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# Prevalence and Pharmacological Management of Traumatic Brain Injury in India – A Systemic Review

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## Abstract

**Introduction:** In India, traumatic brain injury is the main factor contributing to morbidity, mortality, disability, and socioeconomic losses. This is a condition were parenchymal brain damage results from head injuries. It has a substantial effect on the person as well as the community because of its high rate of morbidity and mortality. Fall-related incidents, whether at home or in sports or while driving, affect people of all ages.

**Aim:** The purpose of this review is to comprehend Indian pharmacological methods for the treatment of traumatic brain injury. Estimating the epidemiology of traumatic brain injury in the population is the aim of this review. Traffic accidents are on the rise, and health issues are getting worse all the time. Males and college or university students are most frequently impacted by car crashes.

**Material and Methods:** We obtained every review and research article that was published from 2010 to 2023 on traumatic brain injury from PubMed Central. Every attempt was made to locate all pertinent papers that provide information about traumatic brain injury.

**Conclusion:** To establish benchmarks for the incidence and treatment of traumatic brain injury in India and to support the country's healthcare system in promoting a higher standard of living for its citizens, this article presents an overview of publications on the subject from 2010 to 2023. The etiology, setting in which injuries occur, results, pharmacological treatment, and effect of Traumatic Brain Injury (TBI) on quickly changing societies are all covered in this review. Traumatic brain injury causes 1.5 to 2 million injuries and 1 million deaths annually in India.

**Keywords: Traumatic brain injury; TBI; Epidemiology; Neuropathology; Pharmacological management; Prevalence**

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## Introduction

The term "Traumatic Brain Injury" (TBI) refers to parenchymal brain damage brought on by blows to the head. Due to its high morbidity and mortality rate, it has a significant impact on both the individual and the community. Individuals of all ages are impacted, whether by falls at home or incidents in sports or driving. The term "TBI" refers to a range of clinical presentations with widely varying causes, prognoses, and treatments. The pathophysiological cascade that arises right after the first trauma and can last for several days or weeks is what unites them all. During this stage, medical intervention–whether surgical or pharmaceutical–aims to lessen the effects of the initial injury [1]. Maintaining sufficient brain perfusion pressure and reducing intracranial pressure [2].

The most prevalent neurological and neurosurgical cause of mortality as well as the leading cause of surviving impairment among children and young people is still Traumatic Brain Injury (TBI), a serious public health concern that can cause physical, cognitive, functional, and psychosocial disabilities [3].

While individuals with severe TBI may go through protracted spells of unconsciousness, coma, or even pass away, patients with mild TBI may just have brief changes in consciousness or mentation. Changes in structural imaging, duration of changed mental status, length of loss of consciousness, post-traumatic amnesia, and GCS during the first 24 h are among the factors that are frequently used to categorize severity. One common term for a mild TBI is a concussion [4]. Individuals with a Traumatic Brain Injury (TBI) of any severity are susceptible to persistent post-concussive symptoms, such as altered personality traits, emotional instability or depression, memory or concentration problems, or abnormalities in sensory perception (such as altered vision

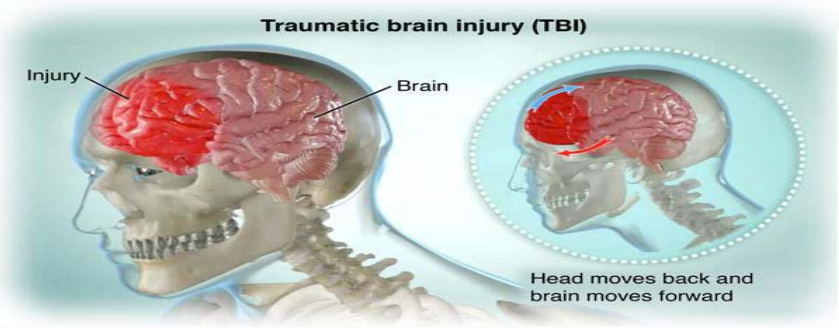


**Figure 1:** Traumatic Brain Injury (TBI).

or hearing).

