Serum S100B Protein as an Outcome Prediction Tool in Emergency Department Patients with Traumatic Brain Injury

Travmatik Beyin Hasarı olan Acil Servis Hastalarında Sonucu Öngörme Aracı Olarak Serum S100B Protein

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SUMMARY

Objectives

Traumatic brain injury is a common cause of death and disability worldwide. Early recognition of patients with brain cellular damage allows for early rehabilitation and patient outcome improvement.

Methods

In this prospective study, the clinical conditions of patients with mild to moderate traumatic brain injury (TBI) were assessed, and patient serum S100B levels were measured. Patients were followed up one month later and evaluated for level of consciousness, presence or absence of post-traumatic headache, and daily activity performance (using the Barthel scale). Student's t-test and the chi-square test were used for data analysis, which was performed using SPSS software.

Results

The mean serum S100B value was significantly lower for patients with minor TBI than for patients with moderate TBI (23.1±14.2 ng/dl and 134.0±245.0 ng/dl, respectively). Patients with normal CT scans also had statistically significantly lower serum S100B levels than patients with abnormal CT findings. The mean S100B value was statistically significantly higher for patients with suspected diffused axonal injury (632.18±516.1 ng/dl) than for patients with other abnormal CT findings (p=0.000): 24.97±22.9 ng/dl in patients with normal CT results; 41.56±25.7 ng/dl in patients with skull bone fracture; 57.38 ±28.9 ng/dl in patients with intracranial hemorrhage; and 76.23±38.3 ng/dl in patients with fracture plus intracranial hemorrhage).

Conclusions

Serum S100B levels increase in patients with minor to moderate TBIs, especially in those with diffused axonal injury. However, serum S100B values cannot accurately predict one-month neuropsychological outcomes and performance.

Key words: Biomarker; head trauma; S100B protein; traumatic brain injury.

ÖZET

Amaç

Travmatik beyin travması dünya ölçeğinde olağan bir ölüm ve özürlülük nedenidir. Beyin hücre hasarı olan hastaların erkenden tanınması erkendsen rehabilitasyon ve hasta sonuçlarında iyileşmeye olanak tanır.

Gereç ve Yöntem

Bu prospektif çalışmada hafif-orta derecede travmatik beyin hasarı (TBH) olan hastaların klinik durumları değerlendirildi ve hastaların serum S100B düzeyleri ölçüldü. Hastalar bir ay sonra takip edildi, bilinç düzeyleri, travma sonrası baş ağrısı olup olmaması ve günlük aktivite performansı (Barthel ölçeğini kullanarak) açısından değerlendirildi. Veri analizinde SPSS yazılımı ile Student t-testi ve ki-kare testi kullanıldı.

Bulgular

Orta derecede TBH geçirmiş olanlara göre hafif derecede TBH geçirmiş hastalarda ortalama serum S100B değeri anlamlı derecede daha düşüktü (sırasıyla, 134,0±245,0 ng/dl ve 23,1±14,2 ng/dl). BT taramaları normal olmayan hastalara göre normal olanlarda serum S100B düzeyleri istatistiksel açıdan anlamlı derece daha düşüktü. Ortalama S100B değeri yaygın akson hasarından kuşkulanılan hastalarda (632,18±516,1 ng/dl) başka anormal BT bulguları olan hastalardan anlamlı derecede daha düşük idi (p=0.000). Normal BT sonuçları olan hastalarda, 24.97±22.9 ng/dl; kafatası kemiği kırıkları olanlarda 41.56±25.7 ng/dl; intrakraniyal kanaması olanlarda 57.38±28.9 ng/dl, kırıkla birlikte intrakraniyal kanaması olanlarda 76.23±38.3 ng/dl.

Sonuç

Hafif ve orta derecede TBH özellikle yaygın akson travması olanlarda serum S100B düzeyleri yükselmektedir. Ancak serum S100B değerleri 1 ay sonrasının nöropsikolojik sonuçları ve performansını doğru biçimde öngörememektedir.

