PSYCHIATRIC SEQUELAE IN TRAUMATIC BRAIN INJURY PATIENTS- A CASE CONTROL STUDY

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ABSTRACT

BACKGROUND

Millions of people are affected by Traumatic Brain Injury (TBI) worldwide and a significant number of affected persons live with disability. Early mortality has considerably improved as a result of advances in the management of the early acute stages. The long-term psychiatric consequences of traumatic brain injury are numerous and have enormous impact on rehabilitation, quality of life and outcomes such as return to work.

MATERIALS AND METHODS

Fifty patients with history of head injury fulfilling the inclusion criteria and 50 attenders of other patients without history of head injury attending same clinic were taken. They were matched for age, sex and socioeconomic background. Patients and controls were administered Hamilton Depression Rating Scale, Hamilton Anxiety Rating Scale and Mini Mental State Examination Scale. A clinical interview was done for assessing personality disorder based on DSM IV criteria. Chi-square test was used with one degree of freedom and Yates correction wherever necessary.

RESULTS

Among cases 62% qualified for psychiatric diagnosis and among controls 12% qualified for psychiatric diagnosis. Among the psychiatric diagnosis of cases majority consisted of depression (24.0%) 12 persons. Statistically, depression and personality disorder have correlation with traumatic head injury ($P < 0.05$).

CONCLUSION

Psychiatric sequelae are more in head injury patients. Depression and personality disorder are significantly more in head injury population. Injury to frontal region has significant association with personality disorder.

KEYWORDS

TBI- Traumatic Brain Injury, HAMD- Hamilton Depression Rating Scale, HAMA- Hamilton Anxiety Rating Scale, MMSE- Mini Mental State Examination.

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BACKGROUND

Millions of people are affected by Traumatic Brain Injury (TBI) worldwide and a significant number of affected persons live with disability. The estimated incidence of traumatic brain injury of all type of severity is about 60 cases to 720 cases per 1,00,000 persons in a year.[1] In 2005, Binder et al estimated that approximately 5 million people live with long-term disability related to TBI in USA. In Europe 6.3 million persons live with disability caused by TBI.[2,3] The commonest cause for TBI is motor vehicle accident and it accounts about more than 50% cases followed by fall, which accounts about 21% cases. The other two causes for TBI are violence (12%) and sports and recreational related injury (10%).[4]

Head injury is the second most important causes of mortality after cancer. Early mortality has considerably improved as a result of advances in the management of the acute stages. Chronic sequelae of TBI remains a challenge to medical care and community resources. It is mental rather than physical disability causes more difficulty in personal and occupational rehabilitation and cause social impairment in affected individual.

Acute Behavioural Consequences

Early phase of recovery from traumatic brain injury is characterised by disorientation, confusion and impaired memory function. Posttraumatic amnesia occurs during the period when the patient is disoriented and confused.

Vocational outcome, personality changes and severity of disability after TBI is best predicted by duration of posttraumatic amnesia.[5] Delirium in brain injured person maybe due to damage to brain tissue, oedema, hypoxia or any seizure.

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Alcohol withdrawal state, serum electrolyte imbalance and infection can contribute to posttraumatic delirium and confusional state.

Chronic Behavioural Consequences

Cognitive and psychiatric disorders are the common causes of disabilities and may cause difficulties in recovery after TBI.[6-8]

Patients with TBI had poorer processing speed, verbal memory, language and executive function. They self-reported more psychological distress, psychosocial dysfunction and postconcussion symptoms. Their level of functioning was rated impaired when compared to control group. TBI of moderate severity accounted for group difference in the analysis.

