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Evaluation of S-100B protein as Prognostic Marker in Head Injury Patients

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Abstract

Objective: The aim of study is to estimate S-100B protein level as a serum marker of brain cell damage after traumatic brain injury and to predict the clinical outcome and course of patients.

Method: Total twenty-six patients of head injury and ten healthy controls were included into study. All subjects were examined in detail and investigated by noncontrast-computed tomography. Head injury associated with other organ involvement was excluded from study. The venous blood was collected on day 0 (within 24 hours), day 3 and day 7. Their serum was stored at -70°C and S100 B were estimated using ELISA S-100B immunoassay kit.

Results: Patients, who survived, showed initially high level of S-100 B, which progressively decreased on day 3 and 7 while patients expired, showed progressively increased levels of S-100 B level with clinical deterioration.

Conclusion: S-100 B represents the new generation of biochemical markers of head injury. There was a significant association between S-100 B protein level and outcome and course of head injured patients.

Keywords: S-100 B, Head injury, Traumatic brain injury, Prognosis

Introduction

Astroglial S-100 is a promising serum marker. It has been investigated in recent years with respect to quality of hypoxic brain damage. S-100, a member of the large family of calcium-binding proteins, has a low molecular weight (10-12 kD), with biological half-life of about 113 minutes, and is highly conserved among vertebrates [1]. As clinical observation and diagnostic measures may fail to clearly predict neurologic and overall outcome, so the role of molecular marker as additional diagnostic tool has been brought into discussion. The clinical impact and the resulting implication of protein S-100 serum levels in different clinical settings such as in cardiac arrest but also in other non-cardiac arrest settings like brain trauma; stroke and cardiac surgery are very interesting.

S-100B has been investigated as a possible marker of brain injury in recent years. It is a calcium binding protein that is highly

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expressed in the astroglial cells of brain tissue. It is known to cross the blood-brain barrier in measurable quantity after head injuries, even those classified as mild [2, 3]. Raabe *et al*., found an inverse relation between serum S100-B level and outcome following severe head injury [4]. Ingebrigtsen et al found that patients with raised serum S-100B concentration following head injury required a longer period of inpatient observation [5] and Hermann et al showed that a raised serum S-100B concentration was associated with a worse neuropsychological outcome six months after head injury [6].

The aim of this study is to estimate S-100B protein level as serum marker of brain cell damage after traumatic brain injury and to analyze S-100B level as predictor in relation to clinical outcome and course of patients.

Patient and Method

The study was conducted at department of Neurosurgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi between 2010 to 2012. Total twenty-six patients of head injury who were admitted in casualty of Sir Sunderlal Hospital were included in the study and 10 healthy controls. All subjects underwent detailed history, clinical examination and laboratory investigations. Non-contrast computed tomography scan was done of all head injury patients. Patients with head injury due to birth trauma, anoxia, inflammatory, toxic, infectious or metabolic encephalopathies, ischemic or hemorrhagic stroke without associated trauma, patients with polytrauma and patients having cardiac co-morbidity were excluded from the study.

After resuscitation and clinical assessment, venous blood samples were drawn on day 0 (within 24 hours of head injury), day 3 and day 7 respectively. The serum was separated and stored at -70° C and later S-100B values were estimated using ELISA S-100 B immunoassay kit.

Statistical Analysis

The statistical analysis was done using SPSS for Window version 16.0 software. Chi-square test was used for non-continuous data. Student's t test was used for comparing two groups while one-way ANOVA test was adopted for multiple groups' comparison.

Results

Among the studied patients, nineteen (73.08%) were male and seven (26.92%) were female. Road traffic accident (53.85%) was most common cause of head injury followed by fall from height (26.92%). Mild head injury was in 26.92% while moderate and severe head injury was in 50% and 23.02% respectively. The half patients of severe head injury expired while it was 36.37% in moderate group. The mortality was 18.18% in mild head injury group. The comparison of S-100B protein in cases and controls depicted increasing trend with time as it was high on 7th day after head injury (Table 1). The mortality was very high in those patients who had high level of S-100B. (Table 2).

Discussion

Traumatic brain injury causes substantial disability and mortality. It may have profound physical, psychological, cognitive, emotional and social effects. The study was carried out in head injury patients admitted during last 3 years in the department of Neurosurgery, Institute of medical Sciences. Traumatic brain injury is a common health hazard with incidence of 16 million per year while it is 14 million in United State.

Table 1: Comparison of S-100B protein in patients and control at different time Interval

	Case (n=26)	Control (n=10)	t-value	p-value
Day 1	67.27 ± 23.44	45.75 ± 8.97	2.804	0.008
Day 3	86.64 ± 28.78	45.75±8.97	2.781	0.008
Day 7	129.08 ± 32.87	45.75±8.97	7.840	<0.001

Protein S-100B fulfills many criteria of an ideal molecular serum marker of brain damage in traumatic brain injuries. Our study showed the high sensitivity of S-100B of brain cell damage even when computed tomography scan was normal as in diffuse axonal injury. We observed it as an excellent prognostic and outcome marker. The patients with very high S-100B level died within 72 hours. These findings indicate that the secondary brain damage may occur at cellular level without being identified by current neuroimaging techniques. The fifteen patients who discharged from hospital showed initial high level of S-100B on day 1 with progressive decrease on day 3 which returned to near normal level on day 7.

Despite of utilizing modern techniques the physician feels difficulty in decision about the condition of patient and further management, the queries like degree of brain insult in diffuse axonal injury patients, severity of brain damage, outcome, response to treatment all can be solved by serial S-100 B estimation to some extent. The progression of pathology with secondary ongoing damage and the decision of repeat scanning can also be judged, and change of management from conservative to operative modality procedure can be predicted in time before irreversible state.

Table 2: Comparison of S-100B protein in final outcome (day 7)

	S-100B protein (pg/ml) (Mean±SD)	t-value	p-value
Improved (n=15)	57.84±6.87	76.42	<0.001
Expired (n=11)	216.87±4.55		

Serum concentration of S-100 B provides the clinical assessment of primary brain damage and has a predictive value for outcome after traumatic injury. S-100 B level below the cut of value can be safely ruled out the evidence of intracranial lesions [7]. Serum S-100B protein reflects about the severity of injury and prediction of outcome. It has a role in assessing the efficacy of treatment. [8]

Serum S-100 B is sensitive marker of brain injury, which correlates with severity of injury. S-100 B has a high negative predictive power as the finding of a normal S-100 B value shortly after trauma excludes significant brain injury with high accuracy. [9, 10]

Conclusions

Patients who survived, showed initially high level of S-100 B that progressively decreased on day 3 and day 7 while patients who expired, showed progressively increased levels of S-100 B level with clinical deterioration.

S-100 B represents the new generation of biochemical markers of brain injury. There was a significant association between S-100 B protein level and outcome and course of head injured patients.

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Authors' Contributions:

KS: Concept of study and final approval

SS: Concept and analysis of study, literature search and preparation of manuscript

DPT: Concept and design of study and drafting of article

AT: Estimation of S-100B protein

Conflict of Interest:

The authors declare that there are no conflicts of interests.

Ethical Considerations

The study was approved by the institute ethics committee.

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None Declared

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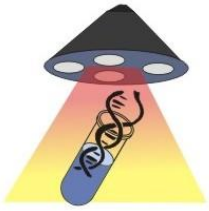

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