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MYELOGRAM INDICATORS IN HIV-INFECTED CHILDREN

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Introduction:

The study of the general clinical blood analysis and bone marrow condition is significant in diagnosing HIV infection. These methods allow the identification of hematological complications, determining the stage and prognosis of the disease [1,2,3].

Objective:

To determine hematological changes in the myelogram of HIV-infected children.

Materials and Methods:

To identify the features of hematopoiesis in HIV infection, we conducted a comparative analysis of the hematological parameters of peripheral blood and bone marrow in HIV-infected children and patients with primary immune thrombocytopenia (ITP). The study sample included 20 patients diagnosed with "HIV infection, clinical stage IV" (according to WHO classification, 2012) aged from 0 to 18 years (13 boys and 7 girls, median age 8 ± 0.98 years) and 20 patients with primary immune thrombocytopenia (10 boys and 10 girls, median age 5 ± 0.5 years). All HIV-infected children received antiretroviral therapy in accordance with the national treatment protocol (Order No. 277 of the Ministry of Health of the Republic of Uzbekistan dated 30.04.2018).

The study was conducted using the "Mindrey" 5000 hematology analyzer (China). For data processing, we used methods of variation statistics with calculations performed on a personal computer (Intel® insideTMCORETMi5) with application software. The calculation of the mean arithmetic value (M), standard mean deviation (σ), standard error of the mean value (m), and relative values (frequency, %) were conducted using "Microsoft Excel". The statistical significance of the measurements when comparing mean values was determined using the

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Student's t-test (t). Changes were considered statistically significant at a confidence level of P<0.05.

Results and Discussion:

Among all examined HIV-infected patients (n=20), 85% (n=17) had decreased hemoglobin (Hb) levels (ranging from 95 to 54 g/l) and erythrocyte counts (ranging from 3.86 to 1.26 x 10^12/l). In 35% (n=7) of cases, a mild decrease in Hb levels (95-91 g/l) was noted, in 25% (n=5) a moderate decrease (90-71 g/l), and in 25% (n=5) a severe decrease (70-54 g/l). In contrast, in patients with primary ITP (n=20), a decrease in Hb was registered in 65% (13) of cases, ranging from 110 to 78 g/l. Mild decrease (110-91 g/l) was found in 40% (8), moderate decrease (90-71 g/l) in 25% (5) cases, and severe cases were almost not registered (table 1).

Additionally, it is important to note that 45% (n=9) of HIV-infected patients had hypochromic anemia, 40% (n=8) had hyperchromic anemia, and 15% (n=3) had normochromic anemia. In patients with primary ITP, 100% (n=20) had hypochromic anemia due to frequent bleeding episodes leading to depletion of iron stores in the body.

Table 1

Hematological parameters of the general clinical blood analysis in patients with HIV infection and primary immune thrombocytopenia (M±m)

Indicator	Обследованные группы		
	Control, (n=40)	HIV-infected patients, (n=20)	Patients with primary ITP, (n=20)
Hemoglobin (g/l)	132,2±6,8	73,2±5,1***	80,5±9,4***
Erythrocytes, $x10^{12}$/l	4,7±0,19	2,7±0,17*	3,2±0,31
Platelets, $x10^9$/l	294,2±12,1	119,2±8,1***	24,8±1,8***
Leukocytes, $x10^9$/l	6,7±0,8	4,8±0,53	6,8±0,71
ESR, mm/h	7,1+0,6	6,2+0,9	6,9+0,84

Note: * - significant compared to control (*-P<0.05; **-P<0.01; ***-P<0.001).*

Along with anemia, thrombocytopenia was detected in all examined patients, defined as a platelet count below 150x10^9/l. In particular, the average platelet count in HIV-infected patients was 119.2±8.1x10^9/l (p<0.001), with variation from 145.7 to 84.6 x10^9/l. In patients with primary ITP, the average platelet count was 248±18x10^9/l, with a maximum level of 646x10^9/l and a minimum of single platelets.

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The results indicate that the average platelet count in HIV-infected patients was statistically significantly lower by 2.5 times ($p<0.001$) compared to the control, and exceeded the count by 4.8 times ($p<0.001$) in patients with primary ITP.

According to the literature, the reduction in platelet count in HIV infection is associated with both suppression of the bone marrow megakaryocyte lineage and accelerated platelet destruction in the bloodstream.

The average leukocyte level in the group of HIV-infected patients was slightly lower (4.8±0.53x10^9/l, max - 6.2x10^9/l and min - 3.4x10^9/l) compared to both the control group (6.7±0.8x10^9/l) and patients with primary ITP (6.8±0.71x10^9/l, max - 8.7x10^9/l and min - 5.8x10^9/l).

The study found that in all HIV-infected patients (6.2±0.9 mm/h) and those with primary ITP (6.9±0.84 mm/h), the erythrocyte sedimentation rate (ESR) was within normal values.

We conducted a morphological study of bone marrow smears in HIV-infected children and those with primary ITP. The bone marrow aspirate in both groups of patients showed all three hematopoietic lineages. Specifically, the bone marrow picture in HIV-infected patients in 65% (n=13) of cases was characterized by normocellularity. In contrast, 35% (n=7) of patients showed suppression of the erythroid and megakaryocytic lineages, indicating hyporegenerative hematopoiesis caused by the negative impact of HIV infection. For instance, this category of patients had erythroid hypoplasia due to a significant reduction in the content of basophilic (1.2±0.01%; $p<0.01$), polychromatophilic (6.9±0.8%; $p<0.001$), and oxyphilic normocytes (0.6±0.01%; $p<0.001$) (Table 2).

