Investigation of Burnout Levels and Their Relationship with Serum S100B Levels in Emergency Department Staff

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Abstract

Background: Burnout syndrome is characterized by physical, emotional, and mental symptoms. This study aims to investigate the relationship between S100B protein levels and burnout syndrome and depression in emergency department staff.

Material and Methods: The study included nurses and paramedics working in the emergency department of our university hospital. Depression levels and burnout severity were assessed using the Beck Depression Inventory (BDI) and the Maslach Burnout Inventory (MBI) before shifts. Blood samples were collected before and after shifts to measure S100B levels. Results were compared with S100B levels, and data were analyzed using SPSS.

Results: The study included 29 nurses (65.9%) and 15 paramedics (34.1%). Participants had an average emotional exhaustion score of 27.2 ± 7.4 (median (IQ) = 28 (22.3-33.0)), depersonalization score of 11.3 ± 4.1 (median (IQ) = 11 (9.0-13.8)), and personal accomplishment deficiency score of 30.0 ± 6.4 (median (IQ) = 28.5 (25.0-35.8)). The average BDI score was 34.4 ± 8.0 (median (IQ) = 33.5 (29.0-36.8)). Pre-shift S100B levels were 77.0 ± 21.8 (median (IQ) = 72.4 (66.4-80.6)), while post-shift S100B levels were 113.0 ± 129.6 (median (IQ) = 72.5 (65.7-87.8)). A statistically significant increase in S100B levels was observed between pre- and post-shift (p = 0.046). However, there was no significant correlation between post-shift serum S100B levels and emotional exhaustion, depersonalization, personal accomplishment deficiency, or BDI scores (p > 0.05).

Conclusion: Although there is a significant change in S100B levels before and after shifts, S100B levels are not correlated with BDI scores and MBI dimensions. These findings suggest that while S100B may not be a long-term predictor of burnout and depression in emergency staff, it could be used to determine shift durations for effective management.

Keywords: Burnout, S100B, Emergency

Introduction

Burnout syndrome is a state of physical, emotional, and mental exhaustion caused by prolonged stress and overwork. It manifests through a range of symptoms, including chronic fatigue, decreased motivation, and emotional detachment from work and personal life (1) Key signs include persistent feelings of exhaustion, irritability, cynicism, and a sense of reduced personal accomplishment. Over time, individuals may experience difficulties in concentration, increased absenteeism, and strained relationships at work and home (1). To combat burnout, strategies such as stress management, fostering supportive work environments, and promoting work-life balance are essential. Prevention requires recognizing early signs and taking proactive steps to address stressors (1,3).

Beck to assess the severity of depression. Each item is scored on a scale of 0-3, with the total score indicating the level of depressive symptoms. The BDI is based on the cognitive approach, which posits that depression arises from cognitive distortions rather than external factors, evaluating both emotional (e.g., pessimism, guilt) and somatic (e.g., fatigue, sleep disturbances) symptoms. The scale was first published in 1961, with subsequent revisions in 1978 (BDI-1A) and 1996 (BDI-2). The inventory is designed to capture two key aspects of depression: emotional and physical symptoms. The BDI has been translated into multiple languages and is widely used globally for both screening and rapid diagnosis purposes (4).

S100B protein is a growth and differentiation factor secreted by astrocytes and oligodendrocytes. This protein can be easily detected as a parameter in human serum in cases of glial activation or injury (5). Some studies have shown that serum levels of S100B protein, a glial marker, are elevated in the depressive phase of patients with bipolar disorder. Successful depression treatments have been associated with a decrease in serum S100B protein levels (6,7).

The aim of this study is to determine the levels of burnout among non-emergency medicine resident emergency department staff and to investigate the relationship between

these levels and serum S100B protein levels. The findings of this study may assist in the early identification and intervention of burnout syndrome in healthcare workers

Materials and Methods

The study received ethical approval from the Bezmialem Vakıf University Ethics Committee. A list of emergency department staff was compiled, and the study's purpose was explained to potential participants. Those who agreed to participate formed the study group. The research was conducted from March to May 2016.

Inclusion Criteria: Volunteers willing to participate. Exclusion Criteria: Individuals who experienced significant psychological or physical trauma in the past month or had chronic illnesses were excluded.

