

REVIEW ARTICLE

Quality of Life Outcomes in Mild Traumatic Brain Injury: A Cohort Study

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ABSTRACT

Aim: To study the impact of mild traumatic brain injury (MTBI) on patients with regards to the course of quality of life outcomes.

Materials and Methods: 100 patients aged 18-65 who fulfilled WHO criteria for mild traumatic brain injury (non-surgically managed) were evaluated at 1, 3 and 6 months post injury data was collected with the help of following questionnaire- The World Health Organization Quality of Life (WHOQOL)-BREF for evaluation of quality of life. Percentage, Friedman Test, Repeated measures ANOVA tests were used. Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 17.0 (IBM SPSS, US) software. Data are reported as means and standard deviations unless not indicated otherwise. For the study of paired observations Wilcoxon` signed-ranks-test was used.

Results: 100 patients who were followed up till six months post trauma. The average age of the study population in our study was 38.5 years. Males were at a higher risk. The male to female ratio was 1: 0.26. Road traffic accidents were the major cause of MTBI. Alcohol consumption has been found to be a major risk factor for the occurrence of TBI. None of the two-wheeler riders or pillion riders were wearing helmets at the time of road traffic accident. In our study the data on QOL was assessed by World Health Organization Quality of Life BREF (WHOQOL-BREF-Tamil). Our study revealed that there was statistically significant progressive improvement in all the four domains of quality of life at 1, 3- and 6-months post trauma. The quality of life in social relationship and environmental areas reached a score of normal healthy population by 3 months. The psychological domain became normal between 3 to 6 months post trauma. The physical health of the study patients continued to improve beyond 6 months post trauma.

Conclusions: Our study revealed that there was statistically significant progressive improvement in all the four domains of quality of life at 1, 3- and 6-months post trauma.

Keywords: Mild Traumatic Brain Injury; Quality of life; WHOQOL-BREF.

INTRODUCTION

Terms like closed head injury, traumatic brain injury, mild brain injury, minor brain injury and concussion are used interchangeably with MTBI.

However, the World Health Organization (WHO) Collaborating Center for Neurotrauma Prevention, Management and Rehabilitation Task Force on Mild Traumatic Brain Injury (MTBI) proposed the following definition: ¹

MTBI is an acute brain injury resulting from mechanical energy to the head from external physical forces.

Operational criteria for clinical identification of MTBI include:

- (i) One or more of the following: confusion or disorientation, loss of consciousness for 30 minutes or less, post-traumatic amnesia for less than 24 hours, and/or other transient neurological abnormalities such as focal signs, seizure, and intracranial lesion not requiring surgery, and
- (ii) Glasgow Coma Scale score of 13-15, 30 minutes post-injury or later upon presentation for health care.

Importantly, these manifestations of MTBI must not be due to drugs, alcohol, medications, other injuries or treatment for other injuries (e.g. systemic injuries, facial injuries or intubation), other problems (e.g. psychological trauma, language barrier or coexisting medical conditions) or by penetrating craniocerebral injury.

The term 'mild traumatic brain injury' (MTBI) can be misleading as many of the afflicted patients may have poor cognitive and social outcomes. A significant number of individuals with MTBI report persisting symptoms which interfere with their working capacity and leisure activities. This in turn leads to social morbidity, decreased productivity, and puts an economic burden on the nation.

After Effects of mild traumatic brain injury encompass the following three domains:²

1. Physical post concussive Symptoms
2. Cognitive impairment
3. Social and occupational functioning (Quality of life).

QUALITY OF LIFE

WHO defines health as "A state of physical, mental and social well-being, not merely the absence of disease and infirmity", hence a study on MTBI is incomplete without studying its impact on the quality of life of the MTBI patient.³

Mild traumatic brain injury deteriorates quality of life as most of the patients report specific and non-specific post-concussive symptoms, and cognitive impairment in the form of impaired attention, memory, language, and visuo-spatial construction abilities.⁴

The physical health, social functioning, social relationships, and mental health are the major domains of the quality of life which are influenced by traumatic brain injury.⁵

Therefore, social support (various types of assistance or help that a patient receives from family, friends, and others) to the MTBI patients is of paramount importance in their satisfactory recovery.

AIMS AND OBJECTIVES

To study the impact of mild traumatic brain injury (MTBI) on patients with regards to the course of Quality of Life outcomes.

