Original Research

An Assessment of the Relationship Between the Beck Anxiety Inventory and Stress Hormones Among Intern Doctors in the Emergency Department

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ABSTRACT

Objective: We aimed to investigate the anxiety effect of working conditions on intern doctors in emergency department (ED), the severity of this effect according to the Beck Anxiety Inventory (BAI), and the hormonal factors involved in the etiology of anxiety.

Methods: A prospective analysis was conducted on a group of 74 intern doctors who completed training in the ED between May and October 2017. Participants were asked to complete the BAI form and have their blood samples taken at 07:00 a.m. during both the first and last night shifts. The blood samples have been utilized in the study of Adrenocorticotropic Hormone (ACTH), Atrial Natriuretic Peptide (ANP) and Cholecystokinin (CCK), hormones that have been found to have a strong correlation with stress levels. A comparison of hormone levels and BAI scores was conducted before and after the internship to assess any changes.

Results: The sample size for the study consisted of seventy-four interns, of which 47.3% (n=35) were identified as male. The average age was 25 +/- 2 years. No significant difference was detected in ACTH levels before and after the internship (p = 0.087), although the end-of-internship BAI score and ANP and CCK levels were found to be significantly higher in the entire group (p=0.001, p=0.001, p=0.048; respectively). While the post-internship BAI score and ANP levels were significantly higher in males (p=0.001, p=0.015, respectively), no significant difference was detected in the ACTH and CCK levels before and after the internship (p=0.128, p=0.077, respectively). While post-internship BAI score, ACTH and ANP levels were found to be significantly higher in female (p=0.001, p=0.026, p=0.001; respectively); No significant difference was detected in CCK levels (p = 0.155).

Conclusion: Emergency departments are places where stress and anxiety are intensely experienced. The post-internship hormone levels reveal a predominantly anxiolytic pattern (with no notable alteration in ACTH levels but a rise in ANP), while the elevated BAI score can be attributed to the subjective nature of this assessment tool. Identifying the hormones that increase or decrease in response to stress and conducting further research on treatment may be one method of coping with stress.

Keywords: Emergency Medicine, Intern Doctor, Stress, Anxiety, Beck Anxiety Inventory, Stress Hormones

INTRODUCTION

Stress refers to the body's response, both psychological and physical, to adapt to external stimuli, whether physical or psychological in nature [1,2]. Prolonged exposure to stress has been associated with the onset of multiple physiological and psychological disorders, such as depression, anxiety disorders, disordered sleep patterns, cardiovascular problems, and cancer. It has been observed that this matter can lead to manifestations such as ambivalence, self-distrust, worthlessness, pessimism, and intense outrage. Developing stress coping skills, especially at a young age, will be crucial in preventing many diseases [3,4]. The emotions of fear, worry, and curiosity can all be classified as anxiety. In broad scope, it may be described as a state of despondency and disquietude stemming from the dread or anticipation of calamity in the midst of a perilous circumstance [3,5]. Studies indicate that anxiety disorders are a frequent occurrence in children and teenagers [3,6]. It is of utmost importance to mention that issues pertaining to the department and security are prominent contributors to the heightened levels of anxiety observed in students [1,7].

Adrenocorticotropic Hormone (ACTH) is one of the most important stress hormones. It stimulates the synthesis of cortisol in the adrenal cortex [8]. Cortisol is a corticosteroid hormone and is secreted in response to stress. Serum cortisol level can vary depending on ACTH level, emotional stress and physiological stress sources (hypoglycemia, disease, fever, acute trauma, surgery, fear, pain, physical strain, etc.) [9,10]. Cholecystokinin (CCK) is a neuropeptide with strong anxiety-inducing properties, and it is commonly present in the central nervous system, particularly in the limbic system. It acts through CCK-A and CCK-B receptors. Even though CCK-A has a stronger influence on anxiety, CCK-B is considered to have a role in panic disorder [10-12]. Atrial Natriuretic Peptide (ANP) is widely found in atrial cells and is a peptide hormone released in response to atrial stretch [13]. It causes diuresis and natriuresis [13]. ANP is widely found in the body outside the atrium and is known to function as a neuropeptide in the nervous system [10,12]. In general, ANP suppresses the hypothalamo-pituitary-adrenal (HPA) system at almost every stage during stressful conditions. However, it has been suggested that ANP is not a general inhibitor of the HPA system, but a complex anti-stress mechanism that operates through the emotional aspects of stress [10,14].

