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The Influence of Serum Cortisol Level Onto Perceptive Experience of Optimism in Patients with Newly Diagnosed Cancer

Mladenka Vukojevic¹, Arta Dodaj², Kristina Galic³, Inga Marijanovic⁴

¹Faculty of Medicine, University of Mostar, Mostar, Bosnia and Herzegovina

²Faculty of Philosophy, University of Mostar, Mostar, Bosnia and Herzegovina

³University Clinical Hospital Mostar, Department of Pulmonary Diseases and Tuberculosis, Mostar, Bosnia and Herzegovina

⁴University Clinical Hospital Mostar, Department of Oncology, Bosnia and Herzegovina

Corresponding author: Mladenka Vukojevic, PhD. Mostar University School of Medicine, Bijeli Brijeg bb, 88 000 Mostar, Bosnia and Herzegovina. E-mail: mladenka.vukojevic@gmail.com

ABSTRACT

The aim: The aim of this study is to investigate the correlation between the morning level of serum cortisol and perceptive experience of optimism in a selected group of 60 patients with newly diagnosed cancer who were treated at Mostar University Clinical Hospital during a one-month period. **Patients and methods:** The morning level of serum cortisol was measured in all patients following the verification of oncological disease. The patients also filled out a questionnaire of socio-demographic data, as well as the scales for optimism/pessimism assessment. **Results:** The average morning serum cortisol level was within the reference values in the majority of patients, independently of their perceptive experience of optimism/pessimism. There was no significant difference in the morning level of serum cortisol among the subgroups of patients high and low on the scale of optimism, as well as the scale of pessimism. No correlation existed between the serum cortisol morning level and expressed optimism/pessimism, as well. The great majority of respondents had secondary and lower education, was retired or unemployed, and suffered lower socio-economic conditions of life. Therefore, their access to medical information and their knowledge of cancer modern treatment options and possibilities were restricted, what may also have an influence onto perceptive experience of optimism/pessimism. **Conclusion:** The results concerned with the perceptive experience of optimism/pessimism assessment were not a consequence of stress reaction but they were more correlated to general personal characteristics, the level of education, and socio-economic status of patients. The results do not confirm the impact of morning serum cortisol level onto physiological reactions to stressful conditions and situations in selected group of patients with de novo carcinoma.

Key words: serum cortisol; optimism; pessimism; denovo cancer; socio-demographic status.

1. INTRODUCTION

The etiology and progression of various diseases are not necessarily influenced by biological factors only. For their understanding it is important to consider the complex interaction of physiological, psychological, behavioral, and social factors.

The most accepted model of the disease is the biopsychosocial model, which distinguishes three groups of factors important for the devel-

opment of a disease, such as biological, psychosocial and behavioral factors (1). Their interaction results in the susceptibility or resistance to disease, as well as in the appearance and/or progression of the disease.

According to this model, the biological factors are the following: heritage, gender, age, exposure to toxins and injury. Psychosocial factors are related to the way of interpretation and reaction to life events

and stressors. This involves personality traits, different moods, social relationships and coping with stress. Behavioral factors reflect the lifestyle, including physical activity, and various habits such as alcohol drinking, cigarette smoking and drug use, as well as sexual behavior.

The interaction of these three groups of factors in the etiology and progression of the disease takes place over an activation of a series of neuroendocrine and immune mechanisms. One of the components of this complex interaction may be the stress which is correlated to hereditary disposition for the disease manifestation. It is well known that stress is responsible for weakening the body defense mechanisms, especially the immune and endocrine systems.

Malignant disease bears a major impact on the patients' mental status due to the gravity of such a condition. A newly discovered malignant disease, as well as coping with such a situation is especially stressful acute event for patients responding through a repetitive activation mechanism, including deregulation of the hypothalamic-pituitary-adrenal axis (HPA) that has an adverse health consequence. More specifically, the entire neuroendocrine response to stress is interconnected to the excessive release of various hormones such are the pituitary vasopressin and growth hormone, glucocorticoids, the thyroid hormones, and pancreatic glucagon (2).

Obvious sign of the endocrine system deregulation as a response to stress, is the change in circadian rhythm of serum cortisol production. In healthy individuals the level of serum cortisol is usually the highest in the morning before waking up and gradually lowered during the day. However, about 70% of patients with newly diagnosed cancer shows flattened circadian cortisol profile, as well as consistently high levels or irregular fluctuations in serum cortisol (3).