The emergency department had two shift periods: 08:00-18:00 and 18:00-08:00. Non-physician emergency staff working the 18:00-08:00 shift were included. Blood samples were collected from volunteers before and after shifts to measure S100B protein levels. Samples were centrifuged and stored at -80°C until analysis. S100B levels were measured, and data were analyzed using SPSS 20.0 to investigate the correlation between burnout levels and protein levels.

Maslach Burnout Inventory (MBI): Developed by Maslach and Jackson (1981), this 22-item scale assesses burnout in three dimensions: emotional exhaustion (9 items), personal achievement (8 items), and depersonalization (5 items). Responses are rated on a 7-point scale from "Never" to "Always." The scale was adapted to a 5-point scale in Turkish by Ergin (1992).

Beck Depression Inventory (BDI): Developed by Beck (1961), this 21-item self-assessment scale measures depression severity across emotional, cognitive, and motivational dimensions. Responses are rated on a 4-point Likert scale, with scores ranging from 0 to 63. Validity and reliability in Turkish were established by Teğin (1980) and Hisli (1988, 1989), with a cutoff score of 17.

4Serum S100B Levels: Blood samples were collected from the antecubital vein using vacutainers. Samples were centrifuged at 3000 xg for 10 minutes, and the serum was stored at -30°C. On the day of analysis, serum samples were thawed to room temperature and analyzed using the Human S100B Elisa Kit (Biovendor) following the manufacturer's protocol. S100B levels were measured by ELISA and reported in pg/ml.

Statistical Methods: Descriptive statistics included mean, standard deviation, median, minimum, maximum, frequency, and percentage values. The Kolmogorov-Smirnov test assessed data distribution. Quantitative data were analyzed using Kruskal-Wallis and Mann-Whitney U tests, while the Wilcoxon test was used for repeated measures. Spearman correlation analysis was employed for correlation studies. SPSS 22.0 was used for all analyses.

Results

Emergency service workers (nurses and paramedics) participated in the study between March 1 and April 30, 2016 at the Emergency Department of Bezmialem Vakıf University Hospital. According to our hospital records, 33 nurses and 17 paramedics were actively working during the study period. 29 (% 65.9) nurses and 15 (% 34.1) paramedics participated in the study. The mean age of the emergency workers participating in the study was 27.8±7.9, and the median age was 25 (minimum 19, maximum 54). 31 (% 70.5) of the participants were female, and 13 (% 29.5) were male. The number of participating nurses was 29 (% 65.9), and the number of paramedics was 15 (% 34.1). The mean working hours in the emergency department was 3.7±3.1, and the median time was 3 (minimum 1, maximum 16). The marital status of the emergency service workers participating in the study was 18 (48.9%) married, 25 (54.8%) single. 1 (2.3%) widowed. 16 (36.4%) had recently taken annual leave and 28 (63.6%) had received a medical report. 10 (22.7%) of the workers had been exposed to both verbal and physical violence. 29 (65.9%) had only been exposed to verbal violence and 5 (11.4%) had not encountered any violence (Table 2). When asked how many more years they could work in the emergency service, 26 (59.1%) answered 5 years, 9 (20.5%) answered 10 years, 6 (13.6%) answered 20 years and 3 (6.8%) answered 15 years. Out-of-hospital activity was present in 22 (50%) and absent in 22 (50%) (Table 2). 17 (38.6%) of the participants were smoking. 24 (54.5%) did not use it regularly, 1 (2.3%) used antidepressants, 1 (2.3%) used cigarettes and alcohol, and 1 (2.3%) used cigarettes and anxiolytics together.

The participants had an average emotional exhaustion level of 27.2±7.4, depersonalization of 11.3±4.1, and a lack of personal accomplishment score of 30.0±6.4. According to the Beck Depression Inventory, 29.5% of the participants were moderately depressed, while 70.5% were found to be severely depressed (Table 1). In our study, serum S100B

Table 1: Burnout levels and Beck Depression levels

	Mean±s.s./n-%			Median	IQR		
Burnout							
Emotional Exhaustion	27.2	±	7.4	28.0	22.3	-	33.0
Lack of Personal Achievement	11.3	±	4.1	11.0	9.0	-	13.8
Depersonalization	30.0	±	6.4	28.5	25.0	-	35.8
Beck Depression Score	34.4	±	8.0	33.5	29.0	-	36.8
BDI 22-29	13		29.5%				
BDI ≥ 30	31		70.5%				