Subjects belonging to moderate severity had poorer cognitive and psychosocial functioning one year post injury among older adults (Rapoport MJ et al 2006).[9]

One third of the subjects had demonstrable lesion in MRI study. Delusional disorder, dementia and organic personality syndrome particularly disinhibited type were the three psychiatric disorders significantly common in subjects with contusion. Disinhibited type of organic personality syndrome was associated with frontal lobe lesion and an inverse association with temporal lobe lesion for depression was noted (Koponen S et al 2006).[10]

Mood disorders particularly major depressive disorders are the most frequent complication of traumatic brain injury. The prevalence of major depressive disorder is about 40% among hospitalised patients for TBI. Anxiety disorder, substance abuse, difficulty in controlling emotional expression and aggressive behavioural outburst are frequently associated with major depressive disorder and their presence indicate a marker for severity of course of illness (Jorge RE, et al 2005).[11]

TBI is also associated with development of many anxiety-related disorders including generalised anxiety disorder, Posttraumatic Stress Disorder (PTSD) and obsessive-compulsive disorder. The true incidence of anxiety post-TBI is unclear with reports ranging from 11 to 70% (Rao and Lyketsos, 2000).[12] The most common anxiety phenotype is generalised 'free-floating' anxiety and consists of persistent worry accompanied by stress and fearfulness (Lewis and Rosenberg, 1990; Rao and Lyketsos, 2000).[12,13] In addition, patients sustaining mild TBI are more likely to develop anxiety-based disorders than those with moderate or severe injury (Mallya et al 2014).[14]

No significant sex differences existed in the outcome measures. Few investigations exist on the effect of patient sex on severity of injury and outcome. In this study, men's levels of injury severity were greater than women's even though both had same criteria for admission (Slewa-Younan S et al 2004).[15]

Major depressive disorder was observed in 30 (33%) of 91 patients during the first year after sustaining a TBI. Major depressive disorder represented more in TBI patients than control group. A history of mood disorder and anxiety disorder was more common in patients with post TBI depressive disorder than control. TBI depressive disorder patients had high level of comorbid anxiety disorder (76.7%) and outburst of aggressive behaviour (56.7%). Impairment of executive function and social function at 6 months and 12 months follow-up as well as significantly reduced volumes of left prefrontal gray matter particularly in the ventrolateral and dorsolateral regions were also associated with TBI-related depressive disorder (Jorge RE et al 2004).[16]

Aggressive behaviour was significantly associated with the presence of major depressive disorder, lesion of frontal lobe, premorbidly impaired social functioning and a history of alcohol and substance abuse (Tateno A et al 2003).[17]

Preexisting personality characteristics are exaggerated or altered by TBI. These changes does not fit into any personality disorder classification fully. However, when the standard criteria applied the common personality disorders identified are avoidant and paranoid personality disorder.[18] This contrasts with the findings of Rapoport et al who found borderline personality disorder to be the most prevalent disorder after traumatic brain injury (34%).[19] Pelegrin et al studied 55 patients 1 year after TBI. About 60% of the patients fulfilled criteria for personality disorder and the common type of changes were apathetic, disinhibited, aggressive and unstable. Apathy was the common symptom occurring in 34.5% of the patients.[20] Kant et al studied 83 TBI patients and reported 10.8% had apathy alone and apathy with depressive symptoms were present in 60% of the patients. Personality disorder ranges from 5.9% to 13.5% in the population studies.[21]

The anatomic site of the lesion is important in the genesis of symptom. Dorsolateral prefrontal lesion is associated with executive dysfunction (Lux 2007)[22] and anxiety is associated more with right-sided brain lesion (Rao and Lyketsos).[12] The presence of left dorsolateral frontal lesions and/or left basal ganglia lesions and to a lesser extent, parietooccipital and right hemisphere lesions was associated with an increased probability of developing major depression (Fedoroff JP et al 1992).[23]

About 0.7-9.8% of TBI patients develop schizophrenic like psychosis despite little or no family history (Abdel Malik et al 2003).[24] Psychotic symptoms associated with TBI are wide ranging and include reports of illogical thinking, delusions, hallucinations, agitation, ideas of reference, grimacing, regression and impulsive aggressiveness (Brown et al 1981; Thomsen 1984).[25,26]

Enough evidence is available in the literature to support the hypothesis that the incidence of psychiatric disorders both the AXIS 1 and AXIS 2 disorders are increased following TBI (Robert van Reekum et al).

AIMS

This study specifically aims to;

1. Compare the incidence of psychiatric sequelae in head injury patients with that in non-head injury populations.
2. Find risk factor for developing depressive disorder and personality disorder in head injury patients.

