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Concentration of mineral requirements in bone marrow tissue of patients with lymphoma malignum

The research of the role of elements is connected with their influence on the tissue changes. The elements are cofactors of the cells enzymes (6,14). For example, ferrum is necessary for building haemoglobin, myoglobin, ferro-sulphurous protein and cytochromes (2, 9, 15, 20). It is known that magnesium may accelerate the progression of neoplastic diseases. The assimilation of vitamin A depends on the presence of zinc in the organisms. Vitaminum A is antioxidant and it is of significance in the inhibition of cancerogenesis (5,12). Also, zinc and copper influence the proper action of the dysmutase peroxidase and zinc is a cofactor of lactate dehydrogenase, too (1). The activity of lactate dehydrogenase is increased in neoplastic diseases and particularly in malignant lyphoma. Manganese is necessary for the functioning of the human organism. This element is a cofactor of enzymes which are needed for the synthesis of glycoproteins and proteoglycans. Manganese and dysmutase manganese is the most important element during the differentiation of the cells (4, 8, 11, 17).

The aim of this work was the determination of the concentration of microelements in bone marrow tissues.

MATERIAL AND METHODS

The concentration of magnesium, zinc, copper, ferrum and manganese was tested in the bone marrow tissue of 20 patients with malignant lymphoma. The patients were not treated. There was no neoplastic infiltration in the bone marrow tissues.

The bone marrow tissues were subjected to desiccation for 72 hours at 80^0C, ashed at 450^0C, and then dissolved in a concentrated HCl, which had been mixed 1 : 1 (v/v) with

H_2O. The concentrations of magnesium, manganese, zinc, copper and ferrum were determined by spectrophotometric method using atomic absorption spectrophotometer (Pye Unicam SP-192) (16,18). We compared the level of elements to the value of blood morphology.

RESULTS

The results are shown in Table 1. The decreased level of manganese, zinc and copper in the bone marrow correlated with the decreased values of MCV (mean corpuscular volume), although the values of MCH (mean corpuscular hemoglobin) and MCHC (mean corpuscular hemoglobin concentration) were proper.

The decreased levels of zinc and copper were connected with reduction erythropoesis. Regarding these two metals the differences are statistically significant ($p < 0.0001$). The

Table 1. Concentration of elements (in ppm) in bone marrow and value of MCV, MCH, MCHC, erythroblasts and red blood cells

Patients with lower value of MCH, erythroblasts and red blood cells		Patients with proper value of MCV, MCH, MCHC, erythroblasts and red blood cells	
Value of MCV, MCH, MCHC, erythroblasts and red blood cells	Concentration of microelements (ppm)	Value of MCV, MCH, MCHC, erythroblasts and red blood cells	Concentration of microelements (ppm)
MCV 0.84 (0.66 - 0.96)	Magnesium (Mg) 180 (160 - 244)	MCV 0.91 (0.90 - 0.94)	Magnesium (Mg) 340 (206 - 358)
MCHC 33 (30 - 36)	Zinc (Zn) 7.20 (6.10 - 7.48)	MCHC 31 (29 - 34)	Zinc (Zn) 13.1 (10.2 - 17.1)
MCH 31 (30 - 32)	Manganese (Mn) 0.27 (0.15 - 0.40)	MCH 30 (29 - 34)	Manganese (Mn) 0.80 (0.45 - 1.10)
Erythroblasts 7% (4 - 11)	Copper (Cu) 1.55 (1.50 - 1.70)	Erythroblasts 18% (13 - 20)	Copper (Cu) 6.30 (4.55 - 7.71)
Red blood cells $2.3 * 10^6$	Ferrum (Fe) 330 (244 - 430)	Red blood cells $3.66 * 10^6$	Ferrum (Fe) 480 (389 - 523)

concentration of ferrum was similar in the bone marrow tissues of people with the different values of MCH, MCHC, MCV and erythropoiesis.

DISCUSSION

The mineral requirements play a very important role in the functioning of the organism. They constitute many enzymes and some of these enzymes sweep away the free radicals (3, 9, 10, 13). It is known that free radicals play an important role in the multistage carcinogenesis process (4, 12). The cofactors of cytosol superoxide dysmutase are copper, zinc and iron. Mitochondrial superoxide dysmutase need as a cofactor the manganese ion. The manganese superoxide dysmutase is responsible for sweeping away the free radicals and is necessary for the differentiation of the cell (17, 19).

In our investigation we observed that the decreased level of manganese, zinc and copper in the bone marrow correlated with the decreased value of MCV, although the values of MCH and MCHC were proper.

Manganese is a cofactor of such enzymes such as: hydrolases, transpherases, isocitrate dehydrogenase, glutaminase. This element is also a cofactor of MnSOD, which is critical in the process of sweeping away free radicals. Also, it is known that manganese and zinc participate in glycoprotein and proteoglycan synthesis (3). Glycoprotein and proteoglycans are components of cell membrane, which may explain the decreased values of MCV without any deviation in value MCH and MCHC.

The red blood cells include the protein – erythrocuprein. This protein is composed of one atom of zinc and one atom of copper. There is twelve times as much zinc in the blood cells as in the serum. The decreased level of zinc, manganese and copper may cause a reduction in erythropoiesis even if the level of ferrum is normal.

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SUMMARY

The concentration of microelements was tested in the bone marrow tissue of 20 patients with lymphoma malignum. The patients were not treated. There was no neoplastic infiltration in their bone marrows. The concentrations of magnesium, manganese, zinc,

copper and ferrum were determined by the spectrophotometric method using atomic absorption spectrophotometer (Pye Unicam SP-192). The level of elements was compared to the value of blood morphology. The small value of MCV (mean corpuscular volume) was accompanied by a low level of copper, zinc and manganese although the values of MCH (mean corpuscular hemoglobin) and MCHC (mean corpuscular hemoglobin concentration) were normal.

Stężenie pierwiastków śladowych w szpiku kostnym u chorych na szpiczaka mnogiego

W pracy badano zawartość mikroelementów u 20 pacjentów chorych na chłoniaki złośliwe. Pacjenci zakwalifikowani do badań nie byli wcześniej poddawani chemioterapii. U tych pacjentów nie stwierdzano również przerzutów do kości. Do oceny zawartości magnezu, manganu, cynku, miedzi i żelaza zastosowano metodę atomowej spektrometrii absorpcyjnej (Pye Unicam SP-192). Poziom oznaczanych pierwiastków porównywano ze wskaźnikami morfologii krwi. Stwierdzono, że obniżony poziom manganu, cynku i miedzi w szpiku kostnym korelował z obniżoną wartością MCV (średnia objętość krwinki czerwonej). Wartości MCH (średnia waga hemoglobiny w krwince czerwonej) i MCHC (średnie stężenie hemoglobiny) pozostawały w normie.