Abbreviations IQR=Interquartile range

Table 2: S100B levels before and after seizure

	Mean ± s.s.	Median	IQR	p
S100 B				
Before Watch	77.0 ± 21.8	72.4	66.4 -80.6	
After Seizure	113.0 ± 129.6	72.5	65.7 -87.8	0.046

Wilcoxon test *Abbreviations: IQR=Interquartile range*

levels of emergency department workers were measured before and after their shifts. The post-shift S100B level was significantly higher compared to the pre-shift level (p=0.046) (Table 2). There was no significant correlation between pre-shift serum S100B levels and emotional exhaustion, depersonalization, lack of personal accomplishment, or BDI score (p=0.624, p=0.827, p=0.946, p=0.833). Similarly, no significant correlation was found between post-shift serum S100B levels and these factors (p=0.633, p=0.218, p=0.694, p=0.538) (Table 3).

Table 3: Correlation of Participants' BDI and Burnout Levels with S100B Levels before and after Seizure

		Emotional Exhaustion	Burnout Lack of Personal Achievement	Depersonalization	Beck Depression Score
S100 B					
Before Watch	r	0.076	0.034	-0.010	-0.033
	p	0.624	0.827	0.946	0.833
After Seizure	r	-0.074	-0.189	0.061	-0.095
	p	0.633	0.218	0.694	0.538

Spearman Correlation

There was no significant correlation between emotional exhaustion scores and age, professional experience, or length of service (p=0.555, p=0.811, p=0.907). However, a significant negative correlation was found between the lack of personal accomplishment scores and age, professional experience, and length of service (p=0.018, p=0.022, p=0.026). Depersonalization scores were not correlated with age or length of service, but there was a significant positive correlation with professional experience (p=0.010).

Discussion

Burnout syndrome is a condition commonly seen in professions that involve frequent face-to-face interactions, where individuals feel emotionally drained, become desensitized to the people they interact with as part of their job, and experience a diminished sense of personal achievement (8,9). In its 1998 World Health Report, the World Health Organization (WHO) defined burnout as a state of extreme emotional exhaustion caused by overwork, leading to an inability to fulfill work and responsibilities. Over time, individuals may experience chronic fatigue, disengagement from their job, withdrawal, and an increasing sense of inadequacy.

Burnout is not listed in the International Classification of Diseases (ICD-10), and therefore, it is not officially recognized as a disease. Consequently, there is no specific diagnostic marker that definitively identifies burnout. In reality, nurses working in emergency departments and intensive care units have significantly higher average burnout levels compared to nurses working in other departments (9). If burnout is not recognized early, it can lead to a loss of productive labor, a decrease in quality of life, and potentially progress toward depression.

Research into the use of biological markers for detecting major depression has been ongoing for a long time. In the early 1990s, the dexamethasone suppression test emerged as the first significant breakthrough in this area. Although it was later found that this test could also be related to other conditions besides depression and that not all patients with depression showed suppression on the test, it remained an important marker. Subsequently, studies on BDNF (Brain-Derived Neurotrophic Factor) demonstrated that this marker could be useful for assessing both depression and response to treatment. Recently, the S100B protein has emerged as a promising biomarker for both depression and treatment response (10).

In a previous study conducted with emergency medicine residents at three separate university emergency departments, a strong correlation was found between S100B levels and Beck Depression Inventory (BDI) scores (11). However, in our study with emergency nurses and paramedics, no such correlation was observed. This may be attributed to the emergency medicine residents being concurrently involved in their education process, with a more intense workload and higher levels of responsibility.

Recent literature has seen an increasing number of studies discussing the potential use of S100B as a biomarker for acute depression in patients with major depressive disorder (12,13). S100B, a glial marker protein, has been found to increase during acute episodes of major depression and decrease with depression treatment (14). Therefore, fluctuations in serum S100B levels have been interpreted as an indicator of acute depressive episodes (15). Gulen et al. also demonstrated a correlation between serum S100B levels and depression. However, there are also studies reporting no relationship between S100B levels and the severity of depression (16). In our study, a weak significance was found between pre- and post-shift serum S100B levels, with levels rising after the shift. This result suggests that the long and intense 16-hour night shift did not have an acute effect on serum S100B levels.

Conclusion

Despite significant changes in S100B levels before and after shifts, these levels are not correlated with depression scores or burnout. These findings suggest that while S100B may not predict burnout and depression in emergency workers in the long term, it could potentially be used to determine the duration of night shifts for effective work.

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