Effects of Carotid Glomectomy on Erythron Parameters in Rats Differing in the Resistance to Acute Hypoxia

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Rats with low resistance to acute altitude hypoxia did not differ from those with high resistance in the erythron parameters recorded under normal environmental conditions. After a bilateral carotid glomectomy, significant falls in the red blood cell count, hemoglobin concentration, packed cell volume, and mean corpuscular hemoglobin were recorded only in the group with low resistance to acute hypoxia, although the "altitude" resistance was decreased to similar degrees in the two groups.

Key Words: *hypoxia; blood; arterial chemoreceptors*

Since animals have been shown to develop signs of anemia after denervation of carotid sinus reflexogenic zones [4,6], we deemed it useful to evaluate the impact of bilateral carotid glomectomy on hemoglobin concentration and major erythron parameters in rats differing in their individual susceptibility to acute hypoxia.

MATERIALS AND METHODS

Bilateral carotid glomectomy was performed, as previously described [3], in 32 random-bred female rats (body weight 180-200 g), including 16 with high resistance to acute hypoxia and 16 with low resistance, as determined in preliminary tests by recording the time (in seconds) during which they were able to maintain postural reflexes in a cylindrical pressure chamber upon its rotation to 25-30 degrees (static load) at an "altitude" of 12 km. The following erythron parameters were measured or calculated for all rats before and after the glomectomy operation: red blood cell count (cells$\times 10^6/\mu l$), hemoglobin concentration (g/liter), packed red cell volume (PCV, %), mean corpuscular hemoglobin (MCH, pg), mean corpuscular hemoglobin concentration (MCHC, %), and mean red cell volume (MCV, μ). After the operation, the rats were again tested for their resistance to acute hypoxia as described above. All tests and measurements were carried out in daytime (from 14:00 to 16:00).

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RESULTS

Under normal environmental conditions, rats of the two groups did not significantly differ in the parameters recorded. After the carotid glomectomy, the "altitude" resistance was decreased in the two groups to approximately equal degrees (2.5 times in the highly resistant group and 2.1 times in that with low resistance), but significant falls in the red cell count, hemoglobin concentration, PCV, and MCH were recorded only for the group with low resistance to acute hypoxia (Table 1). It is noteworthy that rats with high and low resistance to chronic rather than acute hypoxia were also found not to differ significantly in erythron parameters under normal environmental conditions [12]; at an "altitude" of 5.5 km, however, rats with low resistance to prolonged hypoxia, unlike highly resistant rats, deve-

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TABLE 1. Impact of Bilateral Carotid Glomectomy on Hemoglobin Concentration, Red Cell Count, Packed Cell Volume, and Red Cell Indexes in Rats with Different Levels of "Altitude" Resistance ($M \pm m$)

Parameter	Rats			
	with low resistance (n=16)		with high resistance (n=16)	
	before operation	after operation	before operation	after operation
Resistance to acute hypoxia, sec	163.2±35.7	78.61±12.1	1261±74.7	501.2±155.0
Red cell count, cells×10^6/μl	8.180±0.18	7.507±0.15*	7.939±0.15	8.172±0.12
Hemoglobin concentration, g/liter	15.27±0.29	13.70±0.34*	15.01±0.20	14.98±0.18
PCV, %	48.98±0.81	44.15±0.73*	46.94±1.58	47.19±0.68
MCH, pg	19.10±0.38	18.24±0.26*	18.62±0.62	18.35±0.26
MCHC, %	31.80±0.41	31.00±0.48	31.48±0.50	31.79±0.48
MCV, μ	60.17±1.37	58.93±0.88	59.06±1.51	57.91±1.25

Note. PCV = packed red cell volume; MCH = mean corpuscular hemoglobin; MCHC = mean corpuscular hemoglobin concentration; MCV = mean red cell volume. *Significant difference from the value before glomectomy.

loped clearly marked symptoms similar to manifestations of human mountain sickness (polycythemia, thickening of the blood, pulmonary hypertension).

It was suggested more than two decades ago that the response to hypoxia in rats with denervated reflexogenic zones of the carotid sinus could be likened to the state of humans predisposed to mountain sickness, one cause of which is functional insufficiency of arterial chemoreceptors [9]. Denervation of these zones has been shown in many studies to bring about, in both animals and humans, a significant drop of partial oxygen tension in the blood and its diminished saturation with oxygen [2,7,8,10,13,14]. Inactivation of carotid receptors results in an appreciable reduction of functional reserves in the body [1] with a consequent decrease in the resistance to acute hypoxia. Altitude resistance is an integral indicator characterizing the state of various systems. The disruption by carotid glomectomy of the relationships and interactions among various functional systems, which is manifested by considerable changes in neuroendocrine regulation [11] and in 24-h rhythms of hematological parameters [5], appears to have been more severe in the hypoxia-susceptible rats which, in contrast to hypoxia-resistant animals, developed signs of anemia following the inactivation of carotid receptors.

The results of this study indicate that the extent to which reflexogenic zones of the carotid sinus are involved in the regulation of several important erythron parameters depends on the individual resistance of animals to acute hypoxia.

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