REVIEW OF LITERATURE

EPIDEMIOLOGY

MTBI is common in active people, especially in young adults within the second and third decades of life.⁶ Several studies have documented a higher injury rate in males, about twice as high as for females. As the age increases, the gender differences become less evident.⁷ An earlier study published by Gururaj G et al showed that the gender ratio in traumatic brain injury in Indian population was 1: 0.3.⁸ Further, in this study, 65% of total patients with MTBI were aged between 16 - 45 years.

QUALITY OF LIFE IN PATIENTS WITH MILD TRAUMATIC BRAIN INJURY

Significant number of MTBI survivors require rehabilitation and may suffer from long-term physical, cognitive, and psychological disorders.⁴ This may disrupt their social connections and work opportunities, with severe economic and social consequences. Thus, the TBI survivors report a lower fulfillment in life than the general population.

Petchprapai et al.⁴ and Beseoglu et al.⁵ studied quality of life in patients with mild traumatic brain injury both of these studies concluded that the quality of life is significantly affected in a patient with mild traumatic brain injury. Petchprapai et al.⁴ used a scoring system for total social support consisting of average availability and satisfaction, amongst other variables like average health, functional abilities, psychological and spiritual component followed by social and economic component. The study showed that the social support component i.e average availability and satisfaction, was the major factor in predicting the quality of life.

A study by Beseoglu et al.⁵ showed reduction in physical health and emotional aspects of the MTBI patients. The physical components included general health and bodily pain, whereas the emotional component included vitality, social functioning, and mental health. This study particularly focused on the employment status, as it contributes to the self-worth and affects the quality of life significantly.

Most studies on patients with MTBI have focused on symptoms, and only a few have documented the consequences of the injury on disability and quality of life level, which is in contrast to the studies done on patients with severe head injuries.⁶ A prospective cohort study was conducted by Thornhill et al.⁹ in five general hospitals in Glasgow to study the disability in young people and adults one year after head injury. Their results showed that one year after the injury, 47% of patients with MTBI still had moderate to severe disability according to the Glasgow Outcome Scale (GOS). Notably, disability one year after trauma was as common in patients with MTBI as after moderate or severe head injury.

Most patients with MTBI return to work or school shortly after the trauma despite having symptoms related to the accident.¹⁰ Decreased working capacity is commonly documented during the first months after MTBI.¹¹ Johansson et al.¹² in a study using follow-up 1.5 to 3 years after the injury, reported that leisure was affected in 9% of patients with MTBI and it was also the most commonly reported disability among the patients.

As patient's social and occupational activities are affected after MTBI, it is likely to contribute to a decreased quality of life after injury. Although quality of life has been identified as an important outcome measure,¹¹ only a few studies have investigated quality of life in patients with MTBI. Emanuelsson et al, in a follow-up study one year after MTBI, analyzed the quality of life by using the instrument Short Form Health Survey (SF-36). Their results showed low ratings on quality of life in the MTBI patients than by a gender and age-matched control group.¹³

QUALITY OF LIFE ASSESSMENT USING WHOQOL-BREF IN MTBI

WHOQOL-BREF is a questionnaire to assess the quality of life. It was developed by the WHO, and is one of the standard tools available to assess quality of life under various settings.¹⁴ It assesses an individual's perceptions of their life standard in the context of their culture and value systems, and their personal goals, standards, and concerns. The WHOQOL instrument has been globally field-tested.

The WHOQOL-BREF instrument comprises 26 items, which measure 4 domains: Physical health, Psychological health, Social relationships, and Environment. The WHOQOL-BREF is a shorter version of the original instrument and has better applicability in large clinical studies.

A study on the quality of life of 249 patients who suffered TBI was conducted at NIMHANS, India during 2000-2003 World Health Organization Quality of Life BREF questionnaires

were used to measure the quality of life of the study population. The study outcome revealed that the quality of life was significantly affected in these patients. Further, the physical health domain and psychological health domain scores were very low (3% and 10% respectively). Also, a decline was observed in the domain 3 and 4 scores of the World Health Organization Quality of Life BREF.¹⁵

Ganesh et al¹⁶ conducted a study among 300 elderly residents of Puducherry, India in 2014, in which the data on QOL was assessed by using the World Health Organization Quality of Life BREF (WHOQOL-BREF-Tamil). The World Health Organization Quality of Life BREF questionnaire was translated to Tamil, and then back to English, to assess the reliability of the instrument. A pilot-test was conducted before the survey to validate the questionnaire.

