NEW DATA ON THE MORPHOLOGY OF BLOOD IN THE STUDY OF CANCER

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Annotation

Objective: Modern methods of sampling material to perform a biopsy allow to obtain cells of all organs and tissues, including blood, which largely determines the overall condition of the body. Among socially important diseases one of the first places occupies oncurological pathology. It should be noted that bladder tumors are mostly malignant nature. Bladder cancer is poorly diagnosed in the early stages. Early diagnosis of cancer and treatment of patients with bladder cancer remains an urgent problem of modern oncology.

Method: The study involved 20 men (10 healthy patients and 10 patients diagnosed with bladder cancer). Description of morphometry and photographing of the venous blood cells was performed in a scanning microscope “FEI Quanta 200 3D”. In addition, the cells were studied using an atomic force microscope “Ntegra-Aura”.

Result: The percentage of monocytes in patients with bladder cancer was 80.6 ± 0.68% (control group - 75.6 ± 3.14%). Content of microcytes in patients with bladder cancer was equal to - 17.2 ± 1.31% (23.3 ± 3.28%). When bladder cancer macrocytes content was 2.2 ± 0.66 (1.1 ± 0.28%). Presence of megalocytes in the studied samples was not observed. The range of sizes of red blood cells in patients with bladder cancer was 5.8 ± 0.27μm - 9.0 ± 0.42μm (5.60 ± 0.28μm - 8.60 ± 0.22μm).

Conclusion: Scanning Microscopy of blood can be used as an express screening method for the diagnosis of tumor growth.

Key words: Scanning Microscopy, blood, bladder cancer.

Introduction

Innovative approaches in the study of biological objects greatly expand morphology opportunities. Modern methods of sampling material to perform a biopsy allow to obtain cells of all organs and tissues. The progress of medical technology allows to investigate the tissues, which were not widely used in the past such as hair, skin, blood and
lymph to diagnose the body condition for subsequent correction. It became available after appearance of the works, which have shown the ability to interpret the data obtained from a single cell in the holistic interpretation of body condition as there is no illnesses that have only a local effect on the body [1,2]. Among the socially important disease one of the first places is occupied by cancer pathology [3-5]. It should be mentioned that bladder tumors are mostly malignant character. Bladder cancer is poorly diagnosed in the early stages.

In the structure of cancer incidence bladder tumors are from 2 to 5% of all tumors. Yearly 335.8 thousand people in the world become ill with the bladder cancer and 132.4 thousand people (every third) die from this disease. In men, bladder tumors occur 3-4 times more often than women. The growth of bladder cancer patients in Russia amounted to 8.3%, after rising in relative terms from 8.9 to 9.7 per 100 000 people. It should be noted that currently only 45% of bladder cancer patients are diagnosed at an early stage. Thus, an early diagnosis of cancer and treatment of patients with bladder cancer remains an urgent problem of modern oncology. Neoplasms of the bladder in the majority of cases are presented with transitional cell carcinoma. Over 95% of bladder tumors are of epithelial origin, including transitional cell carcinoma (90%), squamous cell carcinoma (6.8%), adenocarcinomas (2%). Undifferentiated cancer occurs less than 1% of cases.

The occurrence of bladder cancer in men is often associated with the stagnation of urine in the bladder, especially in the elderly. One of the known risk factors for the development of bladder cancer is smoking, as chemical carcinogens absorbed and excreted into the urine, where the carcinogens effect on the urothelium [6,7]. An important risk factor after smoking is working in hazardous industries. Increased risk exists among the workers (including former) employed in the coloring materials, rubber and chemical industry, in the leather and shoe industry, among painters. In addition, hormonal factors can be involved in bladder carcinogenesis. There is some evidence of a genetic predisposition of this disease. There are studies that bladder cancer, being aggressive disease, prone to metastasis in the early stages. The frequency of metastasis in superficial bladder cancer is up to 5%, with carcinoma in situ - 20%. In 50% patients with invasive tumors, metastasis is detected in the primary treatment [8-11].

The aim of the research is to study the red blood cells of cancer patients on the example of bladder cancer using innovative research methods (Atomic force and scanning electron microscopy).