The effect of stress onto immune and neuroendocrine system is mediated by a number of psychosocial factors. Recently, it is observed that optimism is a psychosocial factor of particular importance in the response to stress (4), having a direct positive impact on psychological and physical health (5-9). It is associated with a lower incidence of depression and anxiety, better functioning of the cardiovascular system, slower progression of the disease, and improved survival of the malignant disease, as well (5-9). In general, optimists tend to use active strategies aimed at coping with the stress, while pessimists use adverse coping strategies (10). Therefore, one may assume that optimism improves health condition by activating the immune system which allows better psychophysiological adaptation of the body (11). Results of the study investigating the influence of optimism onto the immune system have shown that optimists possess various indicators of cellular immunity (increased proliferation of lymphocytes, enhanced local immune reactions) (5, 12). Therefore, it seems that the serum level of stress hormone—cortisol is relatively lower in optimistic person in comparison to the pessimistic one due to the former more successful coping with the stress (13), what probably contribute to a better functioning of the immune system.

However, previous studies have not taken into account the impact of serum cortisol level to perceptive experience of optimism in persons coping with stressful situations caused by awareness of recently diagnosed malignant disease.

The aim of this study is to investigate the correlation between the morning level of serum cortisol and perceptive experience of optimism in a selected group of patients with newly diagnosed cancer.

2. PATIENTS AND METHODS

The study was conducted on a cohort of patients with recently histologically verified diagnosis of malignant diseases of different organs and organic systems, which have responded to call for examination at the outpatient Department of Oncology, Clinical University Hospital Mostar during the one-month period (December 2014)

The study included 60 patients with newly established diagnosis of cancer (30 males and 30 females) in whom a malignant metastatic disease was found by different diagnostic methods. All participants agreed to participate in the study and signed a letter of informed consent. After confirmation of the diagnosis, patients were given a questionnaire consisting of socio-demographic questionnaire, and a scale for assessing optimism/pessimism. In all the morning cortisol level was measured and analyzed

During the study all patients were treated with corticosteroid therapy and spironolactone.

Those suffering from Chushing's or Addison's disease, as well as those with incompletely or incorrectly fulfilled questionnaires were excluded from the study.

We assumed that the awareness of newly diagnosed cancer is a possible stress inducer for the patient, and as such may increase the level of serum cortisol. At the same time, the assumption of that awareness may also well affect the perceptive experience of optimism/pessimism in every individual patient.

2.1. Measuring instruments

A sociodemographic questionnaire contained demographic and general information of gender and age, the level of education, marital status, employment and economic status was used.

To test the level of optimism/pessimism the Croatian version of Scales of optimism and pessimism was applied containing 14 particles divided into two charts (15). Six particles contained the scale for optimism assessment, while 8 contained the scale for pessimism. Each patient was asked to estimate the extent to which each particular statement was appropriate on a Likert type scale of five degrees. The scale showed satisfactory reliability on a range from 0.74 to 0.77 for the scale of optimism and from 0.78 to 0.83 for the scale of pessimism.

To determine the level of morning serum cortisol a fluorometric method utilizing Delfia Cortisol fluoroimmunoassay was applied (16), using LKB Wallace 1230 Arcus fluorometer measuring device. The measurement method was based on a competitive antigen-antibody reaction between cortisol highlighted by fluorescing europium and cortisol aimed at places of specific monoclonal an-

tibodies derived from mice. The measured fluorescence was inversely proportional to the level of serum cortisol in the samples of subjects.

In all patients serum cortisol level was measured in the morning, between 7 and 10 a.m. To determine if the level of morning serum cortisol have any influence on patient's subjective experience of optimism, respondents were divided into two subgroups. Subjects whose result on the scale of optimism was greater than +0.60 were allocated to a subgroup of highly optimistic (M = 4.64; SD = 0.20), while those whose result exceeded -0.60 were allocated to a subgroup of low-optimistic patients (M = 3.38; SD = 0.30). The same method was applied to test the differences in the level of morning serum cortisol between the two subgroups of pessimistic patients. Those whose result on the scale of pessimism was greater than +0.60 were assigned to the subgroup of highly pessimistic (M = 3.67; SD = 0.23), while those whose result exceeded -0.60 were assigned to the subgroup low-pessimistic patients (M = 2.22; SD = 0.28).

