Opportunities and Challenges for Implementing Neurotrauma Prevention Program: A Practical Perspective for Developing Countries

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Abstract

Neurotrauma is an underestimated and less understood public health issue in low- and middle-income countries for which we need system-based approach to prevention plans. This study was initiated to find rationale of effective plan with projectile vision of neurotrauma prevention. In search of innovative ideas of neurotrauma prevention evidence was explored from the published literature research on traumatic brain injury. Evidence-based global guidelines on recommended content and scheduling on prevention of neurotrauma literature searches data were also synthesized and summarized from research in developed countries. Our study noted that a considerable number of victims of neurotrauma with death and disabilities put mammoth costs to the already compromised health systems of the low- and middle-income countries. We need systems-based four-pronged approach incorporating neurotrauma registry, neurotrauma surveillance, translational research programs, and current approved process for development of clinical guidelines for prevention.

Keywords
► neurotrauma
► prevention
► challenges

Introduction

Neurotrauma consists of two complex close-knit pathophysiologies, namely traumatic brain injury (TBI) and spinal cord injury (SCI). These two entities are usually mutually inclusive and life-changing by significant morbidities and disabilities. In the last few decades, there have been colossal advancements and progress in neurotrauma care with the outcome of decline of mortality-associated spectrum of disabilities. World Health Organization (WHO) has recognized and alerted the global health community about neurotrauma as a significant public health problem causing fatalities to the victims of road traffic injuries. WHO estimated enormous losses not only to individuals and their families but also to national and international communities from TBI and SCI leading to colossal deaths and temporary as well as permanent disabilities.[1] The considerable differences in reported incidence and mortality rates between high-income countries and low- and middle-income countries (LMICs) highlight a need for better standardization and collation of epidemiological data gathering on TBI. Research groups have urged to emphasize the need for standardized definitions, standardized methods, and standardized data collection and reporting,

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especially for mild TBI. Further, there is an urgent need to share and facilitate pooling of data and comparisons to find trends over time between and within countries.[2]

Cost of TBI

Understanding the burden of TBI is an important step as TBI affects a large number of individuals and families and has a huge economic impact. However, accurate cost estimates of TBI are scarce for majority of the regions, and there is wide variation in estimated costs between available studies from countries with welfare state model.[3] Even where public health benefits cover up greater part of the TBI care expenditure, there are huge out-of-pocket expenditures to be borne by the patients and their caregivers. This partly can be blamed on the differences in methods used to calculate costs and variations in research definitions used in exploratory studies, namely direct, indirect, and lifetime costs.[2] Financial impact of neurotrauma continues to increase annually paralleling as the leading cause of death and disability from the growing number of major trauma cases. The economic burden of traumatic injury in Canada was estimated at $26.8 billion per year. The cost for sufferings of human and family on TBI is tremendous, and is particularly tragic given the estimates that up to 95% of injuries have preventable elements.[4]

What Is To Be Done?

TBI burdens encroach on everyday personal life of the survivors and their caregivers with associated vocational, psychological, social, and economic costs for which the global community on neurotrauma research feel that recommendation with long-term vision is needed.[5] The suggested solutions to provide access to neurosurgical care include extending resources from developed countries to LMICs, and help to develop low cost yet efficient and sustainable methods with local resources including providing training to people to administer care to acute TBI patients.[6] Practice of neurotrauma care needs guidelines which can be supported by good data sets; however, in majority of the countries obtaining good data is still a challenge.[7] To overcome these limitations, low cost strategies can be planned to at least have minimum data sets (from hospitals as well as from the communities) to support the neurotrauma care.[8-12] These low cost strategies are needed to be developed not only to collect data but also to develop methods for imparting patient care.[13-15] In the meantime, lessons can be learned by understanding and reviewing the existing research evidence.[16]

Need to Develop a Robust Data Collection Mechanism

TBI registries can provide real-time dependable information and predictable outcomes as a foundation of comprehensive national TBI database. Reflection from the developed countries has proven the importance of "Trauma Registries" to systematically collect data as a recognized instrument of which a subset data can form a dedicated TBI registry. TBI registry helps to assess the burden for all stakeholders for the systematic monitoring and concurrent evaluation with the dashboard indicators of risk factors. In India, an indigenously structured "TBI registry," piloted at the Narayana Medical College, Nellore, Andhra Pradesh, has been designed by Dr. Amit Agarwal to find quality of intervention and prehospital injury care, which is a novel attempt for an Indian national-level TBI registry. With a value addition to this registry and options for more data entry pertaining to long-term and functional parameters, we can march ahead in clinical and epidemiologic translational research on TBI.[17-19] Success story of the Cape Town Trauma Registry has inspired research interest among a good number of research groups with rising efforts to address preventable morbidities on a priority basis.

