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Clinical Study

Persistent hypoalbuminemia is a predictor of outcome in cervical spinal cord injury

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Abstract

BACKGROUND CONTEXT: Hypoalbuminemia is associated with increased morbidity and mortality in various clinical settings and several major diseases. Albumin has multiple physiologic properties that could be beneficial in central nervous system injury.

PURPOSE: We sought to determine if albumin is associated with patient outcome after cervical spinal cord injury by conducting a retrospective analysis.

STUDY DESIGN/SETTING: A retrospective study of cervical spinal cord injury (CSCI) patients was conducted to investigate if serum albumin levels and other characteristics influence outcome (mechanical ventilation and death).

PATIENT SAMPLE: A total of 178 consecutive patients were included in the present study.

OUTCOME MEASURES: Demographic data were recorded, including age, gender, smoking history, time from injury to admission, severity of neurologic injury, neurologic level of lesion, mechanism of neurologic injury, Glasgow Coma Score, vitals in the Orthopedic Department, the occurrence of early surgical intervention (48 hours after injury), and daily serum albumin levels.

METHODS: No funds were received in support of this work. No specific conflicts of interest were involved in this article. Serum albumin levels and other characteristics known to influence outcome were included in univariate statistical analyses and the multiple logistic regression model to analyze the relationship with mechanical ventilation and death after cervical injury.

RESULTS: Approximately 41.0% (73/178) of patients had complete spinal cord injury (ASIA A), 36.5% (65/178) of patients required mechanical ventilation, and 8.4% (15/178) of patients died within the first month after injury. Albumin remained lower than 30 g/L for a period of time (≥5 days) in patients with an unfavorable outcome (patients requiring mechanical ventilation or who had died). Multiple logistic regression analysis identified age (>50 years), persistent hypoalbuminemia (<30 g/L and ≥5 days), C5 and above neurologic injury, and ASIA A as predictors for mechanical ventilation. In addition, persistent hypoalbuminemia, ASIA A, and C4 and above neurologic injury were significantly associated with death.

CONCLUSION: Similar to the ASIA scale and neurologic level, persistent hypoalbuminemia seems to be an independent predictor of outcome in patients with CSCI. Thus, a randomized trial assessing albumin in the treatment of cervical spinal cord injury is warranted.

Keywords: Hypoalbuminemia (HA); Cervical spinal cord injury (CSCI); Albumin; Risk factor; Edema; Death

Introduction

Cervical spinal cord injury (CSCI) is one of the most common injuries that leads to a severe and disabling traumatic state, including motor and sensory dysfunction, sphincter disturbance, respiratory failure, and even death. In the United States, 11,000 patients with SCI require hospitalization every year [1]. Age, neurologic status, the occurrence of complete SCI, and Glasgow Coma Scale

FDA device/drug status: Not applicable.

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(GCS) have been shown to be independent predictors of mortality in patients with traumatic CSCI [2–4]. The American Spinal Injury Association (ASIA) grade and neurologic level are used to assess the severity of a CSCI and the prognosis of these patients. The ASIA classification system may be the same grade for different injury levels, and the same grade can be caused by various mechanisms, such as concussion, contusion, compression, or transection. Thus, the extent of these findings will influence the recovery of neurologic function and can lead to different prognoses of CSCI.

Hypoalbuminemia (HA) has long been reported to be an independent predictor of increased morbidity and mortality in major diseases and various clinical situations [5–7], but not in CSCIs. HA has been reported in patients with acute spinal cord injuries [8], which may due to malnutrition or leakage from the vascular system. It has also been shown to be a marker for poor prognosis for patients with chronic SCI due to inflammatory complications [9]. In patients with acute CSCI, it is critical to control secondary damage, and HA will influence both the central nervous system and other organs, which may aggravate edema of the spinal cord. However, it is currently unknown whether HA is linked to patient outcome, and therefore in this study we assessed the association between HA and clinical outcome after CSCI.

EVIDENCE & METHODS

Context
Hypoalbuminemia has been shown to be an important modulator of morbidity and mortality in a number of clinical conditions, including lower-limb amputation and spinal fusion. The role of low serum albumin in influencing outcomes following spinal cord injury, however, has not been well described.

Contribution
This study is a retrospective review of 178 consecutive patients who sustained spinal cord injury. Low serum albumin was noted in 60% of patients with ASIA A spinal cord injuries. Persistent hypoalbuminemia for periods of greater than five days was significantly associated with the need for mechanical ventilation and mortality.

Implications
This investigation is a level III study that presents some novel information regarding associations between the presence of low serum albumin and outcomes after spinal cord injury. As a retrospective work, however, this analysis is incapable of providing a causative link between hypoalbuminemia and the outcomes observed. There is clearly co-linearity between the extent of spinal cord injury and low serum albumin, and whether hypoalbuminemia was a pre-existing condition or a ramification of the spinal injury itself cannot be answered by this investigation. The authors correctly identify the need for future research in this area.

—The Editors

Materials and methods

Patients and data collection

The study was approved by the Shengjing Hospital ethics committee. The article does not contain information about medical device(s)/drug(s). No funds were received in support of this work. No specific conflicts of interest were involved in this manuscript. We retrospectively reviewed the charts of patients admitted to Shengjing Hospital of China Medical University who were diagnosed with acute CSCI from October 2007 to January 2012. During that period, 245 patients with acute CSCI were admitted to the hospital for treatment. Exclusion criteria included multiple traumas, direct chest trauma, severe medical disease, and a level of consciousness incompatible with a detailed neurologic examination. Patients were also not assessed if the chart had been destroyed or if no outcome measure was available after the first month of treatment. A total of 178 consecutive patients were included in the present study. The serum albumin level of these patients was recorded daily.

The treatment protocol was based on current management guidelines [10] that aim to reduce secondary damage to the spinal cord after CSCI, including adequate fixation, oxygen inhalation, and high-dose methylprednisolone within 8 hours after CSCI. Nasogastric feeding or parenteral nutrition was administered when clinically indicated to ensure nutritional intake each day. No patient received albumin during the study period.

Demographic data were recorded, including age, gender, smoking history, time from injury to admission, severity of neurologic injury, neurologic level of lesion, mechanism of neurologic injury, GCS score, vitals in the Orthopedic Department, the occurrence of early surgical intervention (48 hours after injury), and daily serum albumin levels. The severity of neurologic injury was defined according to the ASIA scale at admission as follows: no function (A); sensory only (B); some sensory and motor preservation, muscle grade less than 3 (C); useful motor function, muscle grade $\geq$3 (D); and normal (E). The neurologic level was determined as the most caudal segment of the spinal cord maintaining normal motor and sensory function on both sides of the body. The neurologic level for this analysis was stratified into the following five groups: C2–C3, C4, C5, C6, and C7–C8. The GCS was calculated by eye, verbal, and motor response and given the following scores: $\geq$13, correlates with a mild brain injury; 9–12, a moderate injury; and $\leq$8, a severe brain injury [11]. The mechanism of neurologic injury was identified on imaging (computed tomography [CT] and magnetic resonance imaging