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ORIGINAL ARTICLE

Cognition in Patients With Burn Injury in the Inpatient Rehabilitation Population

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Abstract

Objective: To analyze potential cognitive impairment in patients with burn injury in the inpatient rehabilitation population.

Design: Rehabilitation patients with burn injury were compared with the following impairment groups: spinal cord injury, amputation, polytrauma and multiple fractures, and hip replacement. Differences between the groups were calculated for each cognitive subscale item and total cognitive FIM. Patients with burn injury were compared with the other groups using a bivariate linear regression model. A multivariable linear regression model was used to determine whether differences in cognition existed after adjusting for covariates (eg, sociodemographic factors, facility factors, medical complications) based on previous studies.

Setting: Inpatient rehabilitation facilities.

Participants: Data from Uniform Data System for Medical Rehabilitation from 2002 to 2011 for adults with burn injury (N=5347) were compared with other rehabilitation populations (N=668,816).

Interventions: Not applicable.

Main Outcome Measures: Comparison of total cognitive FIM scores and subscales (memory, verbal comprehension, verbal expression, social interaction, problem solving) for patients with burn injury versus other rehabilitation populations.

Results: Adults with burn injuries had an average total cognitive FIM score ± SD of 26.8±7.0 compared with an average FIM score ± SD of 28.7±6.0 for the other groups combined ($P<.001$). The subscale with the greatest difference between those with burn injury and the other groups was memory (5.1±1.7 compared with 5.6±1.5, $P<.001$). These differences persisted after adjustment for covariates.

Conclusions: Adults with burn injury have worse cognitive FIM scores than other rehabilitation populations. Future research is needed to determine the impact of this comorbidity on patient outcomes and potential interventions for these deficits.

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Burn injury often leads to significant disability and burden of injury. In the United States, the annual incidence ranges from 1.25 to 2.5 million burn injuries, resulting in approximately 500,000 emergency department visits.[1] Since the early parts of the 20th century, care of patients with burn injuries has improved tremendously, resulting in increased survival after thermal injury.[2]

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This increase in survival has consequently led to other care needs, such as the need for inpatient rehabilitation, where a subset of these patients is transferred after discharge from acute care. These patients requiring transfer are often the more severely injured.

As the critically ill burn patient transitions to the rehabilitation phase of their recovery, certain problems and impairments become more evident. Extensive deconditioning, nutritional deficits, joint contractures, and impaired wound healing are common and often drive the care plan for burn rehabilitation after a typical critical care course for the extensively burn-injured patient.[3,4] Adverse effects of medications such as pain or sedative medications often need to be addressed during the rehabilitation phase. Other potential comorbidities and complications include electrolyte abnormalities, fluid and volume shifts, infection, and cognitive changes.[5] These comorbidities are important predictors of health care outcomes in the acute care setting and important for third-party payer reimbursement.[6]

In the burn injury population, 1 potential comorbidity that is often overlooked and underevaluated is cognitive impairment. Patients with burn injuries have many reasons for potential cognitive impairments including anoxia, toxic fume inhalation, and medical complications from the primary injury such as dehydration and electrolyte abnormalities, hypoperfusion secondary to volume depletion and shock, and use of centrally acting medications, among other potential assaults on cognitive function.

Cognition involves complex processes but clinically has encompassed 5 major domains for the rehabilitation setting. These 5 domains include memory, problem solving, social interaction, verbal expression, and verbal comprehension. These have important implications for health and quality-of-care outcomes, particularly in rehabilitation outcomes in many patient populations.[7] Lower cognition is associated with poorer outcomes in those with multiple trauma, orthopedic injuries, amputations, and joint replacements.[8-10] This issue of impaired cognition may be true for those with burn injuries as well. However, in patients with burn injury, cognition can often be overlooked in the evaluation and assessment of the patient because of the more obvious physical injuries and impairments.

In this study, we investigated whether patients with burn injury have differences in their cognition compared with other rehabilitation populations by using the cognitive FIM instrument, an instrument commonly used for the rehabilitation patient population. A finding of cognitive differences would affect current clinical practices for patients with burn injury.

Methods

Data source

Data are obtained from Uniform Data System for Medical Rehabilitation (UDSMR) from 2002 through 2011. The UDSMR is a repository for inpatient rehabilitation facility (IRF) functional outcome data using the FIM instrument. The Centers for Medicare and Medicaid Services requires IRFs to complete the IRF Patient Assessment Instrument for reimbursement. The IRF Patient Assessment Instrument contains demographic, social, medical, and functional data. UDSMR serves approximately 70% of all IRFs in the United States.[11]

List of abbreviations:

IRF	**inpatient rehabilitation facility**
TBSA	**total-burn surface area**
THA	**total hip arthroplasty**
UDSMR	**Uniform Data System for Medical Rehabilitation**

FIM instrument and measurement of cognition

The FIM instrument ("FIM") was developed to assess disability severity and outcomes of medical rehabilitation. It is a standardized instrument that assesses function by using 18 items categorized into 2 domains, motor and cognitive.[12] Reliability and validity of the FIM instrument have been reported previously by other members of our group.[13] Each domain has an ordinal scale assessing the level of assistance required by the patient for the specific tasks that are scored, with the scale ranging from 1 (requiring full assistance) to 7 (independent function).[14] The cognitive domain includes 5 items: memory, verbal comprehension, verbal expression, social interaction, and problem solving.[15,16] For this study, we focused on only the total cognitive FIM score and the individual domains.

Data collection

The inclusion criterion is a primary diagnosis of burn injury as indicated by the impairment code for the primary population of interest. To place the burn population in context within the rehabilitation population in general, we compared the burn population with other patients with a primary impairment code of spinal cord injury, amputation, polytrauma and multiple fractures, and total hip arthroplasty (THA). We chose these comparative populations because the leading impairment codes at rehabilitation facilities nationally correspond to these populations and reflect the general variety of patients at these facilities. These populations are different in many respects to the burn population, but each provides a different type of control. For example, those with polytrauma and multiple fractures have undergone a traumatic experience, something a burn patient most likely has undergone as well. A patient with a THA typically uses centrally active medications such as narcotics and pain medications, which can affect cognition.

Exclusion criteria are as follows: age <18 years, discharge against medical advice, death in the rehabilitation facility, and receiving treatement in a zero-onset facility. Zero-onset facilities are defined as facilities with more than 5% of cases admitted on onset day 0. Onset day is a variable computed by UDSMR and is defined as the number of days from injury to IRF admission.[17] Admission on onset day 0, essentially the day of injury, is clinically unexpected in the burn rehabilitation population.[18] Prior research when using this data set showed that the characteristics of the zero-onset facilities are not consistent with typical IRFs.[14] These facilities likely represent facility-specific practice or coding patterns that are not representative of the remainder of the inpatient burn rehabilitation population and therefore were excluded from this analysis.[18]

Correlates/predictors of rehabilitation outcomes for patients with burn injury

Variables include demographic and medical variables; these variables have been shown to be associated with outcomes in previous studies.[19] Demographic data include age, sex, race, marital status, preadmission employment status, preadmission living situation (alone or with others), and primary payer source (private pay, Medicare, Medicaid, other). Medical data include length of