Injury Surveillance

Injury surveillance systems are poorly equipped or nonexistent in many of the LMICs. Yet, ongoing surveillance in different countries has clearly demonstrated that there are significant qualitative and quantitative variations across the global regions regarding risk factors, natural history, interventions, and outcome of neurotrauma on the person, family, and nation. [20] Completion of trauma data forms by clinicians is a major concern in hospital practices with limited personnel in the health care delivery systems of the LMICs; there exists definite concern among research groups to obviate negative attitudes on compliance. These issues stem from the mindset of the health care provider community as the outcome of the holistic deficiency or nonexistent teaching and learning on research in undergraduate and postgraduate courses and curricula in LMICs. This has led to a paradigm ranging from lack of sensitization to think trauma as a public health issue compared with other communicable and noncommunicable diseases.

Developing Telehealth to Increase Access and Cost-Effectiveness

Telehealth infrastructure with nationwide network of neurosciences experts in real-time consultations with primary and secondary care levels optimizes care and reduce unnecessary transfer and referrals. It promotes prevention at the personal level to minimize recurrence or reinjury revoking to normal health free of disabilities by array of interventions. *Tertiary prevention* encourages longer life span embedded in "living with disease" philosophy by conceptual framework of disability limitation and rehabilitation measures in four contextual agenda, namely medical, social, vocational, and psychological under the aegis of the International Classification of Functioning, Disability and Health. Every country needs to formulate systems approach based on their assessments of unmet need and barriers for implementation. *Quaternary prevention* conceptual framework is relatively new to prevent medical invasion by overdiagnosis and overtreatment, namely hospitalize all cases in the medical establishments

refuting concepts of domiciliary care at primary and secondary care levels. Prevention measures that target TBI occurrence, whether at the primary or secondary care levels, should be supported with the updated knowledge of epidemiology, risk factors and risk correlates, and identification of vulnerable group of population.[2]

Telehealth Advantages

In the position statement on telemedicine, the Joint Section on Neurotrauma and Critical Care of the American Association of Neurological Surgeons clearly mentioned the advantages of using telemedicine in guidance of prehospital care, timely transfers, and delivering optimum neurotrauma care for the victims in dedicated centers under trained manpower team.[21] Research groups have concluded from trauma care translational research that neurosurgical telemedicine consultation coordinated by the teleneurotrauma system can help potentially life-threatening and time-sensitive conditions. Further, there was gross reduction of unnecessary neurotrauma referrals and transfers, and head or spine injury cases unquestionably had better prognosis at the regional centers through structured and coordinated telemedicine network. Thus, this newer approach of innovative care for TBI and SCI cases have unlimited potential in places with inadequate neurosurgery resources globally.[22-24] Electronic and communication revolution has gifted us remote and Internet-based systems in telehealth to bridge site of trauma through prehospital care for first responders to dedicated care centers allowing neurosurgical expert care earlier, outside the scope of primary and secondary health care levels even in LMICs.[25] Thus, telemedicine has helped minimize constraints of "distance" and "terrain" by connecting victims of neurotrauma with "virtual" specialists in real-time access of resources existing in a tertiary care referral center.[26]

Telehealth Options in Neurotrauma

Telehealth supplements conventional health care systems by making most of the virtual technology as the most basic element of "eHealth," by means of a wider spectrum of information and communication technologies using Internet on ordinary computers and cell phones. Telehealth has opened a huge opportunity ranging from capacity building by webinar and VSAT-based interactive teaching–learning programs from long distances to real-time guidance from professionals away in diagnosis, health care, and optimum referral of emergency cases in inaccessible health care settings for vulnerable groups. Apart from reducing queue lengths, telehealth provides smarter health care embedded with the national level cost curtailment to already overburdened economic costs of LMICs. Thus, the number of visits to health care facility, logistics, and other operational requirements are reduced along with concurrent decrease in infrastructural demand in short, medium, and long term with great impact on natural resources.[27]

