ERYTHROPOIETIC ACTIVITY OF THE BLOOD IN MAN AFTER EXPOSURE TO HYPERBARIC HYPEROXIA

V. I. Voitkevich, A. M. Volzhskaya, and A. P. Myasnikov

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The erythropoietic activity of the blood plasma taken from a person 18-20 h after exposure to compressed air in a hyperbaric chamber, equivalent to a depth of 100 m, was considerably reduced. No significant changes were found in the peripheral blood indices at this period.

KEY WORDS: *Hyperbaric hyperoxia; erythropoietins; erythropoiesis.*

Among the most important factors stimulating erythropoiesis are the specific humoral substances known as erythropoietins, the concentration of which in the blood rises sharply in hypoxia [1]. The question of the effect of increased pressure and of hyperoxia on the erythropoietic activity of human blood is one of particular importance at the present time.

Erythropoietic activity of the plasma and the composition of the peripheral blood were investigated in persons exposed to hyperbaric hyperoxia equivalent to a depth of 100 m.

EXPERIMENTAL METHOD

Experiments were carried out on nine healthy men aged 20-40 years before and after exposure to compressed air in a hyperbaric chamber. The pressure in the chamber was raised from 1 to 11 kg/cm^2 for 5 min, and the subject stayed "at a depth of 100 m" (mean partial pressure of oxygen PO_2 2.3 kg force/cm^2, i.e., about 1800 mm Hg). They remained under these conditions for 10 min. Next, for about 4.5 h, they underwent decompression (PO_2 during this period was reduced to 0.21 kg force/cm^2), and during the first 15-20 min the subjects were "raised" from a depth of 100 to 36 m. During the 6 months before the investigation seven of the subjects had been exposed repeatedly to hyperbaric conditions, i.e., they were to some degree adapted to hyperoxia. The plasma erythropoietic activity, hemoglobin concentration, erythrocyte, reticulocyte, and leukocyte counts, and hematocrit index in the peripheral blood were investigated before and 18-20 h after the beginning of the experiments. The plasma erythropoietic factor was determined from the mitotic activity of a

TABLE 1. Composition of Peripheral Blood of Subjects before and 18-20 h after Hyperbaric Hyperoxia

Index	Before hyperoxia		18-20 h after hyperoxia		
	n	$M \pm m$	n	$M \pm m$	P
Hemoglobin, g %	9	14,0±0,5	8	14,6±0,4	>0,2
Erythrocytes, millions/mm^3	9	4,99±0,27	9	4,70±0,12	>0,3
Reticulocytes, %	9	0,7±0,1	8	0,6±0,1	>0,2
Hematocrit, %	9	38±1	7	38±1	1,0
Leukocytes, thousands/mm^3	9	5,5±0,1	9	5,2±0,2	>0,1

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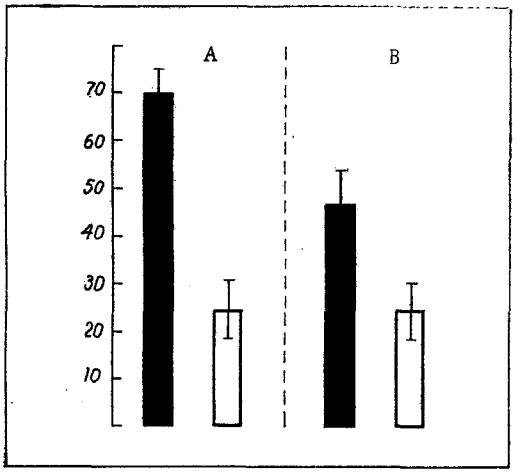

Fig. 1. Mean erythropoietic activity (in c.u.) of subjects untrained (A) and trained (B) for hyperoxia before (black columns) and 18-20 h after (white columns) exposure to hyperbaric hyperoxia. Values of M ± m shown.

bone marrow culture in liquid medium in the presence of colchicine [9, 10] (from the difference between the statmokinetic indices of the erythroblasts after the addition of the test plasma and of Hanks's solution to the culture) and expressed in conventional units (c.u.).

