

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Prenosological Diagnosis as An Improving Element of The Health Care of Working-Age Population.

V.V. Bubekova^{1*}, A.V. Meshkov², I.D. Sitdikova¹, F.V. Khuzikhanov³, G.Sh. Alieva³, and A.R. Sitdikov³.

¹Kazan Federal University, 420008, Kremlevskaya Str. 18, Kazan

²Branch No.1 FSBI "A.A. Vishnevsky 3rd Central Military Clinical Hospital" Ministry of Defense of the Russian Federation

³SBEI HPE "Kazan state medical University of Ministry of healthcare of the Russian Federation", 420012, Kazan, Butlerova St., 49

ABSTRACT

Studying red blood cells in the pathogenesis of tumor growth increasingly attracts attention due to the high biological activity. There is evidence of changes in red blood cells under the influence of negative production factors. The study applied screening tests for the presence of inter-erythrocyte lagoons and luminescent red blood cells. The object of the study were military servicemen engaged in the chemical weapons storage and destruction facilities. The objective of the study was to conduct analysis of the peripheral blood with the further development of preventive measures to reduce the risk of malignancies. The results of the study revealed the following trends: a risk group for the emergence of malignant tumors includes the retired and former military servicemen. The highest percentages of positive tests for the presence of inter-erythrocyte lagoons and luminescent red blood cells were observed in the contingent group (95.1% for each indicator). Analysis of the results by age and employment structure revealed a direct correlation – the older the age and the greater the working experience is, the higher the risk of cancer development is. The risk group includes persons over 70 years old (100% of positive results for the presence of lagoons and luminescent red blood cells). High percentages of positive tests are in working intervals of 30-39 years (71.6% for lagoons and 70.1% for luminescent red blood cells), 10-19 years (58.8% for lagoons and 70.6% for luminescent red blood cells), and 20-29 years (58.6% for lagoons and 69% for luminescent red blood cells).

Keywords: inter-erythrocyte lagoons, luminescent red blood cells, risk of malignancies.

**Corresponding author*

INTRODUCTION

The study of red blood cells in the pathogenesis of tumor growth has been attracting the attention of researchers for a long time. Erythrocytes are more often examined due to the revealed high biological activity of the membrane, the ability to absorb, transport, and in some cases metabolize hormones, neurotransmitters, immunologically active substances, and other compounds, as well as perform a number of important functions of the body [1, 7].

Under modern technological progress, workers are exposed to the combined effects of industrial and environmental factors. Modern literature has evidence of changes in red blood cells under the influence of negative factors of production of various nature [2, 8, 11].

The development of malignancy in the body is accompanied by disorders of many organs and systems, including the erythron system (red blood cell system). Among the early signs of involvement of the erythron in the pathological process in tumor growth are changes of a surface topography, ultrastructure of red blood cells of peripheral blood and the increase in the number of deformed cell shape [3].

It is also known that disorders of structural and functional properties of the red blood cells play an important role in enhancing the aggregation processes, including growth and malignancy. The related microrheology disorders (increased blood viscosity, microcirculatory block, blood deposition) worsen the tissue hypoxia [3].

Standard approaches to the determination of malignancies are limited to a set of classical methods: biochemical and immunological determination of tumor markers, morphological and immunocytochemical study of biopsy tissue samples, instrumental methods of research [4]. Modern approaches to the clinical diagnosis of human cancers in most cases allow defining the pathology already at a certain stage of its development [4, 9, 13]. It is therefore important to recognize the prenosological signs of cancer in a yet healthy worker in order to prevent the development of the clinical form of the tumor [5, 10, 12].

Our study applied screening test for the presence of inter-erythrocyte lagoons and luminescent red blood cells. This method allows quickly determining the cytogenetic nature of various compounds. The simplicity of the method, its accessibility and visibility allow determining malignant disease at the initial stages during dispensary examination, which is very important for prompt response.

Objective of the study was to conduct analysis of the peripheral blood in the military servicemen with the further development of preventive measures to reduce the risk of malignancies.

MATERIALS AND RESEARCH METHODS

The study involved military servicemen (private soldiers, officers, retired servicemen). We also formed a control group – people not related to military activity.

We chose the test for the presence of inter-erythrocyte lagoons and luminescent red blood cells.

First stage involved study of Romanowsky-Giemsa stained blood smears. During phase-contrast microscopy, the presence or absence of inter-erythrocyte lagoons was determined. The presence of inter-erythrocyte cavities is a consequence of increased red blood cell agglomeration. In healthy people, no lagoons are formed, and a blood drop homogeneity is retained.