Anahtar sözcükler: *Biyobelirteç; kafa travması; S100B proteini; travmatik beyin hasarı.*

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Introduction

Traumatic brain injury (TBI) is a common cause of death and disability worldwide. TBI is a public health priority because it is associated with extensive physical, psychological and social impacts and a high economic burden.[1] Some studies have demonstrated that more than 10-40% of patients with TBI are still disabled 6-12 months after trauma, including those with mild TBI and unremarkable neuroimaging findings. Although early recognition and proper management of patients with TBI may result in better rehabilitation and substantial outcome improvement, assessing different cellular and clinical aspects and effects of TBI is still less than optimal.[2-4]

S100B, a calcium binding protein highly expressed in astroglial cells of the brain and released in cerebrospinal fluid (CSF) and blood, can be measured by available immunoassay kits. Different studies have evaluated S100B as a biomarker for different brain injuries, such as stroke[5,6], bacterial meningitis[7], carbon monoxide poisoning[8] and TBI[9-12]. Some recent studies have also highlighted the complex release pattern of S100B and its potential role in brain tissue repair processes[13-17]

This prospective study evaluates the diagnostic and prognostic roles of serum S100B protein in emergency department (ED) patients with minor to moderate TBI.

Materials and Methods

Patients were enrolled conveniently between March and May 2012 at two teaching hospitals with a total annual census of 80,000 adult patients. The institutional ethics committee (Faculty of Medicine, Iran University of Medical Sciences) approved this prospective study, and informed consent was obtained from all patients.

Participants

Patients at least 18 years old with a clinical diagnosis of acute mild to moderate TBI were enrolled. Patients with a history of isolated head trauma and Glasgow Coma Scale (GCS) score between 9 and 15 who presented in the ED within the first six hours of their head injury were considered to have mild to moderate TBI. All clinical assessments, including GCS calculations, were performed by a research assistant who was a physician. The research assistant was blinded to other assessments results.

Patients with the following were excluded: severe TBI (GCS≤8); hemodynamic instability; body temperature greater than 38.5°C; concurrent trauma to any other organs; concurrent primary and secondary brain injury, including refractory severe hypoxia (arterial oxygen saturation <92% while receiving 100% oxygen), post-traumatic seizure, and skull bone fracture; and any other identified or suspected differential diagnosis for the patient's decreased level of consciousness, including alcohol abuse, drug abuse, substance abuse, drug toxicity, hypo/hyperglycemia, hypo/hypernatremia, endocrine disorder, or infection. Patients who did not undergo a head CT scan were also excluded.

Intervention

S100B assay: A blood sample was drawn from the peripheral veins within the first six hours of ED admission. The time of blood sample collection was recorded. Samples were centrifuged, and the serum was refrigerated at -20°C until analyzed.

Neuroimaging: Ten millimeter thick slices obtained using a GE VCT Lightspeed 64 multi-slice detector were interpreted by a board certified radiologist and confirmed by another consultant radiologist who was blinded to the first interpretation. Both radiologists were blinded to the clinical conditions and S100B results of the patients. All pathologic findings, including skull bone fracture and any type of intracranial hemorrhage (e.g. brain contusion, subdural/epidural intracranial hematoma), were reported as positive computed tomography findings.

Follow up: The patients were called by two blinded research assistant one month later. During follow-up, patients were evaluated for level of consciousness, presence or absence of post-traumatic headaches, and daily activity performance (using the Barthel scale) to determine if any significant intracranial complications had occurred (.i.e. complications requiring further neuroimaging).

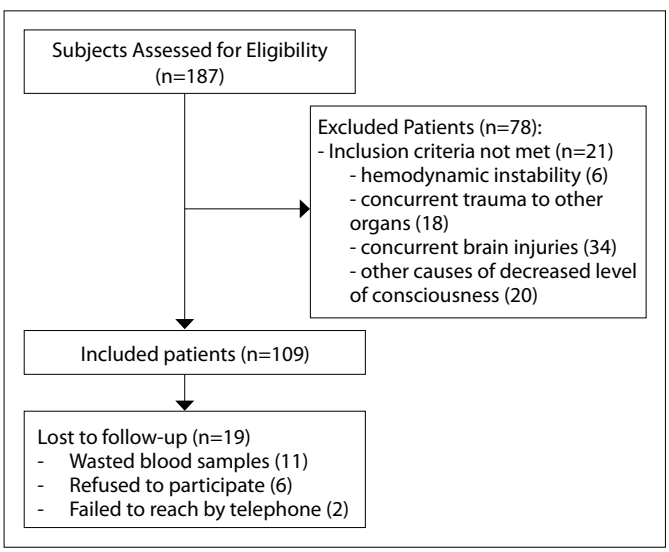

Figure 1. Participant flow over the course of the study.