Long-Term Care

Neurotrauma is a classic example of unexpected brisk brutal event leading to temporary and permanent impairments that may be persistent, sometimes life-long cost of survival with disabilities. The "right care" at "right time" at "right place" provided by "the missing link," that is, prehospital care, rendered by the first responders at the site of injury with triage and onsite specialized care and transporting them at the earliest after resuscitating proper support systems. All these serial activities can make people to continue to live with their full potential, despite having experienced a near-fatal injury.[28,29]

Translational Concept of Prevention in Neurotrauma

The neurotrauma prevention programs will improve TBI care for patients and their caregivers across injury spectrum highlighting on knowledge translation by multisectoral- and multistakeholder-collaborated evidence-based trauma care. Approaches to prevention incorporate a broad spectrum of interventions to reduce risk factors and consequence of compromised health. Conventionally, prevention is discussed in five groups, namely primordial, primary, secondary, tertiary, and quaternary without "one-size-fit-all" rule. *Primordial prevention* aims at preventing the exposure to risk factors and risk correlates to decrease undesirable health issues, namely improved inbuilt control systems; protected devices; sensitize and educate for consistent use of personal protective equipment; redesign and reorganization; holistic continuation of health education and universal training and retraining from kindergarten to postgraduate levels for safety concepts of all citizens; and town and country planning with purpose-built road, signal, and all infrastructure in "safety-first philosophy." *Secondary prevention* anticipates and optimizes intervention of natural history preferably in presymptomatic stage for positive outcomes entailing early detection and prompt treatment of injury.

Supporting Neurotrauma Research

Dedicated neurotrauma research for the development of innovative understanding is an indispensable component to reach from known to unknown by addressing the loopholes. Multicentric studies conducted by research groups in India and other countries visualized that the inevitability of long-term care with associated soaring economic cost to already overburdened health care delivery systems can be halted by national neurotrauma registry and surveillance systems. Further, population-based epidemiologic studies are needed in each country to assess the impact of TBI and SCI along with associated injuries to develop effectual precautionary approaches. Implementation of already proven methods of science and technology on prevention of TBI to the last man on the road is a definite challenge today. Examples include consistent and correct use of crash-proof helmets by both driver and pillion riders even for shorter distances; compulsory use of seat belt and child restraint for all passengers; and random blood and breathe alcohol test for all drivers on road. Similarly, research on cost-effective interventions are also ongoing.[1,30-34]

TBI Prevention Need

Vision of TBI prevention need, first to provide leadership in research, advocacy, education on interventions, and tailor-made knowledge translation for different segments of population; second, to collaborate for participatory contribution from all sectors to design and deliver targeted prevention strategies and trauma system improvements; third, to periodically audit outcomes of activities and perpetual updating of the plan of actions. Targets of TBI prevention will be to build up evidence-based health care standard operative procedures (SOPs) for smooth access to dedicated care, reduction of hospital stay, and optimize excellence in outcomes. Through public policy advocacy, first responder training on prehospital care, and expansion of health care provision all through injury spectrum, the continuum of holistic care will establish paradigm of community-level intervention.[4]

Conclusion

TBI is a poorly quantified global public health issue. Yet, there is paucity of leadership in sustaining implementation initiative through intra- and intercountry approach to improve neurotrauma outcomes by increasing optimum access to public health care resources networks by horizontal collaboration. Further, there is need of more epidemiological research on prevention of neurotrauma compared with hospital-based studies on specific clinical parameters and process evaluation. Translational research are expected to be initiated from the stakeholders and policy makers to save productive age and breadearners who are major victims particularly in all LMICs. Our research group has been working on neurotrauma prevention for more than a decade for development of health care guidelines for prevention at the primary, secondary, and tertiary care levels. We firmly believe that there is an urgent need of systems-based approach including four closely knit, mutually exclusive approaches, namely national neurotrauma registry for real-time data entry, national program on neurotrauma surveillance, translational research initiatives from union government to find "clinical practice guidelines," and "SOP" for "first contact neurotrauma care." These will be adopted on the current evidence of the natural history of neurotrauma and medically probable interventions to suit the individual needs.

Conflicts of Interest

None declared.

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