Research on patients who have had recurrent TBI is ongoing; some studies have shown that the cumulative impact of TBI puts patients at risk for permanent damage.

Numerous risk factors for addiction and traumatic brain injury overlap, suggesting that young trauma patients who have never used opioids may be more susceptible to developing suds. It is linked to the emergence of mental health issues like depression and chronic pain [5,6].

Early regaining consciousness is an important predictor of long-term functional recovery and a crucial factor in determining admission to rehabilitative care for patients with traumatic brain injury admitted to the intensive care unit. On neurological evaluation, patients who stay unconscious are frequently thought to have a bad prognosis and are at a higher risk of dying in the intensive care unit. Several treatments, such as pharmaceutical stimulant therapy, transcranial direct current stimulation, and central thalamic deep brain stimulation, have been investigated in the subacute and chronic phases of TBI recovery [7]. In addition, vasopressors, statins, and IL 1 receptor antagonists are utilized to treat traumatic brain injury [8-11].

In India and other developing nations, Traumatic Brain Injuries (TBIs) are a major cause of illness, mortality, disability, and socioeconomic losses. Head injury is the most common (29.52%) among (60%) is traffic accidents, which are followed by falls (20%-25%) and violent incidents (10%). 15% to 20% of TBIs are known to have involved alcohol at the time of injury. People who have suffered brain injuries have very high rehabilitation needs, and these needs are growing yearly [12] (Figure 1).

## Neuropathology

Acute reactions follow the initial injury and coordinate the process of neuronal healing; however, in a portion of people, these physiological alterations are linked to symptoms and deficiencies that continue into the sub-acute and, in some cases, the chronic phases of recovery. The present focus of the study is on the poorly known mechanisms that determine individual variability in recovery [13,14] (Figure 2).

## Management

The initial impact may cause extra- or intra-parenchymal hemorrhages, as well as the acute death of neuronal and nonneural cells due to blood vessel damage. Early pathophysiological alterations in the brain, which involve an intricate web of secondary injury

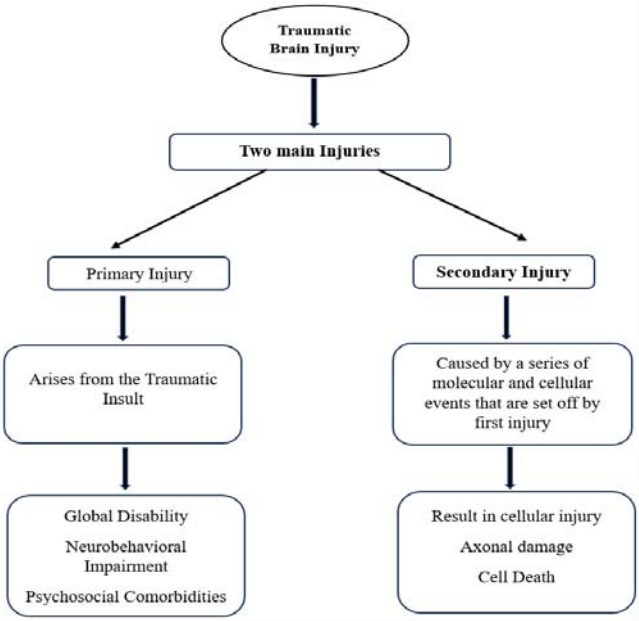


**Figure 2:** Neuropathology.

processes, worsen this initial injury. Reducing secondary insults, such as hypoxia, hypotension, and coagulopathy, is a major objective of prehospital therapy of TBI since the wounded brain is extremely susceptible to these types of insults. Stabilization of critical parameters must be maintained upon arrival at the Emergency Department (ED), and numerous treatment options must be taken into consideration at the same time. To lower acute mortality, more improvement in the acute management of TBI is required, with a focus on early detection and reduction of secondary injuries [15,16] (Figure 3).

