Prevalence and determinants of depression and its association with quality of life in Traumatic Brain Injury (TBI) patients

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Abstract: *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 impairments represent significant causes of disability. Depression may be the most common and disabling psychiatric condition in individuals with TBI. *Objective*: This cross-sectional study was design to investigate prevalence and risk factors of depression in Traumatic brain injury (TBI). *Material and method*: The Group studied consists of 204 patients of mild and moderate TBI between 14- days to one-year post injury. Demographic characteristics of the participants were assessed on a self-designed semi structured performa. Interviews focused on assessment of severity of TBI, depression and quality of life (Qol) using GCS, PHQ-9 and WHOBREF-QOL respectively. *Results*: Total 204 patients were included. 42.15% participants were found to have depression. None of the demographic variables were associated with depression except female sex, severity and time since injury. Moderate TBI patient (55.80%) had significantly higher occurrence of depression than the mild cases (44.2%). Patients with lesser duration (time since injury) of TBI had high incidence (50.2%) of depression compare to longer duration of TBI. Depressed patients also had poor Qol than those without depression in all domains except physical health domain. Neuroanatomical localization was also correlated with depression. Cerebral contusions were the most common (44.24%) lesions associated with depression. *Conclusion*: Depression is commonly associated, yet under diagnosed clinical entities in head injury and have tremendous impact in overall outcome measures. Every patient of head injury warrants psychiatric evaluation and concomitant treatment if required to ensure the attainment of not only neuroanatomical intact but overall productive and qualitative life vindicating the holistic and multidisciplinary treatment approach.

Key words: Traumatic Brain Injury, depression, quality of life

Introduction

Traumatic brain injury (TBI) is a major cause of death and disability (21). Many patients face long-term disability. With regard to emotional functioning, depression is often a significant clinical concern. Major depressive disorder (MDD) may be the most common and disabling psychiatric condition in individuals with TBI (24).

Depression after TBI is well documented in the literature. The frequency of depressive disorders has been reported to range between 16% and 60% (21), and MDD is the most commonly reported mood disorder after TBI, ranging from 24% to 35%. (21), (13). The

frequency of MDD is particularly noteworthy when contrasted with base rates of 6% to 7% in community-based samples (12). Although some persons who experience post-TBI depression have a history of MDD or other depressive disorders before their TBI, the frequency of depression after TBI far exceeds premorbid rates (11).

Post-TBI depression has been associated with numerous negative outcomes including sadness, irritability, loss of interest, fatigue, sleep disturbance, psychomotor retardation, greater sexual dysfunction, and lower ratings of health, poor subjective well-being, poorer QOL, and increased rates of suicidal ideation (11)(18)(2). These negative consequences can hamper the person's reintegration into the community, adjustment after injury, and overall QOL.

Despite researchers' best efforts, the rates, predictors, and outcomes of MDD after TBI remain uncertain. Incidence of depression has varied widely, ranging from 6-77%. (19). More elaborative studies may prove more informative and credible in recognition of this important secondary condition. The present study was designed to investigate the prevalence and determinants of depression in TBI and its correlation with quality of life. We have also implored the connection between neuroanatomical localization of TBI and depression.

Material and method

Study design

The present study was a cross sectional study conducted at SMS Medical College and group of hospitals (SMSH) over a period of six months from Jan 2013 to June 2013. SMSH is a tertiary care super specialty treatment Centre. Being the largest medical institute in the state of Rajasthan, it caters the health needs of entire state as well as neighboring states. The institutional ethical committee approved the study protocol.

Participants

The Group studied consists of 204 patients of mild and moderate TBI between 14- days to one-year post injury. Sample was recruited through the follow up in neurosurgery OPD and Indoor of SMSH. Definition of mild traumatic brain injury was adopted as developed by the mild traumatic brain injury committee of the Head injury (4). 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),
4. Focal neurological deficit(s) that may or may not be transient".

Moderate head injury was classified as if the lowest post resuscitation GCS score was 9±12 with or without evidence of lesion on CT. 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 with severe head injury and history of current or past psychosis, substance abuse disorder were excluded from the study as these factors can affect outcome independently.