The Beck Anxiety Scale (BAI) is a validated psychological test of the Likert type, commonly used internationally to measure anxiety severity and assess the frequency of anxiety symptoms [15,16].

The main goal of our investigation is to advance the current methods of stress management by analyzing the levels of anxiety and stress hormones in newly appointed intern doctors within the emergency setting.

MATERIALS AND METHODS

Study Design and Setting

The study was conducted prospectively at Gaziantep University Şahinbey Research and Application Hospital Emergency Department (ED) between 1 May 2017 and 31 October 2017.

Selection of participants

A total of 74 intern doctors, consisting of 9 groups, who worked as physician candidates in the ED for 2-month periods between these dates, and were included in the research. A pregnant woman and two male intern doctors receiving psychiatric treatment were not included in the study. Six Intern doctors refused to participate in the study.

Inclusion Criteria of the Research

- Be a volunteer,
- To be in a state of complete mental and physical well-being,
- As a physician candidate, working in the ED at Gaziantep University Şahinbey Research and Application Hospital.
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Exclusion Criteria of the Research

- To refuse being a volunteer.
- Condition of being pregnant or potentially pregnant
- Having a disease that affects ACTH and cortisol levels, such as a pituitary gland tumor or adrenal gland tumor, or using medication that affects ACTH and cortisol levels,

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Main Points

- The health of emergency workers is greatly impacted by stress and anxiety.

- The function of CCK in stress and anxiety remains uncertain, despite the known roles of ACTH and ANP in these conditions.

- Studies are needed to develop methods to deal with stress in emergency services.

- Having a disease that affects the ANP level, such as chronic renal failure, congestive heart failure, or using medication that affects the ANP level,
- Having a gastrointestinal system disease that will affect the CCK level or using medication that will affect the CCK level,
- Having a psychiatric illness such as severe anxiety disorder, active psychosis, or major depression,
- Using medications such as steroid, anxiolytic, sedative
- Having hormonal dysfunction.
- Having recently experienced any mental or physical trauma (death of a close relative, traffic accident, divorce, etc.) that may lead to emotional depression.

Method of Data Collection

A four cc blood sample was taken from the antecubital region of the arm that the person does not actively use, either right or left, around 07:00 in the morning during the night shifts, corresponding to the start and completion period of the ED internship. Two cc were equally distributed between the hemogram and biochemistry tubes. The blood in the tubes was centrifuged at 4000 rpm for 10 minutes and separated it into plasma and serum components, respectively. After the serum and plasma samples were placed in separate Eppendorf tubes and recorded, they were stored in the deep freezer at -80 oC in the Basic Medical Sciences Biochemistry Laboratory of Gaziantep University Faculty of Medicine until the study date.

Before and after the internship, intern doctors were asked to fill out the BAI simultaneously while blood samples were taken.

Measurements

ACTH was studied from plasma samples obtained by centrifuging blood in hemogram tubes. CCK and ANP were studied from serum samples obtained by centrifugation of blood in biochemistry tubes.

Plasma samples were taken from the deep freezer and allowed to reach to room temperature.

ACTH levels in plasma samples were measured using a human ELISA kit (SunRed, PRC). This examination works with the immunoassay competitive enzyme inhibition technique.

Serum samples were taken from the deep freezer and then allowed to reach to room temperature.

ANP levels in serum samples were measured using the human ELISA kit (SunRed, PRC). This kit utilizes the double antibody sandwich ELISA technique to quantify ANP serum levels.

CCK levels in plasma samples were measured using the human ELISA kit (SunRed, PRC). This examination works with the immunoassay competitive enzyme inhibition technique.

Definitions

The Beck Anxiety Inventory is a self-assessment scale with 21 items, and each item is scored between 0 and 3. Patients' anxiety levels are determined by the scores obtained from the scale. 0–7 points indicate low levels of anxiety, 8–15 points suggest mild anxiety, 16–25 points indicate medium anxiety, and 26–63 points indicate high levels of anxiety [15]. For blood parameters (e.g. CCK) and BAI, 'first' refers to the pre-internship values, and 'last' refers to the post-internship values.

