

Original article

Study of traumatic brain injury in schizophrenia

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Abstract:

Introduction- Studies about (traumatic brain injury) TBI in patients suffering from schizophrenia are sparse in India. This study was undertaken to find association between TBI and schizophrenia across demographic and clinical variables.

Material and method- 32 patients attending the psychiatry department of a general hospital in Mumbai and suffering from schizophrenia (DSM IV) were interviewed using a structured questionnaire.

Results- 71.9% patients had history of TBI of which 43.8% had TBI before the onset of schizophrenia. Females were more likely to have post TBI schizophrenia with a lesser interval between schizophrenia and TBI compared to males. Males were more likely to have post schizophrenia TBI with a lesser interval between TBI and schizophrenia compared to females. Onset of schizophrenia was earlier in those with history of TBI. TBI occurred at a significantly early age in post TBI schizophrenia subjects. The mean interval between TBI and schizophrenia was more compared to the mean interval between schizophrenia and TBI. Factors which are known to increase vulnerability of schizophrenia (winter birth, history of seizures, history of birth related complications, history of neurological disorder, family history of schizophrenia) were more common in patients with TBI.

Conclusion- The findings of the study suggest that (1) TBI may have an additive effect with other risk factors in development of schizophrenia or (2) the presence of risk factors of schizophrenia may increase the risk for TBI. The study is limited by small size. Future studies with larger sample size are recommended.

Keywords- schizophrenia, traumatic brain injury

Introduction-

Traumatic brain injury (TBI) is defined as an alteration in brain function, or other evidence of brain pathology, caused by an external force¹. TBIs occur in approximately 30% of the general population². The association between schizophrenia and TBI has been reported as controversial³. The question of whether TBI is a risk factor for schizophrenia remains unclear. Studies examining this issue have yielded conflicting results⁴. Some studies support an increased prevalence of TBI in schizophrenia⁵⁻¹¹, while another study¹² concludes that it is unlikely that head injury causes schizophrenia. Indian studies of TBI in schizophrenia are sparse.

Aims and objectives-This study was done to (1) Find the prevalence of traumatic brain injury in patients suffering from schizophrenia and (2) To study associations between traumatic brain injury and schizophrenia across demographic and clinical variables.

Materials and methods-

The study was conducted in psychiatry department of a general hospital in Mumbai. Clearance was obtained from the Institution Ethics Committee. Informed consent was obtained from each study subject. Subjects were 32 consecutive outpatients who were diagnosed with schizophrenia, based on the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV)¹³ diagnoses. In the presence of a reliable and complete informant,

patient's data was collected for demography- gender, age, religion, marital status, season of birth. Socioeconomic status was calculated using Modified Kuppaswamy scale¹⁴. (Class I, II was included in upper class and class III, IV, V in lower class). Clinical history was taken for level of intelligence, history of substance use, history of seizures, any birth related complications, history of neurological disorder, signs of schizophrenia, family history of schizophrenia, history of traumatic brain injury, severity of traumatic brain injury, timing of traumatic brain injury in relation to schizophrenia. Traumatic brain injury was diagnosed according to criteria developed by Department of Defense and Department of Veterans Affairs (2008)¹⁵. Subjects were asked whether they had ever had any head injuries associated with loss of consciousness (LOC) and/ or post traumatic amnesia (PTA). The traumatic brain injury was classified as mild for LOC less than 30 minutes and/ or PTA less than 24 hours, moderate for LOC of 30 minutes to 24 hours and / or PTA of 1-7 days, severe for LOC more than 24 hours and / or PTA more than 7 days. The data was tabulated in excel sheet. Statistics- Variables are expressed in percentages. The significance of differences in proportion and means was determined using chi square test and unpaired t test (graphpad.com). Probability level for significant difference was set at P <0.05.

Results

23 patients (71.9%) had history of traumatic brain injury. The results are tabulated (table-1).

Table-1 Demographic and clinical variables in study subjects.

N=32	No traumatic brain injury n=9(28.1%)	Traumatic brain injury n= 23(71.9%)	
		Traumatic brain injury before onset of schizophrenia n=14 (43.7%)	Traumatic brain injury after onset of schizophrenia n=9 (28.1%)
Gender			
Males (22, 68.7%)	6(27.3%)	9(40.9%)	7(31.8%)
Females (10, 31.2%)	3(30%)	5(50%)	2(20%)
Age			
<40 years (18, 56.3%)	6(33.3%)	9(50%)	3(16.7%)
>41yrs (14, 43.7%)	3(21.4%)	5(35.7%)	6(42.9%)
Marital status			
Single/divorced (14, 43.7%)	3(21.4%)	6(42.9%)	5(35.7%)
Married (18, 56.3%)	6(33.3%)	8(44.4%)	4(22.2%)
Religion			
Hindu (17, 53.1%)	5(29.4%)	7(41.2%)	5(29.4%)
Muslim (12, 37.5%)	3(25%)	5(41.7%)	4(33.3%)
Christian (3, 9.4%)	1(33.3%)	2(66.7%)	0(0%)
Socio economic status			

