Case report

Do not trust in low serum level: protein S100B – a case report

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ABSTRACT

The introduction of the calcium-binding peptide protein S100B into traumatic brain injury diagnostics proves to be a potential screening alternative for patients who need a computed tomography (CT) scan. The current literature estimates that this biomarker could reduce unnecessary cranial CTs and the included hazards of ionization by about one third. Authors report the case of a young patient with an S100B serum level directly at the reference point after mild traumatic brain injury, who turned out to have a subdural hematoma, subarachnoid hemorrhage and a temporal skull fracture.

KEYWORDS: Protein S100B; traumatic brain injury; subdural hematoma; subarachnoid hemorrhage

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INTRODUCTION

Traumatic brain injuries (TBI) have been accounted with approximately 1.5 million cases per year in the United States. In comparison, their estimated incidence in Europe is 2.35-2.54 per 1000 each year (1). Hereof, mild traumatic brain injuries (MTBI) account for 95% (1, 2). Their clinical spectrum ranges from brief confusion up to transient focal neurological symptomatic. Although the majority of all MTBI cases is expected to recover, patients may suffer from prolonged neurological disabilities. The current diagnostic algorithm includes a precise neurological status followed by cerebral computed tomography (CCT) as the preferred radiologic choice (2). However, the use of computed tomography (CT) includes the potential hazards of ionizing radiation such as the slightly increased cancer risk (3). Recently, neurobiochemical markers for detection of TBI have been topic of interest in several clinical and laboratory trials. Here, Protein S100B has gained popularity due to its commercial availability and evaluability in serum samples. This has been stated to be a potential screening method for patients needing CCT. The authors report the case of a young patient with an S100B serum level directly at the reference point after MTBI, who turned out to have a subdural

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hematoma (SDH), subarachnoid hemorrhage (SH) and a temporal skull fracture.

CASE REPORT

A 23-year-old man presented in the emergency department of our level-I-trauma center immediately after he had hit his head on the ground of a swimming pool. The primary Glasgow Coma Scale (GCS) was 15 and the patient complained about headache, vertigo, and pain within chewing. The conducted skull X-Ray was without evidence of fractures. Due to the patient's young age the protein S-100B was controlled to exclude intracerebral hemorrhage. Here, the value was exactly at the reference point (0.105 µg/L). The patient was admitted for overnight due to his severe headache. On the next day, CCT was conducted since the patient complained about persisting headache symptomatic. This revealed a left sided, front lateral SH with a width of 5 mm and left sided front lateral-temporopolar SDH including a temporal skull fracture (Figures 1 & 2). A control CT three days after the primary examination did not result in deterioration of the primary results and therefore, the patients could be released four days after the trauma in good condition.

DISCUSSION

The introduction of protein S100B into TBI diagnostics has enabled a potential screen mechanism for patients who need a CT scan. The current literature estimates that this biomarker could reduce unnecessary CCTs and the included hazards of ionization by about one third (2). S100B is a calcium-binding peptide of low molecular weight (approximately 9-13 kD) (4-7). It mainly contributes to normal central nervous development and is further associated with several neurological diseases such as multiple sclerosis, amyotrophic lateral sclerosis, Alzheimer's among others (7). S100B is mainly found in astrocytes and Schwann cells (5, 7); however it has also extracerebral sources in adipocytes, chondrocytes or melanocytes. Its main targets are regulation of the cytoskeleton's structure as well as cell proliferation. Additionally, S100B can be detected in amniotic and cerebrospinal fluid, cord blood and urine beneath peripheral blood samples (7). Among its use in TBI diagnostics, the biomarker is used for follow-up of diverse cancer types such as histiocytoma, melanoma, or Schwannomas due to its occurrence in various peripheral cell types. Its use has also been extended to the investigation of post-traumatic courses. Heidari et al. (8) enrolled 176 patients in a prospective trial to identify potential risk factors for post-concussion syndrome following MTBI. Here, the S100B serum concentration six hours after trauma was a significant predictor for the outcome among others. Additionally, the protein has been proven to be diagnostic for complications following SAH, such as cerebral infarction or intracranial hypertension (7). Shakeri et al. (6) focused on Protein S100B's ability to predict brain death following severe TBI. Therefore, the authors surveyed the serum levels and CCTs of 72 patients with initial GCS below 8 and found the primary and last GCS as predictors of brain death and a significant correlation between GCS and S100B. Regarding standard serum level, Thelin and colleagues (2) concluded in their narrative review that the currently suggested threshold serum level of 0.10 µg/l would be a reasonable cut-off point. Undén and Romner (9) performed a meta-analysis concerning MTBI diagnostics including 12 articles and 2.466 patients. This showed a sensitivity of 97% for S100B in detection of CT-visible intracranial pathologies at the threshold of 0.10 µg/l. However, the authors stated that the serum sample must be gained six hours post trauma. Further, the marker is said to be not valid in patients with concomitant extracranial injuries since in such cases S100B could be released from the latter. This analysis is the main basis for the 2013 Scandinavian CT guidelines for mild and moderate TBI (2).