Similarly, Sathvik BS et al.¹⁴ in 2008 compared QOL of hemodialysis patients with general healthy south Indian (Mysore) population using WHOQOL- BREF questionnaire (Table 1). According to the study outcomes, the normative values for each of the domains in a healthy south Indian population were 71.1 ± 14.2 , 63 ± 13.6 , 68.8 ± 14.6 , and 61.26 ± 12.8 for Domain 1 - Physical health, Domain 2 - Psychological health, Domain 3 - Social relationships and Domain 4 – Environment respectively.

Table 1: Normative values for WHOQOL- BREF (Sathvik BS et al)

WHOQOL-BREF	Normative value (Sathvik BS et al) ⁹³
Domain 1 - Physical health	71.1 ± 14.2
Domain 2 - Psychological health	63 ± 13.6
Domain 3 - Social relationships	68.8 ± 14.6
Domain 4 - Environment	61.26 ± 12.8

An extensive normative data for the Latin American population was published by Luciane N et al in 2011 (Table 2). Normative data for total population sample and subsamples stratified by gender, age, economic class, years of study, and presence of a chronic disease was published.¹⁷

Table 2: Normative values for WHOQOL- BREF (Luciane N et al)

WHOQOL-BREF	Normative value (Luciane N et al) ⁹⁶
Domain 1 - Physical health	58.9 ± 10.5
Domain 2 - Psychological health	65.9 ± 10.8
Domain 3 - Social relationships	76.2 ± 18.8
Domain 4 - Environment	59.9 ± 14.9

SUBJECTS AND METHODS

SETTING

All patients with traumatic brain injury, treated within one month of trauma, by the Department of Neurosurgery, Mahatma Gandhi Medical College and Research Institute (MGMCRI), Pondicherry were considered for this study. The population included both in-patients and out-patients. The inclusion and exclusion criteria were as follows:

MEASURES

INCLUSION CRITERIA

1. Patients aged 18-65 with traumatic brain injury who fulfilled WHO criteria for Mild Traumatic Brain Injury and also consented for this study.

EXCLUSION CRITERIA

1. Patients with associated severe chest, abdominal or orthopedic trauma.
2. Patients with MTBI requiring surgical intervention.

3. Prior psychiatric illness.
4. Alcohol or drug dependence.
5. Previous history of brain injury.
6. Existing or any previous neurological illness.
7. Patients who cannot read, write and have not received at least 3 years of formal education.

All these patients were briefed about the study and consent was obtained after explaining in detail in the language in which they will be able to understand about the study. The consent form available as an annexure.

SAMPLE SIZE

The sample size was calculated based on the following formula (sample size for proportions and prevalence) using the data that 80% of traumatic brain injuries are mild traumatic brain injuries:

$$n = \frac{z^2 \times \hat{p}(1-\hat{p})}{\epsilon^2}$$

n is sample size

Z is the z score (1.96)

ϵ is the margin of error (0.08)

\hat{p} is the population proportion (0.8)

The sample size was calculated to be 97 after considering 10% loss to follow up the final sample size was 107.

SAMPLING METHOD

Sequential sampling was done i.e. first 107 patients who fulfilled criteria and consented for the study during the recruitment period of 1 year, June – June 2019. The study proforma was filled at the first visit and assessments were done at 1, 3, 6 months from the date of trauma.

DATA COLLECTION PROCESS

ASSESSMENT ON THE DAY OF THE FIRST VISIT OF A STUDY PATIENT

On the first visit (Outpatient / Emergency department), demographic and clinical data was collected as per patient information proforma including their address and phone number. The patients were treated as per routine mild traumatic brain injury treatment protocols followed in the Department of Neurosurgery.

ASSESSMENT ON SUBSEQUENT VISITS

Study patients were evaluated at 1 month, 3 months and 6 months post injury at the Brain injury Clinic on Saturdays for treatment review and for assessment. The patients were simultaneously treated by the Department of Psychiatry when they came for routine follow up in the Neurosurgery Outpatient department. On each of these visits in addition to routine history and clinical examination, patients were assessed for quality of life outcomes using simple questionnaires. Medication and non-medication advice were given as standard treatment protocol for the treatment of MTBI followed in the Department of Neurosurgery, MGMCRI.

