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Study of Epidemiology of Traumatic Brain Injury and Prevalence of Psychiatric Disorders in Traumatic Brain Injury at 3 Months Follow-Up

Traumatic brain injury (TBI) is a major global health problem with an annual incidence of 10 million cases globally. Despite the good recovery with modern treatment measures, the cognitive and behavioural deficits give rise to the major morbidity. These deficits amount in failure to return to work and maintain social activities. A prospective clinical study of 187 inpatients with Traumatic Brain Injury was done in Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh from August 2015 to August 2017. All patients aged between 15-60 years, with normal premorbid personality admitted with traumatic brain injury, were included in the study. Appropriate socio-demographic and clinical data was collected while inpatient, and 3 months post trauma. All the patients were subjected to structured interview using MINI PLUS (English version 5.0.0) for assessment of cognitive and neurobehavioural disorders. The prevalence of cognitive and neurobehavioural disorders following traumatic brain injury in the present study was 40.6%. Patients with traumatic brain injury often experience enduring emotional and cognitive consequences; major depressive disorder being the most common, followed by somatoform and anxiety disorders. Treatment of these patients should involve a multidisciplinary approach, with the psychiatrist working in close collaboration with the patient, family, neurologist/neurosurgeon, psychologist and social worker.

Key Words: depression, neurobehavioural disorders, neurosurgery, Psychiatric Disorders, Traumatic Brain Injury,

Traumatic brain injury (TBI) is a major global health problem with an annual incidence of 10 million.¹ The problems experienced by those suffering TBI, such as impairments in memory or cognition, are

often not visible; it has been referred to as the “silent epidemic”.¹ Despite the emphasis placed on physical deficits during the early stages of recovery from a severe TBI, it is cognitive and behavioural deficits that give rise

to the major morbidity, which most impairs the capacity to return to work and maintain social activities.²

Once the patient is beyond the acute and subacute phases, many are left with neuropsychiatric or neuro-behavioural sequelae of TBI. Underscoring the importance of addressing TBI sequelae, Robert Karol warns that “treatment providers who attend only to cognitive and physical deficits after brain injury and downplay emotional concerns, are unlikely to ameliorate behavioural dyscontrol.”³ Psychiatric disorders following TBI are important for a number of reasons. Firstly, TBI accounts for most cases of permanent disability after trauma. Given that trauma injuries occur most frequently in the young (<45 years), the cost, both to the individual and to society, is enormous.⁴ Secondly, the psychiatric sequelae of TBI may frequently be overlooked, and as such, under treated. Nowhere is this more apparent than in people with mild TBI, who comprise over 85% of all TBIs, and who routinely do not receive adequate follow-up care.⁵ In addition, TBI is associated with an increased risk of developing numerous psychiatric disorders and will need psychiatric interventions years after the injury.⁶

As mentioned by Gould, Ponsford et al. the functional consequences of these changes can be challenging, potentially restricting a person’s employment, study, leisure activities and independence; which may, in turn, impact on life satisfaction.⁷ Relapse of pre-existing affective or anxiety disorders is more likely, but de-novo mood and anxiety disorders arise with greater frequency after head injuries than in a comparative sample of the uninjured general population.⁸ An increased awareness of these sequelae with consequent early psychiatric intervention may result in improving function and limiting disability.⁹

MATERIALS AND METHODS

Aims and Objectives

1. To study the socio demographic variables and clinical variables of In-patients with traumatic brain injuries.

2. To study the prevalence of cognitive, neuro psychological or behavioural problems following traumatic brain injuries at three months follow up period.

A prospective clinical evaluation of neuro psychological/ behavioural problems of 187 patients with Traumatic Brain Injury admitted at Alluri Sitarama Raju Academy of Medical Sciences (ASRAM), Eluru, Andhra Pradesh from August 2015 to August 2017. All the patients and their first-degree relatives were informed about the nature of the study and a written and informed consent was taken. Both male and female patients aged between

15-60 years, with normal premorbid personality admitted with traumatic brain injury, whether in isolation or as part of polytrauma were included in the study. Patients, who were severely ill, have long standing physical disability and with past history of any psychiatric illnesses were excluded from the study. Appropriate demographic and clinical data were collected while inpatient, and after 3 months patients were subjected to structured interview using M.I.N.I.P.L.U.S (Mini-International Neuropsychiatric Interview- Plus) (English version 5.0.0).¹⁰

OBSERVATIONS AND RESULTS

Out of 331 in-patients with traumatic brain injury, 187 were included into the study and the rest were excluded due to various reasons (Figure 1). They were distributed into groups based on socio-demographic details, mode of injury and severity of injury (Table 1). At 3 months follow-up, 76 patients were found to have various psychiatric disorders (Table 2) and their distribution in relation to the socio-demographic details and severity of injury was evaluated. (Table 3) the most patients having multiple overlapping disorders rather than a single disorder.