The nature and purpose of the study was explained to the participants and written informed consent was obtained. Demographic characteristics of the participants were recorded on a self-designed semi structured per-forma by interviewing the participants by psychiatrist and exploring the medical records and neuro-radiological investigations. The interview was focused on assessment of severity of TBI, depression and Quality of life (Qol) measured on post injury GCS, PHQ-9 and WHOQOL-BREF respectively.

Instruments

Severity of the TBI was assessed using the Glasgow coma scale (GCS) (8). It is used for assessing the depth and duration of impaired consciousness and coma. According to this measurement, GCS scores between 13 and 15 defined mild head injury; between 9 and 12, moderate head injury; and between 3 and 8, severe head injury. 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.

Depression was assessed by administering the nine-item PHQ-9, a self-report version of PRIME-MD11 which assesses the presence of major depressive disorder using modified Diagnostic and Statistical Manual, Fourth edition (DSM-IV) criteria. There is good agreement reported between the PHQ diagnosis and those of independent psychiatry health professionals (for the diagnosis of any one or more PHQ disorder, kappa=0.65; overall accuracy, 85%; sensitivity, 75%; specificity, 90%) (15). In this study Hindi version of PHQ-9 was used. It has been validated in Indian population and is considered to be reliable tool for diagnosis of depression (16). For the diagnosis of depression, we defined clinical significant depression as: a PHQ-9 score of 10 or above.

The WHOQOL-BREF was developed by the World Health Organization Quality of Life Group, in 15 international field centers (22). It is a self-report questionnaire that contains 26 items, and each item represents one facet. Among the 26 items, 24 of them make up the 4 domains of physical health (7 items), psychological health (6 items), social relationships (3 items), and environment (8 items). The other 2 items measure overall quality of life and general health. In this study Hindi version (20) was used. The scale has been shown to have good discriminant validity, sound content validity and good test-retest reliability at several international WHOQOL centres.

Lesion Location- Assessment of lesion location was obtained via retrospective assessment of clinical record and post injury CT scan. For the purpose of this analysis, results were characterized as presence or absence of contusion, epidural bleed, subdural bleed in different brain regions grouped as frontal, temporal, parietal, occipital, subcortical, and/or cerebellar sites.

Statistical analyses

Data were analyzed using SPSS version 20, with a 2-tailed α level of 5%. Statistical analyses were performed by correlation analyses (Pearson and Spearman), and independent t test analyses. The criterion for statistical significance was set at p_0.05, and for statistical trend at p_0.10.

Results

Participants and prevalence

Total 204 patients were included in study, mean age of patients were 33.34 (SD12.89) year. 77.9 percent were males (n=159) and 22.1 percent (n=45) were female. Motor vehicle accidents were the most common cause (52.9%, n=108) of TBI, followed by falls and assaults each accounted for 19.6 %(n=40) and 21.1% (n=43) respectively. Eighty-six of the 204 participants (42.15%) were found to have depression as measured by PHQ- 9 with a cut off score of 10 and above. (Table I)

Relationship between demographic variables, injury characteristics with depression

Depression was found in 37.33 % of male patients against 57.77 % females and this difference was statistically significant (p <0.016, df 1). Other sociodemographic variables did not appear to have significant association with depression. Amongst injury

characteristics, time since injury and severity of TBI had significant association with depression. Moderate TBI patients (55.8%) had significantly higher occurrence of depression than the mild cases (44.2%). (P=0.000, df 1). Half (50.0%) of the patients with depression had lesser duration post injury (< 3-month) compare to longer duration since injury. This was found statistically significant (P<0.037). (Table II).

Distributions of CT finding in depressed individuals

Neuroanatomical localization was also correlated with depression. 44.2% of depressed patients had cerebral contusion followed by multiple lesion including contusions as well in 18.6% of the cases. Other injury like EDH, SDH, SAH and even fracture were also found to be involved although in lesser frequency with depression. A very few patients with depression were also found to have normal CAT Brain (Table II). We further tried to explore the distribution of cerebral contusion in patients with depression and observed multiple contusions in most (36.8%) of the patients, though single lobe contusion were also associated with depression particularly in left frontal and left temporal region. (Table III)

TABLE I

Correlation of depression and No Depression with demographic and Injury-Related Factors