FOLLOWING QUESTIONNAIRE WERE USED FOR MTBI OUTCOME ASSESSMENTS AT EACH VISIT

- The World Health Organization Quality of Life (WHOQOL)-BREF for evaluation of quality of life. (Tamil Translation)

The Tamil versions of all the questionnaires were used and most components were self-administered.

The quality of life data from The World Health Organization Quality of Life (WHOQOL-BREF) scale was converted to domain, raw and transformed scores. The calculated transformed score is expected between the range of 0 and 100 higher the scores better and lower the scores worse quality of life. Any external psycho-social factors unrelated to the mild traumatic head injury, affecting the Quality of Life was factored in during the evaluation.

Statistical analysis was done to determine the course of persisting symptoms of MTBI 1, 3 and 6 months after MTBI. The neuropsychological evaluation and quality of life at 1, 3 and 6 months was evaluated with statistical tests.

DATA ANALYSIS

Percentage, Friedman Test, Repeated measures Analysis of Variance (ANOVA) tests were used. Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 17.0 (IBM SPSS, USA) software. Data are reported as means and standard deviations unless not indicated otherwise. For the study of paired observations Wilcoxon signed-ranks-test was used.

PROTECTION OF HUMAN SUBJECTS

The institutional human ethics committee of MGMCRI, Pondicherry has considered and approved this study at the meeting held on 06th June 2018.

All patients were informed about the purpose of this study. Participation in this study was voluntary, and each patient could withdraw at any time. There were no direct benefits to the subjects for participating in this study, and their decisions regarding participation did not affect the services that they received from the hospital.

RESULTS

QUALITY OF LIFE OUTCOMES

The mean scores for physical health domain (Table 3) at 1, 3 and 6 months were 52.41, 60.00 and 70.53 (Normative score 71.10); mean scores for psychological health (Table 6) at 1, 3 and 6 months were 49.91, 59.95 and 68.10 (Normative score 63.00); mean scores for social relationship (Table 9) at 1, 3 and 6 months were 59.36, 67.70 and 74.10 (Normative score 68.80) and mean scores for environment (Table 12) at 1, 3 and 6 months were 52.24, 64.00 and 68.36 (Normative score 61.26). (Figure 1)

Friedman Test (Table 4, 7, 10 and 13) showed statistically significant difference in “WHOQOL-BREF” domain scores at 1, 3 and 6 months with a p value of 0.001.

We compared 3rd versus 1st, 6th versus 3rd and 6th versus 1st follow up scores with Wilcoxon Signed Ranks Test (Table 5, 8, 11 and 14). This showed that the mean ranks differed significantly with a p value of 0.001 (Figure 2).

DOMAIN 1 - PHYSICAL HEALTH

Table 3: Table showing mean scores on WHO QOL BREF of “Physical Health” at 1, 3 and 6 months

Domain 1 - Physical Health	N	Mean	Standard Deviation	Minimum	Maximum
1 st month follow up	100	52.41	16.976	6	81
3 rd month follow up	100	60.00	12.900	31	88
6 th month follow up	100	70.53	10.313	44	88

Table 4: Friedman Test applied to “Physical Health” scores at 1, 3 and 6 months showing statistically significant difference in the values.

Domain 1 - Physical Health	Mean Rank	Chi-Square	P value
1 st month follow up	1.33	132.974	0.001
3 rd month follow up	1.85		
6 th month follow up	2.83		

Table 5: Wilcoxon Signed Ranks Test applied to “Physical Health” scores at 1, 3 and 6 months showing that the population mean ranks differ significantly.

Domain 1 - Physical Health	3 rd month vs 1 st month follow up	6 th month vs 3 rd month follow up	6 th month vs 1 st month follow up
Z	-5.832 ^a	-7.690 ^a	-8.032 ^a
Asymptotic Significance Value(2tailed)	0.001	0.001	0.001
a. Based on negative ranks.			

DOMAIN 2 - PSYCHOLOGICAL HEALTH**Table 6: Table showing mean scores on WHO QOL BREF of “Psychological Health” at 1, 3 and 6 months**

Domain 2 - Psychological Health	N	Mean	Standard Deviation	Minimum	Maximum
1 st month follow up	100	49.91	16.911	25	88
3 rd month follow up	100	59.95	11.608	31	88
6 th month follow up	100	68.10	10.072	44	94

Table 7: Friedman Test applied to “Psychological Health” scores at 1, 3 and 6 months showing statistically significant difference in the values.