Further, Asadollahi et al. (10) found a sensitivity of 94.9% and a specificity of 35.4% for a cut-off point of 0.115 µg/L three hours post trauma. However, Cervellin and colleagues1 stated a sensitivity of 100% and specificity of 58% for a threshold of 0.38 µg/L at the same time interval. Varying values as seen in these examples may be traced back to different study populations. Interestingly, the serum level is increased in persons with darker skin, potentially because of higher melanocyte activity, which needs to be considered (2). A further possible reason for the varying thresholds may be differences in analytical techniques of S100B measurement.

Conflict of interest

The authors have no conflicts of interest relevant to this article.

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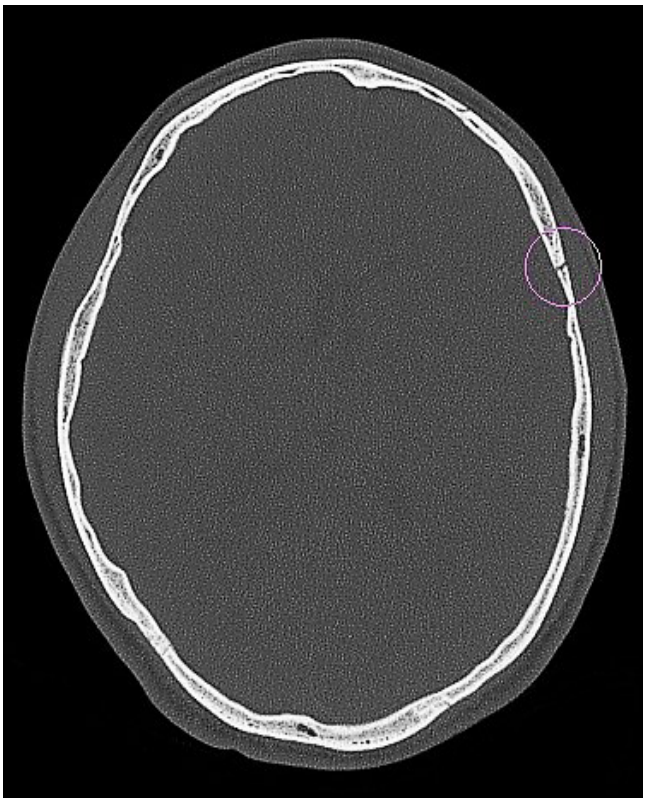

Figure 1. CT scan depicting the temporal skull fracture.

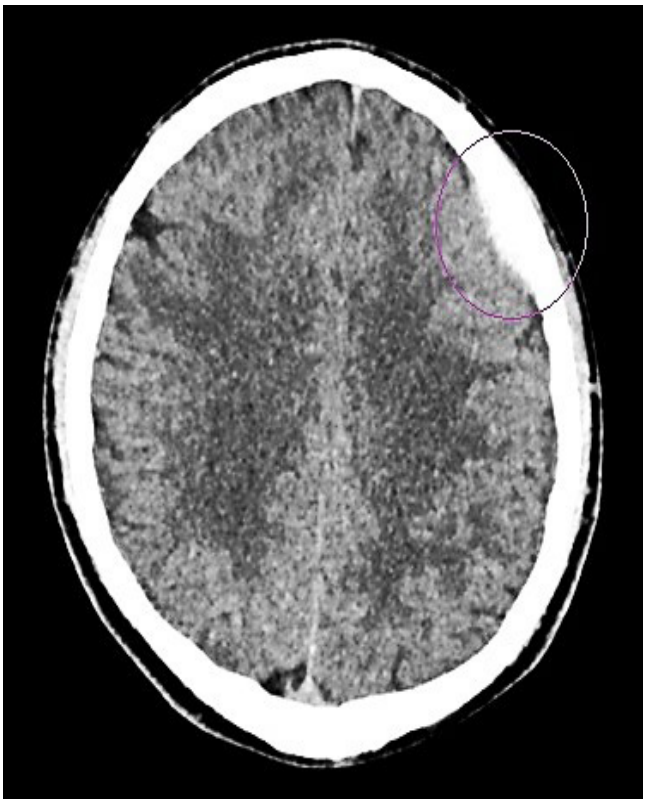

Figure 2. Left sided front lateral-temporopolar subdural hematoma.

Informed consent

Informed consent was obtained from the patient.

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