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Microcirculatory Bed of the Rabbit Ear under Conditions of Hemoconcentration

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Studies of the microcirculation under an extreme hematocrit have shown that the hematocrit parameters are not always the dominant factor affecting blood viscosity and disturbances of blood flow in the microvessels [1,3,4]. The microvessel hematocrit proved not to follow the systemic hematocrit in the case of hemodilution, whereas such a parallel was noted for hemoconcentration [6,7]. It was also found that a more than 1.5-fold augmentation of hemoconcentration does not result in such severe disorders in the central hemodynamic indexes: the carotid pressure rose by no more than 15% and the venous pressure was not affected. An increased hemoconcentration on the microcirculatory level led to a 4% increase of a venule pressure, but the changes of the average diameter of venule and arteriole did not exceed 10% and were aimed at reducing the regional resistance [7]. A specifity of the effects of an extrem hematocrit on various organs was noted [5]. The present investigation was

TABLE 1. Relative Contribution of Individual Factors in the Changes of MCB Resistance (R) after Poiseuille

Experimental conditions	MCB Indexes					Predominant factors that change R
	μ/μ_o	L/L_o	D/D_o	$(D_o/D)^4$	$q=R/R_o=\mu/\mu_o\times L/L_o\times\times(D_o/D)^4$	
A Left ear	0.985*	1.170	0.975	1.106	1.274	Increase of number of perfused vessels and constriction
Right ear	1.086	0.980*	1.049	0.826	0.877	Microvessel dilatation
B Left ear	0.954*	0.884	0.956	1.197	1.009	Drop of number of perfused vessels and constriction
Right ear	1.165	0.924	0.985*	1.062	1.143	Vessel constriction and increase of blood viscosity

Note. Asterisk: the changes are not significant ($p>0.05$). The conventional symbols of the indexes are the same as in Fig. 1; mean values of the ratios listed in the table; A) a complex of bed indexes 2 h after treatment; B) same 5 h later.

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undertaken to study the microcirculatory bed (MCB) of paired rabbit ears under conditions of hemoconcentration.

MATERIALS AND METHODS

Experiments were carried out on newly formed ear microvessels 3-4 months after implantation of chambers, as described previously [2]. Six rabbits weighing 2.5±0.1 kg were used; 12 chambers were implanted, and 72 MCB fragments were observed. Hemoconcentration was achieved by the administration of a diuretic (furosemide) injected i.m. in a dose of 2 mg/kg. The effects of the drug were assessed 2 and 5 h after treatment. Blood samples were taken from the internal vein of the ear. The apparent viscosity μ, erythrocyte concentration (N), mean volume of an erythrocyte (V), and its electrophoretic mobility (EPM) were measured. The images of the microvessels were processed using a Leitz-TAS analyzer to obtain the MCB indexes: the projection area of the microvessels in mm^2 (A), the length in mm (L), and the mean diameter of the microvessels in μ (D). The distributions of the microvessel areas with different diameters were plotted. The changes of the regional resistance were analyzed using the Poiseuille formula. The reliability of the differences was assessed by Student's test for conjugated pairs.

RESULTS

The dynamics of the MCB parameters in relation to their initial values is depicted in Fig. 1. Administration of the diuretic resulted in an elevation of the erythrocyte content in the venous blood. Five hours after treatment the hemoconcentration for the left MCB had increased by 66.7%, and for the right MBC by 49.8%. The erythrocyte mass, calculated as W=N×V, had increased more moderately: by only 42.3% on the left and by 32.5% on the right, thit being related to a decrease of the erythrocyte volume due to the hemoconcentration. Viscosity on the left side did not change, and on the right it increased only by 16.5%. Changes of the MCB area were revealed on the left only, any changes on the right being insignificant.

The bed indexes which may affect the bed resistance according to the well-known Poiseuille law are listed in Table 1. The value of parameter q reflects the changes in the regional resistance: an increase when q>1 and a decrease when q<1. For instance, after 2 h the resistance of the left MCB rises owing to an increase of the number