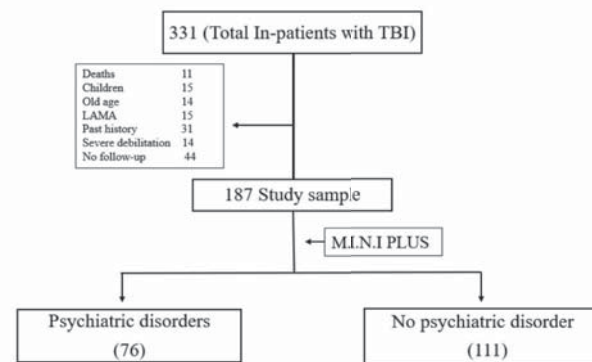


Figure 1: Showing patient population based on selection and exclusion criteria.

AGE	15-30	73	39%
	31-45	67	35.8%
	45-60	47	25.1%
GENDER	Male	164	87.7%
	Female	23	12.3%
AETIOLOGY	RTA	156	83.4%
	Sports	8	4.3%
	Fall	19	10.2%
	Assault	4	2.1%
SEVERITY OF INJURY (GCS) (12)	Mild	133	71.1%
	Moderate	29	15.5%
	Severe	25	13.4%

Table 1: Distribution of socio-demographic and clinical variables in the study population

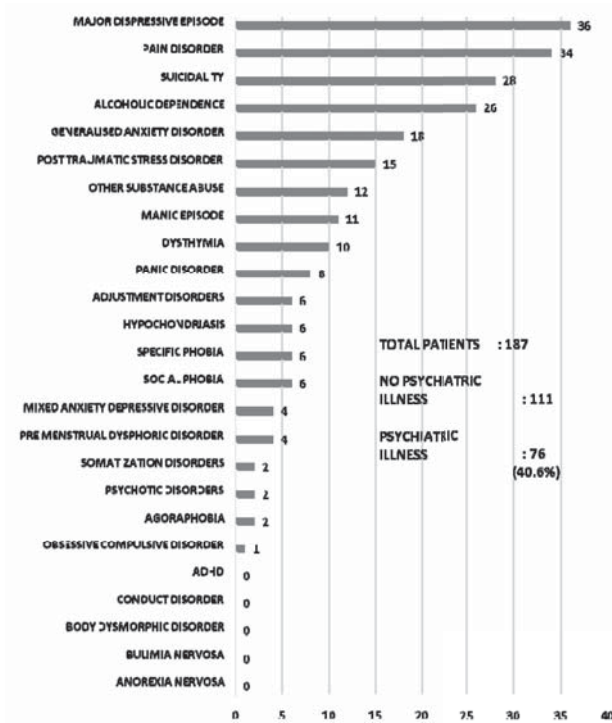


Table 2: Prevalence of each psychiatric disorder among the study population

The prevalence of psychiatric illness is 40.6%, amongst which only 10.2% of the whole population have an illness that occurs independently. The rest occur in association with another regardless of whether or not directly related.

DISCUSSION

Global incidence of Traumatic brain injury (TBI) is rising, and it is predicted to surpass many diseases as a major cause of death and disability by the year 2020.¹³ TBI is the leading cause of disability in people under forty; severely disabling 15–20/100,000 population per year.¹⁴ The World Health Organization (WHO) estimates that almost 90% of deaths due to injuries occur in low and middle-income countries (LAMICs) where 85% of

population live, and this situation will continue to represent an important global health problem in the upcoming years.^{15, 16}

The greatest number of TBIs occur in people aged 15–24.^{17, 18} Regardless of age, TBI rates are higher in males.¹⁸ Men suffer twice as many TBIs as women do and have a fourfold risk of fatal head injury.¹⁹ However, when matched for severity of injury, women appear to fare more poorly than men.^{20, 21}

INDIAN SCENARIO: In a review by Gururaj G et al.,²² it is estimated that nearly 1.5–2 million persons are injured, and 1 million die every year in India. India and other developing countries are facing the major challenges of prevention, prehospital care, and rehabilitation in their rapidly changing environments to reduce the burden of TBIs. For policymaking, there is a lack of reliable and larger data regarding TBI in our settings.²²

