INFLUENCE OF THE RIGHT AND LEFT VAGUS NERVES ON PROTEIN METABOLISM IN DIFFERENT PARTS OF THE DOG MYOCARDIUM

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Division of each vagus nerve separately varies in its effect on the content, synthesis, and physicochemical properties of the contractile proteins of the right and left ventricles.

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Morphological and physiological investigations have demonstrated differences in the action of the right and left vagus nerves on cardiac activity [5, 6, 10, 12, 13].

The object of the present investigation was to study protein metabolism in the right and left ventricles after division of the vagus nerves.

EXPERIMENTAL METHOD

Experiments were carried out on 45 dogs. The vagus nerves were divided distally to the ganglion nodosum. Myocardial tissue was investigated on the 3rd and 30th days after the operation. Proteins were isolated by Ivanov's method [2], protein nitrogen was determined by Kjeldahl's method, ATPase activity by the increase in inorganic phosphorous [2], and the content of SH-groups by Poglazov's method [3]. Changes in solubility of actomyosin were investigated by Dubuisson's method [8]. The velocity of protein synthesis was estimated from the incorporation of methionine-S^{35} injected in a dose of 30 000 pulses/min/g body weight. The animals were sacrificed 60 min after injection of the label. All procedures on the tissues were carried out in the cold.

EXPERIMENTAL RESULTS

Three days after division of the right or left vagus nerve no changes were found in the protein composition of the myocardium. Thirty days after separate division of each nerve, no changes likewise were found in the protein content and intensity of incorporation of methionine-S^{35} into the total tissue proteins and sarcoplasmic proteins. Changes were found only in relation to the contractile proteins (Table 1).

The content of contractile protein was reduced in both ventricles after division of the right or the left vagus nerve, but the intensity of incorporation of the labeled amino acid into actomyosin and myosin differed. After division of the right vagus nerve, a decrease in the specific radioactivity of protein by 33% was found in the right ventricle. After division of the left vagus nerve this index in the left ventricle was reduced by 25%.

Incorporation of methionine-S^{35} into actomyosin in the ventricles opposite to the divided nerve rose by 28-30%, although the protein content was lower than in the control.

Under pathological conditions the decrease in protein content could result not only from changes in protein synthesis, but also of disturbance of their extractability [7, 8, 9, 11]. Determinations of the solubility of actomyosin in fact showed that the decrease in its content in the ventricles opposite to the divided nerve was associated with a decrease in extractability of the protein. Qualitative changes in the protein also took place, as revealed by an increase in the ATPase activity of myosin of the left ventricle after division of the right vagus (from 114.6 to 131.6 μg phosphorus/mg nitrogen) and of the left vagus nerve (from

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TABLE 1. Indices of Protein Metabolism in Myocardium after Division of Vagus Nerves in Dogs

Indices	Statistical index	Control				Division of nerve							
		nitrogen content (in mg/g fresh tissue)		specific activity (pulses / min/g protein)		right				left			
						nitrogen content (in mg/g fresh tissue)		specific activity (in percent of control index)		nitrogen content (in mg/g fresh tissue)		specific activity (in percent of control index)	
		Ventricle											
		left	right	left	right	left	right	left	right	left	right	left	right
Total tissue nitrogen	*M*	26,9	26,7	202	164	25,5	24,9	−13	−8	25,6	24,6	No change	+4
	± t	0,5	0,8	7,2	8,0	0,7	0,17			0,4	0,4		
	P				<0,01								
Nitrogen of sarcoplasmic proteins	*M*	8,7	8,5	218	170	9,3	8,2	−11	−4	9,2	8,8	−7	No change
	± t	0,25	0,27	10,3	6,4	0,2	0,3			0,24	0,35		
	P				<0,02								
Nitrogen of actomyosin	*M*	6,6	6,5	199	118	5,8	4,9	+30	−33,5	5,09	5,13	−25	+28
	± t	0,2	0,18	6,8	9,2	0,16	0,22			0,05	0,2		
	P				<0,01	=0,02	<0,01			<0,001	<0,01		
Nitrogen of myosin	*M*	1,86	1,6	225	198	1,4	1,46	+18	−37	1,99	1,55	−7	−5
	± t	0,09	0,04	7,0	5,5	0,06	0,1			0,09	0,16		
	P				<0,01	<0,001							
Actomyosin content in 1 ml extract after treatment of tissue with 0.5 M KCl or KI solutions	*M* 0,5M KCl	0,97	0,96			0,78	0,9			0,62	0,60		
	± t	0,02	0,02			0,02	0,01			0,09	0,08		
	P									<0,01	<0,01		
	M	1,04	1,07			1,16	1,07			0,88	1,1		
	± t 0,5 M KI	0,03	0,03			0,01	0,01			0,02	0,07		
	P												

114.6 to 152 μg phosphorus/mg nitrogen). Meanwhile an increase was observed in the content of free SH-groups of myosin, characterizing the active center of the enzyme molecule (from 0.03 to 0.039–0.04 μmole/mg protein).

The changes observed in the content and properties of contractile proteins were due not only to division of the parasympathetic fibers, but also to partial destruction of the sympathetic innervation of the myocardium, since the vagus nerve is a mixed nerve. This form of denervation, as morphological [4, 5] and physiological [1] investigations have shown, is accompanied by degenerative changes in the myocardium.

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