Lower (27, 84.4%)	6(22.2%)	13(48.1%)	8(29.6%)
Upper (5, 15.6%)	3(60%)	0(0%)	2(40%)
Substance use			
Yes (15, 46.9%)	4(26.7%)	5(33.3%)	6(40%)
No (17, 53.1%)	5(29.4%)	9(52.9%)	3(17.6%)
Season of birth			
Monsoon=9 (28.1%)	1(11.1%)	2(22.2%)	6(66.7%)
Winter=11 (34.3%)	3(27.2%)	8(72.7%)	0(0%)
Summer=12 (37.5%)	5(41.7%)	4(33.3%)	3(25%)
History of seizures			
Yes (2, 6.2%)	0(0%)	1(50%)	1(50%)
No (30, 93.8%)	9(30%)	13(43.3%)	8(26.7%)
Birth related complications			
Yes (3, 9.4%)	0(0%)	3(100%)	0(0%)
No (29, 90.6%)	0(0%)	29(100%)	0(0%)
History of neurological disorder			
Yes (1, 3.1%)	0(0%)	1 (100%)	0(0%)
No (31, 96.9%)	0(0%)	31(100%)	0(0%)
Signs of schizophrenia			
Delusions (28, 87.5%)	8(28.6%)	11(39.2%)	9(32.1%)
Hallucinations (25, 78.1)	5(20%)	13(52%)	7(28%)
Disorganized speech (18, 56.3%)	5(27.8%)	7(38.9%)	6(33.3%)
Disorganized behavior (17, 53.1%)	4(23.5%)	7(41.2%)	6(35.3%)
Negative symptoms (2, 6.2%)	1(50%)	0(0%)	1(50%)
Family history of schizophrenia			
Yes (5, 15.6%)	2(40%)	2(40%)	1(20%)
No (27, 84.4%)	7(25.9%)	12(44.4%)	8(29.6%)
Type of traumatic brain injury, n=23			
Mild (17, 73.9%)	0(0%)	11(64.7)	6(35.3%)
Moderate (5, 21.7%)	0(0%)	3(60%)	2(40%)
Severe (1, 4.3%)	0(0%)	0(0%)	1(100%)
Time of traumatic brain injury, n=23			
≤5 years (13, 56.5%)	0(0%)	5(38.5%)	8(61.5%)
>5 years (10, 43.5%)	0(0%)	8(80%)	2(20%)

The patients suffering from Schizophrenia in this study were in majority males, those >40 years, married, Hindus and those from lower socioeconomic status. Patients had more positive signs of schizophrenia compared to negative signs. All patients had average intelligence. TBI was more common in males, Hindus, those from lower socioeconomic status, marginally more in those >40 years of age and those with no substance use.

Age- - The mean age of subjects was 39.9 years (SD, 13.5 years; range, 19-76 years). The mean age of onset of schizophrenia was 30.4 years (SD, 11.13 years; range, 18-64 years). It was 31.6±7.02 in females and 29.2±10.7 in males. It was later in those with no history of TBI (33.7±13.3 years; range, 22-64 years). For those with history of TBI, it was earlier (29.1±7.8; range, 18-46 years, in post TBI schizophrenia and 29.2±8.02; range, 18-38 years, in those with post schizophrenia TBI). It was not statistically significant ($t = 1.22$, $P = 0.23$).

The mean age at TBI was 25.3 years. (SD, 10.8; range, 5- 40 years). The mean age at TBI in post TBI schizophrenia subjects was significantly less compared to mean age at TBI in post schizophrenia TBI subjects (18.5±7.8 vs 34.1±7.2) ($P < 0.0001$, $t = 4.83$, $df = 21$).

Gender- female subjects were more likely to have had post TBI schizophrenia compared to males (50% vs 40.9%). Males were more likely to have post schizophrenia TBI compared to females (31.8% vs 20%). It was not statistically significant ($\chi^2 = 0.47$; $P = 0.49$).

The mean interval between schizophrenia and TBI was 4.9±3.9 years (range, 1-15 years). TBI was significantly more likely to occur within 5 years after the onset of schizophrenia ($\chi^2 = 3.96$, $P = 0.04$). It was 2.5±0.7 in females. It was 5.5±4.2 in males. The difference in gender was not statistically significant ($t = 0.96$, $P = 0.36$). The mean interval between TBI and schizophrenia was 10.6±11.1 years (range, 1-41 years). It was 14.4±15.9 in females and 8.3±7.1 in males. It was not statistically significant ($t = 0.97$, $P = 0.35$).

Type of TBI- The mean time lag between TBI and schizophrenia was lesser in subjects with moderate TBI compared to those with mild TBI (4.3± 3.2 vs 12.5±21.02). It was not statistically significant ($t = 1.14$, $P = 0.28$, $df = 12$).