The second stage involves application a drop of saline to the blood smear and covering it with a glass slide. To remove air bubbles the glass is lightly pressed down. An enclosed space is formed between the slides with limited access of air. To prevent drying, the edges of slides are smeared with vaseline or immersion oil. The specimen is placed in a dark place for 3-5 hours, then examined with the use of phase contrast microscopy. Green-, yellow- or red-glowing erythrocytes are to be identified. Luminescence indicates the biological activity of erythrocyte in extreme for them conditions and serves as a characteristic sign of malignancy. The tumor-free smears show no evidence of biological activity [6].

The obtained results were processed subject to contingent, age, length of military service, and a type of troops, using parametric and non-parametric statistical methods.

RESULTS

Positive test results of the study on the presence of inter-erythrocyte lagoons have been identified in all test groups. The highest percentage of positive results among the groups accounted for the contingents of "the retired and former military servicemen" (the lagoon were detected in 95.1% of this contingent), "the operating military servicemen" (the lagoon were found in 76.5% of patients). The percentage of private soldiers with a positive test for the lagoon was 27.7%.

The luminescent red blood cells were also detected in the retired and former military servicemen – in 95.1%. Among the operating military servicemen, the luminescent red blood cells were found in 84.3%, among the private soldiers – in 62.7%.

It follows that the risk group for the development of malignant tumors includes the retired and former military servicemen, as well as the operating military servicemen, to some extent.

Test for the presence of inter-erythrocyte lagoons and luminescent red blood cells was negative in the control group.

Analysis of the age-specific results showed that the positive tests for inter-erythrocyte lagoon have been identified in all age categories. Lagoons were detected in 98.4% of patients older than 70 years, 68.8% of patients aged 40-49 years, 60.7% of patients aged 50-59 years, 50% of patients aged 30-39 years, and 28.6 % of patients aged 18-29 years.

Luminescent red blood cells were also found in 86.9% of the patients older than 70 years, then in 80.1% of patients aged 40-49 years, 68.6% of patients aged 60-69 years, 60.4% of patients aged 18-29 years, 59.1% of patients aged 30-39 years, and in 57.1% patients aged 50-59 years.

There is a direct correlation determined between the presence of inter-erythrocyte lagoons, luminescent red blood cells and age: the older the age is, the greater the risk of cancer development is.

Analysis of laboratory tests depending on length of military service showed that the significantly higher percentage of positive results for the presence of inter-erythrocyte lagoons is observed in soldiers with 30-39 years of experience (71.6%), with 10-19 years of experience (58.8%), with 20-29 years of experience (58.6%), with 3-9 years of experience (42.9%), and with 1-2 years of experience (27.4%).

Positive test results for the presence of luminescent red blood cells depending on working experience were as follows: a significantly higher percentage was noted in service intervals of 10-19 years (70.6%), 30-39 years (70.1%), 20-29 years (69%), 1-2 years (61.9%), and 3-9 years (42.9%).

A direct correlation was determined between the presence of inter-erythrocyte lagoons, luminescent red blood cells and the length of service: the older the length of service is, the greater the risk of cancer development is.

Subject to the type of troops, the analysis revealed positive results for the presence of inter-erythrocyte lagoons in 94.4% of patients in the missile forces, and in 42.5% of patients in the ground troops.

Luminescent red blood cells were found in 100% of patients in the missile forces, in 100% of patients in SV, and in 67.5% - in ground troops.

These are the highest percent rates of positive tests, which indicate a high risk of cancer.

SUMMARY

The above results of the study revealed the following trends: a risk group for the emergence of malignant tumors includes the retired and former military servicemen. The highest percentages of positive tests for the presence of inter-erythrocyte lagoons and luminescent red blood cells were observed in the contingent group (95.1% for each indicator). The operating military servicemen (76.5% positive results for the presence of lagoons and 84.3% for the presence of luminescent red blood cells) and private soldiers (62.7% for the presence of luminescent red blood cells) can be also referred to the risk group.

Analysis of the age structure of patients with positive tests among the surveyed showed a direct correlation: the older the age is, the greater the risk of malignancies is. The risk group includes persons over 70 years old (100% of positive results for the presence of lagoons and 100% for luminescent red blood cells) and 40-49 years (68.4% for lagoons and 80% for luminescent red blood cells).

A direct correlation was revealed also in the analysis of the results of working experience: the more the experience is, the greater the risk of malignancies is. The highest percentages of positive tests are in working intervals of 30-39 years (71.6% for lagoons and 70.1% for luminescent red blood cells), 10-19 years (58.8% for lagoons and 70.6% for luminescent red blood cells), and 20-29 years (58.6% for lagoons and 69.1% for luminescent red blood cells).