EXPERIMENTAL RESULTS

In eight of the nine subjects before exposure to hyperbaric hyperoxia the blood plasma contained erythropoietins (mean 47 ± 7 c.u.). After exposure in the hyperbaric chamber the erythropoietic activity fell by almost half to a mean level of 25 ± 6 c.u. ($P < 0.05$). In the case of people never previously exposed to hyperbaric conditions, however, it fell on average by almost two thirds (from 70 ± 5 to 25 ± 6 c.u.; $P < 0.001$). In two persons, no erythropoietins whatever could be detected in the plasma after exposure to hyperbaric hyperoxia, and in one subject an inhibitor of erythropoiesis was actually found. The decrease in plasma erythropoietic activity could be explained by a decrease in erythropoietin production and also, evidently, by the appearance of an inhibitor of erythropoiesis neutralizing erythropoietins in the blood [2, 3].

The dependence of the plasma erythropoietic activity on the degree of adaption of the subjects to hyperoxic conditions is noteworthy. In the adapted subjects the concentration of erythropoietins before the experiment was lower than in untrained subjects ($P < 0.001$; Fig. 1).

The composition of the peripheral blood 18-20 h after exposure to hyperbaric hyperoxia was substantially unchanged (Table 1). The inhibition of erythropoiesis had evidently not yet had time to affect the peripheral blood indices. In the later stages after exposure of man and animals to hyperoxia, several workers [4-8, 11] have observed changes in these indices.

It can be concluded from the results described above that exposure of man to compressed air (hyperbaric hyperoxia) leads to a reduction in the concentration of erythropoietins in the blood stream.

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RELATIONSHIP BETWEEN STRUCTURE, MICROCIRCULATION, AND TISSUE VASCULAR PERMEABILITY OF THE LIVER IN EXPERIMENTAL TOXIC HEPATITIS

N. Kh. Abdullaev, K. A. Zufarov*, and Kh. Ya. Karimov

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Biomicroscopic investigation of the liver showed that in experimental toxic hepatitis induced by heliotrine, very early and marked disturbances of the microcirculation arise, before injury to the parenchyma. Progression of the disturbances of the microcirculation and tissue vascular permeability, leading to hypoxia of the liver tissue and disturbance of liver metabolism, play a dominant role in the intensification of the pathomorphological changes and conversion of the acute pathological process in the liver into chronic.

KEY WORDS: *Microcirculation; tissue vascular permeability; toxic hepatitis; heliotrine.*

The object of this investigation was to study some mechanisms of the formation and development of the liver lesions during poisoning by heliotrine, which produces a picture very similar to that of epidemic hepatitis in man [1-6].

EXPERIMENTAL METHOD

Experiments were carried out on 115 albino rats of both sexes weighing initially 130-200 g. Heliotrine was given as a single subcutaneous injection in a dose of 25 mg/100 g body weight. Tests were carried out during the first 3 h, after 24, 48, and 72 h, and also after 7, 10, 20, 30, and 90 days. The microcirculation of the liver was studied by intravital luminescence microscopy [8], tissue vascular permability by injection of luminescent serum (0.7 ml intravenously), and the diameter of the microvessels by scanning photometry [3]. Liver sections were stained with hematoxylin and eosin.

EXPERIMENTAL RESULTS AND DISCUSSION

A uniform dilatation of both terminal afferent vessels and sinusoids and also of the hepatic and collecting venules was observed 10-15 min after injection of heliotrine. Later the vasodilatation increased and the blood flow was slowed. The state of aggregation of the blood cells (a juxtamural arrangement of the leukocytes was observed in the microvessels after 40-50 min) and the tissue vascular permeability showed parallel changes. Juxtamural ad-

*Academician of the Academy of Sciences of the Uzbek SSR.

Departments of Pathophysiology and Histology, Tashkent Medical Institute. Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 82, No. 11, pp. 1300-1302, November, 1976. Original article submitted May 26, 1976.