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# THE ROLE OF HORMONAL CHANGES IN ADAPTATION DISORDERS OF YOUNG SYSTEMS IN THE COURSE OF COMMUNITY-ACQUIRED PNEUMONIA

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***Abstract***

*Community-acquired pneumoniae are considered as life-threatening infectious diseases and are one of the main causes of morbidity, hospitalization, and mortality.*

*The main goal is to study and assess the role of the hormone imbalance in the adaptation disorders of young organism during the community-acquired pneumonia.*

*To achieve the goals of the research 296 male patients with pneumonia, aged 18-21, were examined. The control group consisted of 63 practically healthy male individuals of the same age. Besides standard examinations, the levels of cortisol, testosterone, prolactin, thyroid stimulating hormone, triiodothyronine, thyroxine, antithyroglobulin and anti-thyroid-peroxidase were determined in the blood serum.*

*The analysis shows that the level of prolactin in all research groups tends to increase; the level of testosterone in all the groups tends to decrease; the level of cortisol in the 18-19 age group tends to decrease; in the 20-21 age group this indicator increases, but it remains below the level of the indicator of the control group.*

*The impact of unfavorable factors of military service, the neuropsychological and physical overstrain, the change in the diet and rations, army-specific conditions, and the unusual situation for some individuals lead to an overstrain and exhaustion of the protective adaptation reactions of the organism, manifested also by hormonal shifts.*

*In the conditions of community-acquired pneumonia, the adaptation process of the organism was accompanied by a similar phasal endocrine shifts, manifested by marginal hyperprolactinemia, a decline in testosterone levels, with no increase in the levels of cortisol detected, regardless of the fact that community-acquired pneumonia was a stress factor for the organism. The main pathogen of the community-acquired pneumonia among the military was mycoplasma pneumoniae and chlamydophila pneumoniae. The course of the pneumonia cases was clinically atypical and rapid, swiftly complicating with hemorrhagic alveolitis. In some cases, the clinical course of the illness lagged behind the findings by X-ray imaging examination results.*

***Keywords:****community-acquired pneumonia (CAP), endocrine changes, adaptation disorder, thyroid gland dysfunction.*

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### INTRODUCTION

Community-acquired pneumonia (CAP) are considered as life-threatening infectious diseases and are one of the leading causes of morbidity, hospitalization and mortality. CAP ranks first in terms of causes of death among infectious diseases and sixth among all causes of death [*Menéndez R et al., 2004; Bilichenko T et al., 2012; Kolosov V et al., 2012*].

The available literature presents but little research on the specificities of severe and complicated pneumoniae among the military whereas the army is a very conducive environment for respiratory infections [*Swami S, Banerjee R, 2013; Yakovlev S, 2013; Abaturov A, Gerasimenko O, 2014*].

The age suitable for military service (18-21 years old) is a critical age period, at which the risk of distortion of the body's defensive reaction mechanisms is high under the influence of unfavorable factors [*Bradley J et al., 2011; Belkova Yu, Rachina C, 2012; Vysochina I et al., 2014; Levina A et al., 2014*]. In the process of prolonged CAP and development of complications, a great importance is assigned to the changes in immunological properties of the body [*Dwyer L et al., 2013; Feshchenko Y et al., 2014*], the forming chains of which (humoral, cellular, non-specific and etc.) have not been adequately studied.

The literature contains singular data that in case of severe intoxication and stress the adaptation of the organism is accompanied with some phasal shifts in the endocrime system, which may lead to the overstrain and, ultimately, exhaustion of the body's protective adaptive reactions, which in its own turn, further aggravated the course of the illness, leading to various and multiple complications [*Tsigos C, Chrousos G, 2002; Nadolnik L, 2010*].

Given the high level of morbidity among military with CAP, the specificities of the course of the illness, the age-related physiological peculiarities, the changes in the social and routine living conditions, and the unusual physical overload, it becomes topical to identify the changes in the endocrine indicators among the military, in order to assess the adaptation process for the organism. [*Tsigos C, Chrousos G, 2002; Shapovalova T, 2012; Evdokimova O, Gorodetskaya I, 2012; Lassi Z et al., 2014; Long Sarah S, 2014; Makarova M, 2015*].

The research aimed to study and assess the role of the hormone imbalance in the adaptation disorders in young adults (thyroid stimulating hormone, triiodothyronine, thyroxine, their antibodies, prolactin, cortisol and testosterone levels in blood) during the community-acquired pneumoniae.

