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CLINICAL RESEARCH

Adrenocorticotropic Hormone and Cortisol Secretion Changes among the Law Enforcement Personnel during the Mission to the Areas of Armed Conflicts

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Abstract

The adrenocorticotropic hormone and cortisol changes among law enforcement personnel during mission to the areas of armed conflicts were studied. At the beginning of the mission an increase of all hormones was detected, which corresponded to basic points of general adaptation syndrome theory. A further investigation revealed an imbalance of hormonal secretions in the hypophysis-adrenal system. Such an imbalance can lead to disregulation of interhormonal relations and can be a factor in decreasing the organism's stress resistance.

Keywords: *armed conflict; law enforcement personnel; adrenocorticotropic hormone; cortisol.*

Introduction

The main problem of any country is providing safety for its citizens. To achieve this goal, a state must secure the safety of all forms of activity.

In the twenty-first century, the world community is entering a new era with intensification of different conflicts and crises—political, ideological, economic, etc. Much impact to social transformation includes many technical accidents and changes in the global environment [1-3].

To maintain law enforcement and citizens' safety in different territories, a special subdivisions are organized in the Ministry of Internal Affairs of the Russian Federation. The professional activity of law enforcement personnel takes place in extreme conditions and often in emergency situations. Discharges of one's duties are in medium security with hardware assistance, including special equipment, hazmat suits, and different weapons [4,5]. Also, besides professional destabilizing factors to an armed person who arrives from another region, there are the effects of specific climatologic and geographical environments that are typical for a territory where combat is occurring [6,7].

The intensity and duration of these factors can cause disturbances to health, from functional faults up to pathological conditions with permanent impairments [8,9]. In a human organism that undergoes the listed negative factors, functional changes occur to adapt to conditions. The endocrine system has a main role in forming a compensatory regulatory mechanism to counter extreme impacts. A top-ranked endocrine link in this response is sympathoadrenal system activation [10,11].

In this connection, the aim of our investigation was to study changes in adrenocorticotropic hormone and cortisol secretions among officers of the Ministry of Internal Affairs that had professional functions in extreme conditions during a mission to a local territory where armed conflict was taking place.

Materials and methods

Personnel of Ministry of Internal Affairs (48 males, mean age 28.28±0.51 yrs) who were sent to the regions of the North Caucasus to maintain law enforcement were investigated. The mission's duration was 4 months.

The case monitoring was as follows: before the mission,

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14 days later in the conflict zone, at 1 and 2 months afterwards, and after the mission was finished.

We tested all men for blood serum adrenocorticotropic hormone (ACTH) by radioimmunoassay (CIS Bio International, France) and cortisol by enzymoimmunoassay (Monobind Inc, USA).

Results were statistically processed using the *software* package SPSS 15.0 for Windows. *The mean (M)* and standard deviation (SD) were deduced. Analysis of the distribution of values obtained was performed using the Shapiro-Wilk normality test. The Wilcoxon criterion was used to compare the differences between the paired samples. A value of $P<0.05$ was considered statistically significant.

Results

Analyses of our results show that hormonal levels of all persons were within normal physiological limits. We also found significant differences in studied hormonal parameters means between comparative groups.

The mean of ACTH at the 14-day point was more than double the mean recorded before mission (Table 1). However, after one month the increase in ACTH had more than quadrupled ($P<0.001$). In 2 months we estimated a subsequent ACTH augmentation, but it was less significant ($P=0.005$, compared to previous period). At the end of the mission, the ACTH mean decreased, but it remained higher than before the mission ($P<0.001$).