Domain 2 - Psychological Health	Mean Rank	Chi-Square	P value
1 st month follow up	1.28	127.011	0.001
3 rd month follow up	1.94		
6 th month follow up	2.78		

Table 8: Wilcoxon Signed Ranks Test applied to “Psychological Health” scores at 1, 3 and 6 months showing that the population mean ranks differ significantly.

Domain 2 - Psychological Health	3 rd month vs 1 st month follow up	6 th month vs 3 rd month follow up	6 th month vs 1 st month follow up
Z	-6.236 ^a	-7.640 ^a	-8.071 ^a
Asymptotic Significance Value (2-tailed)	0.001	0.001	0.001
a. Based on negative ranks.			

DOMAIN 3 - SOCIAL RELATIONSHIPS**Table 9: Table showing mean scores of WHO QOL BREF on “Social Relationships” at 1, 3 and 6 months.**

Domain 3 - Social Relationships	N	Mean	Standard Deviation	Minimum	Maximum
1 st month follow up	100	59.36	20.319	19	100
3 rd month follow up	100	67.70	16.338	6	100
6 th month follow up	100	74.10	12.107	44	100

Table 10: Friedman Test applied to “Social Relationships” scores at 1, 3 and 6 months showing statistically significant difference in the values.

Domain 3 - Social Relationships	Mean Rank	Chi-Square	P value
1 st month follow up	1.37	92.595	0.001
3 rd month follow up	2.09		
6 th month follow up	2.55		

Table 11: Wilcoxon Signed Ranks Test applied to “Social Relationships” scores at 1, 3 and 6 months showing that the population mean ranks differ significantly.

Domain 3 - Social Relationships	3 rd month vs 1 st month follow up	6 th month vs 3 rd month follow up	6 th month vs 1 st month follow up
Z	-5.596 ^a	-5.092 ^a	-7.163 ^a
Asymptotic Significance Value (2-tailed)	0.001	0.001	0.001
a. Based on negative ranks.			

DOMAIN 4 - ENVIRONMENT**Table 12: Table showing mean scores of WHOQOL BREF on “Environment” at 1, 3 and 6 months.**

Domain 4 - Environment	N	Mean	Standard Deviation	Minimum	Maximum
1 st month follow up	100	52.24	15.723	24	88
3 rd month follow up	100	64.00	13.285	31	94
6 th month follow up	100	68.36	10.231	44	94

Table 13: Friedman Test applied to “Environment” scores at 1, 3 and 6 months showing statistically significant difference in the values.

Domain 4 - Environment	Mean Rank	Chi-Square	P value
1 st month follow up	1.20	126.378	0.001
3 rd month follow up	2.18		
6 th month follow up	2.63		

Table 14: Wilcoxon Signed Ranks Test applied to “Environment” scores at 1, 3 and 6 months showing that the population mean ranks differ significantly.

Domain 4 - Environment	3 rd month vs 1 st month follow up	6 th month vs 3 rd month follow up	6 th month vs 1 st month follow up
Z	-6.861 ^a	-5.209 ^a	-8.068 ^a
Asymptotic Significance Value (2-tailed)	0.001	0.001	0.001
a. Based on negative ranks.			