2.2. Statistical data processing

Confidence interval (CI) was greater than 95%. The Mann-Whitney U test was used for comparison of continuous variables due to the small sample size. The Spearman coefficient of correlation was used as a measure of correlation. The level of statistical significance was set at p<0.05.

A software system SPSS for Windows (version 13.0, SPSS Inc., Chicago, Illinois, USA) was used for statistical data analysis.

3. RESULTS

The study group consisted of a sample of 60 patients, including 30 males and 30 females, aged 49-88 years (M = 62.68; SD = 8.67).

In the entire sample, 20 (33.33%) patients completed primary school, 25 (41.66%) had a high school level of education, and 15 (25%) were college or university educated. (Table 1). Values of morning serum cortisol level were in the range between 5.80 and 698.50 (MDN = 242.85; Q1-Q3 = 83.75 to 372.45). There were within proper range in 36 patients (60.00%), were increased in

Variable	N (%)	
The overall group	60 (100%)	
Female	30 (50%)	
Male	30 (50%)	
Age	49-59 years	26 (43.33%)
	60-69 years	21 (35%)
	70-79 years	10 (16.66%)
	≥80 years	3 (5%)
Marital status	Marrtied	52 (86.66%)
	Single	8 (13.33%)
Emoloyment status	Employed	12 (20%)
	Unemployed	16 (26.66%)
	Retiree	32 (53.33%)
Education	Primary school	20 (33.33%)
	Secondary school	25 (41.66%)
	College or university decree	15 (25.00%)

Table 1. Basic demographic data (N = 60)

one (1.66%), and decreased in 23 patients (38.33%). (Table 2).

The average value of morning serum cortisol level in the subgroup of optimistic patients was within the proper range (MDN = 262.00; Q1-Q3 = 197.50 to 376.00), as well as in the group of pessimistic ones (Mares = 217.10; Q1-Q3 = 74.00 to 330.40).

There was no statistically significant difference in the level of morning serum cortisol between optimistic and pessimistic subgroup of patients (Z = -0.89; p = 0.37) (Figure 1).

There was no statistically significant correlation between the level of morning serum cortisol and expressed optimism (r = 0.09; p> 0.05), as well as between the level of morning serum cortisol and expressed pessimism (r = 0.12; p>0.05) (Figure 1).

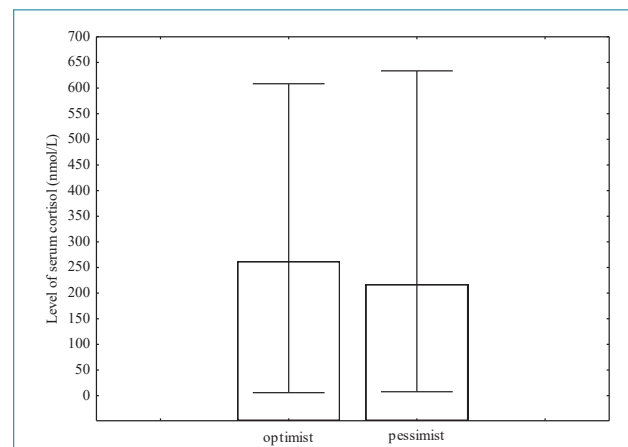


Figure 1. Level of morning serum cortisol in subgroups of optimistic and pessimistic patients

4. DISCUSSION

The aim of this study was to determine the relationship between the level of morning serum cortisol and perceived experience of optimism/pessimism in selected group of patients with de novo diagnosed cancer treated at the University Clinical Hospital Mostar during the one-month period.

The expectation of good or bad events to happen in the future is the simplest definition of optimism or pessimism (17). Perceived experience of optimism and pessimism are the two ends of one continuum. They are not clearly separated as a constant (e.g. a person may be optimistic in terms of job promotion, but pessimistic about getting married). Only a small number of persons show a systematic tendency to adhere onto one of the extremes of either optimism or pessimism. However, there are certain life events influencing a person to incline to a higher level of one of the perceived experience extremes.

Our findings point out to the fact that the majority of patients did not emotionally react to stressful awareness

The serum cortisol level	Number of patients (%)
Proper levels (171-536 nmol/L)	36 (60.00%)
Elevated levels (>536 nmol/L)	1 (1.66%)
Reduced levels (>171 nmol/L)	23 (38.33%)

Table 2. Level of morning serum cortisol

about the newly diagnosed cancer, since in most of them (60%) the level of morning serum cortisol as an objective indicator of reaction to a stressful event, was not increased (Table 2).

