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Outcomes in nursing home patients with traumatic brain injury

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ABSTRACT

Background: Traumatic brain injury is a leading cause of death and disability in the United States. In survivors, traumatic brain injury remains a leading contributor to long-term disability and results in many patients being admitted to skilled nursing facilities for postacute care. Despite this very large population of traumatic brain injury patients, very little is known about the long-term outcomes of traumatic brain injury survivors, including rates of discharge to home or risk of death in long-term nursing facilities. We hypothesized that patient demographics and functional status influence outcomes of patients with traumatic brain injury admitted to skilled nursing facilities.

Methods: We conducted a retrospective cohort study of Medicare fee-for-service beneficiaries aged 65 and older discharged alive and directly from hospital to a skilled nursing facility between 2011 and 2014 using the prospectively maintained Federal Minimum Data Set combined with Medicare claims data and the Centers for Medicare and Medicaid Services Vital Status files. Records were reviewed for demographic and clinical characteristics at admission to the skilled nursing facility, including age, sex, cognitive function, ability to communicate, and motor function. Activities of daily living were reassessed at discharge to calculate functional improvement. We used robust Poisson regression with skilled nursing facility fixed effects to calculate relative risks and 99% confidence intervals for mortality and functional improvement associated with the demographic and clinical characteristics present at admission. Linear regression was used to calculate adjusted mean duration of stay.

Results: Overall, 87,292 Medicare fee-for-service beneficiaries with traumatic brain injury were admitted to skilled nursing facilities. The mean age was 84 years, with 74% of patients older than age 80. Generally, older age, male sex, and poor cognitive or functional status at admission to a skilled nursing facility were associated with increased risk for poorer outcomes. Older patients (age ≥80 years) with traumatic brain injury had a 1.5 times greater risk of death within 30 days of admission compared with adults younger than 80 years (relative risk = 1.49, 99% confidence interval = 1.36, 1.64). Women were 37% less likely to die than men were (relative risk = 0.63, 99% confidence interval = 0.59, 0.68). The risk of death was greater for patients with poor cognitive function (relative risk = 2.55, 99% confidence interval = 2.32, 2.77), substantial motor impairment (relative risk = 2.44, 99% confidence interval = 2.16, 2.77), and patients with impairment in communication (relative risk = 2.58, 99% confidence interval = 2.32, 2.86) compared with those without the respective deficits. One year after admission, these risk factors continued to confer excess risk for mortality. Duration of stay was somewhat greater for older patients (30.1 compared with 27.5 average days) and patients with cognitive impairment (31.7 vs 27.5 average days). At discharge, patients with cognitive impairment (relative risk = 0.86, 99% confidence interval = 0.83, 0.88) and impairment in the ability to communicate (relative risk = 0.67, 99% confidence interval = 0.54, 0.82) were less likely to improve in physical function.

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Conclusion: Our results suggest that among patients with traumatic brain injury admitted to skilled nursing facilities, the likelihood of adverse outcomes varies significantly by key demographic and clinical characteristics. These findings may facilitate setting expectations among patients and families as well as providers when these patients are admitted to skilled nursing facilities for rehabilitation after their acute episode.

Introduction

In 2010, 2.5 million people suffered a traumatic brain injury (TBI) at a cost of $76.5 billion. TBI is a leading cause of death and disability in the United States, accounting for 30% of all trauma-related deaths. Despite the high rate of mortality, it is estimated that 5.3 million individuals are living with disabilities resulting from TBI.[1] Many of these patients suffer physical, emotional, cognitive, and behavioral disabilities that require treatment in postacute care facilities. The largest proportion of patients with TBI necessitating postacute care are discharged to skilled nursing facilities (SNFs).[2,3] Little, however, is known about the TBI population admitted to SNFs and their outcomes. As such, postacute care for patients with TBI in SNFs remains unstandardized with no evidence-based guidelines or treatment protocols. Before such treatment protocols can be established, however, an understanding of the population and their trajectory is needed to guide the development of treatment strategies.