	No Depression		**Depression**		**P valve**
	N	**%**	**N**	**%**	
Sex					**R .168, p<.016,**
Male	99	62.26	60	37.73	
Female	19	42.22	26	57.77	
Age (years)					**R .01, p< .882**
18–24	28	23.7	26	30.2	
25–34	44	37.3	23	26.7	
35–44	25	21.2	18	20.9	
45–54	8	6.8	11	12.8	
55–64	12	10.2	5	5.8	
65 or older	1	0.8	3	3.5	
Type of injury					**R -.016, p <. 882**
RTA	60	50.8	48	55.8	
FFH	25	21.2	15	17.4	
Assault	27	22.9	16	18.6	
Other injury	6	5.1	7	8.1	
GCS					**R .272, p<. 001**
Mild	84	71.2	38	44.2	
Moderate	34	28.8	48	55.8	
Duration of head injury					**R .130, p<. 005**
Less <3 Month	79	66.9	43	50.0	
3-6 Month	23	19.5	29	33.7	
>6 Month	16	13.6	14	16.3	
Monthly income					**R -.024, p< .734**
<50000	72	61.0	57	66.3	
5000-10000	36	30.5	22	25.6	

10000-20000	10	8.5	5	5.8	
>200000	0	0	2	2.3	
Marital status					**R .068, p< .379**
Married	94	79.7	64	74.4	
Unmarried	24	20.3	22	25.6	

SN	CT Finding	Frequency	Percent
1.	Contusion	38	44.2
2.	Multiple lesions	16	18.60
3.	SDH	11	12.79
4.	EDH	5	0.05
5.	Fracture	6	0.06
6.	SAH	2	0.02
7.	IVH	8	0.09
	Total	86	100

TABLE II

Distribution of CT finding in depressed patients

Distribution of contusions	Frequency	Percent
Multiple lobe contusions	**14**	**36.8**
Right Frontal lobe	**4**	**10.5**
Left frontal lobe	**6**	**15.8**
Right temporal lobe	**3**	**7.9**
Left Temporal lobe	**10**	**26.3**
Total	**38**	**100**

TABLE 3

Distribution of cerebral contusions in depressed patients

SN	CT Finding	Frequency	Percent
7	Left subcortical	**1**	**2.6**
8	Right parietal lobe	**0**	-
9	Left parietal lobe	**0**	-
10	Right Occipital	**0**	-
11	Left Occipital	**0**	-
12	Right subcortical	**0**	-
13	Cerebellum and brain stem	**0**	-
	Total	**38**	**100**

TABLE 4

Quality of life in Depressed and non-depressed patients

Domains	*Non depressed (mean)*	*SD*	*Depressed (mean)*	*SD*	*T test*	*P value*
Physical health	*59.65*	*19.63*	*55.73*	*19.14*	*1.423*	*.156*
Psychological health	*63.22*	*19.63*	*57.06*	*18.36*	*2.2*	*.024*
Social relationship	*62.88*	*19.47*	*56.98*	*18.34*	*2.186*	*.030*
Environmental health	*58.70*	*19.39*	*53.29*	*18.75*	*1.996*	*.047*

Assessment of Qol in depressed and nondepressed individuals

Patients with depression scored lower than those without depression in all four domains of QOL including physical health (55.73v/s 59.65,p=0.156), psychological health (57.06 v/s 63.22,p=0.024), social relationship (56.98 v/s 62.88,p=0.030) and environmental health (53.29 v/s 58.70,p=0.047). This finding was statistically significant in respect of all domains except physical health (Table IV).

Discussion

Depression was found in 42.15% of study sample after mild and moderate head injury. The cumulative rate of depression in this study sample was almost 7 times higher than general population (42.15% in our cohort v/s 6.71 % in general population (12). This rate was virtually identical to that reported by Jorge et al (11) who applied DSM criteria to establish prevalence rate and less than the 77% reported by Varney et al (25) who used DSM-III

criteria, Conversely, it is considerably more than the 14% reported by Deb et al (5) who relied on ICD-10 diagnostic criteria. This variation in prevalence rates may have been caused by methodological issues including differences in depression assessment tools used in the research, the time course of depression assessment, and differences in injury severity of persons with TBI (mild vs. severe injuries).