Statistics

The statistical analysis was conducted using the SPSS 22.0 software package. The normal distribution suitability of numerical data was tested using the Shapiro-Wilk test. The Mann Whitney U test was used to compare variables that did not show normal distribution in two groups, and the Kruskel Wallis test was used to compare them in more than two groups. A Paired T test was used to compare normally distributed dependent variables, and a Wilcoxon test was used to compare non-normally distributed dependent variables. All data were expressed as mean ± standard deviation, and a P value of <0.05 was considered statistically significant.

RESULTS

A total of 74 intern doctors, 47.3% of whom (n=35) were male, were included in the study. The average age was 25+/- 2 years. At the end of the internship, Beck Anxiety Inventory scores were significantly higher in intern doctors (p=0.001).

No significant difference was detected between ACTH levels before and after the internship among the participants (p = 0.087). However, ANP and CCK levels were found to be significantly higher at the end of the internship (p = 0.001 and p = 0.048, respectively).

No significant difference was detected between the ACTH and CCK levels of male intern doctors before and after the internship (p=0.128 and p=0.077; respectively). However, ANP levels

were found to be significantly higher at the end of the internship (p=0.015).

ACTH and ANP levels of female intern doctors were found to be significantly higher at the end of the internship (p=0.026 and p=0.001; respectively), but no significant difference was detected between CCK levels before and after the internship (p=0.155). The pre-internship BAI scores of women were significantly higher than those of men (p=0.048). No significant difference was detected between genders in BAI scores after internship (p=0.124) (Table 1).

No significant difference was found in the pre-internship levels of ACTH, ANP, and CCK between genders (p=0.713 and p=0.066; p=0.110; respectively) (Table 2).

There was no significant difference in ACTH, ANP, and CCK levels between the genders after the internship (p=0.176, p=0.063 and p=0.141, respectively) (Table 3).

Table 1. The distribution of pre and post-internship Beck Anxiety Inventory scores by gender.

Beck Anxiety Inventory	Gender	N	Mean (pg/ml)	P*
Pre-Internship	Male	35	7,57 ± 8,06	0,048
	Female	39	10,05 ± 7,26	
Post Internship	Male	35	13,40 ± 9,52	0,124
	Female	39	15,71 ± 7,80	

P<0,05 significant.

Table 2. Distribution of Pre-Internship ACTH, ANP and CCK Levels among Gender

Hormone	Gender	N	Mean (pg/ml)	P*
CCK	Male	35	623,62 ± 136,82	0,110
	Female	39	572,99 ± 139,09	
ANP	Male	35	1939,87 ± 1086,69	0,066
	Female	39	2339,78 ± 737,85	
ACTH	Male	35	1695,98 ± 2442,03	0,713
	Female	39	2701,30 ± 4614,46	

P<0,05 significant. CCK: Cholecystokinin; ANP: Atrial natriüretik peptid; ACTH: Adrenocorticotropic Hormone

Tablo 3. Distribution of Post-Internship ACTH, ANP and CCK Levels among Gender

Hormone	Gender	N	Mean (pg/ml)	P*
CCK	Male	35	667,34 ± 221,54	0,141
	Female	39	602,09 ± 132,00	
ANP	Male	35	2836,58 ± 2393,35	0,063
	Female	39	3636,44 ± 2272,01	
ACTH	Male	35	2681,09 ± 4607,89	0,176
	Female	39	3539,66 ± 4873,93	

P<0,05 significant. CCK: Cholecystokinin; ANP: Atrial natriüretik peptid; ACTH: Adrenocorticotropic Hormone

DISCUSSION

An important aspect of stress physiology is regulated by hormones, such as ACTH, glucocorticoids, catecholamines, prolactin play a role in the stress response. Adrenal glands play a key role in hormonal responses to stress. The adrenal glands function on both the sympathetic nervous system and the HPA axis [9,17].

