Chapter 4
CT Imaging in Neurosurgical Interventions:
Optimizing Seizure Management and Surgical Planning

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ABSTRACT

Traumatic Brain Injury (TBI) is a significant morbidity and mortality cause worldwide, and post-traumatic seizures (PTS) are a common and severe complication. TBI can be followed by early (within seven days of injury) or late-onset (beyond seven days) seizures, both of which are linked to neurological deterioration and poor patient prognosis. The Brain Trauma Foundation recommends anticonvulsants for the prophylaxis of early seizures. Its high bioavailability and low drug interactions were responsible for increased tolerability and long-term efficacy. Brivaracetam is a desirable choice for early seizure prophylaxis in TBI patients with greater efficacy and fewer adverse effects compared to traditional anticonvulsants. More large-scale randomized controlled trials are necessary to validate these findings and establish Brivaracetam as a standard of care in post-traumatic seizure management.

DOI: 10.4018/979-8-3373-2807-2.ch004

1. INTRODUCTION

One of the main causes of death and morbidity in the world is Traumatic Brain Injury (TBI). Every year, millions require emergency treatment for it while 1.5 million succumb to its effects(Bernhard et.al, 2019; Carney et.al, 2017). The World Health Organization predicts that traffic injuries will be one of the leading causes of disease burden by 2023 as per their report titled "The Global Burden of Disease" (Khaleghi and C, 2017). Patients with TBI may experience seizures as one complication; these have been classified into early post-traumatic seizures occurring within seven days after head trauma and late ones appearing thereafter (Adewusi et al., 2020). Across different global locations including civilians experiencing blunt head traumatism registered cases reveal widespread variance suggesting varying incidence rates from about 4% up to up-to-25% for early-onset conditions whereas later onsets showcase an incidence range specializing between approximately 9%-50% (Wiles et.al, 2023; Rowe et.al, 2024). Neurologic complications resulting from such events can cause severe impairments causing poor patient outcomes(count) (Saeed, 2017), recent research findings also indicate acute worsening at times attributable directly or indirectly through this form's occurrences during recovery meaning prevention remains crucial when concerned individuals come forward seeking help immediately [10]. Several experimental studies have indicated the formation of a permanent zone with abnormal activity, resulting in post-traumatic epilepsy syndrome (Saeed and Abdullah, 2022; Saeed et.al, 2022). To prevent early seizures, the Brain Trauma Foundation recommends using anticonvulsants but does not recommend their use for late-stage post-traumatic seizures. Drugs such as carbamazepine, valproic acid, and phenytoin have been studied to find preventive measures against these conditions; specifically, Phenytoin is recommended by the Brain Trauma Foundation (level II evidence). Despite this recommendation, disadvantages include its narrow therapeutic window accompanied by intravenous site reactions along with exfoliative dermatitis granulocytopenia transient hemiparesis and fatal hypersensitivity reaction known as "Phenytoin Hypersensitivity Syndrome (Saeed et.al, 2017; Saeed, 2023)." In polytrauma patients who experience shock Phenytoin associated hypotension presents further danger. Class II data demonstrates that both phenytoin and carbamazepine negatively affect cognition, especially regarding tasks requiring significant motor skills or speed components due to being metabolized through the P450 system causing various drug interactions possibilities. Inadequate levels of medication may result in breakthrough seizures highlighting how important it is to maintain therapeutic serum levels(Saeed et.al, 2023; Saeed et.al, 2021; Saeed et.al, 2023). Thus, it is crucial to monitor regularly. However, countries such as Pakistan face challenges in accessing free biochemical tests for phenytoin-level assessment, leading to inconvenient and costly maintenance strategies within large populations.