Table 1.
The blood serum adrenocorticotropic hormone changes during the combat mission

№	Period of the mission	ACTH (pg/ml)
1.	Before	20.07±3.20
2.	After 14 days	55.80±15.68
3.	After 1 month	86.43±17.56
4.	After 2 month	96.60±17.18
5.	After 4 month	55.37±10.70
Statistical differences between groups (P)		$^{1-2}<0.001$ $^{1-3}<0.001$ $^{1-4}<0.001$ $^{1-5}<0.001$ $^{2-3}<0.001$ $^{2-4}<0.001$ $^{2-5}=0.81$ $^{3-4}=0.005$ $^{3-5}<0.001$ $^{4-5}<0.001$

The cortisol changes during the combat mission differed from ACTH dynamics (Table 2). In particular, 14 days after the beginning of the mission, the cortisol mean increased compared to the level before the mission ($P=0.002$). However, in the following periods a decrease in cortisol was detected: at 1 month ($P = 0.006$) and at 2 months ($P<0.001$), compared to 14 days. However, a mean cortisol matching at 1 and 2 months with the initial level did not show statistical differences ($P>0.05$). Towards the end of the mission, once more blood cortisol had increased; the increase was similar to the second period (14 days), but higher than the first time and higher than the results at 1 month and 2 months ($P=0.05$ and $P=0.003$).

Table 2.
The blood serum cortisol changes during the combat mission

№	Period of the mission	Cortisol (nmol/l)
1.	Before	404.81±124.54
2.	After 14 days	489.25±112.46
3.	After 1 month	426.80±102.54
4.	After 2 month	407.82±101.66
5.	After 4 month	471.16±117.78
Statistical differences between groups (P)		$^{1-2}=0.002$ $^{1-3}=0.35$ $^{1-4}=0.89$ $^{1-5}=0.003$ $^{2-3}=0.006$ $^{2-4}<0.001$ $^{2-5}=0.44$ $^{3-4}=0.37$ $^{3-5}=0.05$ $^{4-5}=0.006$

Discussion

It is known that suprarenal hormones have a major impact on the organism's adaptive response to environmental factors [12]. In excessive and long-term exposure to disturbing environmental agents, an abnormal adrenal regulatory function occurs that results in exhaustion of the organism's reserve capacities (distress). The principal manifestations of these abnormalities are hormonal hyper secretion, target cell resistance, and a fault in feedback regulation mechanism [13,14].

The different investigations show that combatants, after first obtaining a mission order, have allostasis laboratory markers – ACTH and cortisol increasing. These markers reach a maximum after 2 weeks. At the end of the combat mission, these parameters decrease but remain higher than they were at the beginning. These results indicate homeostasis imbalance retention [15]. Some investigations conjecture that after more than 6 months, high levels of catecholamine remain. ACTH and cortisol in combatants predetermine a triggering pathogenic mechanism of posttraumatic stress disorder [16-18].

In our investigation, the stability of the ACTH level increased after 2 months of a combat mission. At the end of the mission, the ACTH level decreased, but was still twice as high as it was before the mission. Concerning cortisol changes, in spite of sharp augmentation after the first 2 weeks the next time this hormone was checked it had decreased though ACTH had increased. Therefore, hormonal imbalance can provide evidence of the first signs of a disturbance in hypophysis – the adrenal gland regulation system. At mission's end, our results showed a dramatic increase in cortisol comparable to the first 2 weeks. It fact, in our opinion, this can predict a derangement of the adaptation process.

Similar results have been found in other investigations. Military personnel on an armed mission were observed to have hormonal dynamics that were attributable to the adaptation process but in some cases with distress signs. Even so, hormonal imbalance can remain up to 6 months and more [19].

Conclusion

In combatants during tours to areas of armed conflicts, a secretory function of adrenal gland changes consistent with the principles of general adaptation syndrome theory. In the first weeks at the combat zone a sharp increase of secretory activity occurs in the medulla and cortical adrenal gland. At the end of the combat mission, signs of dysfunction in hypophysis were observed – the adrenal gland regulation system that leads to interhormonal relation disturbances and a reduction in stress tolerance.

A feature of endocrine regulation demands that an organization take special measures to lower these deviations. The aim of these precautions is to increase the organism's viability and resistibility to extreme emergency conditions and prevention of morbid conditions. These measures should be:

• A long-range and clear-cut planning of combat missions

• Early diagnostics, including laboratory tests of health disturbances for personnel that undergo harmful professional conditions

• Those involved in emergency zone work must have received special training

• After a combat mission ends, it is necessary to provide special medical rehabilitation measures that favor rapid restoration of the organism.

Competing interests

The authors declare that they have no competing interests.

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