Factors associated with depression were investigated in this study. None of the sociodemographic variables were associated with depression in TBI except gender variable. However, female gender has not been consistently associated with posttraumatic depression. Fedoroff et al. (7) and blazer et al. (1) have reported that women are at twice the risk of developing depression than men while Jorge et al. (11) on contrary have reported no significant differences in this regard between the patients with major depression and those who did not have depression.

Correlation between depression and injury characteristics were also assessed. Severity of TBI was found strongly associated with higher proportion of depression, as depression was much higher in moderate TBI cases than the mild cases. Controversy exists whether severity of TBI is directly correlated with increased prevalence of depression. Dickmen et al. (6) showed an inverse relationship and Holsinger et al. (9) noted increased prevalence with increasing severity of TBI. Some researchers have postulated the reason for this counterintuitive finding lies in the fact that the people with severe brain injury likely underreport and those with milder injury are more aware of their problem and therefore more likely to report about depression. Moderate TBI patients exhibited more severe injuries, had greater frequency of diffuse injury, which may have led them to develop mood symptoms.

The study data also support the relationship between incidence of depression and duration of TBI post injury (time post injury). Depression rate was high (50%) with lesser duration of TBI compare to longer duration post injury. Several studies found that depression is common after years following injury (14) while other studies determined that depression rates decrease with time from injury within the TBI population (20). Jorge et al. (11) found that 80% of persons were diagnosed with depression within the first 3 months post injury. At 1 year post-injury only 33% of persons were troubled by depression, which could either be due to decreased depression rates in the population or due to the natural recovery of symptoms over time. Our data in this regard contradicts the theory that poor awareness of impairment precludes depressive reaction during the first six month of injury (10) and suggests a window of opportunity for early identification and treatment or prevention efforts. During the acute stage, depression of mood appears to be a function of the diffuse disruption of cerebral functioning in the wake of both direct physical damage to the brain and secondary neuropathological events. As brain functioning becomes re-organized and some degree of neurologic stabilityis re-established, mood symptoms could be expected to normalize.

This study has also tried to explore the neuroanatomical localization of injury in respect of depression. Cerebral contusion was the most commonly implicated lesion involving multiple lobes particularly left frontal and left temporal lobe, however single lobe involvement like right frontal and right temporal lobe and extradural injury was also associated with depression in few of the cases. Jorge et al. (10,11) reported in two studies that major depression post-TBI is consistently associated with damage to the prefrontal cortex, basal ganglia, and the white matter tracts that connect these structures. Brain injury (by an extradural, subdural or intraparenchymal hematoma or parenchyma

contusion of cerebral hemispheres), can potentially compromise these fronto-striatal-thalamic circuits. Rao et al. (17) in his assessment of 17 brain injury patient suggest a possible role for frontal cortex, temporal lobe, and basal ganglia pathology in post-TBI depression, as well as reduced left occipital volume.

We also tried to understand the association between injury severity and presence of depression with QOL. Depressed patients had poor quality of life than those without depression in all domains except physical health domain. Charles HB et al. (3) described major depressive disorder within first year of TBI was associated with greater problems leading to poor health related quality of life (HRQL). Many other studies (23) in recent past have also reported significant association between depression and poor Qol in TBI. This finding implies that long-term rehabilitation intervention programs for preventing the occurrence of depression and its deterioration are required.

Limitations of the study

There are multiple limitations in the current investigation. Patient complaints were based on self-reported questionnaire, which may have resulted in underreporting or over reporting of symptoms. It is recognized, however, that subjective depression experience provides only a partial, and sometimes inaccurate, portrayal of the nature and severity of objective depressive difficulties. Patients with depression often report greater disruption than is evidenced by objective recordings. Severe TBI cases were not included in our study owing to their inability to comprehend the directions, and hence present study does not give overall picture of TBI population. It is therefore important to consider objective depressive data in addition to subjective measures to understand post-TBI depression. This represents an important direction for further study.

Conclusion

Depression after TBI is highly prevalent and associated with adverse impact on QOL. Because depression after TBI is an invisible disorder within invisible injury, aggressive and scrupulous efforts are needed to educate the clinician about the importance of mood symptoms in this population to promote integrated system of detection and multidisciplinary care.

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