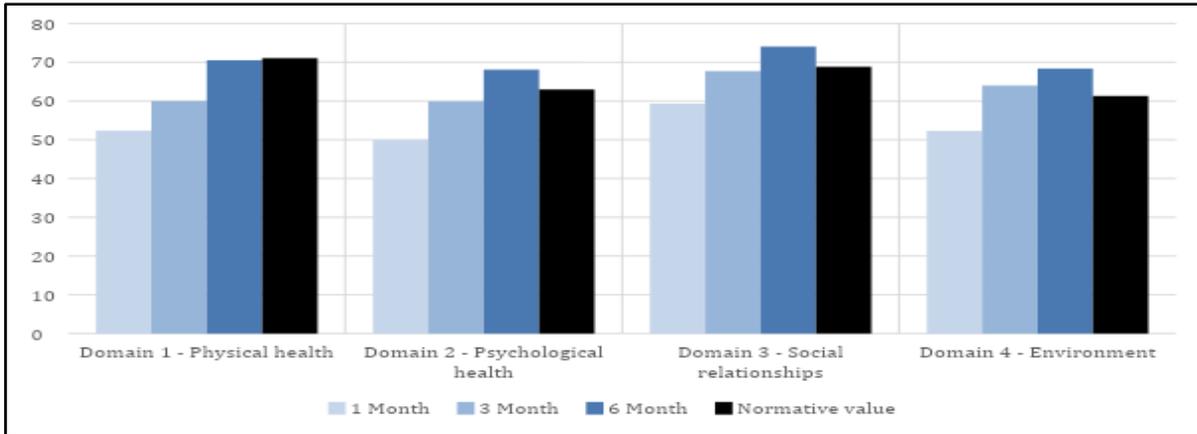


Figure 1: WHOQOL BREF mean scores in patients with MTBI over a period of 6 months.

Figure 1 shows that there was statistically significant progressive improvement in all the four domains of quality of life at 1, 3 and 6 months post trauma. The quality of life in social relationships and environmental areas reached a score of normal healthy population by 3 months. The psychological domain became normal between 3 to 6 months post trauma. The physical health of the study patients continued to improve beyond 6 months post trauma.

