SPECIAL COMMUNICATION

Traumatic Brain Injury as a Chronic Health Condition

John D. Corrigan, PhD,a,* Flora M. Hammond, MD,b,*

From the aDepartment of Physical Medicine and Rehabilitation, Wexner Medical Center at The Ohio State University, Columbus, OH; and bDepartment of Physical Medicine and Rehabilitation, Indiana University School of Medicine, and the Rehabilitation Hospital of Indiana, Indianapolis, IN.

Abstract

Growing evidence indicates that multiple types of brain injury, including traumatic brain injury, are dynamic conditions that continue to change years after onset. For a subset of individuals who incur these injuries, decline occurs over time and is likely due to progressive neurodegenerative processes, comorbid conditions, aging, behavioral choices, and/or psychosocial factors. Deterioration, whether directly or indirectly associated with the original brain injury, necessitates a clinical approach as a chronic health condition, including identification of risk and protective factors, protocols for early identification, evidence-based preventive and ameliorative treatment, and training in self-management. We propose that the acknowledgment of chronic brain injury will facilitate the research necessary to provide a disease management approach.

Archives of Physical Medicine and Rehabilitation 2013;94:1199-201

© 2013 by the American Congress of Rehabilitation Medicine

Most traumatic brain injuries (TBIs) are mild and cause temporary disruption of neurologic function; however, some mild TBIs, and most more severe injuries, can cause permanent impairments. The clinical precept to date has been that residual effects of TBI are static once initial recovery has plateaued. However, data from the TBI Model Systems National Database suggest that change is more common than stability for long-term global outcomes of persons with moderate or severe TBI who require rehabilitation (fig 1). Indeed, after 10 years, as many as 1 in 3 persons decline from a previously achieved outcome, with most deteriorating 2 categories on the Glasgow Outcome Scale—Extended. Additionally, there is accumulating evidence that a subset of TBIs triggers progressive degenerative processes affecting cognitive or motor function, or both. The emerging picture is not of a static condition; so much so, that a recent consensus conference of professionals in brain injury rehabilitation concluded:

"Injury to the brain can evolve into a lifelong health condition termed chronic brain injury (CBI). CBI impairs the brain and other organ systems and may persist or progress over an individual’s life span. CBI must be identified and proactively managed as a lifelong condition to improve health, independent function and participation in society."

Although considerable attention has been given recently to the possibility that multiple concussive forces affecting the brain can result in chronic traumatic encephalopathy, the evidence that TBI is associated with degenerative disease is neither recent nor speculative. The Institute of Medicine’s (IOM) Committee on Gulf War and Health: Brain Injury in Veterans and Long-Term Health Outcomes conducted a review of the scientific literature including all relevant studies of adult, human TBI in any population (civilian or military) caused by any mechanism. The Committee found sufficient evidence to conclude that an association exists between moderate and severe TBI and dementia of the Alzheimer type as well as parkinsonism. Johnson et al compared brain pathology of patients with a single TBI 1 to 47 years previously with that of age-matched controls. Patients with TBI showed greater neurofibrillary tangles (34% vs 9% of those younger than 60y) and a greater density of amyloid-beta plaques among those positive for plaques (73% vs 38% high density). These investigators concluded that long-term neuropathologic changes indicative of neurodegenerative disease are not limited to individuals who have incurred repetitive blows to the head, but can occur in some with a history of a single TBI.

Both the delayed onset and progressive, degenerative nature of these consequences of TBI depart from the more common conception that the long-term effects manifest at the time of the
With health and function varying over time, the medical management of CBI should be capable of addressing evolving issues both proactively and reactively. This need begs the question, could the adoption of a disease management approach to CBI improve outcomes and reduce costs as has been observed for other chronic conditions and anticipated in the Affordable Care Act? And, if so, what strategies focusing on which complications would be most effective? The prevention or delay of complications through early detection and intervention is a key principle of disease management. Thus, there is an initial need to identify which consequences of CBI are sufficiently prevalent and potentially preventable or modifiable with early detection or treatment, or both, and who is at greatest risk. The potential benefits of practicing long-term healthy behaviors (ie, exercise, nutrition, abstinence from nicotine and alcohol) in CBI disease modification need delineation, especially given the propensity for poor self-control in this population. Also, some individuals may potentially benefit from receiving periodic therapy to help regain or maintain motor, if not cognitive, function. Self-management training through patient education and internalization of personal responsibility, central to managing other chronic diseases, is likely to be beneficial for persons with CBI but may require adaptation.

The cognitive impairment (including deficits in executive function, memory, awareness, generalization) commonly caused by TBI may pose unique challenges that demand the identification of specific strategies in the implementation of self-management. There are multiple questions that research will need to address to have sufficient evidence to embrace a disease management approach for CBI. Perhaps most critical will be prevalence data on long-term consequences that will allow protocols to focus on the most common and preventable complications. Longitudinal data will be necessary to determine those members of the cohort most at risk. The TBI Model Systems National Dataset already contains more than 11,000 cases of persons who received acute rehabilitation. This dataset has been found representative of the U.S. population older than 15 years requiring rehabilitation for a primary diagnosis of TBI and includes some cohort members followed up for 20 years postinjury. While this source of data will eventually provide needed information on prevalence, risk factors, and even markers of disease onset for that part of the population who incurred the most serious initial injuries, for every 1 adult who is discharged to rehabilitation with a moderate or severe TBI, there are 4 others who go directly home. There are no longitudinal data on this portion of the population despite the potential seriousness of the injuries. Finally, there will be a significant need for research on the efficacy of specific disease management protocols, as well as cost-effectiveness studies of an overall disease management approach.

In summary, evidence suggests that some TBIs are chronic and represent an evolving disease process that negatively impacts the lives of those affected. CBI stands in stark contrast to the long-accepted dogma that TBI results in static, long-term consequences. With its high prevalence, especially in the young, and vast consequences, CBI carries high economic, personal, and social costs. Acknowledging CBI as a dynamic disease process prompts the question of how providing a disease management approach may reduce costs and improve outcomes. Application of such an approach for CBI has unique considerations demanding clinical innovation and research.

**Keywords**

Chronic brain injury; Disease management; Rehabilitation; Traumatic brain injury

**Corresponding author**

John D. Corrigan, PhD, The Ohio State University, Dept of Physical Medicine and Rehabilitation, Wexner Medical Center, 480 Medical Center Dr, Columbus, OH 43210. E-mail address: corrigan.1@osu.edu.

**References**


