The morphometric analysis of the erythrocytes in patients with iron deficiency anemia and anemia of malignant growth

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The article dealt with the study results of the morphometric erythrocytes changes in peripheral blood. The differential-diagnostic and prognostic importance of the morphometric erythrocytes changes in peripheral blood in patients with iron deficiency anemia and anemia of malignant growth is discussed.

Key words: anemia, erythrocytes, peripheral blood, investigations.

The anemic syndrome often occurs as a result of the development and progression of the tumor process, and cytostatic and (or) radiation therapy used to treat cancer, the presence of hemolysis, splenomegaly, hemorrhagic syndrome, hemodilution, ineffective erythropoiesis, the cascade of disorders in iron metabolism regulation in the body of the patient, whose key link is now considered to be the changes in the synthesis of hepcidin [1, 3, 6].

In the erythrocytes of a person in the course of his life changes occur due to gender, age-specific features of metabolism, hematopoiesis [8]. In the hematopoiesis system itself, when pathological conditions and disease development occur, certain functional and morphological changes appear [1, 2, 7]. Iron deficiency anemia (IDA, MKH – D50) is a disease that is accompanied by significant changes in erythropoiesis, qualitative and quantitative changes in erythrocytes, impaired functioning of organs and systems [2, 7, 8]. Fundamentally different mechanisms of formation have anemia of malignancies (malignant anemia, MKX – D63.0), which, no doubt, should affect the particular qualities of erythropoiesis [1, 3, 6]. Among malignant diseases of the urinary system stipulates the urothelial bladder cancer (UBC) [4]. In the available literature, we have not encountered data on the comparison of morphometric changes in erythrocytes in patients with IDA and patients with malignant anemia in malignant diseases of the urinary system, so it prompted us to conduct appropriate study.

The objective: is to conduct a morphometric analysis of peripheral blood erythrocytes in patients with iron deficiency anemia (IDA) and malignant anemia in urothelial bladder cancer (UBC) to identify specific changes and use them in a differential diagnostic practice.

MATERIAL AND METHODS

As the study material blood of 110 patients (58 men and 52 women) was taken. Among them 53 patients (31 women and 22 men) with IDA were examined, they formed the first (I) observation group and 57 patients (36 men and 21 women) with UBC, where the course of the underlying disease was burdened by malignant anemia second (II) observation group. The age of the patients under the survey is from 22 to 69 years. All patients were examined before any treatment was prescribed.

The diagnosis of IDA was verified based on a typical clinical picture (signs of anemic hypoxia and sideropenic syndrome), typical hematologic picture of peripheral blood and indicators of iron metabolism.

The severity of anemia was defined according to the criteria proposed by the National Cancer Institute (USA) as follows:

– mild Hb from 10 to 12 g/dL,
– moderate Hb from 8 to 10 g/dL;
– severe Hb from 6.5 g/dL to 8 g/dL,
– life-threatening Hb below 6.5 g/dL.

Among the patients with IDA, 19 were diagnosed with a mild type, 15 with a moderate, 11 with severe, and 8 with a life-threatening one. Among the patients with malignant anemia 29 were diagnosed with a mild type, 12 with moderate, 10 with severe, and 6 with life-threatening.

The study was conducted in compliance with the main provisions of the Council of Europe Convention on Human Rights
and Biomedicine, Declaration of Helsinki Ethical Principles for Medical Research and (1964, with further additions, including 2000 version) and the Ministry of Health of Ukraine Order No. 690 dated September 23, 2009. All patients admitted to the hospital were examined with the use of clinical, laboratory, instrumental and special research methods, and were consulted by specialists of related specialties, if necessary. The examination and treatment of patients were performed in accordance with the World Medical Association Declaration of Helsinki (Seoul, 2008), and the relevant programs. The significance of the difference was assessed using the Student’s Difference Factor t-test (p<0.05).

### RESULTS OF THE STUDY AND DISCUSSION

When analyzing the obtained data, it was found that the erythrocyte indicators in the examined patients were as follows (Table 1):

As it is seen from the data above, significant changes in the morphometric parameters in patients with IDA and malignant anemia with UBC were found in the peripheral erythrina link. Besides, patients from group I showed a significant (p<0.01) increase in RDW compared with patients from group II. We have not found any significant changes in the above indicators depending on the sex and age of the patients from the observation groups I and II (p>0.05). Data on the erythrocyte cytometry indicators in patients under the observation is given in Table 2.

As it is seen from data in table 2, patients in both groups showed a significant increase in the number of transformed erythrocytes (stomatocytes, echinocytes, etc.), and, accordingly, a decrease in the number of normal discocytes. A more significant decrease in the average diameter of erythrocytes, an increase in the proportion of microcytes and an increase in the level of anisocytosis (p<0.05) was found in patients from group I. In addition, a clear poikilocytosis was found in patients from group I, that showed a significant decrease in the number of discocytes, an increase in the number of echinocytes and irreversibly altered pre-hemolysed forms of erythrocytes.

An increase in the number of echinocytes is always accompanied by an increase in blood viscosity. Moreover, rigid erythrocyte forms, due to their loose contact with the vessel wall, cannot fully participate in a gas exchange, which enhances tissue hypoxic processes. The movement of these cells in the total volume of capillary blood flow slows down, which can create a favorable background for the formation of microtubules. If we take into account that these processes occur in the vessel crease, where pathophysiological and pathobiochemical shifts occur, the significance of these disorders in the formation of anemic hypoxia syndrome in the examined patients of both groups will become more obvious. In the erythrocyte formula in patients from group I, against the background of a decrease in the average size of erythrocyte cell diameter and an increase in anisocytosis due to an increase in the number of microcytes we observed a significant decrease (p<0.01) in the number of discocytes, an increase in the number of echinocytes and reversibly changed prehemolysed erythrocyte forms, that can obviously affect the life span of erythrocytes.

### CONCLUSIONS

1. Malignant anemia is an urgent problem in the modern oncology clinic since anemic syndrome is one of the common complications of cancer. Instead, the number of studies
highlighting this problem in cancer of the urinary system is limited. Also, the issues of secondary metabolic disorders in anemic hypoxia in combination with tumor intoxication are insufficiently covered.

2. Malignant anemia at UBC is accompanied by significant changes in the morphometric characteristics of erythrocytes, which is manifested by a decrease in the proportion of discocytes, an increase in the proportion of echinocytes and irreversibly altered prehemolytic forms of erythrocytes.

3. The changes that we have detected in the erythrocyte link of peripheral blood, on the one hand, is a reflection of the peculiarities of hemapoiesis and, in particular, erythropoiesis, and on the other, evidence of deeper pathophysiological disorders in people with malignant anemia while UBC.

4. IDA is characterized by changes in morphometric parameters: a decrease in the average diameter of erythrocytes, an increase in the number of microcytes and an increase in the level of anisocytosis, clear poikilocytosis, which showed a significant decrease in the number of discocytes, an increase in the number of echinocytes and irreversibly changed prehemolized erythrocyte forms.

5. Further study of the pathophysiological and biochemical changes in the erythrocyte link of hemapoiesis with IDA and malignant anemia is a promising area of scientific research. Its implementation will allow optimizing diagnostics, differential diagnosis and pathogenetic treatment regimens in these categories of patients, which, in the end, will obviously lead to an improvement in their quality of life.

REFERENCES