### Pharmacological management

Blood Transfusion and Erythropoietin: It is debatable whether a hemoglobin level (9 g/dl) should be appropriate for TBI patients to initiate transfusion. With effects on numerous organ systems, Erythropoietin (EPO) is a possible neuroprotectant that has been extensively studied in both clinical and experimental traumatic brain injury [15].

**Anti-Coagulant Therapy:** Warfarin is associated with higher mortality and bleeding extension than Direct Oral Anticoagulants (DOACs). Vitamin K1 (Vit K) must be added to Prothrombin Complex Concentrate (PCC) for fast reversal in sTBI patients taking warfarin or dabigatran [15].

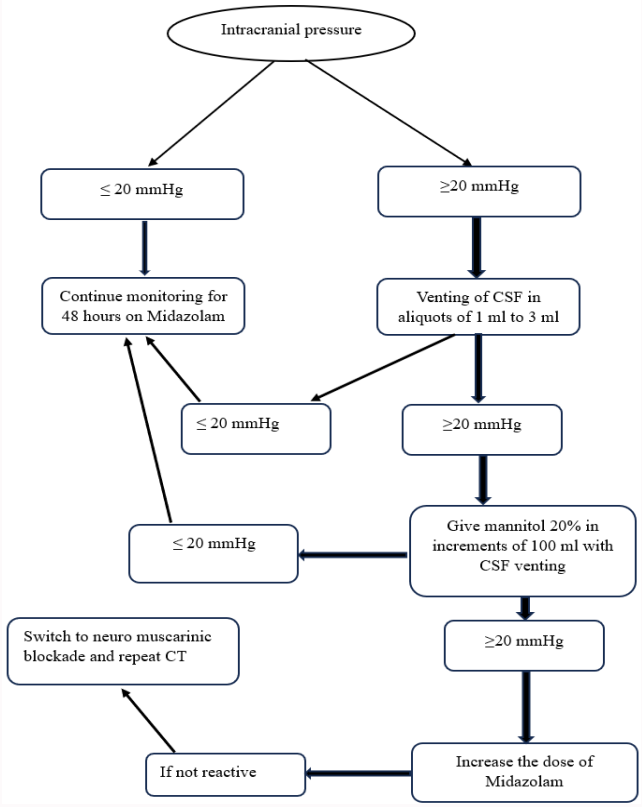


**Figure 3:** Intracranial pressure-reducing therapies.

**Coagulants:** In traumatic brain injury cases, coagulants such as tranexamic acid are commonly used to help control bleeding and prevent further complications.

**Steroids:** Dexamethasone should not be used in the acute treatment of sTBI since it is not useful in improving outcomes and is linked to a noticeably higher incidence of complications and death.

**Benzodiazepines:** To reduce intracranial pressure by inducing a state of sedation and relaxation which reduces metabolic demands and cerebral blood flow. These are also used to prevent seizures. Ex midazolam, lorazepam [17].

**Antiepileptic drugs:** Antiepileptic drugs have neuroprotective properties, meaning they can help protect brain cells from further damage.

It may contribute to improved recovery and outcomes. Ex. Phenytoin, levetiracetam, etc. [17].

**Osmotic agents:** Osmotic agents are used in traumatic brain injury primarily for their ability to reduce intracranial pressure. They also improve cerebral perfusion. example. Mannitol, Hypertonic solution [17].

