CHANGES IN PROTEIN AMIDO GROUPS IN VARIOUS ORGANS OF RABBITS ON DEATH AND RESUSCITATION

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UDC 616-036.882-08-07:616-008.939.6-074

Investigation of the effect of extremal states on the content of protein amido groups in various organs showed that lowering the body temperature to 17-19°C leads to a decrease in the level of labile and stable amido groups in all the organs tested. Postmortem cooling of the rabbit leads to a more marked decrease in the protein amido groups than hypothermia. This decrease is reversible with difficulty and is practically unchanged during warming and resuscitation. On death of the animal without a subsequent fall of body temperature the content of labile and stable protein groups is practically unchanged.

The content of amido groups in homoiothermic animals falls during a state of hypothermia [4, 12]. Exposure to oxygen in a pressure of 4-6 atm causes a decrease in the content of labile groups in the period of restlessness and convulsions [7]. During muscle fatigue the brain proteins become deaminated, and during rest they are reaminated [3]. Most investigations have been devoted to the study of the dynamics of brain protein amido groups [1, 2, 15]. Only isolated studies have been made of the proteins of heart muscle, liver, and kidneys [5, 11].

The content of protein amido groups was determined in intact animals in a state of anabiosis created by hypothermia, after clinical death under normothermic conditions, and also after postmortem cooling and subsequent resuscitation, for it was important to discover to what extent the changes in the content of these active groups of protein are reversible.

EXPERIMENTAL METHOD

Male rabbits weighing 2800-3200 g were used. The animals were divided into four groups: 1) intact animals, 2) animals in a state of hypothermia, 3 and 4) rabbits resuscitated or not after clinical death with postmortem cooling. Hypothermia was produced in an ice bath for 30-40 min to a temperature of 17-19°C. The animals were killed by exsanguination and compression of the trachea. They were cooled to 17-19°C from 10 to 15 min after the onset of clinical death by perfusion with cooled blood from an artificial circulation apparatus (ACA) or by immersion in ice-cold water. All the animals were warmed with the ACA 60-90 min after the onset of clinical death to 38°C [8] and perfusion at this temperature was continued for a further 60 min. The resuscitated and nonresuscitated animals were then disconnected from the ACA. The content of amido groups was determined by Seligson's method [14] in the modification of Silakova et al. [10], concluding with Nessler's method [6, 13].

EXPERIMENTAL RESULTS AND DISCUSSION

The results given in Table 1 show that the highest content of amido groups, both labile and stable, in the intact animals was found in the heart. The lowest content of amido groups was in the spinal cord. The ratio between labile and stable amido groups varied from 0.6 to 1.1. In hypothermia the maximal decrease in the content of labile amido groups was observed in the heart. In the liver and cerebral hemispheres the

Laboratory of Biochemistry, A. V. Vishnevskii Institute of Surgery, Academy of Medical Sciences of the USSR, Moscow. (Presented by Academician of the Academy of Medical Sciences of the USSR, A. A. Vishnevskii.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 77, No. 5, pp. 44-46, May, 1974. Original article submitted May 16, 1973.

TABLE 1. Content of Protein Amido Groups (in μ/mg dry weight) in Intact Animals and Its Dynamics in Extremal States (M ± m)

Amido groups	Organ	Group of animals				
		control (1)	hypothermia (19–17°) (2)	after death: cooled, not resuscitated	after death: cooled, resuscitated	after death: Neither cooled nor resuscitated
Labile	Heart	3,33±0,101	2,24±0,069	0,88±0,080	0,95±0,068	2,81±0,098
	P		<0,001		>0,5	
	Liver	2,25±0,121	1,92±0,158	1,00±0,001	1,00±0,092	2,91±0,003
	P		<0,01		>0,2	
	Spleen	3,29±0,145	2,55±0,093	1,68±0,001	1,40±0,023	3,39±0,207
	P		<0,01		>0,1	
	Cerebral hemispheres	2,31±0,140	2,00±0,185	1,43±0,053	1,42±0,153	2,21±0,093
	P		<0,1		>0,5	
	Spinal cord	2,04±0,092	1,52±0,151	0,84±0,001	1,32±0,001	2,12±0,001
	P		<0,05		<0,001	
Firmly bound	Heart	3,80±0,187	3,45±0,222	2,65±0,092	2,89±0,113	3,02±0,043
	P		>0,2		>0,2	
	Liver	3,69±0,201	2,80±0,194	2,47±0,001	2,89±0,258	2,80±0,040
	P		<0,02		>0,1	
	Spleen	3,22±0,47	2,92±0,47	2,52±0,001	1,94±0,012	3,40±0,16
	P		>0,2		<0,001	
	Cerebral hemispheres	3,64±0,26	2,88±0,185	2,38±0,177	2,30±1,10	4,03±0,069
	P		<0,5		>0,5	
	Spinal cord	2,31±0,074	1,61±0,185	1,51±0,001	1,48±0,001	2,02±0,001
	P		<0,02		>0,5	

Legend. Significance of differences calculated for group 2 relative to group 1 and for group 3 relative to group 4.

decrease in the level of labile amido groups was very small. The content of stable and labile amido groups varied differently. The smallest decrease in the content of firmly bound amido groups was observed in the heart.

In the rabbits cooled before they were killed there was a sharp decrease in the content of labile and firmly bound protein amido groups. The extent of the decrease in the content of amido groups in the organs of the rabbits cooled after death was considerably greater than the decrease in this parameter in animals cooled before death (Table 1). This decrease was reversible with difficulty and was virtually unchanged after warming and resuscitation of the rabbits despite the fact that their movements and respiration were restored, their corneal reflex reappeared, and the biosynthesis of proteins and nucleic acids was resumed in the resuscitated animals.

In animals in a state of clinical death and not subjected to postmortem cooling, but maintained at a constant temperature of 37–38° C, virtually no decrease in the content of protein amido groups was observed.

The experiments thus showed that changes in the content of protein amido groups in all the organs as a result of the various extremal states investigated were chiefly due to changes in the body temperature. The sharp decrease in their content observed during postmortem cooling was not easily reversible and it persisted after resuscitation of the animals. Meanwhile, by contrast with the dynamics of the content of sulfhydryl groups [9], the content of protein amido groups was unchanged after clinical death and maintenance of the temperature at 38° C. The loss of protein amido groups and the changes in charge connected with it, as well as the intramolecular reconstruction of the polymers, constitute a generalized reaction of the protein molecules to lowering of the body temperature.

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