Season of birth- Subjects with winter births are significantly more likely to be associated with onset of schizophrenia after TBI ($\chi^2 = 9.6$; $P = 0.001$).

Substance use was significantly more common in males ($\chi^2 = 7.94$, $P = 0.004$).

Discussion-

According to literature, males have about 30%–40% higher lifetime risk of developing schizophrenia^{16,17} and younger age¹⁸ of onset of schizophrenia compared to females. In present study too, schizophrenia was more common in males with an earlier age of onset. Current reported main risk factors for TBI are age (15-24 years), male gender, a lower socioeconomic status¹⁹, mental disorders²⁰, high alcohol blood concentration and substance abuse²¹⁻²³. In present study, too TBI was more common in males, in those from lower socioeconomic status. The mean age at TBI was 25.3 years. Higher incidence rates of TBI are found in persons with schizophrenia before onset of illness, with rates ranging from 8.8% to 39.6%⁵⁻¹⁰. In the present study 43.7% of subjects had post TBI schizophrenia. Fann and colleagues¹¹ found an increased rate of preexisting psychosis among individuals with head injury and speculated that psychosis increases the risk for TBI. In the present study 28.1% had TBI after the onset of schizophrenia.

Type of head injury- In the present study 73.9% of subjects had mild TBI. In literature too, mild head injury comprise over 85% of all head injuries²⁴. According to literature greater injury severity may be associated with an

increased risk of post-injury psychosis²⁵⁻²⁷. However in the present study greater injury severity (moderate/ severe) was almost equally present in post TBI schizophrenia and post schizophrenia TBI.

Gender- men appear to be more frequently affected by post-head injury psychosis than women²⁸. However in the present study female subjects were more likely to have had post TBI schizophrenia compared to males. (50% vs 40.9%).

Age- In study by Sachdeva et al 2001²⁶ the mean age of onset of psychosis was 26.3 years. In the present study the mean age of onset of schizophrenia was 30.4 years. Sachdev et al 2001²⁶ reported a mean latency of 54.7 months between head injury and onset of psychosis, with the minimum being two weeks and the maximum 17 years. In the present study the latency between TBI and schizophrenia was 10.61±11.09 years. According to literature patients with psychosis secondary to TBI are more likely to have sustained a head injury prior to adolescence than TBI patients without psychosis⁶. In the present study the mean age of TBI in post TBI schizophrenia subjects was 18.5 years. Literature suggests a shorter time lag before psychotic onset for cases with mild brain injury²⁵. However in the present study the mean time lag between TBI and schizophrenia was lesser in subjects with moderate TBI compared to those with mild TBI. (4.3±3.2 vs 12.5±21.02).

Signs of 295- according to literature post TBI psychosis has a prominence of persecutory and other delusions and auditory hallucinations. Negative and catatonic features are unusual^{25,26}. The findings of present study concur with literature.

Risk factors for schizophrenia-

(1) Family history of schizophrenia- Family history was present in 14.3% of patients of post TBI schizophrenia. In study by Davison and Bagley²⁹, family history of schizophrenia was reported in 2.9% to 18% of patients with psychosis secondary to TBI.

(2) Low IQ- Schizophrenia has been associated with low IQ³⁰. However in this study all patients had average intelligence.

(3) Winter birth- according to literature individuals with schizophrenia are more likely to be born in the winter^{31,32}. The seasonal effects may increase one's risk of schizophrenia via the interaction with genetic vulnerability³³. In the present study subjects with winter births were significantly more likely to be associated with onset of schizophrenia after TBI ($\chi^2=9.6$; $P=0.001$).

(4) Lower socio economic status- according to studies low socioeconomic position may be risk for schizophrenia^{34,35}. In the present study 84.4% of subjects were from lower socio economic status.

(5) Birth related complication- birth complications may be a risk factor for the later onset of schizophrenia^{36,37}. In the present study birth related complications were found exclusively in those with post TBI schizophrenia.

Conclusion- the present study was conducted to study the association between schizophrenia and TB. The prevalence of TBI in patients suffering from schizophrenia was found to be 71.9%. Post TBI schizophrenia was (a) more common in females, (b) had an earlier age of onset and was (c) characterized by positive symptoms and almost absence of negative symptoms of schizophrenia. This makes it perhaps a distinct syndrome. The known vulnerability/ risk factors for schizophrenia (winter birth, seizures, birth related complications, family history of schizophrenia, lower socioeconomic status, presence of neurological disorder) were more pronounced in patients with TBI. TBI decreases the age of onset of schizophrenia. The higher prevalence of TBI in schizophrenia precludes

it from being incidental. TBI too is a risk factor for schizophrenia. The findings of the study suggest that (1) TBI may have an additive effect with other risk factors in development of schizophrenia or (2) the presence of risk factors of schizophrenia may increase the risk for TBI. Future studies with larger sample size are recommended.

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