

THE STUDY OF SOME LEUCOCYTE VARIATIONS IN NORMAL AND PATHOLOGICAL CONDITIONS

Ionuț Stoica, Daniela Tiță, Maria Prisecaru, Florian Prisecaru

Key words: *circulating leukocytes, numerical variations, diagnostic elements*

INTRODUCTION

In many pathological conditions, circulating leukocytes can show morphological, functional or numerical changes. Although, the absolute numerical changes of leukocytes are common for many pathological conditions, they can sometimes constitute essential elements in the diagnosis of some conditions. Counting leukocytes and their morphological assessment on a regular hemogram performed under conditions of great urgency and without "technical claims" can be of great use to any clinician, regardless of his specialty.

The plus or minus variations in the number of leukocytes are most frequently associated with benign conditions but can also be present in myelodysplastic syndromes (preleukemic states) in chronic myeloproliferative diseases and in other malignant diseases, including leukemias.

MATERIALS AND METHODS

100 patients were investigated during the year 2022 with the diagnosis falling under different types of diseases. The cases came from the municipality of Bacău, and the investigation was carried out in the Clinical Laboratory of the Bacău County Emergency Hospital.

The following classic work methods and techniques were used:

a) Blood smear, May-Grunwald-Giemsa panoptic staining.

b) Leukocyte formula using the SYSMEX XN-3000 hematological analyzer.

RESULTS AND DISCUSSIONS

The study group was represented by 55% women and 45% men (Fig. 1), aged between 1 and 90 years (Fig. 2). Of all the investigated patients, 62% of women and 38% of men had normal values (Fig. 3). The patients were diagnosed with different types of diseases, 32% with hematopoietic origin and 68% with other categories of diseases (Fig. 4).

Leukopenia (Fig. 5 and 6)) represents the decrease in the total number of leukocytes below the values considered normal (adult $40-100 \times 10^3/\mu\text{l}$),

especially neutropenia (normal values $\text{NN} = 1-4\%$; $\text{NS} = 60-70\%$) it could be present in patients who have received various drugs, some of which are of common use (anti-inflammatory, antibiotic, antidiarrheal, tranquilizers, antihistamines). The risk of severe infections exists only when the total number of leukocytes falls below $4000/\text{mm}^3$, none of the patients taken in the study presented a similar value of total leukocytes. Neutropenia can be one of the elements of the picture of pancytopenia (pathological condition characterized by the decrease of the figurative elements of the blood regarding the three conditions: erythrocytic, leukocytic, thrombocytic). In our study (fig. 6) men are more affected by leukopenia (72%), women in a much reduced percentage (28%) compared to men.

Neutropenia can also be caused by other conditions, such as viruses, but it also occurs in some malignant diseases, such as leukemia or multiple myeloma.

Lymphocytopenia, defined by the decrease in the number of lymphocytes below the value of 25-35%. Lymphocytopenia occurs as a consequence of treatment with corticosteroids and cytotoxic drugs, in very varied diseases (respiratory infections, biliary colic, scarlet fever, appendicitis, etc.). It is also characteristic to decrease the number of lymphocytes in uremia (urinary infections, pyelonephritis, granulocytic leukemia, etc.).

Agranulocytosis, or the extremely marked reduction in the total number of neutrophil granulocytes in the peripheral blood, can be produced by the combination of some drugs (antithyroid, thiouracil, tranquilizers - chlorpromazine), some antibacterial substances - sulfonamides, some anti-inflammatory - phenyl-butanose. The mechanism of action of these drugs is not well known, they either cause a reaction from the body or interfere with one or more metabolic processes, at the level of neutrophil precursors.

Leukocytosis (figures 5 and 7) represents an increase in the absolute number of neutrophil leukocytes, eosinophils, basophils, monocytes, lymphocytes, above the normal values. 25% of the analyzed subjects have leukocytosis (Fig. 5).

An important cause of leukocytosis, especially with neutrophils (Fig. 7) is infection with pyogenic

germs (acute respiratory infection, acute cholecystitis, tonsillitis, pharyngitis, laryngitis, urinary infection, etc.) when the number of leukocytes shows values between 5000-30000/ mm³. Also, in these cases, the leukocyte count is shifted to the left, with a large number of unsegmented neutrophils and a small number of myelocytes and metamyelocytes, and occasionally with myeloblasts.

E.g:

Left Right
 NN=0% B- 0.3%
 NS=62% L- 29%
 EO= 2.6 % M- 5.8

Neutrophils, in addition to their significant numerical increase, may contain toxic granules or Dohle bodies. The toxic granules, intensely azurophilic, are spread in the cytoplasm, and Dohle bodies are cytoplasmic inclusions 1-2 microns long, blue-gray in color, located at the periphery of the cell. The significance of the deviation to the left of the leukocyte formula, the presence of toxic granulations and Dohle bodies is an accelerated granulocytopoiesis not only in acute infections, but also in severe burns or rheumatoid arthritis. While the adult responds to an acute bacterial infection with leukocytosis, children develop lymphocytosis.

