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Systemic Changes in Patients with Acquired Skin Hyperpigmentation

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Introduction

Topicality of the study and scientific novelty: Acquired hyperpigmentation is widespread in the population and significantly affects the quality of life of patients [1]. It is known that one of the clinical signs of skin hyperpigmentation is localised hyperkeratosis in the lesional area, associated with high levels of cell proliferation and melanin saturation of the cells. Cell proliferation and hyperkeratosis are associated with an increased local metabolic rate. It was therefore of interest to investigate the likely characteristics of systemic blood changes in patients with acquired skin hyperpigmentation (ASH).

Scientific hypothesis: Whether indices of blood gas transport function are altered in ASH.

Aim of the study: To study the indices of blood gas transport function in patients with skin hyperpigmentation in comparison with the control group.

Materials and Methods

The level of (2,3-diphosphoglycerate (2,3-DPG)) in venous blood erythrocytes of study participants (n=50) was determined by non-enzymatic method in TCA (trichloroacetic acid) filtrate of haemolysed erythrocytes [2, 3], and the concentration of lactate and pyruvate (PBC) by hardware methods (biochemical analyser VitaLine-200, Russia).

Fifty women living in Rostov-on-Don, mean age 42.3±1.1 years, 25 of them with skin hyperpigmentation (mean age 41.52±1.68 years), treated in the dermatological department and included in the main group, and 25 practically healthy (according to the results of occupational examinations) individuals (mean age 43.57±1.43 years), who made up the control group.

Statistical processing of the obtained data was performed using Microsoft Office Excel 2007 (Microsoft Corp., USA) and Statistica 10.0 (StatSoft Inc., USA) programmes. Data are presented as M±m, where M is the mean value of the trait value, m is the mean error of the trait value, as well as the expression of the frequency of occurrence of the trait in absolute values (n) and per cent (%). The significance of differences between subgroups was assessed using Student's T-test. Correlation analysis was performed to determine the relationships between the various parameters. A value of $p < 0.05$ was accepted as the threshold level of statistical significance. Mann-Whitney test was used for comparative analysis of absolute differences between samples.

Results

The process of formation of hyperpigmentation is pathogenetically associated with impaired microcirculation, which leads to changes in oxygen transport. In this aspect, the functional state of erythrocytes in skin hyperpigmentation and in the control group was studied. Taking into account the role of the circulatory system in oxygenation homeostasis, we evaluated metabolic regulation of oxygen transport function of erythrocytes on the basis of determination of such indicators as lactate, PBC, 2,3-DPG. An indirect indicator reflecting the utilisation of molecular oxygen is the degree of oxidation of substrates and products of the common pathway of catabolism, in particular PBC and lactic acid. According to

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the results of the study it was found that in erythrocytes of women of the clinical group with skin hyperpigmentation the concentration of PBC was reduced by 86% (p=0.03) compared to the control group, which indicates a reduced rate of glycolysis. At the same time, a significant (by 167.4%; p<0.05) increase in the lactate level was observed relative to the control group, which, on the one hand, is a reflection of the severity of hypoxia, on the other hand, also indicates the intensification of anaerobic glycolysis.

The decrease in the level of PBC towards the increase of lactate in erythrocytes of patients with hyperpigmentation indicates the presence of tissue hypoxia, which leads to the disturbance of microcirculation in the pathological focus. In the main clinical group there was a significant increase in the level of lactate, which may indicate the presence of tissue hypoxia in the pathogenesis of hyperpigmentation. The increase in lactate concentration can be considered as an adaptive response to the process of hypoxia in the area of hyperpigmentation [4]. The character of preservation of 2,3-DPG at the same level in the clinical group and control is an indicator of the adaptation mechanism associated with an increase in the efficiency of the functions of the oxygen transport and utilisation system, as well Obviously, the increased concentration of lactate against the background of maintaining a constant level of 2,3-DPG indicates that part of oxygen is used not for tissue respiration, but for enhanced melanin synthesis and saturation of neighboring keratinocytes with it. In other words, there is a change in the priority of oxygen consumption towards melanin synthesis.

Conclusions

Summing up the results obtained, it can be noted that the phenomenon of skin hyperpigmentation is accompanied by a rearrangement of blood cell metabolism aimed at preserving oxygen and energy homeostasis of skin structures. The obtained data indicate redistribution of oxygen in cellular structures and tissues, which is accompanied by a significant increase in the concentration of lactate and the formation of local tissue hypoxia.

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