Results of previous studies have shown that increased levels of serum cortisol are associated with a reduced resistance to infection and deranged immune system what may well contribute to stressful reaction (18, 19). It is characterized by cytokines over secretion contributing to inflammatory processes (21, 22). Such a reaction is also characterized by increased activity of adrenal gland secreting cortisol in large quantities which consequently enhances the secretion of cytokines. Therefore, it is to expect that perceived expression of optimism affecting the immune response may reduce the stress. However, our results do not support this, since the increased values of morning serum cortisol, as a possible indicator of respond to a stressful event, were not observed in the majority of patients in our series. Additionally, no statistically significant correlation between the level of morning serum cortisol and perceived expression of optimism/pessimism was recorded ($p>0.05$) (Table 2, Figure 1). Hence, most patients in our series did not react to the stress event by changing their mood. The possible explanation of this could be the fact that the study was conducted on a sample of patients with de novo discovered cancer who had not previously been exposed to the treatment of malignant disease or had not a metastatic disease (e.g. brain metastases may affect the behavior and psychological status). Consequently, such patients had not been exhausted and frustrated by illness yet, and were just initially confronted with the awareness of newly discovered disease. Therefore, the impact of past experience and the environment were excluded as possible stressors in such patients (23). This group of patients had not been confronted by the extreme conditions of the prolonged disease that may well affected their mental status and provoke a stressful reaction (24-27).

Our results partially support the affective model of correlation between stress and physiological changes (13). According to this model, optimistic mood is beneficial for the body only when the attempt to cope with stressful situations results in positive outcome. On contrary, in a case of failure to meet expectations (i.e., solution to problem), optimism can lead to a negative effect having an impact on the overall condition of the body consequently.

Our results can also be regarded through the fact that containing the disease usually requires compliance between the perception of optimism and pessimism. Results of previous studies dealing with the perception of optimism/pessimism in cancer patients show a greater perceived level of optimism before the start of chemotherapy and increased perceived level of pessimism after chemotherapy in most patients (28, 29).

Regarding the level of education, most of the sample consisted of patients with secondary school (41.66%), followed by those with primary school completed (33.33%).

There was only one with a college or university degree in our series. Regarding the employment status, the vast majority of patients were those retired and unemployed (79.99%) (Table 1). Accordingly, most of them were of lower socioeconomic status and level of education, and their access to medical information or knowledge about the modern possibilities of cancer treatment was notably limited, which may have well affected their perception of the experience of optimism/pessimism (20).

Having that in mind, we would like to underline that our results considering the assessment of perceived experience of optimism/pessimism in regard to a stressful event were ambivalent and dichotomized. Therefore, we can conclude that the perceived experience of optimism/pessimism was not necessarily affected by a stressful event, but was most likely related to personal character, as well as the patients' level of education and socio-economic status.

During the study certain methodological limitations became apparent primarily stemming from its retrospective character, relatively small number of patients and short period of research. Only the patients with newly diagnosed cancers were analyzed what may also present a certain methodological limitation of the study. Therefore, future research should take into consideration patients exposed to the consequences of malignant disease long duration having in mind the potential impact of therapeutic response to neuroendocrine changes caused by such a disease.

The sample of patients of both genders was analyzed when assessing hormonal influence to perceived expression of optimism/pessimist. That may also present the study bias. Methodologically, it would be more appropriate to analyze one gender only, bearing in mind that different sex hormones, as a test variables, may have different effects on the immune system function affecting physiological changes.

5. CONCLUSION

The study results did not confirm the effect of psychological status and the influence of physiological reaction to stressful condition, neither the impact of the level of cortisol to the perceived experience of optimism in selected groups of patients with newly diagnosed cancer. The results concerned with the perceptive experience of optimism/pessimism assessment were not a consequence of stress reaction but they were more correlated to general personal characteristics, the level of education, and socio-economic status of patients. The results do not confirm the impact of morning serum cortisol level onto physiological reactions to stressful conditions and situations in selected group of patients with de novo carcinoma.

For further study it would be necessary to conduct a prospective research on a larger sample during a longer period.

CONFLICT OF INTEREST: NONE DECLARED.

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