Leukocytosis with eosinophils is represented in figure 7. Sometimes a very high number of eosinophils, associated with anemia or thrombocytopenia occurs in an infection of unknown etiology called hypereosinophilic syndrome. It also occurs in heart disease, especially post-myocardial infarction. The lesions consist of areas of eosinophilic infiltration, processes of necrosis and fibrosis affecting especially the endocardium and the subendocardial region of the myocardium, attributed to the cytotoxic effects of granules contained in eosinophilia. The number of eosinophils can also

increase in allergic respiratory or liver diseases, in case of drug hypersensitivity.

The causes of eosinophilia can be others, such as: parasitic diseases, allergic diseases, numerous skin diseases, leukemias and other malignant diseases.

Basophilia may also be present (Fig. 7). Basophils contain on their surface the Fe R1 receptor that has a high affinity for the Fc portion of Ig E. When Ig E attaches to the basophil, it undergoes a series of morphological and biochemical transformations and releases a series of mediators that influence inflammatory processes, basophils being involved in acute hypersensitivity reactions.

The percentage of basophils can increase in very different conditions: allergic conditions, myeloproliferative diseases, myxedema colitis, ulcers, infectious diseases, stress, etc.

Lymphocytosis is characterized by an increase in the number of lymphocytes over 55% (fig. 7). Lymphocytosis constitutes the body's usual response to numerous viral infections such as: viral mononucleosis, respiratory virosis, osteomyelitis, superinfected burn, etc. It is also characteristic of malignant lymphomas, in lymphatic leukemia.

Monocytes and macrophages can also undergo quantitative changes (fig. 7). Monocytes are formed from a common precursor cell with the neutrophil granulocyte series. It originates in the bone marrow, circulates in the peripheral blood and differentiates functionally in the tissues, where they become macrophages. Monocytes can show differences in their morphological appearance and enzyme content, depending on the tissue type. Proliferations of the monocyte and macrophage series (more than 4-8%) can be benign and malignant. Thus, the percentage of monocytes appears significantly increased in anemias, infectious or inflammatory diseases.

