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Original Research

Pharmacologic Treatment for Depression at Injury Is Associated With Fewer Clinician Visits for Persistent Symptoms After Mild Traumatic Brain Injury: A Medical Record Review Study

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Abstract

Background: Depression and traumatic brain injury (TBI) substantially contribute to the US health care burden. Depression is a known risk factor for prolonged recovery after TBI. However, the effect of depression treatment on health care utilization has yet to be studied.
Objective: To examine whether an association exists between pharmacologic treatment of depression at the time of mild or concussive TBI and the number of subsequent clinician visits for persistent injury-related symptoms.
Design: Retrospective medical record review.
Setting: Tertiary care medical center.
Participants: A total of 120 patients (mean age 45.6 years) with a history of depression who subsequently experienced a mild or concussive TBI were included.
Methods: Individuals were identified with co-occurring diagnoses of depression and mild or concussive TBI by retrospective electronic medical record review. The diagnosis of depression must have preceded the diagnosis of TBI.
Main Outcome: The number of clinician visits for postinjury symptoms were counted at 3, 6, and 12 months postinjury.
Results: Clinician visits for persistent injury-related symptoms were significantly fewer at all 3 time points for the group treated for depression at time of injury.
Conclusions: Depressed individuals who were pharmacologically treated for depression at the time of TBI had significantly fewer clinician visits for persistent postinjury symptoms than those not pharmacologically treated for depression at the time of injury. Routine depression screening in patients with a high risk for TBI may identify a mood disorder that could contribute to persistent symptoms if left untreated, with its effective management potentially reducing health-related costs.
Level of Evidence: III

Introduction

Traumatic brain injury (TBI) and depression each have a tremendous impact on society, associated with estimated annual direct medical costs in the United States of $9.1 billion and $46.5 billion, respectively [1,2]. Mild and concussive TBI account for 92% of TBI events, and associated symptoms commonly resolve within a week to several months [3,4]. Depression has been linked to an increased risk for chronic symptoms after TBI, and their co-occurrence may lead to increased use of health care resources and poor health-related outcomes [5,6]. Recent systematic reviews have identified concussive TBI as posing a potential risk for developing mental health disorders [7], and mental health history has also been associated with worse outcome after concussive injury [8]. It could be anticipated that treatment of depression would mitigate its contribution to prolonged symptoms after TBI and be associated with a decrease in health care utilization. To test this hypothesis, we examined whether an association exists between pharmacologic treatment of depression at the time of mild or concussive TBI and the number of subsequent clinician visits for persistent injury-related symptoms.

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Methods

The study was approved by the Mayo Clinic Institutional Review Board.

Sample

The study sample was acquired using Mayo Clinic's Advanced Cohort Explorer (ACE) chart review program. The ACE is a rich clinical data repository maintained by a Unified Data Platform, an integrated set of technologies and core infrastructure for data management. This set of technologies is used for movement, integration, storage, and access of data. The ACE contains patient demographics, diagnoses, clinical notes, and hospital and laboratory flowsheets, which allows for identification of unique patients using specific keywords and identifiers. The Electronic Health Records of all Mayo Clinic patients who consented to have their records used for research purposes were searched for co-occurring diagnoses of depression and mild TBI or depression and concussive TBI during the period January 1, 2000, to June 10, 2015. Traumatic brain injury was defined as a traumatically induced injury that contributed to physiological disruption of brain function. Injury severity was classified using the Mayo classification system [9]. This system was designed to classify TBI severity across its full spectrum, using all relevant available positive evidence in the medical record to designate a case as follows: Definite (consistent with "moderate-severe") defined as death, or Glasgow Coma Scale score <13, or loss of consciousness ≥ 30 minutes, or duration of posttraumatic amnesia $\geq$ 24 hours; Probable (consistent with "mild") defined as Glasgow Coma Scale score ≥ 13, or loss of consciousness <30 minutes, or posttraumatic amnesia <24 hours, or isolated skull fracture; or Possible (consistent with "concussive") defined as TBI associated only with blurred vision, confusion (mental state changes), dazed, dizziness, focal neurologic symptoms, headache, or nausea. This classification system has been used extensively in the literature and has been shown to be more accurate than single indicator systems [9].

Cases of depression and either probable ("mild") or possible ("concussive") TBI were identified using specific ICD-9 codes and keywords listed in Table 1. This identified 5322 potential cases. The criteria listed in Table 2 were then applied to the sample, yielding 620 potential subjects. This sample was then separated into 2 groups: those receiving pharmacologic treatment for depression at the time of TBI and those not receiving pharmacologic treatment for depression at the time of TBI. Depression treatment was defined as any oral medication that is FDA approved for the treatment of depression. Further, the record must have explicitly stated that the indication for antidepressant therapy was current, active depression. The study sample was obtained by randomly selecting records from the 620 potential cases and confirming them by manual record review, until the desired sample size was achieved as determined by the effect size and power calculations. A total of 428 potential cases were manually reviewed to obtain the desired sample size of 120 cases, after rejecting cases not conforming to the inclusion and exclusion criteria.

Table 1
ICD-9 codes used in ACE for case identification

TBI	Depression
• Concussion (850, 850.0, 850.9, 850.1)	• Depression/depressed (311, 296, 296.2, 296.3, 293.83)
• TBI/traumatic brain injury (854, 854.01, 854.09, 854.19, V80.01)	
• Head injury (959.01)	
• Postconcussion syndrome (310.2)	

ACE = Advanced Cohort Explorer chart review program; TBI = traumatic brain injury.

Outcome

The outcome of interest was the number of clinician visits (physician, midlevel provider, neuropsychologist or psychologist, physical and occupational therapist) that each individual attended specifically for postinjury symptoms (ie, symptoms not present before the injury and described as injury-related in the clinician's note). The visits were counted by manual record review and are reported as cumulative from injury to 3 months, injury to 6 months, and injury to 12 months.

We also examined whether covariates of age, gender, mechanism of injury, injury severity, and education influenced the number of visits at each time point beyond treatment for depression.

Data Analysis

To achieve the desired effect size of 0.5, a sample size of 60 in each group was determined to have 80% power to detect a mean difference of 4 clinician visits ($\mu 1 = 5$, $\mu 2 = 9$), with the assumption that the common standard deviation is 8.000 visits using a 2-group *t*-test with a .05 significance level. Categorical variables were reported as frequency and percentage, and continuous variables were summarized as mean (standard deviation) and median (interquartile range, range). Categorical variables were compared between the groups with and without depression treatment using χ^2 test or Fisher exact test; continuous variables were compared using Wilcoxon rank-sum test. Multivariate Poisson regression models were used to evaluate the effect of treatment on number of visits at 3, 6, and 12 months, after adjusting for age, gender, mechanism of injury, injury severity classification, and education. All tests