Article published online: 2024-04-16

Editorial

Frontiers in Traumatic Brain Injury

Anita Jagetia[1]

[1] Department of Neurosurgery, G.B. Pant Institute of Postgraduate Medical Education and Research, New Delhi, India

Indian J Neurosurg 2024;13:1–2.

Traumatic brain injury (TBI) is a major concern for health care professionals as it has far-reaching consequences for the individual and causes significant morbidity and mortality in the population. While TBI has long-lasting effects on the individual, disrupting daily life and function, it has been labeled a national crisis with nearly 1 million people affected and with a mortality of around 100,000.

Today, there is an urgent need for interventions to limit the personal and community implications of TBI, and the frontiers of human endeavor range from preventive, diagnostic, therapeutic, rehabilitative, and disability limitation to awareness generation and advocacy.

The commonest causes of TBI are road traffic accidents and falls from height. While globally, the World Health Organization (WHO) reports a 5% reduced mortality due to road traffic accidents, the figures for India show an increase from 150,785 in 2018 to 153,792 in 2021. The difference between low- and high-income countries is significant with mortality in low-income countries three times that in high-income countries despite the former accounting for only 1% of the world's motor vehicles. Road safety initiatives are urgently required with 80% of the world's roads failing to meet pedestrian safety standards and only 0.2% having a separate cycle track. Initiatives to create awareness and advocacy to implement road safety measures are urgently required, as are stricter law enforcement of existing rules and provisions. This is particularly true for India, a country that is on its way to becoming the country with the maximum number of motor vehicles by 2050. Preventing road traffic accidents and consequent morbidity and mortality is currently the frontier we need to urgently conquer!

There is emerging understanding of the epidemiology, risk factors, and biomarkers of posttraumatic syndromes that will upgrade clinical practices and guide future research. There appears to be a multifactorial and multimodal nature of the risk factors encompassing clinical, demographic, and genetic elements. Some of the identifiable risk factors include injury severity and mode, intracranial vascular alterations, age, gender, and molecular biology dictated by genetic influences. Neuroinflammation and associated pathways with roles of astroglia and microglia are being investigated, which may fuel targeted therapy and interventions to reduce morbidity and mortality.

Direct causative mechanisms of TBI include primary pathogenic effects causing brain injury due to the trauma as well as secondary pathogenic cascades that involve complex processes that may be modifiable. Increasing understanding of the molecular mechanisms include contributions from neurofilament light chain (NF-L), ubiquitin carboxy-terminal hydrolase-L1 (UCH-L1), tau, and glial fibrillary acidic protein (GFAP). Future therapeutic approaches are poised to refine and exploit the current understanding redirecting TBI treatment to hitherto undreamt of and uncharted territory.

Further, neuroprotective and neuromodulation initiatives are being matured for clinical application. Neurotrophic factors, known to play a role in diagnostic and prognostic assessments after TBI, may be used to potentially modify the course of TBI using neural plasticity and neural repair.

Not all patients need surgical intervention. There are guidelines available to decide on the timing of surgical intervention, which needs to be modified in accordance with the local needs. The advances in surgical technique of decompressive craniectomies and cranioplasties are worth mentioning. We have dedicated this issue to TBI, and the highlight of this issue are the articles on the two topics (i.e., decompressive craniectomy and cranioplasty). Polymethyl methacrylate (PMMA) prosthesis after decompressive craniectomies has shown lesser complication rates with better cranial symmetry. The other article on cranioplasty showed surgical site infection with heat or chemically cured PMMA and none with titanium or autologous implants.

The problem with autologous bone flaps is resorption and therefore the need for timely surgery.

Neuromodulation techniques have been shown to restore altered brain function reducing symptoms and improving

Address for correspondence
Anita Jagetia M.B.B.S., M.S, M.Ch., Department of Neurosurgery, G.B. Pant Institute of Postgraduate Medical Education and Research, New Delhi, India
(e-mail: anitajagetia@gmail.com).

DOI https://doi.org/10.1055/s-0044-1782661.
ISSN 2277-954X.

© 2024. The Author(s).
This is an open access article published by Thieme under the terms of the Creative Commons Attribution License, permitting unrestricted use, distribution, and reproduction so long as the original work is properly cited. (https://creativecommons.org/licenses/by/4.0/).

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

function. Improved firing of neurons and synaptic strength, altered neurotransmitter levels, and reduced excitotoxicity after TBI have been reported when neuromodulation was used in the rehabilitative regimen of TBI. Transcranial magnetic stimulation (TMS) has been shown to improve cognitive functions such as recall, neural substrates, and performance in psychological tests.

Rehabilitation of TBI patients remains the mainstay of management today in the majority of cases. Several studies have shown that early intervention by the rehabilitative procedure has a significant impact on the morbidity and final outcome of TBI. Rehabilitation is the need of the hour and providing a continuity of care after discharge of the patient from the hospital is the key. While institutional care is optimally delivered in most cases, a community-based rehabilitative (CBR) protocol with peripheral workers and family support systems may be the key for enhanced clinical results. This will include dietary as well as continued psychological support by dedicated and motivated professionals and volunteers. Social and economic support as well as family awareness programs would go a long way to alleviating issues after TBI. Artificial intelligence (AI) directed protocols and algorithms, emerging virtual reality systems, and robotic rehabilitation would usher in a new era of improved function after TBI.

Conflict of Interest
None declared.

Additional Reading

1 Corrigan JD, Selassie AW, Orman JA. The epidemiology of traumatic brain injury. J Head Trauma Rehabil 2010;25(02):72–80
2 Kazis D, Chatzikonstantinou S, Ciobica A, et al. Epidemiology, risk factors, and biomarkers of post-traumatic epilepsy: a comprehensive overview. Biomedicines 2024;12(02):410
3 Calderone A, Cardile D, Gangemi A, et al. Traumatic brain injury and neuromodulation techniques in rehabilitation: a scoping review. Biomedicines 2024;12(02):438
4 Treble-Barna A, Petersen BA, Stec Z, Conley YP, Fink EL, Kochanek PM. Brain-derived neurotrophic factor in pediatric acquired brain injury and recovery. Biomolecules 2024;14(02):191
5 Silvestro S, Raffaele I, Quartarone A, Mazzon E. Innovative insights into traumatic brain injuries: biomarkers and new pharmacological targets. Int J Mol Sci 2024;25(04):2372
6 Guleria C, Nalin S, Kumar D. A scoping review to evaluate the clinical efficacy of indigenously produced, patient-specific acrylic cranial prosthesis in decompressive craniectomy in India. Indian J Neurosurg 2023