MATERIALS AND METHODS

Patients were selected from follow up clinic of neurosurgery department of a medical college hospital for a period of six months after getting ethical committee clearance.

Fifty patients with history of head injury fulfilling the inclusion criteria and 50 attenders of other patients without history of head injury attending same clinic were taken. They were matched for age, sex and socioeconomic background.

Inclusion Criteria

Age >18 years, history of head injury of moderate or severe in nature, patient having received neurosurgical intervention and at least 1 month has elapsed after head injury.

Exclusion Criteria

Age >18 years, patients having delirium, cognitive or physical deficits making interview impossible, patients having mild head injury, past history of psychiatric illness, grossly psychotic status, other medical or surgical problems, Mini Mental State Examination (MMSE) score below 23 and those not given consent.

Moderate and severe head injury is defined as a score of 3-12 in Glasgow Coma Scale and obtained from patient medical record at the time of admission. Patients and control group were administered the test tools and a clinical interview was done as separate session for assessing personality disorder based on DSM IV criteria.

Tools Used in this Study

The tools used in this study are- proforma for collecting sociodemographic details, DSM IV criteria for personality disorder, Hamilton depression rating scale, Hamilton anxiety rating scale and mini mental state examination.

1. HAMILTON DEPRESSION RATING SCALE (HAM-D)[27,28]

Hamilton is depression rating scale a 21-item scale formatted for use with the general scoring sheet, the scale points vary from 3 to 5. The Hamilton depression scale is one of the most widely used instruments for the clinical assessment of depressive states. The scale provides a simple way of assessing the severity of patient condition quantitatively and for showing changes in that condition. The symptoms are rated finely or coarsely, the former are on a five-point scale (0-4) where the numbers are equivalent to absent, doubtful or mild and obvious distinct or severe special problems regarding the female population are also considered separately.

2. HAMILTON RATING SCALE FOR ANXIETY (HAM-A).[29,30]

The HAM-A is the first scale developed to rate symptoms of anxiety. It is widely used in research and clinical setting. The scale consists of 14 items, each item is scored on a scale of 0 (not present) to 4 (severe) with a total score range of 0-56 where less than 17 indicates mild severity, 18-24 mild-to-moderate severity and 25-30 moderate-to-severe.

3. Mini Mental State Examination (MMSE)[31,32]

The MMSE is cognitive test developed in the mid 1970's to provide a bedside assessment of a broad array of cognitive functions including orientation, attention, memory, construction and language. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment. The MMSE takes only 5-10 minutes to administer and is therefore practical to use repeatedly and routinely. For patients with extensive education who may score 30 out of 30 despite clear evidence of functional decline, a more difficult cognitive tests full neuropsychological battery may be done.

Statistical Analysis

Chi-square test was used with one degree of freedom and Yates correction wherever necessary to statically compare the sequel of psychiatric disorders between cases and controls. 'P' value obtained was <0.05 indicating that psychiatric sequelae incidence is statistically significant in patients with traumatic brain injury compared to control population.

RESULTS

SOCIODEMOGRAPHIC CHARACTERISTICS

Age and sex matched controls were taken for study. Males constituted the majority of patients in this study (Table-1, 2). Among cases majority were married (82%, N=41) and in control group (90%, N=45) were married. There was no significant statistical difference between patients and controls in marital status. Among cases majority (74%, N=37) were from nuclear families, 26% (N=13) were from joint families. Among controls 58% (N=29) were from nuclear families and 42% (N=21) from joint families. 36.0% (N=18) of study group patients had a middle school educational qualification and controls 44.0% (N=22) were similarly matched. No statistically significant difference between cases and controls in income (P=0.21). Majority of patients and controls belonged to 0-1000 income group. RTA (road traffic accident) constituted the majority among causes of head injury with fall from heights causing 22% of the injury (Table-3). In our study, (34%) had injuries sustained in frontal region and majority (90%) are of moderate severity. Seventy two percent of patients sustained head injury within one year (1-12 months) of recruitment to this study (Table- 4,5,6).