No changes were observed in granulocyte maturation, but there was an increase in lymphocyte content (29.4±1.7%; $p<0.001$) in 55% (n=11) and plasma cells (6.8±0.3%; $p<0.001$) in 25% (n=5) of patients. The leukocyte-erythroblast ratio was 10.5:1 compared to 3.2:1 in the control and 3.3:1 in HIV-infected patients with normal hematopoiesis.

Additionally, there was a reduction in the number of megakaryocytes to an average of 4.1±0.1 ($p<0.001$), with 1.01±0.001 showing platelet budding, 2.01±0.1 being inactive forms, and 1±0.01 having bare nuclei.

Table 2

Hematological parameters of bone marrow in patients with HIV infection and primary immune thrombocytopenia (M±m)

Indicator	Examined groups	
	HIV-infected patients with	HIV-infected patients with

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	normal hematopoiesis, (n=13)	impaired hematopoiesis, (n=7)
Blasts, %	1,3±0,01	1,8±0,01
Neutrophilic promyelocytes, %	3,1±0,04	2,7±0,001
Myelocytes, %	9,1±1,2	7,2±1,1
Metamyelocytes, %	10,5±1,04	8,0±1,2
Band neutrophils, %	18,8±1,1	15,6±0,4
Segmented neutrophils, %	19,7±1,7	17,1±0,7
Eosinophils, %	1,7±0,21	2,0±0,01
Basophils, %	-	-
Monocytes, %	1,8±0,01	0,7±0,01***
Lymphocytes, %	9,8±1,7	29,4±1,7***
Plasma cells, %	0,9±0,01	6,8±0,3***
Erythroblasts, %	0,91±0,01	-
Pronormoblast, %	0,5±0,01	-
Basophilic normoblasts, %	2,4±0,3	1,2±0,01**
Polychromatophilic normoblasts, %	16,2±1,8	6,9±0,8***
Oxyphilic normoblasts, %	3,29±0,64	0,6±0,01***
Leuko-erythroblast ratio	3,3:1	10,5:1***
Megakaryocytes - with shedding - platelet-containing - inactive - bare nucleus	8,7±0,3 3,2±0,1 3,4±0,01 2,1±0,01 -	4,1±0,1*** 1,01±0,001 - 2,01±0,01 1±0,01

Note: * - significant compared to the control (*-P<0.05; **-P<0.01; ***-P<0.001).

The myelogram in patients with primary immune thrombocytopenia (ITP) was characterized by irritation of the megakaryocytic lineage with normal cellularity of the erythroid and myeloid hematopoietic lineages. The content of myeloid and erythroid cells was within normal values. The leukocyte-erythrocyte ratio was 3.3:1. Irritation of the megakaryocytic lineage manifested as an increase in the average number of megakaryocytes to 15.3±1.4, among which demarcated platelets accounted for 7.1±0.02, platelet-containing and inactive forms were 6.2±0.01 and 2.0±0.01, respectively (Table 3).

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Table 3

Hematological parameters of bone marrow in patients with primary immune thrombocytopenia (M±m)

Indicator	Examined groups	
	Control, (n=40)	Patients with primary ITP, (n=20)
Blasts, %	0,3±0,001	1,3±0,01
Neutrophilic promyelocytes, %	2,7±0,02	3,1±0,04
Myelocytes, %	8,9±0,91	9,1±1,2
Metamyelocytes, %	12,7±0,72	10,5±1,04
Band neutrophils, %	16,1±1,12	18,8±1,1
Segmented neutrophils, %	21,4±1,3	19,7±1,7
Eosinophils, %	2,3±0,1	1,7±0,21
Basophils, %	-	-
Monocytes, %	1,1±0,01	1,8±0,01
Lymphocytes, %	10,4±1,5	9,8±1,7
Plasma cells, %	0,3±0,01	0,9±0,01
Erythroblasts, %	0,7±0,01	0,91±0,01
Pronormoblast, %	0,3±0,001	0,5±0,01
Basophilic normoblasts, %	3,2±0,9	2,4±0,3
Polychromatophilic normoblasts, %	15,4±1,41	16,2±1,8
Oxyphilic normoblasts, %	4,2±0,87	3,29±0,64
Leuko-erythroblast ratio	3,2:1	3,3:1
Megakaryocytes - with shedding - platelet-containing - inactive - bare nucleus	12,51±1,31 5,3±0,82 7,21±0,94 - -	15,3±1,4 7,1±0,02 6,2±0,01 2,0±0,01 -

Note: * - significant compared to the control (*-P<0.05; **-P<0.01; ***-P<0.001).

Conclusion:

Thus, hematological disorders in HIV infection primarily manifest as anemia and thrombocytopenia, which develop due to the suppression of erythroid and megakaryocytic hematopoietic lineages. Consequently, anemia and

thrombocytopenia are common and often early manifestations of HIV infection. These facts indicate the necessity of monitoring hematological parameters in patients with HIV infection to determine the severity and prognosis of the disease, as well as to initiate targeted treatment early, which will directly contribute to reducing morbidity and mortality rates.

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