owing to their inability to comprehend the directions; hence present study does not give overall picture of TBI population. It is therefore important to consider objective assessment of sleep problems in addition to subjective measures to have robust inference in this regard. Another limitation was that we had used close relatives as a control groups, but many studies have mentioned that QOL is also decreased in case of caregivers, particularly from psychological aspects.

Conclusion

QOL is an important aspect to be considered while management of TBI is performed especially during follow-ups. Impact of severity and the duration of injury with associated sleep problems have significant bearing on QOL. The assessment of QOL in TBI patients should be made an essential component of management protocol, as the aim should be overall well-being of the patients and not merely the attainment of physical and neurologic improvement. Further research focusing the involvement of psychological problems in TBI and its impact on QOL should be encouraged so as to get the comprehensive understanding of TBI affecting the QOL.

Disclosure
The authors report no conflicts of interest.

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