Age Group (Yrs.)	No. of Cases	Controls	Chi-square	P value
20-30	11 (22.0%)	12 (24.0%)	1.58	0.67 not significant
30-40	22 (44.0%)	26 (52.0)		
40-50	11 (22.0%)	9 (18.0%)		
>50	6 (12.0%)	3 (6.0%)		
Total	**50**	**50**		

Table 1. Age Distribution

There was no statistical significance difference between cases and control in age distribution.

Type of Subjects	Male	Female	Total	Chi-square	P value
Patient	46 (92.0%)	4 (8.0%)	50	0.71	0.40 NS
Control	48 (96.0%)	2 (4.0%)	50		
Total	**94 (94.0%)**	**6 (6.0%)**	**100**		

Table 2. Sex Distribution

Types of Injury Cause	No. of Cases	%
RTA	33	66.0%
Assault	4	8.0%
TTA	2	4.0%
Fall	11	22.0%

Table 3. Types of Injury

RTA (road traffic accident) constituted the majority among causes of head injury with fall from heights causing 22% of the injury. Train Traffic Accident (TTA).

Severity	No. of Cases	Percentage
Moderate	45	90.0%
Severe	5	10.0%

Table 4. Severity

Site	No. of Cases	Percentage
Frontal	17	34.0%
Parietal	6	12.0%
Temporal	9	18.0%
Occipital	4	8.0%
Parietooccipital	1	2.0%
Frontoparietal temporal	2	4.0%
Frontoparietal	3	6.0%
Frontotemporal	8	16.0%

Table 5. Site of Injury

Time After Injury	No. of Cases	Percentage
1-6 months	17	34.0%
6-12 months	19	38.0%
1-3 yrs.	12	24.0%
>3 yrs.	2	4.0%

Table 6. Time After Injury

Psychiatric Sequelae	Group				Significance
	Control (50)		Study (50)		
	n	%	n	%	
Absent	44	88.0%	19	38.0%	$\chi2$=26.81 P=0.001 (S)
Anxiety	1	2.0%	2	4.0%	$\chi2$=0.34 P=0.55 (NS)
Depression	5	10.0%	12	24.0%	$\chi2$=3.84 P=0.05 (S)
Psychosis	-	-	2	4.0%	$\chi2$=0.51 P=0.48 (NS)
Personality disorder	-	-	4	8.0%	$\chi2$=4.17 P=0.04 (S)
Anxiety with personality disorder	-	-	3	6.0%	$\chi2$=3.09 P=0.08 (NS)
Depression with personality disorder	-	-	5	10.0%	$\chi2$=5.26 P=0. 02 (S)
Depression with anxiety	-	-	3	6.0%	$\chi2$=3.09 P=0. 08 (NS)

Table 7. Psychiatric Sequelae Post TBI

Table 7 shows among cases, 62% qualified for psychiatric diagnosis and among controls 12% qualified for psychiatric diagnosis. Among the psychiatric diagnosis of cases majority consisted of depression (24.0%) 12 persons, 5 persons (10.0%) had mixed diagnosis of both depression and personality disorder and 4 persons (8%) had personality disorder, 3 persons had (6%) anxiety with personality disorder, 2 persons had anxiety (4%) and 2 persons had psychosis (4%).

Among the head injury patients, depressed patients were 12 in number. They were analysed over sociodemographic variables. Age, sex, education and income did not have any correlation.

DEPRESSION AFTER TBI

Severity of Injury	Depression				Significance
	Not Depressed		Depressed		
	n	%	n	%	
Moderate	34	89.4%	4	33.3%	$\chi2$=15.7 P=0.001 (S) OR (95% CI) = 17 (3-70)
Severe	4	10.6%	8	66.7%	
Total	**38**	**100.0%**	**12**	**100%**	

Table 8a. Severity of Injury

Time	Depression				Significance
	Not Depressed		Depressed		
	n	%	n	%	
1-6 months	10	26.3%	8	75.0%	$\chi2$=8.32 P=0.04 (S)
6-12 months	15	39.5%	4	25.0%	
1-3 yrs.	11	28.9%	0	-	
>3 yrs.	2	5.3%	0	-	
Total	**38**	**100.0%**	**12**	**100.0%**	

Table 8b. Time after Injury

There is a significant statistical difference between head injury patients regarding duration of head injury and appearance of depression.