In a study showing that stress factors trigger the adrenal gland, leading to an increase in the release of glucocorticoids and/or catecholamines. It was stated that the increase in these hormones constitutes a front line of defense to protect the organism against stress conditions [17]. In a different study conducted on nurses working shifts, it was found that cortisol levels and anxiety frequency were significantly higher in those working at night compared to those working during the day. The research was conducted on nurses in the same age group, and it was stated that the higher cortisol and anxiety levels in night workers were not attributed to age differences [18]. In our study, we did not find a significant difference in the ACTH levels before the internship and at the end of the internship (p = 0.087). This result was not consistent with the literature. We believe this situation arises from the heightened activity of ANP, which suppresses the HPA pathway to reduce the anxiety experienced by intern doctors in the emergency department. The level of ACTH is significantly higher in female intern doctors after the internship compared to before. These differences could be due to the relationship between sex hormones, such as estrogen, and ACTH through the HPA pathway. We think that further research is needed to better explain this situation.

It is accepted that ANP functions as a neuropeptide in the nervous system [10,12]. It is stated that it suppresses the HPA system at almost every stage under stress conditions [10,14]. In two different studies conducted on patients with panic attacks, it was shown that ANP limits panic attacks and that high ANP levels during the attack are associated with low anxiety levels. It has been stated that ANP limits panic attacks by suppressing the HPA pathway and reducing the CCK4 level [19,20]. Studies on patients with predominantly heart-related issues have indicated that anxiety and depression symptoms decrease as the ANP level rises as a result of physical activity (exercise) [21,22]. It has been shown that the level of ANP is inversely proportional to depression and anxiety scores in patients with heart failure. Additionally, depression and anxiety scores decrease as the ANP level increases [23]. In another study on patients with congestive heart failure, the researchers used the HADS (Hospital Anxiety and Depression Scale) to measure anxiety levels. The study demonstrated that the HADS score decreased as the levels of ANP and Pro ANP increased [24]. In our study, we found that the levels of ANP in intern doctors were significantly higher after their internship than before (p=0.001). No statistically significant difference was detected between gender groups and the result was consistent with the literature. The response of ANP to stress factors can be better understood through additional studies. We believe these studies can help in identifying and treating stress. CCK is thought to play a role in panic attacks, a type of anxiety disorder. It has been demonstrated that CCK-B receptor agonists, like CCK4, trigger panic attacks, while CCK-B receptor antagonists produce anxiolytic effects [10,11,28]. Peptides such as CRF, leptin, orexin, neuropeptide y and CCK have been found to impact both nutrition and the stress response [25,26]. CCK receptors are mainly found in the mesolimbic structures, hypothalamus, and brainstem nuclei in the brain. Dopamine, glutamate, serotonin, and neuropeptides interact with these receptors. It has been demonstrated that CCK receptors in the raphe nucleus control the impact of serotonin, and it has been proposed that CCK receptors could be utilized in the additional treatment of schizophrenia and mood disorders [27]. It has been shown that CCK4 induces panic attacks by acting on GABA-A receptors in patients with panic attacks [28]. In our study, we found that CCK levels in intern doctors at the end of the internship were significantly higher than before the internship. We did not detect any difference between genders. This result, which is supported by the literature, may have a positive effect on determining the anxiety state.

The study results might have been different if it had been carried out at different centers with different intern doctors, since the results could vary based on the participants' personality traits.

CONCLUSION

While the hormone levels measured after the internship show a rather anxiolytic picture (no change in ACTH level, increased ANP). The higher BAI score after the internship can be explained by the fact that BAI is a subjective evaluation. The role of CCK in anxiety is still controversial. While CCK B receptor agonists such as CCK 4 have an anxiety-increasing effect, CCK B receptor antagonists have an anxiolytic effect. In our study, CCK levels after the internship were found to be significantly higher than before the internship.

Identifying the hormones that increase or decrease during stressful circumstances, as well as conducting further research on treatment for this subject, may be one of the most important stages in developing coping methods for stress. It is clear that more detailed research is needed for all three hormones.

Availability of Data and Materials: Submitted work is original and has not been published elsewhere in any language.

Informed Consent: Written consent was obtained from all intern doctors included in the study.

Competing Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship and/ or publication of this article.

Ethical Approval: Before the study, we obtained approval from the Gaziantep University Faculty of Medicine Ethics Committee (Ethics committee decision no: 2017/162, date: 26.04.2017).

Human Rights

The study protocol was conducted in accordance with the Declaration of Helsinki.

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