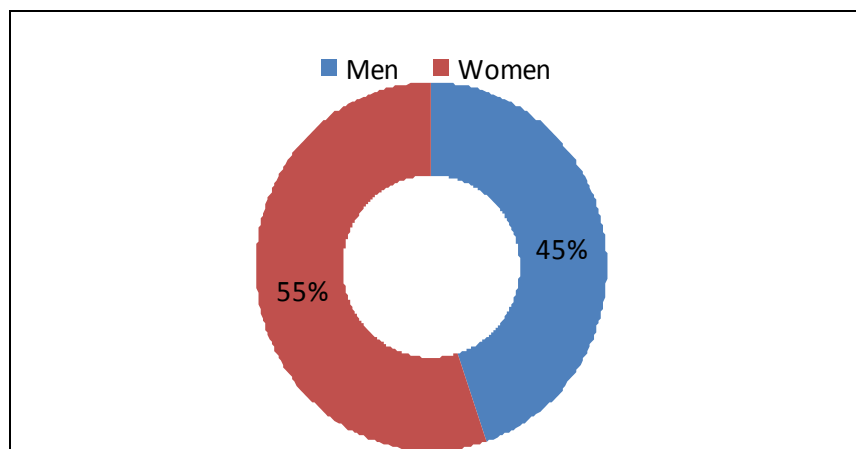


Fig. 1. Percentage distribution of patients by sex

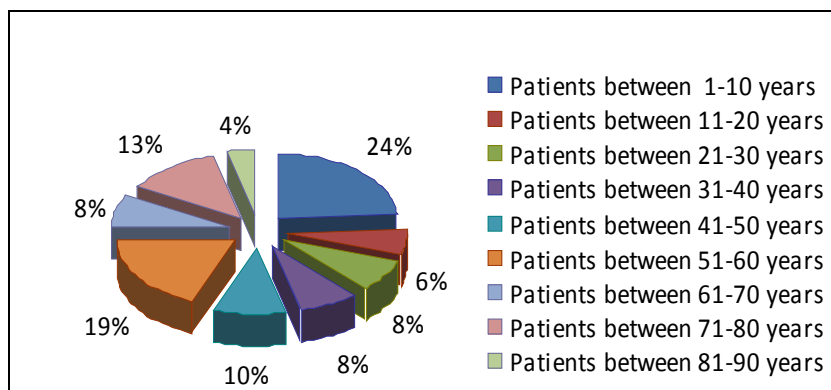


Fig. 2. Distribution of patients by decade of age

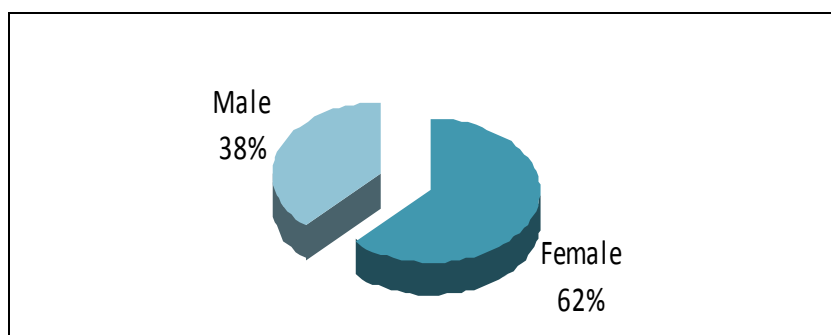


Fig. 3. Percentage distribution of patients according to normal value

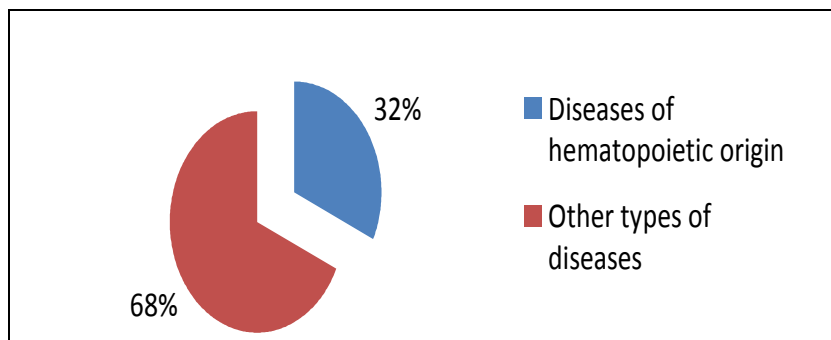


Fig. 4. Percentage distribution of patients according to the type of condition

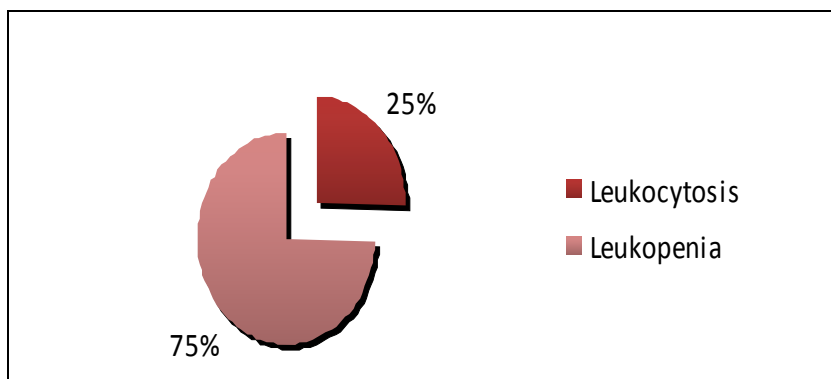


Fig. 5. Percentage distribution of patients according to the numerical changes of leukocytes

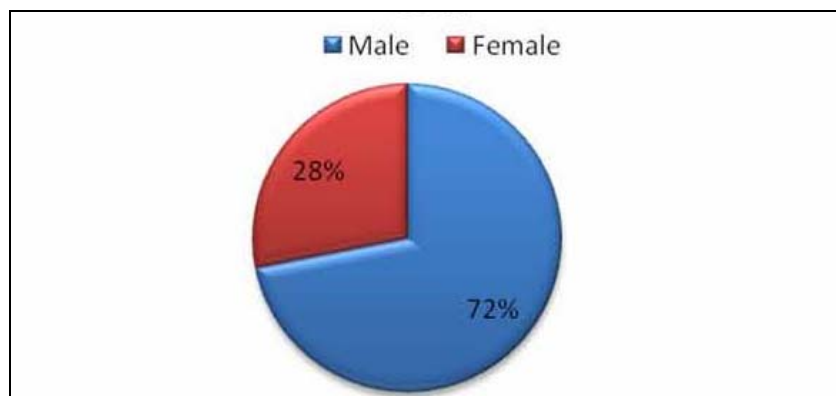


Fig. 6 Percentage distribution of patients after leucopenia according to sex

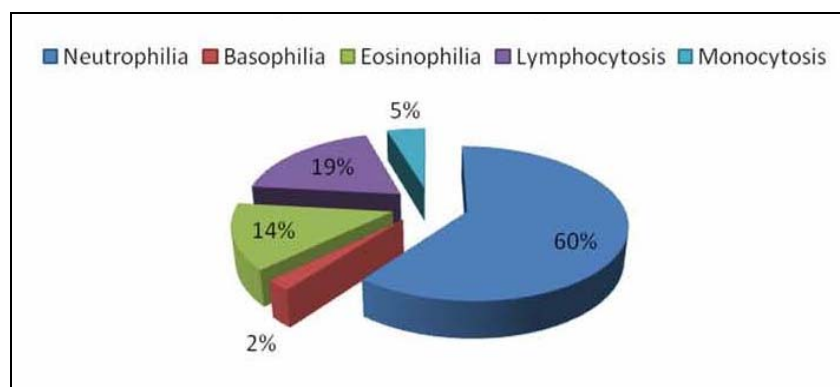


Fig. 7. Percentage distribution of patients with leukocytosis in different types of leukocytes