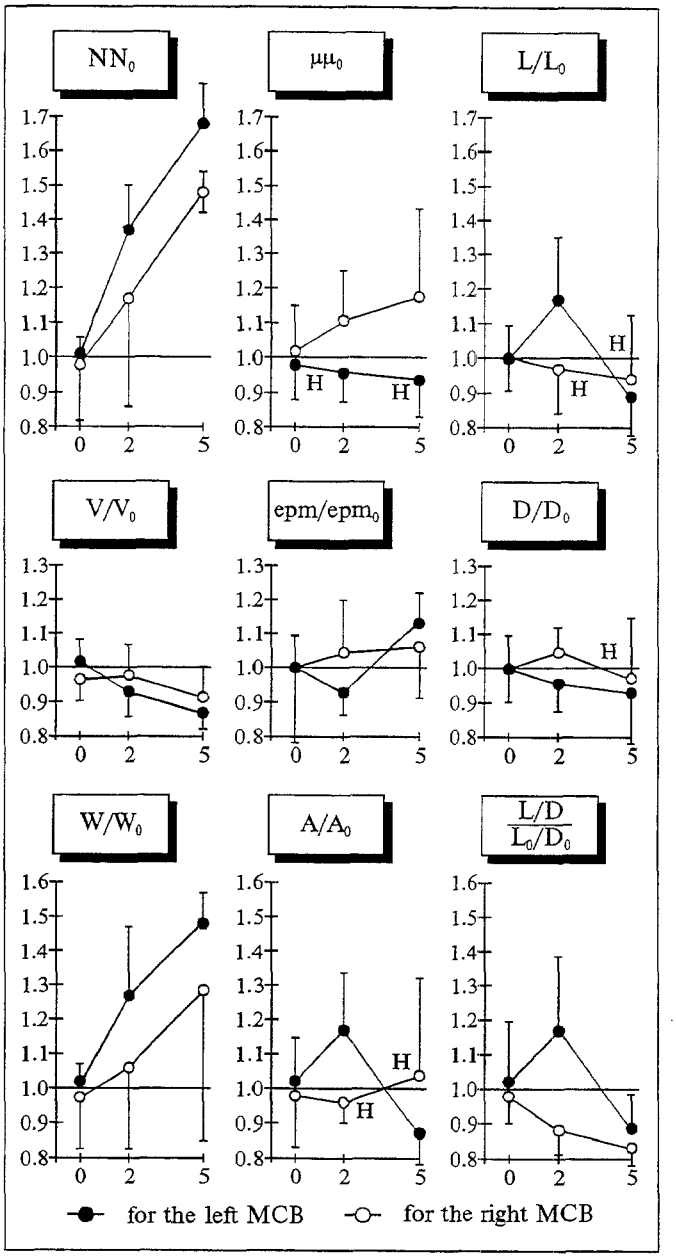

Fig. 1. Dynamics of MCB indexes of paired rabbit ears after i.m. injection of furosemide. Abscissa: time after treatment (h); ordinate: changes of MCB indexes in relation to initial levels (control with a subscript 0, experiment without subscript). Data are represented as $x \pm S$, where x is the mean value and S is the standard deviation. On the plots: H denotes unreliable differences ($p>0.05$).

of perfused vessels and to their constriction, the amount of which depends on the fourth power of the change in diameter. Dilatation of the vessels on the right side results in a decrease of resistance. The viscosity, on the other hand, is a factor increasing the resistance. The left MCB resistance does not differ from the initial one 5 h later, the number of perfused vessels diminishes, and there is constriction that prevents the resistance from falling. Dilatation of the right vessels

5 h later gives way to constriction, which affects the resistance by 6.2%. The increase of resistance mainly due to the rise in viscosity is reflected by parameter q.

If we considering the resistance as an index of a normal state and its change as a disorder, the aim of correction could be to stabilize the resistance. However, in the present case (Fig. 1) the left MCB index that is not affected by hemoconcentration is the viscosity of the venous blood, while on the right such an index is the bed area. The changes of all other indexes are geared towards preserving the conditions for maintaining a stable state. So, in this case correction for resistance remains disputable.

Returning to the problem of viscosity as a hematocrit function, it may be noted that the viscosity increased only by 8% when the hemoconcentration rose 8.5% (the right MCB). When the hemoconcentration increased by 50% there was no respective increase of the viscosity (it was only 16.5%). It is believed [7] that this result may be due to an interaction between the rheological and vascular mechanisms of homeostasis regulation, and this is indeed confirmed by the present analysis.

Thus, the findings prove that there are differences between the disorders in the paired MCB under hemoconcentration and support our previous results.

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Reaction of Nonapeptidergic Neurosecretory Cells of the Hypothalamic Accessory Groups to Cold and Immobilization Stress in Rats

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Rat hypothalamus nonapeptidergic neurosecretory cells (NSC) are located not only in the supraoptic, postoptic, and paraventricular nuclei, but also in small clusters called accessory groups. The localization and cellular composition of accessory groups have been previously described [13] but there are no reports about their functional role in the organism.

According to A. L. Polenov' concept, nonapeptide neurohormones synthesized in large neuro-

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