Site	Depression			
	Not Depressed		Depressed	
	n	%	n	%
Frontal	12	31.6%	5	41.7%
Parietal	4	10.5%	2	16.7%
Temporal	6	15.8%	3	25.0%
Occipital	3	7.9%	1	8.3%

Parietooccipital	1	2.6%		
Frontoparietal temporal	1	2.6%	1	8.3%
Frontoparietal	3	7.9%		
Frontotemporal	8	21.1%		
Total	**38**	**100.0%**	**12**	**100.0%**

Table 8c. Site of Injury

Among the depressed patients, majority belonged to severe head injury group, developed depression within first 6 months of injury and frontal lobe injury is most frequently observed (Table 8 a, b, c).

PERSONALITY DISORDER

Time	Personality				Significance
	No Disorder		Disorder		
	n	%	N	%	
1-6 months	16	34.7%	2	50.0%	$\chi 2=1.71$ P=0.63 (NS)
6-12 months	17	37.0%	2	50.0%	
1-3 yrs.	11	23.9%			
>3 yrs.	2	4.3%			
Total	**46**	**100.0%**	**4**	**100.0%**	

Table 9a. Time after Injury

Site	Personality			
	No disorder		Disorder	
	n	%	n	%
Frontal	14	30.4%	3	75.0%
Parietal	6	13.0%		
Temporal	9	19.6%		
Occipital	4	8.7%		
Parietooccipital	1	2.2%		
Frontoparietal temporal	2	4.3%		
Frontoparietal	2	4.3%	1	25.0%
Frontotemporal	8	17.4%		
Total	**46**	**100.0%**	**4**	**100.0%**

Table 9b. Site

Age, sex, education and income did not have any correlation with personality disorder. Also, timing of head injury did not have any correlation. Frontal lobe injury followed by frontoparietal lobe injury was associated with personality disorder (Table 9 a, b, c).

DISCUSSION

In our study, incidence of psychiatric sequelae in head injury patients was 62% (range 48%-75%). This is in accordance with study by Koponen et al[10] who reported incidence of 48.3% and similar to findings by Rao et al[33] who reported a variety of psychiatric disturbances ranging from subtle deficits in cognition mood and behaviour to severe disturbance that cause impairment in social, occupational and interpersonal functioning. This study shares similarities with studies by Deb et al,[34] which reported cases in which dual diagnosis was made. In this study, 3 patients had anxiety with personality disorder, 5 patients had depression and organic personality disorder and 3 patients had depression with anxiety and significant statistical difference had been reported. The personality disorder diagnosed in 5 patients, 3 had apathetic and 2 had aggressive behaviour. This is in accordance with study done by Tatano et al[17] who found that 33.7% of TBI patients demonstrated significant aggression more frequent in depressive patients and also had poor social functioning, which was not assessed in this study.

In our study, depression was present in 12 out of 50 patients (12%) and tested above 14 on HAM-D compared. Deb et al[34] had reported incidence of 12.8%. Based on ICD-10, the first report of a higher incidence of psychiatric diagnosis in the adult population suffering from depression post TBI was made by this author. Study by Rapoport et al 19 had reported 28.4% of patients with depression and he had also reported a high association with injures to anterior temporal and frontal lobes, which is similar in this study.

One study by Reekum et al[35] had reported female predominance in post TBI depression, incidence has been studied to be 44%. Jorge et al had described alcohol abuse and mood disorder to be a co-occurring condition and he had reported comorbid depression with anxiety (76.7%) and aggressive behaviour (56.7%). O'Caroll RE[36] in his study found no correlation between severity of head injury and anxiety depression or psychosexual changes following head injury. There was a statistically significant difference in the number of patients found depressed in first six months after head injury as compared to non-depressed subjects. Findings are consistent with Jorge et al who had reported 42% of TBI patients had suffered from depression and majority had been diagnosed in the first 3 months after injury.

