

State of the Globe: Traumatic Brain Injury and Infections: The Two-Hit Insult

Traumatic brain injury (TBI) has been called the “silent epidemic” of modern times, and is the leading cause of death and disability in children and young adults in both developed and developing nations worldwide. The global incidence is estimated to be 369–790 per 100,000, and the incidence is increasing.^[1,2] Approximately 10% of patients with TBI require admission to an intensive care unit (ICU).^[3] Hospital and 6-month mortality of patients with TBI treated in the ICU are approximately 15% and 20%, respectively.^[4] Factors, such as underreporting, varying levels of health-care infrastructure and the absence of uniform data collection system, make it difficult to gather a precise number of TBI cases in a developing country like India. With a very conservative estimate of 1.6 million people across the subcontinent now seek hospital care for TBI every year, with over 200,000 associated deaths and over 1 million survivors requiring rehabilitation.^[5]

It is well known that TBI causes great morbidity and mortality as mentioned above. Often times the individual is struck down during their prime with a major brain injury and usually the best one can hope for until we find a way to regenerate neurons is to prevent secondary injury. The article from Kar et al illustrates the percentages of various infections as a major villain of secondary injury to those hospitalized with TBI. Traumatic brain injuries, often the result of accidents, falls, or other sudden impacts, are associated with a significantly increased hospital stay. However, the intersection of TBI with infections presents an added layer of complexity. Available evidence suggests respiratory tract infections (RTI) to be the most common infections associated with TBI patients, along with surgical site infections, meningitis, and other device-related infections.^[6-9]

Study published in the current edition by Kar *et al.*^[10] conducted at a tertiary care center in northern India sheds light on the prevalence of this dual threat, in an attempt to identify the patterns and risk factors of infections in TBI patients along with the causative organisms and their antimicrobial sensitivity.

A total of 86 episodes of infections were reported in the study among seventy two included patients, indicating a huge burden of infections in hospitalized patients with TBI, thereby increasing the hospital stay and cost. ICU length of stay, length of hospitalization, ICU admission and patients on the endotracheal tube or tracheostomy tube were found to be significant risk factors along with diabetes, hypertension, coronary artery disease, chronic kidney disease, and other comorbidities. Identified risk factors were similar to some of the previous studies by Boque *et al.* and Harna *et al.*^[11,12] A few experimental models have shown that TBI can alter systemic

immunological responses toward an immunosuppressive state, making the patient vulnerable to infections.^[13]

Ventilator-associated pneumonia was the most common associated infection in the present study, followed by bloodstream infections, urinary tract infections, and surgical site infections. *Acinetobacter*, *Klebsiella*, *Pseudomonas*, *Escherichia coli*, *Enterobacter*, and *Staphylococcus aureus* were the common organisms isolated in the present study, and a significant resistance to various classes of antimicrobials was also observed. Sites of infections, causative organisms, and antimicrobial sensitivity patterns can be attributed to institutional patient care protocols and practices. Another common source of infection is invasive monitoring of intracranial pressure (ICP). The incidence of ICP device infection has been reported to range from 1% to 27%.^[14]

The findings of the study paint a stark picture, emphasizing the urgent need for a comprehensive approach to address both traumatic brain injuries and the subsequent risk of infections. TBI patients are at an increased risk of infections, and therefore, prevention of infections in TBI patients, as with any other hospitalized patients, is crucial for their recovery.

Some of the strategies that can be adopted to decrease the infections in TBI patients may include:

- Early mobilization
- Transfer of patients to specialized rehabilitation centers so as to decrease the length of hospital stay
- Hand hygiene
- Maintenance of environmental hygiene
- Prompt and proper care of any open wound or surgical site
- Respiratory care with the implementation of ventilator bundles
- Care of central lines and urinary catheters
- Strict adherence to antibiotic stewardship
- Emphasis on adequate nutritional support
- Regular monitoring and surveillance of infections
- Patient and caregiver education.

While one ponders what appears to be extraordinary amounts of pulmonary infections in their cohort of patients, it is only outdone by the astonishingly high rate of multi-drug resistant bacteria the physicians are battling in their Indian rural hospital arena. In comparison to other studies attempting to evaluate the same situation in different venues, there is less of a secondary infection injury pattern, however still pervasive and hindrance to recovery. Many of these patients will either die or spend the rest of their lives in a poor quality of life

scenario unless we can find a way to reduce these infections and continue to discover new antibiotics whereby the bacteria are not resistant and thus treatable. Unraveling the prevalence of TBI and associated infections is only the first step in the battle against this silent menace. The study sheds light on the challenges faced by healthcare providers in diagnosing and treating these intertwined conditions. The study and article does not touch on promising other research possibilities such as trying to improve the disrupted blood brain barrier, which accompanies TBI and also solve the riddle of the dysfunctional immune system, which suffers from suppression due to TBI for not entirely clear reasons. Beyond the clinical realm, the socioeconomic impact of TBI and associated infections is a major concern for a developing country. The financial burden on affected families, coupled with the strain on healthcare resources, underscores the need for targeted interventions and policy initiatives. As the curtains draw on the study's revelations, the prevalence of traumatic brain injury and associated infections emerges as a formidable challenge demanding immediate attention and concerted action. We as physicians and the facilities where we practice our craft can strive to be more meticulous with our sterile techniques and understand that it is a fairly ubiquitous happening for multi-drug resistant bacteria to inhabit rooms and units, whereby the next poor unsuspecting innocent soul is brought into the lion's den of the petri dish of the ICU. We must endeavour to rid our hospitals of these unwanted guests we refer to as infective organisms and reduce nosocomial infections.

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