Risk Factors for Neuropsychiatric Disorders:

The major risk factors for neuropsychiatric disturbances after head injury include increasing age, arteriosclerosis, and alcoholism. These risk factors delay the reparative process within the central nervous system.^{19, 23} Premorbid personality also plays a significant role in the process of rehabilitation, as was pointed out by Symonds: “The late effects of head injury can only be properly understood in the light of a full psychiatric study of the individual patient; it is not only the kind of injury that matters, but the kind of head”.²⁴ Similarly, factors such as marital discord, poor interpersonal relationships, problems at work, or financial instability are important contributors to the neuropsychiatric disability.¹⁹

A group of 187 TBI patients with variable aetiology and variable severity were followed up after 3 months and the prevalence and nature of psychiatric disorders were assessed using a validated scale. The assessed data was correlated to sociodemographic and TBI related clinical variables. The population in the present study were categorized into groups based on age, gender, and clinical variables such as aetiology and severity. The prevalence of TBIs in our study was seen more in young age group

		Psychiatric disorder		No psychiatric disorder	
		Count	Percentage	Count	Percentage
Age	15-30 (73)	27	37%	46	63%
	31-45 (67)	21	31.3%	46	68.7%
	45-60 (47)	28	59.6%	19	40.4%
Gender	Male (164)	61	37.2%	103	62.8%
	Female (23)	15	65.2%	8	34.8%
Severity of injury (GCS)	Mild (113)	30	22.6%	103	77.4%
	Moderate (29)	21	72.4%	8	27.6%
	Severe (25)	25	100%	0	0%

Table 3: Distribution of psychiatric disorders in TBI in relation to socio demographic details and severity of injury

	n	%
No Psychiatric Disorders	111	59.4%
With 1 Disorder	19	10.2%
With 2 Disorders	19	10.2%
With 3 Disorders	13	7.0%
With 4 Disorders	10	5.3%
With 5 Disorders	3	1.6%
>5 Disorders	12	6.5%

Table 4: Distribution of psychiatric disorders in the study population

(15-30 years), male gender. A similar study done in a tertiary care hospital in the rural setting in Wardha, India has shown results close to our study; majority of TBIs occurred in age group 21-30, in males (70%) and the most common mechanism of injury was RTAs.²⁵ Another study from New Delhi has clearly highlighted the predominance of males (72%).²⁶ A study by Gururaj on the epidemiology of traumatic brain injuries in Indian scenario has shown RTAs as the leading cause of TBIs (60%), followed by falls (20-25%) and violence (10%).²⁷ Our study has shown RTAs as the leading cause (83.4%), followed by falls (10.2%); most of them were mild in nature. Lack of awareness about road safety measures, unregulated driving behaviour and improperly maintained roadways cumulatively increase the number of RTAs in rural population.

The prevalence of psychiatric disorders following traumatic brain injury in the present study was 40.6%. In a follow-up of 425 subjects by Gururaj et al., at four months post discharge, it was observed that 42% had different post-traumatic sequelae.²⁸ Jorge et al in 2004 in a prospective case-controlled study of 91 patients reported 33% having major depression.²⁹ Kreutzer in 2001 reported 42% having depression in 722 TBI patients after an average 2.5 years post trauma.³⁰ In a large study of 939 TBI patients, the prevalence of a psychiatric disorder in the first year was 49% with moderate to severe TBI and 34% with mild TBI. The authors concluded that while moderate to severe TBI is associated with a higher initial risk, mild TBI is associated with persistent psychiatric disorders.⁸ In another study, common psychiatric disorders after TBI were major depression (44%), substance abuse (22%), posttraumatic stress disorder (PTSD) (14%), obsessive compulsive disorder (OCD) (6.5%), mania

(4%) and psychosis (1%).³¹ A follow up study of sixty patients about 30 years after TBI revealed that 29 (48.3%) had developed an axis I disorder after the injury, including major depression (26.7%), alcohol abuse or dependence (11.7%), panic disorder (8.3%), specific phobia (8.3%), and psychotic disorders (6.7%).³² In a recent study by Leong Bin Abdulla MFI *et al*, depressive disorders were seen in 25%; anxiety disorders were seen in 14% of which post-traumatic stress disorder was the most common; seven percent had comorbid depressive and anxiety disorder.³³ A recent TBI registry shows that 18% of patients had various post-traumatic sequelae, major economic problems, and poor quality of life at two years post discharge.³⁴

Prevalence of psychiatric disorders in relation to socio-demographic data

The majority (39%) of the present study population fall under the age group 15-30 years, followed by 30-45years (35.8%) and 46-60 years (25.1%). The mean age is 46.68 years; but the prevalence of psychiatric illness is more in the 46-60 years age group. The ratio of TBIs between males and females is 7:1 in our study whereas the prevalence of psychiatric illness is 37.2% among all the males with TBI, and in females it is 65.2%. Psychiatric sequelae had been statistically significant in severe traumatic brain injuries which infers even though mild TBIs are more in number, psychiatric illness had been prevalent amongst severe injuries implying the extent of injury is directly proportional to development of illness.