The objective of this study was to describe the outcomes of patients with TBI who are admitted to SNFs for postacute care by key demographic and clinical characteristics. We hypothesized that within the population of TBI patients receiving postacute care, clinical and demographic characteristics, such as older age, male sex, and lower functional status at admission, confer excess risk for poor outcomes. Understanding this specific population and whether or not differences exist by readily available risk factors and assessed at admission to postacute care will assist in care planning, optimizing therapy (physical, occupational, psychological), and informing clinical expectations to families.

Methods

Data

Data for this study come from several sources (Medicare Claims [Part A] and Enrollment Records, Minimum Data Set [MDS] resident assessments). Medicare Claims data were used to identify all hospitalizations and discharges to SNF among Medicare fee-for-service beneficiaries. The Medicare enrollment records contain demographic information about each beneficiary ever entitled to Medicare including their date of death. The MDS is a federally mandated database that includes a comprehensive clinical assessment of individuals admitted to Medicare or Medicaid certified nursing facilities. The MDS contains items that measure physical, psychological, and psychosocial functioning and give a multidimensional view of the resident's functional capacities. These data are required to be collected at admission, quarterly, annually, at discharge, and whenever there is a substantial change in a resident's status.

Study population

The study was conducted on a cohort of hospitalized Medicare beneficiaries with an active diagnosis of TBI who were discharged directly to an SNF between January 1, 2011 and December 31, 2014. We excluded individuals who were <65 years of age and who had prior postacute SNF use within 1 year of the index hospitalization. TBI was identified if any one of the following *International Classification of Diseases, Ninth Revision* (ICD-9) codes was present on the hospitalization claim: 800–801.99, 803–804.99, 850–854.99, 310.2, 959.01, 907.0, 905.0, 873.0, 873.1.[1] This study was approved by the Institutional Review Board at Brown University.

Outcomes

We examined mortality at 30 days, 90 days, and 1 year after admission to an SNF. For residents who were discharged from the SNF, we assessed the duration of SNF stay and functional improvement during the SNF stay.

Functional improvement was measured using change in the 28-point Activities of Daily Living (ADL) Scale score[4] between admission and discharge assessments. The ADL score ranges from 0 (no impairment) to 28 (total dependence). Residents were considered to have improved in function if their discharge ADL score was less than their admission score. Because functional improvement may influence discharge, this data point was analyzed separately for patients with duration of stay less than 30 days.

Demographics and admission characteristics

The factors examined have been linked previously to outcomes of patients with TBI in other settings.[5-7] Specifically, we examined differences in outcomes by age, sex, cognitive function, communication ability, and motor function. Age and sex were obtained from the Medicare enrollment records. Cognitive function, communication ability, and motor function were derived from the MDS admission assessment. Cognitive function was captured with the Cognitive Function Scale (CFS),[8] derived from the Brief Interview for Mental Status and the Cognitive Performance Scale.[9] Scores ranges from 1 (cognitively intact) to 4 (severely impaired). We dichotomized this variable to indicate whether or not patients were cognitively intact (CFS = 1) versus impaired (CFS <1). Ability to communicate was determined by staff rating of the level to which patients were able to make themselves understood (verbally and nonverbally), such as through expression of ideas and wants. Patients were considered to have severe impairment in communication if they were rarely or never understood. Motor function was ascertained from the transferring ADL score: a rating of the patient's ability to move between surfaces (to or from) such as a bed, chair, wheelchair, or simply transition from sitting to standing. Patients were considered to have severe impairment in motor function if they were totally dependent on staff to transfer or transferring did not occur during the week of the assessment. Finally, we calculated the Deyo-Charlson Comorbidity Index from the diagnoses present on admission to the SNF as descriptors of patient acuity.[10,11]

Statistical analysis

Descriptive characteristics of the study population were summarized with standard measures, including means ± standard deviations, frequencies, and proportions. Using robust Poisson regression,[12] we calculated relative risks (RRs) for mortality and

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