In our study, personality disorder was diagnosed in 4 patients using the DSM IV TR criteria compared with the control group and it was statistically significant. Patients were compared across sociodemographic variables and no significance was noted. Of the 4 patients 3 had aggressive personality in accordance with study by Koponen et al[10] who reported a rate of 5.9% to 13.5%. In our study, one person above 50 had personality disorder. Considering that personality disorder declines with age the most common disorder reported by Hibbard et al[18] was avoidant and paranoid (26%) personality disorder. It seems that traumatic brain injury can increase the vulnerability to develop suspiciousness, anxiety and detachment and borderline personality disorder is the most prevalent disorder after traumatic brain injury. Only one organic personality disorder was diagnosed in our study. Koponen et al[10] reported an incidence of 15.0% for organic personality disorder and severity of brain injury was not associated with the presence of personality syndrome. Similar finding was also reported by Franulic et al.[37]

In our sample, only 2 patients had anxiety (4%). Since the sample population is small, patients were not assessed

across all variables, but other studies have found anxiety after head injury high (26%) by O"Carrol RE.[36] Other anxiety disorders, panic disorder was diagnosed in 8.3% of the patients. Since, social support is high, patients might have had lesser incidence. In the acute stages due to fear about consequences and circumstances of injury, patients reported anxiety. PTSD was increased according to Wright JC et al,[38] but Sbordone et al[39] found PTSD absent in cases of mild head injury. In our study, 5 patients of 50 had coexisting depression with personality disorder. The other psychiatric sequelae like anxiety with personality disorder (6%), depression with anxiety (6%) were not statistically significant.

There is significant statistical difference in depression between head injury patients and control group. In our study, depression was 24.0% (n=12) among patients with traumatic brain injury. The first report of a higher rate of depressive episode in patients with TBI compared with controls was by Dep et al[34] who reported a rate of 13.9% compared with 2.1% of general population and another study by Salla Koponen et al[10] reported that the most common Axis I disorder after traumatic brain injury were major depression (26.7%). Chamelian and Feinstein[40] in their analysis of 63 outpatients reported 18.5% patients had depression at 6 months after mild-to-moderate traumatic brain injury.

There is no significant statistical difference between traumatic injury patients and controls in personality disorder. In our study, 8.0% (4 patients of 50) showed personality changes and 3 patients showed aggressive changes and 1 patient showed apathetic changes. This is in accordance with studies by Graffman et al,[41] Persinger et al in his study on personality changes following head injury found that injures to frontotemporal regions was more commonly associated with personality changes.[42]

There is no significant statistical difference in psychosis between traumatic brain injury patients and control. In our study, even though percentage of psychosis was high, no significant difference was made and this contrasts with other studies by Koponen et al,[10] which reported a rate of 8.3%, but a careful review of studies by Von Reekum et al had reported 0.7%.[43] Daryl Fujii et al[44] reported age of onset of psychosis after head trauma was 33.4 years and onset of psychosis was 4-6 years. In our study, age of onset was around 30-40 years and onset of psychosis after traumatic brain injury was within 1 year similar to study by Koponen.[10]

There is no significant statistical difference in anxiety between head injury patients and control. The difference in proportions between the two groups is statistically insignificant. Two patients were found to have scores >14 on HAM-A.

This is in contrast to various studies showing incidence of anxiety after head injury, which is higher than normal population. Van Reekum et al[35] has reported an incidence of 9.1% of generalised anxiety disorder in which evidence of temporal sequence was consistently positive. In the same study, 6.4% had obsessive compulsive disorder, 9.2% for panic disorder and 14.1% for posttraumatic stress disorder.

LIMITATIONS OF THE STUDY

The limitation of the study includes small sample size, cross-sectional nature of sample and alcohol dependence/abuse was not taken into study, but literature reveals association between alcohol dependence and depression, which needs to be explored.

CONCLUSION

Psychiatric sequelae are more in head injury patients when compared with non-head injury population and more in the initial few months after injury. Moderate-to-severe head injury has significant correlation with psychiatric sequelae. Depression and personality disorder are significantly more in head injury population. Injury to frontal region has significant association with personality disorder.

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