### MATERIAL AND METHODS

A total of 296 male 18-21-year-old patients with pneumonia were examined. The control group was made up of 63 healthy male of the same age. Around 150 patients consider the cause of the disease to be the cold; in 15 patients pneumonia has developed along with chicken pox; 61 patients do not mention the cause; in 70 patients, the disease was detected through ongoing X-ray examinations conducted in large masses for preventive purposes. The prodromal period of the disease was short, with typical symptoms of acute respiratory diseases and laryngitis, which lasted for 1-2 days. In the course of the following days, the common symptoms of body intoxication became more apparent: headache (sometimes severe), general weakness, muscle aches, a sense of "brokenness" throughout the body, increased body temperature (up to 38-39 degrees Celsius), excessive perspiration. The fever persisted for 7-12 days, was irregular and intermittent, subsequently, some patients were persistently subfebrile. Almost all patients had dry, barking cough with a small amount of bloody sputum. Most patients mentioned retrosternal pain especially when coughing. In the clinical picture, non-respiratory symptoms were often present, such as expressed dyspeptic syndrome (nausea, vomiting, diarrhea), hepatic cytolysis syndrome, muscle and joint pain, enlarged lymph nodes. In approximately 20% of the patients, cardiovascular disorders were recorded: cardias arrhythmias, signs of subclinical myocarditis and pericarditis. There were a number of cases when the kidney lesions in the form of fever proteinuria were detected; two pa-


*To overcome it is possible, due to the uniting the knowledge and will of all doctors in the world*

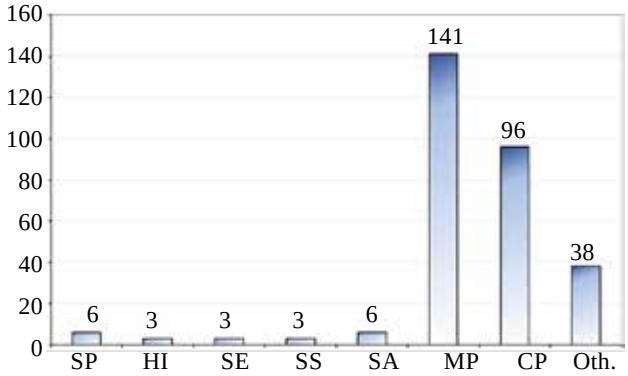


***Figure 1.*** *The results of the microbiological sputum tests*
***Notes****: SP - Streptococcus pneumoniae, HI - Haemophilus influenzae, SE - Staphylococcus epidermidis, SS - Staphylococcus saprophyticus, SA - Staphylococcus aureus, MP - Mycoplasma pneumoniae, CP - Chlamydophila pneumoniae, OB - Other bacteries*

tients had developed acute glomerulonephritis, one of them had prolonged duration with persisting urinary syndrome. 98 patients had right-sided and 85 patients had left-sided focal or lobar focal or lobar pneumonia; 113 had bilateral pneumonia.

The X-ray image reflected variable, changing non-homogeneous cloudy pulmonary infiltrates combined with interstitial changes of lung tissue. In 15% of the patients, a small amount of exudate in the pleural cavity was detected.

In addition to the common clinical, biochemical, and instrumental examinations, the serum levels of cortisol, testosterone, prolactin, thyroid stimulating hormone, triiodothyronine, thyroxine, antithyroglobulin and anti-thyroid-peroxidase were determined by immuno-fermentative analysis.

Microbiological classic methods for sputum analysis (to detect Streptococcus pneumoniae, Staphylococcus epidermidis, Staphylococcus saprophyticus, Staphylococcus aureus) and Polymerase Chain Reaction (to detect Haemophilus influenzae, Mycoplasma pneumoniae, Chlamydophila pneumoniae).

Hormonal texts were done with the equipment – Cobas 6000 (Roche diagnostics, Switzerland), using the following reagents: Eleesys thyroid stimulating hormone, Eleesys – triiodothyronine, Elecsys thyroxine, Eleesys antithyroglobulin, Eleesys anti-thyroid-peroxidase, Eleesys Prolactin, Eleesys cortisol II, EleesysTestosteron. The levels of prolactin, cortisol and testosterone were determined taking into account the circadian rhythms in young organisms.

### *RESULTS AND DISCUSSION*

The results of the microbiological sputum tests among the patients are presented in figure 1.

The results of the tests indicate that in the examined patient groups the main pathogens were Mycoplasma pneumoniae and Chlamydophila pneumoniae.

The results of the hormonal examinations are presented in table 1.

The analysis shows that compared with the group of practically healthy individuals: the level of prolactin in all research groups tends to increase; the level of testosterone in all groups tends to decrease; the level of cortisol in the group of 18- and 19-year-old patients tends to decrease; in the 20-21 age group this indicator increases to some extent, but remains below the level of the indicator of the control group (Table 1).

Thus, it seems that the reaction of the excretory glands to CAP is paradoxical and meanwhile these pneumoniae were mainly moderate or severe and extremely severe.