Methods: We studied 20 men who formed 2 groups of 10 people. First group included almost healthy patients without severe somatic disease with a favorable prognosis. The second group consisted of patients with diagnosed bladder cancer.
Native red blood cells were used as the material for the study. Venous blood was sampled in the morning on an empty stomach in the vacuum tubes with the addition of heparin. The Procedure of consecutive laundering of erythrocyte mass and the formation of blood smear was carried out for 30 minutes. Morphometry description and photographing of cells in the obtained samples was performed in a scanning microscope “FEI Quanta 200 3D”. The obtained erythrocyte sizes were divided into 3 groups: microcytes (up to 6.4μm), normocytes (6.5 - 8.9μm), macrocytes (9.0 - 10.9μm), megalocytes (more than 10.9 μm). In addition, the cells were studied using “Ntegra-Aura” atomic force microscope. Investigations were carried out in modes of constant and intermittent contacts. Processing and composition of the AFM images was performed using the “NOVA” (NT-MDT, Russia) and “Image Analysis” (NT-MDT, Russia) software. The data were processed with a personal computer with the following analysis of results in «Microsoft Excel» software.

**Results**

Analysis of scanning electron microscopy of red blood cells data revealed that among patients with bladder cancer and in the control group most of the erythrocyte population has a diameter of 6.5μm to 8.9μm (normocytes) (Fig.1, 2).

![Figure 1. Red blood cells in almost healthy people (x8000). Scanning electron microscopy (x8000).](image1)

![Figure 2. The red blood cells in patients with bladder cancer.](image2)
Shape and size changes of erythrocytes.

Scanning electron microscopy (x5000).

Thus, the average size of erythrocytes among patients with bladder cancer was $7.2\pm0.07\mu m$ and in the control group this index was $7.00\pm0.05\mu m$ (Table 1).

The percentage of normocytes in patients with bladder cancer was higher than in the control group and it was $80.6 \pm 0.68\%$, while in the control group it was equal to $75.6 \pm 3.14\%$ (Table 2). The amount of microcytes in patients with bladder cancer was equal to $-17.2 \pm 1.31\%$. In the group of almost healthy individuals, the index was higher and amounted to $23.3 \pm 3.28\%$ of the total number of the scanned cells. The amount of macrocytes in the control group was $1.1 \pm 0.28\%$. In patients with bladder cancer macrocytes content was higher and amounted to $2.2 \pm 0.66\%$. Megalocytes were not observed in the studied samples. The range of sizes of red blood cells in the control group was within $5.60 \pm 0.28\mu m - 8.60 \pm 0.22\mu m$. In patients with bladder cancer it was $5.8 \pm 0.27\mu m - 9.0 \pm 0.42\mu m$.

Table 1: The percentage of red blood cells sizes in patients with bladder cancer.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Control group</th>
<th>Patients with bladder cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microcytes (%)</td>
<td>23.3±3.28</td>
<td>17.2±1.31</td>
</tr>
<tr>
<td>Normocytes (%)</td>
<td>75.6±3.14</td>
<td>80.6±0.68</td>
</tr>
<tr>
<td>Macrocytes (%)</td>
<td>1.1±0.28</td>
<td>2.2±0.66</td>
</tr>
</tbody>
</table>

Table 2: The average sizes of red blood cells in bladder cancer.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Control group</th>
<th>Patients with bladder cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>The average diameter of RBCs ($\mu m$)</td>
<td>7.00±0.05</td>
<td>7.2±0.07</td>
</tr>
<tr>
<td>The range of sizes of RBCs ($\mu m$)</td>
<td>5.60±0.28 - 8.60±0.22</td>
<td>5.8±0.27 - 9.0±0.42</td>
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While studying the red blood cells by atomic force microscopy we revealed a violation of the relief surface of red blood cells (Fig.3, 4).

Figure 3. Erythrocytes in patients with bladder cancer.
Violation of the surface relief of RBCs.

Histogram and graphic image. Atomic force microscopy.

Figure 4. Erythrocyte in patients with bladder cancer.

Smoothing of RBCs surface.

Histogram and graphic image. Atomic force microscopy.

**Conclusion**

Thus, in patients with bladder cancer, there was a reduction of microcyte percentage of the total number of the scanned cell, and an increased content of macrocytes in comparison with the control group. In addition, in the basic group there was an increase of the minimum and maximum sizes of erythrocytes, as well as increasing the average diameter. Scanning Microscopy of blood can be used as an express screening method for the diagnosis of tumor growth.

**References**


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