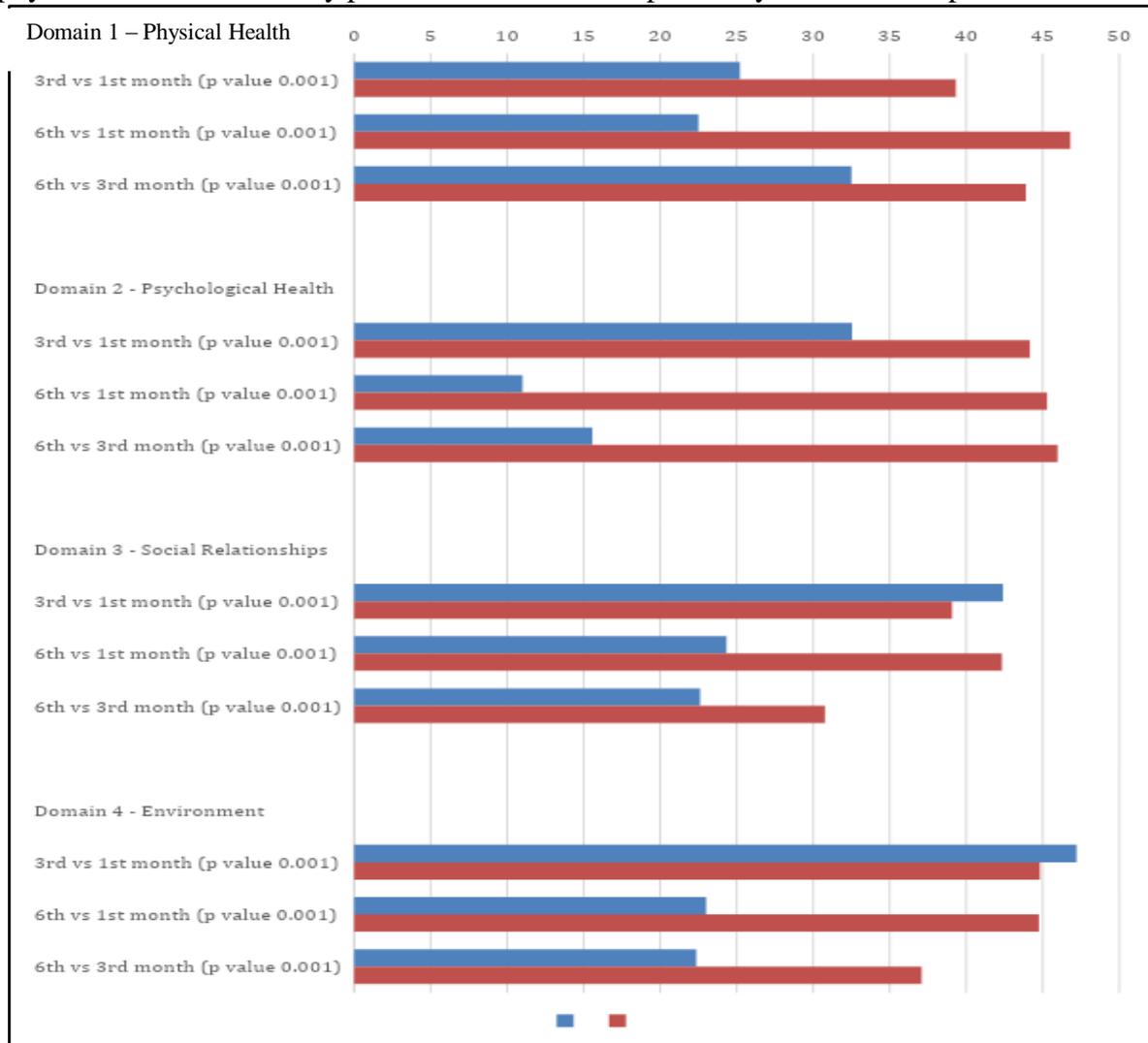


Figure 2: Comparison of WHOQOL BREF at 1, 3 and 6 months showing statistically significant progressive improvement in the mean scores of all the four domains.

QUALITY OF LIFE IN MTBI

A study on the quality of life of 249 patients who suffered TBI was conducted at NIMHANS, India during 2000-2003.¹⁵ The study outcomes revealed that the quality of life was very poor in these patients. Significantly, it was poor in the areas of physical and psychological domains in nearly 3% and 10% patients, respectively. Further, the quality of life in social relationship and environmental areas was significantly affected in nearly 15 – 20% of these subjects.

In our study the data on QOL was assessed by World Health Organization Quality of Life BREF (WHOQOL-BREF-Tamil) Our study revealed a statistically significant progressive improvement in the four domains of quality of life at 1, 3 and 6 months post-trauma. The quality of life in social relationships and environmental areas also reached the score of healthy population by 3 months. The psychological domain continued to become normal between 3 to 6 months post trauma, and the physical health of the patients continued to improve beyond 6 months post trauma. Thus, although MTBI significantly affects QOL, it does return to normal values within 6 months.

In our study population, 19 working days were lost for the patients who suffered MTBI. This was consistent with the previous studies on MTBI, which reported as a loss of 2 to 3 weeks of work (Wrightson & Gronwall, 1981).¹⁸ In a developing country like ours, with the trauma impact on predominantly young males, loss of almost 3 weeks of work is a big burden on the family and the country.

LIMITATIONS OF THE STUDY

Different aspects of patients afflicted with MTBI were evaluated using multiple standardized scoring tools. However, the study lacks an effective control group, which would have been patients with trauma, but without any brain injury. In this study the results were compared to an existing normative data for India population as the data for the local Tamil population was not available. A monthly assessment of the outcomes might have given a more precise analysis of the temporal profile of the MTBI outcomes. Small sample size was another limitation of this study, hence a study with bigger patient group preferably a metacentric study with monthly follow ups for assessment of the outcomes for a total follow up period of one year is required

CONCLUSIONS

Our findings reiterate that mild traumatic brain injury affects quality of life of the patients for a significant period following the trauma. It impacts various aspects of life, including physical well-being, psychological fulfilment, environmental cohesiveness, and social integration. The study outcomes were significant since the effect on psychological aspect of the patients is commonly overlooked leading to poor social integration and delayed return-to-work.

Based on our results, we recommend the regular use of standardized scales like WHOQOL-BREF in out-patient clinics. The need for regular follow-up at least for 6 months following head injury cannot be overemphasized at this juncture.

The availability of various assessment forms in local languages is essential and researchers and clinicians need to devote their expertise to validate these scales to improve patient care and research on this important and avoidable disability. Availability of WHO-QOL in over 30 languages globally makes it clinically feasible to incorporate these scales in the routine clinical practice.

The significant impact of the “mild” injury on quality of life for prolonged period necessitates early interventions using a multi-modality approach. Initial medical therapy may not yield

adequate outcome in most patients and various therapies like yogatherapy, physiotherapy, psychotherapy, and cognitive behavior therapy may be required to treat the refractory symptoms. Gearing-up the brain injury care centers with these facilities is becoming imperative. Further, cognitive and emotional rehabilitation is essential though physical rehabilitation may be required in certain groups of patients with associated injuries.

Any effort in improving outcomes of traumatic brain injury would fall short without adequate preventive measures. The brain injury clinic can prove to be an optimal space for educating the patients and their caregivers regarding the necessity of following the traffic rules, wearing a helmet while riding, and abstaining from alcohol while driving. The follow-up period should serve as reinforcement of these values.

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