



Longitudinal Incidence and Concurrence Rates for Traumatic Brain Injury and Spine Injury: A Retrospective Analysis of the National Inpatient Sample Database over a Twenty-Year Period

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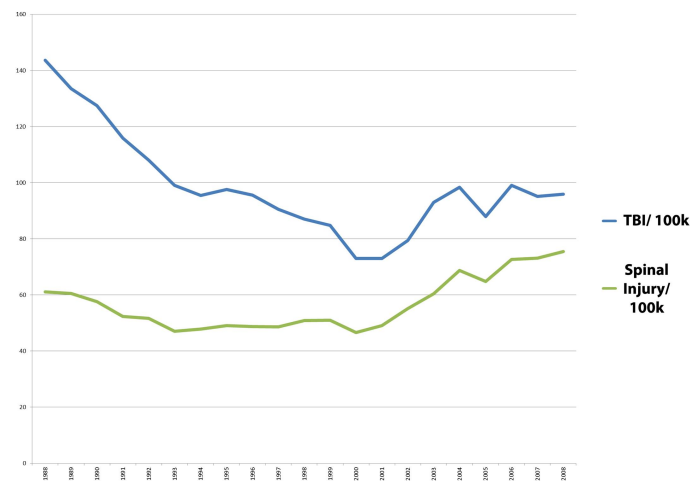
Background

Traumatic spine and spinal cord injuries, which affect thousands of new Americans each year, represent a significant source of death and disability. Primarily occurring in the younger and most productive members of society, spinal injury contributes to dramatically shortened lifespans and a severely diminished quality of life. Occurring with a significantly greater frequency, approximately 1.7 million new patients are afflicted with a traumatic brain injury (TBI) annually. It has long been recognized that a substantial percentage of spinal injury patients suffer from concomitant TBI and that a significant number of TBI patients have concurrent spine injury. The co-occurrence of these pathologies has been termed a dual diagnosis. The early recognition of a dual diagnosis is critical to the triage, acute management, and long-term rehabilitation of these patients. The past four decades have seen multiple attempts to define the true incidence of concurrent TBI and acute spinal injury. A thorough literature search reveals highly variable incidences, with reports ranging from 16–74%. This heterogeneity is due, in part, to differences in experimental design (prospective versus retrospective analyses), sample size, diagnostic criteria for both TBI and spinal injury, and the setting in which the diagnosis was made (trauma center versus rehabilitation center). Furthermore, the vast majority of existing data consists of retrospective analyses, with only more recent efforts focusing on prospective investigations.

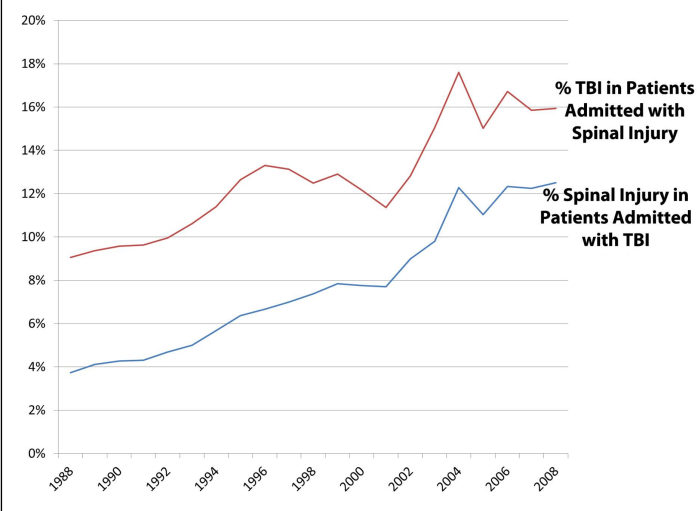
Methods

We queried the NIS database from 1988 to 2008 using ICD-9 codes specific to traumatic brain, spine, and spinal cord injury admissions (Table 1). Results of individual searches were recorded for: TBI cases (including brain injury and skull fractures), spinal fractures without SCI, spinal fractures with SCI, and SCI without evidence of bony injury. Annual incidence was expressed as the number of admissions for a given ICD-9 code per 100,000 admissions recorded in the NIS. From this data, we calculated the annual incidence of hospital admissions for concurrent spine trauma and TBI. Age was recorded on an annual basis as a percent quartile. The sex of the injured patient was recorded for patients suffering TBI, spine injury, and concurrent injuries. The NIS database was also queried to identify the race of the injured patients (Caucasian, African American, Hispanic, Asian, and other) within the same categories. Using this data, we were able to calculate the annual incidence of TBI, spinal injury, and concurrent injury admissions for both sexes and each of the identified races.

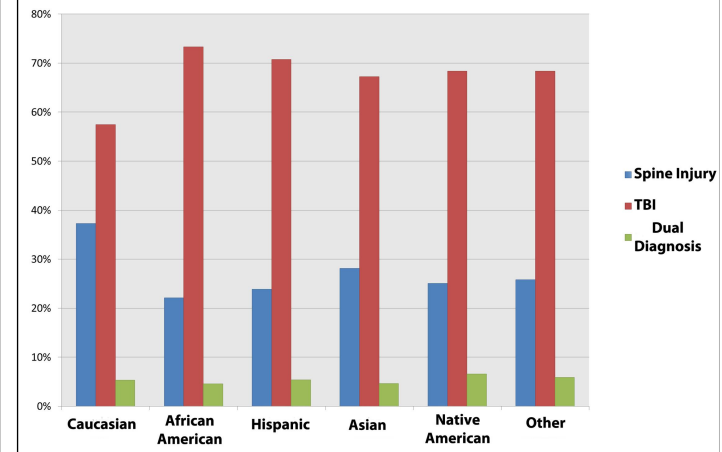
Incidence of TBI and Spinal Injury, 1988 – 2008



National Inpatient Sample Trends in Dual Diagnoses, 1988 – 2008



Incidence of TBI, Spinal Injury, and Dual Diagnosis Among Different Races



The incidence of TBI declined, while admissions for spine injury increased. Within the population admitted with a diagnosis of TBI, the annual incidence of spine injury increased from 3.7% (1988) to 12.5% (2008). Of those patients admitted with a diagnosis of a spinal injury, the incidence of TBI rose from 9.1% (1988) to 15.9% (2008). The annual incidence of admission for a dual diagnosis of TBI and spine injury did not significantly differ between races.

Discussion and Conclusions

The annual incidence of TBI admissions has declined over the twenty-year study period, while the incidence of spinal injury has increased. TBI patients displayed a progressive increase in the incidence of spinal injury and those presenting with spinal injury showed an increasing co-occurrence of TBI. To our knowledge, this study represents the first demonstration of the rising incidence of co-occurrence of TBI and spinal injury in a large national patient cohort. The existing literature contains a paucity of contemporary data. Future investigations are required to develop protocols for the early diagnosis and management of this unique patient population and to identify the trends and variables predictive of the presence of a dual diagnosis. Furthermore, physicians must maintain a heightened sense of awareness to avoid missed diagnoses.