**Prevalence:** Globally, traumatic brain injury is the primary cause of death. These days, it's a rapidly evolving, potentially fatal illness that can cause irreversible harm, non-cognitive behavioral changes, and cognitive behavioral abnormalities. In India, traffic accidents result in 15 to 18 fatalities each hour, with head injuries being the most common cause of death. In India, there is a 29.52% prevalence of traumatic brain injury, of which 60% results from traffic accidents. The second most common cause of Traumatic Brain Injury (TBI) is

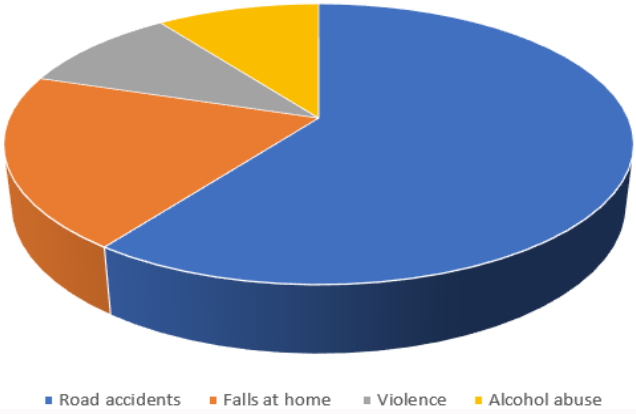


**Chart 1:** Prevalence of TBI.

alcohol use while driving; at-home falls account for 20% to 25% of TBI cases, while violence accounts for 10% of cases. The military and youths between the ages of 18 and 30 are the groups most commonly impacted by traumatic brain injury globally (Chart 1).

## Material and Methods

All the published reviews and research articles from PubMed Central related to traumatic brain injury from 2010 to 2023 were retrieved. All efforts were made to identify all relevant articles that report data related to traumatic brain injury.

## Discussion

To enhance the healthcare system, this review aims to ascertain the prevalence rate in India and gain a deeper understanding of the administration of therapy for traumatic brain injury. Our goal is to gain a better understanding of the present treatment environment by looking into trends, preferences, and adherence to standards. This may help us discover areas where patient care and medication utilization could be improved. We hope that this analysis will provide insightful information that can enhance treatment strategies and advance improved outcomes for traumatic brain injury patients [18].

## Conclusion

This paper presents a summary of publications on traumatic brain injury from 2010 to 2023 to establish benchmarks for the incidence and treatment of traumatic brain injury in India and to support the country's healthcare system to improve community well-being. This review covers the etiology, setting in which injuries occur, results, pharmacological treatment, and the influence of traumatic brain injury on quickly changing cultures. Every year in India, traumatic brain injury causes 1.5 to 2 million injuries and 1 million fatalities.

## Future Aspects

Examining Traumatic Brain Injury (TBI) includes many aspects that are currently being investigated and developed. Future considerations should take the following into account:

**Advanced imaging techniques:** As imaging technologies such as Magnetoencephalography (MEG), Diffusion Tensor Imaging (DTI), and functional Magnetic Resonance Imaging (fMRI) continue to progress, they will be able to offer increased detail regarding the structural and functional alterations in the brain that result from traumatic brain injury.

**Diagnosis and prognosis biomarkers:** Research is being conducted to find trustworthy biomarkers in blood, CSF fluid, or imaging data to help in TBI early diagnosis, prognosis, and follow-up.

**Neuroprotective therapies:** Creating and improving treatments, such as neurodegeneration methods, medication therapies, and neuromodulation strategies, to shield brain tissue from subsequent harm following traumatic brain injury.

**Virtual reality and rehabilitation:** By offering individualized and captivating therapeutic experiences, the use of Virtual Reality (VR) and immersive technology in rehabilitation programs can improve the cognitive, motor, and emotional recovery of persons with traumatic brain injury.

The use of machine learning algorithms and predictive analytics in Traumatic Brain Injury (TBI) research can aid in the identification of patterns, prognostication of outcomes, and enhancement of treatment strategies by leveraging extensive datasets and intricate variables.

Establishing strong mechanisms for long-term monitoring, follow-up treatment, and outcome evaluation can help us better understand the long-term impacts of Traumatic Brain Injury (TBI) and inform long-term management plans.

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