During the review of the acquired data, we ad-

***TABLE 1.***

The levels of prolactin, cortisol, testosterone in the blood serum of the examined patients

| Indicators | Practically healthy | Patient groups | | | |
|---|---|---|---|---|---|
| | | 18 years old | 19 years old | 20 years old | 21 years old |
| Prolactin | 8.2±1.29 | 10.53±1.8 | 9.85±0.93 | 11.79±2.1 | 10.22±1.75 |
| Testosterone | 5.89±0.59 | 4.36±0.91 | 4.98±0.99 | 4.48±0.9 | 4.40±0.66 |
| Cortisol | 488.4±51.73 | 408.02±39.6 | 437.47±42.75 | 434.63±36.98 | 416.92±38.17 |
| Triiodothyronine ($T_3$) | 1.49±0.23 | 1.25±0.1 | 1.33±0.21 | 1.38±0.19 | 1.33±0.18 |
| Thyroxine ($T_4$) | 7.98±1.19 | 8.51±0.39 | 9.37±1.27 | 9.24±1.57 | 9.36±0.82 |
| TTG | 2.88±1.35 | 2.02±0,71 | 1.90±0.55 | 2.10±0.71 | 2.15±0.72 |
| Antithyroglobulin (antiTG) | 24.76±3.36 | 16.25±2.24 | 15.21±2.62 | 17.34±1.96 | 28.93±3.73 |
| Anti-thyroid-peroxidase (antiTPO) | 17.08±3.20 | 7.96±2.12 | 11.17±2.28 | 11.03±1.58 | 9.28±0.98 |

mitted that in the endocrine chain of hypophysis-adrenal glands-reproductive system there are autonomous interhormonal nodes, acting on the basis of interhormone collaboration and correlations.

It is known that in the mature organism prolactin and cortisol along with somatotropic hormone act as a powerful modulating factor that selectively activates metabolism in parenchymal organs. Therefore, the relatively low level of the mentioned hormones, recorded among CAP patients should be considered from the viewpoint of forming inadequate adaptive reactions, which can in practice lead to slow or rapid halting of the metabolic processes in the parenchymal organs in specific emergencies. Since the relatively high level of prolactin (if we do not compare with the control figures in our particular case) is within the limits of the values of general indicators set for male gender, it is not excluded that in this case we deal with overstrained hormone synthesis, which eventually results in its incomplete release.

It is confirmed that the prolactin, in a number of emergencies including stress of different origin, activates the glucocorticoid function of the adrenal glands via quantity dependent way. For this reason, it is not excluded that the tendency of cortisol level to decrease may be due to the intensive synthesis-consumption processes of pituitary prolactin. At the same time, it is not excluded that specifically in this case the prolactin-glucocorticoid neuroendocrine chain does not function. In this case, during the CAP the mechanisms of cortisol level reduction are diverse as they are implemented by inclusion of broad-spectrum central and peripheral hormones into general endocrine network.

As it has been shown, the patients with CAP have a relatively low level of testosterone (compared to the control group). This circumstance most likely needs to be considered in terms of long-term adaptation resource exhaustion of the organism in the new development conditions of the CAP, during which it is not excluded that in this particular case, the neuroendocrine chain is activated by step-by-step realization of the result in the following sequence: prolactin, glucocorticoid, testosterone.

Thus, first, it is known that glucocorticoids depending on quantity are directly modulating (activating or suppressing) synthesis of testosterone in the seminal vesicles.

According to the literature the hyperprolactinemia, even transient, indirectly (activating the tumor necrosis factor in the seminal vesicles) suppresses chorionic gonadotropin synthesis. As it is known, the chorionic gonadotropin itself accelerates the release of testosterone from the Leydig cells. For this particular reason, the relative decline in levels of testosterone in blood serum of patients with CAP should be viewed from a general biological point of view of decrease of protective adaptation responses of hypophysis -adrenal gland-seminal vesicles and of hypophysis-seminal vesicles axis.

Such a reconstruction in the pituitary-adrenal system, which in this study was manifested in a marked decrease in the glucocorticoid function of the adrenal glands, means a decrease in adaptation. This can be seen as a protective incomplete reaction of the thypophysis-adrenal-glands system to non-specific stress CAP.

### *Conclusion*

Based on the above, it can be inferred that the impact of the unfavorable factors of the military sector on the military, the neuropsychological and physical overstrain, the change in the diet and rations, the conditions specific to the army and military service, and the unusual situation for separate individuals lead to an overstrain and exhaustion of the protective adaptation reactions of the organism, manifested also by hormonal shifts.

In the course of the CAP, the adaptive process of the organism in all groups of servicemen was accompanied by similar phase endocrine shifts, which manifested as marginal hyperprolactinemia and a decrease in testosterone levels. However, no increase in cortisol levels was detected, despite the fact that CAP was a stress factor for the body. The main pathogen of the CAP among the military was Mycoplasma pneumoniae and Chlamydophila pneumoniae. The course of the pneumonia cases was clinically atypical and rapid, swiftly complicating with hemorrhagic alveolitis. In some cases, the clinical course of the illness lagged behind the findings by X-ray imaging examination results.

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