EFFECT OF ACUTE MASSIVE BLOOD LOSS DURING HYPERBARIC OXYGEN THERAPY ON NUCLEIC ACID METABOLISM IN THE ALBINO RAT LIVER

I. M. Tyrtyshnikov

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Acute blood loss (equivalent in volume to 3% of the animal's body weight) in rats is accompanied in the period of agony by inhibition of RNA synthesis and a decrease in the RNA and DNA content in the liver. Hyperbaric oxygen therapy immediately after blood loss prevents these changes. The animals treated with oxygen survived, unlike untreated rats which died within a few hours after blood loss.

Hyperbaric oxygen is being used increasingly for the treatment of potentially lethal states [1, 5, 10, 11, 14-16]. The metabolic mechanisms of its therapeutic action are being studied [7].

The object of this investigation was to study the effect of hyperbaric oxygen therapy in acute massive blood loss on nucleic acid metabolism in the liver, an organ in which the functional and structural changes play an important role in determining the outcome of potentially lethal states [6, 9].

EXPERIMENTAL METHOD

Experiments were carried out on 179 albino rats of both sexes weighing 150-210 g. Blood was taken from the jugular vein in a volume equivalent to 3% of the body weight over a period of 30 min. Hyperbaric oxygen therapy was given for 1 h with an oxygen pressure of 2 atm.

The content of DNA and RNA in the liver was determined by a modified method of Schmidt and Thannhauser [3, 12, 17, 18], and expressed in mg/100 g wet weight of tissue.

The intensity of RNA synthesis (in pulses/min/mg RNA) was estimated from the rate of incorporation into RNA of radioactive phosphorus injected subcutaneously in a dose of 0.5 μCi/g body weight 2 h before decapitation. The radioactivity of the samples was measured with the NK-108 apparatus (Gamma) in a well counter.

The numerical results were subjected to statistical analysis [2].

EXPERIMENTAL RESULTS AND DISCUSSION

Immediately after blood loss an increase of 17.8% in the RNA content was observed in the liver and there was a tendency for its synthesis to increase (Table 1). This evidently reflects a nonspecific response aimed at increasing the supply of structural materials for compensatory changes [4, 8].

The development of agony in the animals (45-85 min after blood loss) was accompanied by marked inhibition of RNA synthesis in the liver and also by a decrease in the content of the nucleic acids (chiefly RNA).

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TABLE 1. Content of Nucleic Acids and Incorporation of P^{32} into Total Liver RNA of Albino Rats after Acute Massive Blood Loss and Hyperbaric Oxygen Therapy (M ± m)

	Content of nucleic acids in liver (in mg/100 g wet weight of tissue)		Radioactivity (in pulses/min/mg RNA)
	RNA	DNA	
Intact animals	414±19,4	215,4±5,6	324±36,1
Initial phase of anemization	487,8±20,5 $P<0,05$	220,9±6,7 $P>0,05$	373±31,7 $P>0,05$
Agonal phase of anemization	307±12,3 $P<0,01$	198,3±6,1 $P\leqslant 0,05$	205±26,1 $P<0,05$
Hyperbaric oxygen therapy of anemized animals	404,5±12,5 $P>0,01$	213,4±10,7 $P>0,05$	390±86,8 $P>0,05$
Hyperbaric oxygenation of intact animals	423±15,9 $P>0,05$	238±10,3 $P>0,05$	355±77,6 $P>0,05$

Administration of hyperbaric oxygen during the period of agony did not prevent death of the animals, but its use in the initial period of anemization prevented the development of agony. The RNA content in the liver was 31% higher than the intensity of its synthesis, 90% higher in the treated than in the untreated animals.

RNA synthesis in the liver of the anemized animals can be considered to be activated both by the direct effect of hyperbaric oxygen on the supply of energy for synthetic processes in the liver cells and by its indirect action through the system of neuroendocrine regulation of metabolism, notably through the hypothalamic-pituitary-adrenal system, increased activity of which may stimulate RNA synthesis in the liver [8, 13].

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