Amongst the psychiatric disorders, the most prevalent is major depressive episode (n=36/19.3%) followed by pain disorder (n=34/18.2%), suicidality (n=28/15%), alcohol dependence (n=26/13.9%), generalized anxiety disorder (n=18/9.6%), post-traumatic stress disorder (n=15/8%), other substance abuse (n=12/6.4%), manic episode (n=11/5.9%), dysthymia (n=10/5.3%), panic disorder (n=8/4.3%), social phobia (n=6/3.2%), specific phobia (n=6/3.2%), hypochondriasis (n=6/3.2%), adjustment disorders (n=6/3.2%), mixed anxiety depressive disorder (n=4/2.1%), pre-menstrual dysphoric disorder (n=4/2.1%), agoraphobia (n=2/1.1%), psychotic disorders (n=2/1.1%), somatisation disorders (n=2/1.1%) obsessive compulsive disorder (n=1/0.5%) in descending order of prevalence. There has been no prevalence of eating disorders, body dysmorphic disorder, conduct disorder and ADHD in our study population.

Major depression occurs in approximately 25% of patients with TBI.^{35, 36} The prevalence of depression in our study was 19.3% and our results are slightly higher than Gould 2011 (18.0%), Mc.Cauley 2005 (15%), Mearns 2011 (10.7%) and Rao 2010 (16.3%).³⁷⁻⁴⁰ The presence of multiple injuries might also contribute to depression, possibly as a result of increasing functional disability.

Dysthymia was seen in 5.3% of the study population, which is close to the 7.7% by Fedoroff 1992, comprising 13.2% of the illness population.³⁵

The prevalence of an episode of **mania** in the present study was seen in 5.9%, which is less than the 9% in Jorge et al., and among the illness population it is 14.5%.³⁶ These have occurred mostly following or preceding depressive episodes inferring a probability of bipolar disorder. Few patients have a positive family history similar to the findings of Robinson et al.⁴³

The prevalence of **anxiety disorder spectrum** was 29.9% with individual rates of panic disorder (4.3%), agoraphobia (1.1%), social phobia (3.2%), specific phobia (3.2%), obsessive compulsive disorder (0.5%), post-traumatic stress disorder (8.0%), generalized anxiety disorder (9.6%); and accounts to 65.7% (10.5%; 2.6%; 7.9%; 7.9%; 1.3%; 19.7%; 23.7% respectively) of the whole illness population. The findings of our study although a little higher, fall in close proximity to Gould et al., 2011³⁷ with a prevalence of 24.6% and Ashman 2004⁽⁴⁴⁾ with a prevalence of 27.0% at a period of 3-6 months.

The prevalence rate of **panic disorder** was 4.3% in our study and 10.5% among the illness population; which is less than Bryant et al 2010 (7.4%) and Maeres et al 2011 (10.7%).^{39,45} The prevalence rate of **agoraphobia** was 1.1% in study population and 2.6% among the psychiatric illness population. The studies have not shown any increase in the prevalence following traumatic brain injury; those that had agoraphobia developed it beyond 1 year. The prevalence rate of **specific phobia** in our study was 3.2%; and 7.9% of illness population. There aren't many studies pertaining to this. In our current study patients developed phobias to the vehicles or the roads that they met with accident, when passed by.

The prevalence of **social phobia** in our study was 3.2% and 7.9% in the illness population, which is persistent with Maeres et al., 2011(3.6%).³⁹ These are sometimes attributable to the individual's concern about functional recovery, speech/motor or cognitive deficits that hamper their social relationships and loss of income or debts. The patients that had social phobia and/or specific phobia had another co-morbidity such a Generalized Anxiety Disorder or depression etc, mostly occurred in females, with no particular significance to severity.