CONCLUSIONS

Circulating leukocytes, the effector cells of the myeloid series, can present numerical alterations that can constitute important diagnostic elements in the case of many diseases.

The main plus or minus variations in the number of leukocytes associated with benign (more often) or malignant conditions are: leukopenia, agranulocytosis, leukocytosis, eosinophilia, basophilia, lymphocytopenia, lymphocytosis and monocytosis.

Both sexes and all age groups can suffer, in some diseases, more or less significant changes in leukocytes with different pathological meanings.

Leukopenia, especially with neutropenia, can be the consequence of long-term treatment with drugs, some commonly used (anti-inflammatory drugs, antibiotics, tranquilizers, antihistamines, antidiarrheals), but also in infectious (viral) or malignant diseases (leukemia, multiple myeloma).

In our study, males are more affected by leukopenia (72%) compared to females (28%).

Lymphocytopenia occurs in the investigated subjects as a consequence of corticosteroid treatments and cytotoxic drugs in very varied diseases (respiratory infections, bilious cysts, scarlet

fever, appendicitis, etc.) and is also characteristic in uremia, leukemia, etc.

Agranulocytosis occurs as a reaction from the body to the consumption of some antithyroid drugs - especially sulfonamides, some anti-inflammatory (phenyl-butanose). In case of severe agranulocytosis or neutropenia, there is a risk of severe infections added to the underlying disease, which can lead to death.

Leukocytosis, especially with neutrophilia, is found especially in infections with pyogenic germs (respiratory, urinary infections, peritonitis, appendicitis, gargitis, laryngitis, septicemia, superinfection states, etc.). In such situations, the leftward deviation of the leukocyte formula is characteristic, with the increase of unsegmented neutrophil granulocytes. 25% of the investigated group presented leukocytosis, 60% leukocytosis with neutrophilia.

Eosinophilia is characteristic in the present case for the hypereosinophilic syndrome, of unknown etiology, the increase of eosinophils is associated with anemia, but it also occurs in post-myocardial infarction heart damage, in allergies, respiratory or liver diseases due to allergies, or in case of hypersensitivity medicinal. 14% of patients had leukocytosis with eosinophilia.

Basophilia occurs, in our study, in 2% of cases, also as a consequence of an allergic condition, basophils also being involved in acute hypersensitivity reactions.

Lymphocytosis is the usual immune response to many viral infections. It is also characteristic of malignant lymphomas or in lymphatic leukemia and is represented in 19% of investigated cases.

Monocytosis, is recorded in 5% of cases and is found in both malignant and benign diseases. Thus, the percentage of monocytes appears significantly increased in hemolytic anemias, infectious or inflammatory diseases or in malignant lymphoproliferative diseases.

ABSTRACT

100 patients were investigated during the year 2022 with the diagnosis falling under different types of diseases. The cases came from the municipality of Bacău, and the investigation was carried out in the Clinical Laboratory of the Bacău County Emergency Hospital. The following classic working methods and techniques were used: blood smear, May-Grunwald-Giemsa panoptic staining and the leukocyte formula using the SYSMEX XN-3000 hematology analyzer. The main plus or minus variations in the number of leukocytes recorded, associated with some conditions benign (more common) or malignant were: leukopenia, agranulocytosis, lymphocytopenia, leukocytosis, eosinophilia, basophilia, lymphocytosis and monocytosis. Both sexes and all age groups can suffer, within some diseases, more or less significant changes in leukocytes, with different pathological meanings.

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AUTHORS' ADDRESS

STOICA IONUȚ, PRISECARU MARIA – „Vasile Alecsandri” University of Bacau, Faculty of Science, Department of Biology, Marasesti Street, No 157, Bacau, Romania, e-mail: ionut_stoica23@yahoo.com; priscecaru_maria@yahoo.com (Corresponding author)
 TIȚĂ DANIELA - County Emergency Hospital Bacau St. Spiru Haret, no.2-4, Bacau, Romania, e-mail: danielatita2007@yahoo.com;
 PRISECARU FLORIAN – Siret Water Directorate, I. Cuza Voda Street, Bacau, Romania; e-mail: florin.prisecaru@yahoo.com.