Analysis of the results based on the type of troops found that the risk group for the emergence of malignancies includes missile forces.

CONCLUSION

Research work on the evaluation of carcinogenic and mutagenic hazard in a military technogenesis is relevant in terms of scientific research and social significance.

It is known that a military contingent undergoes medical examination at various stages of military service. However, such surveys are oriented to the identification of the pathological process and do not include prenosological investigations. This study was conducted for the purpose of preclinical diagnosis in the absence of typical complaints, clinical and pathognomic signs.

In this study we determined the relation between the exposure to hazardous conditions of military service and the availability of inter-erythrocyte lagoons and luminescent red blood cells that can serve as a criterion for the carcinogenic risk of varying degrees. Information on the carcinogenic effects of chemicals on the human body can provide a basis for the formation of scientific approaches to reduce cancer risk and primary prevention of cancer.

ACKNOWLEDGEMENTS

The team of authors expresses its gratitude to the Kazan Federal University for the opportunity to conduct this study.

REFERENCES

- [1] Chaplygina M.A. Innovative examination methods in oncology / M.A. Chaplygina, Iu.A. Kharchenko, T.V. Pavlova, K.I. Proshchaev, I.A. Pavlov, V.A. Markovskaia // International journal of experimental education. - 2014. - No.5. - Pp. 36-39.
- [2] Aleksandrov N.P. Changes in human red blood cells (erythrocytes) in adapting to new conditions / N.P. Aleksandrov // Zemsky doctor. - 2010. - No.1. - Pp. 23-27.
- [3] Chasovskikh N.Iu. Surface architectonic, ultrastructure and the aggregation properties of red blood cells of peripheral blood in patients with cancer: Author. Dis. ... Cand. Med. Sciences: 14.00.16, 14.00.14 / Chasovskikh Natalia Iurievna; Tomsk, 1997. - 23 p.
- [4] Brazhnik K.I. New trends in research and early detection of cancer using the fluorescent nanocrystal sensing systems / K.I. Brazhnik, M.A. Baryshnikov, Z.A. Sokolova, I.R. Nabiev, A.V. Sukhanova // Russian Biotherapeutic Journal. - 2013 - V.12, No.3. - Pp. 12-24.

- [5] Meshkov A.V. Prevention of malignant tumors based on the assessment of cytogenetic status / A.V. Meshkov, I.K. Vaziev, L.I. Gerasimova, G.S. Alieva, I.Kh. Vakhitov // Modern problems of science and education (Electronic journal). – 2015. – No.1. – URL: <http://science-education.ru/ru/article/view?id=18720> (accessed date: 19.06.2016).
- [6] Pat. 2037152 RF, 6 G01N 33/48 Method of diagnosing malignant tumors / D.I. Finko, I.I. Golovanov (Russian Federation). - No.5021049/14; Pend. 03/01/92; Publ. 09.06.95. Bull. No.16.
- [7] Pavlova T.V. Development of endothelial dysfunction in system mother-placenta-fetus at hypertensive disease in gravidae / T.V. Pavlova, A.V. Selivanova // European journal of natural history. – 2008. - №4. – 52 p.
- [8] Bogar L., Juricskay I., Kesmarky G. et al.. Erythrocyte transport efficacy of human blood: a rheological point of view// Eur J Clin Invest. 2005 Nov; 35 (11): 687-90.
- [9] Casal J.I., Barderas R. Identification of cancer autoantigens in serum: toward diagnostic/prognostic testing?//Mol Diagn Ther. -2010. -14. -P. 149-54.
- [10] Bonassi, S. Validation of biomarkers as early predictors of disease/S. Bonassi, M. Neri, R. -Puntoni. mutat res., 2001. -Vol. 480-481. -P. 349-358.
- [11] Desmetz C., Maudelonde T., Mange A. et al. Identifying autoantibody signatures in cancer: a promising challenge//Expert Rev Proteomics. -2009. -6. -P. 377-86
- [12] Review of the U.S. Army's health risk assessments for oral exposure to six chemical-warfare agents. Introduction. J. toxicol environ health A., 2000. -Mar. 59. -(5-6). -P. 281-526.
- [13] Pavlova T.V., Pozdniakova N.M., Proshcjaev K.I. The possibilities of studying morphological and functional properties of erythrocytes in the pre-disease diagnosis // Medical science and clinical practice: Proceedings of the conference dedicated to the 150th anniversary of the Kharkiv Medical Society. - Kharkiv. - 2011. - 54 p.