The prevalence of **Obsessive-Compulsive Disorder** in our study was 0.5% and 1.3% among the illness population. Current thinking suggests multiple potential aetiologies in the development of post-TBI OCD; these include pre-existing variables (ex: coping style, premorbid personality), type and location of lesion (ex: orbitofrontal

region and frontal-subcortical circuits), and psychological response to TBI-related disturbances (ex: cognitive deficits) and subsequent functional impairments. There was a high frequency of aggressive, contamination, need for symmetry/exactness, somatic and sexual obsessions as well as cleaning/washing, checking and repeated compulsions.⁴⁶ The prevalence of **Post-traumatic stress disorder** in our study was 8.0% (19.7% of illness population), which is persistent with Mauri 2014 6.3%; Bryant 2000 7.1% and lesser than Meares et al 2011 19.6%.^{39,47,48} The prevalence mostly occurred in mild traumatic brain injury, in patients that did not have loss of consciousness.

The prevalence of **alcohol abuse** was 13.9% (34.2% of illness population); similar to Horner et al., 2005 at 15.4%.⁴⁹ The prevalence of **other substance abuse** was 6.4% making 15.2% of illness population. Other substances included nicotine in smoking and chewing forms. The hospitalization or clinic visits following the injury presents a key opportunity for intervention in substance abuse. Individuals who present to the hospital with a brain injury and substance abuse are in what can be described as a "critical period of insight;" the opportunity to refer them for prompt evaluation and care of their substance abuse should not be lost.

The prevalence of **psychotic disorders** in our study was 1.1%, that makes 2.6% of the illness population, similar to 1% of Keshavan et al. Sachdev et al., 2001 when evaluated 45 patients with schizophrenia like psychosis after TBI, persecutory delusions and auditory hallucinations were found to be more frequent in those subjects who suffered from delayed psychosis.^{50,51}

The prevalence of **pain disorder** was 18.2% (44.7% among the illness population). Most of the traumatic brain injuries in our study have occurred in combination with poly trauma; so, pain was a significant concern among the study population. The findings of a study by M.jodon et al., highlight that mild TBI exacerbates pain perception early on (acute phase), when occurring in concomitance with an isolated limb fracture.⁵²

The prevalence of **somatization** was 1.1%; and 2.6% among the illness population. The prevalence of **hypochondriasis** in our study was 3.2%, that makes 7.9% of the illness population. The prevalence of **adjustment disorders** was 3.2% (7.9% among the illness population).

The prevalence of **premenstrual dysphoric disorder** was 2.1% in the study population, which is 5.2% of the illness population, 17.3% among all the female traumatic brain injuries; and these percentages are not any excess than the general populations.

The prevalence of **mixed anxiety depressive disorder** was 2.1% in the study population, and 5.2% among the illness population. **Body dysmorphic disorders, eating disorders and ADHD** were not observed in the study.

Only 19, out of 187 study population, had single psychiatric disorder while the rest of the illness population had overlapping symptoms with 12 patients having more than 5 psychiatric disorders.

TBI results in significant changes in mobility, cognition, behaviour and emotional state which have an enduring impact on participation in vocational, social and leisure activities, on relationships and on mental health of the injured individual. These outcomes are ultimately determined, not just by the nature or severity of the injury but also by a diverse range of personal factors, including age, gender, genetic status, education, IQ, pre-injury employment status, pre-injury psychiatric status and coping style, and social factors including family and social support and cultural background. An understanding of prognostic factors and their interactions is vital to maximise the efficiency of resource allocation and the effectiveness of rehabilitative interventions to enhance outcomes following TBI. Family-based interventions may be employed to enhance adaptive family interactions to maximise psychosocial outcome. It would appear to be important to identify individuals who are more at risk of negative emotional responses to injury, such as those with a history of pre-injury substance use or other psychiatric history or more non-productive coping patterns; and provide psychological therapy with the aim of altering these patterns of behaviour and emotional response.

CONCLUSION

Patients with traumatic brain injury, whether mild, moderate, or severe, often experience enduring emotional and cognitive consequences; major depressive disorder being the most common, followed by somatoform and anxiety disorders. Psychiatric sequelae are more common in older adults, females and in those with severe TBI. An understanding of the ways in which age and gender affect outcome may also allow for more appropriately tailored forms of rehabilitation, and guide planning for the future needs of those who sustain such injuries. Though the size of the study population is small to make any recommendations about specific psychiatric disorders, it clearly warns about the need to watch out for psychiatric sequelae in all traumatic brain injury patients. Treatment of these patients should involve a multidisciplinary approach, with the psychiatrist working in close collaboration with

the patient, family, neurologist/neurosurgeon, psychologist and social worker.

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