REACTION OF THE BLOOD VESSEL WALL TO BIOGENIC AMINES IN EXPERIMENTAL ATHEROSCLEROSIS

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In rabbits with experimental atherosclerosis contraction of an isolated strip of the aorta and stimulation of its tissue respiration by adrenalin were reduced. Contraction of a strip of aorta induced by serotonin was the same as in the control.

In rabbits with cholesterol-induced atherosclerosis changes in the enzymes of glycolysis, respiration, and lipid and protein metabolism are found [2, 13, 15, 17, 20]. The tissue respiration and reactivity of the blood vessels in atherosclerosis, however, are still matters on which opinions differ, largely because different stages of the disease have been studied by the use of different methods and models [1, 3-6, 14, 16].

This paper describes a parallel study of tissue respiration and the reaction of the blood vessel wall to biogenic amines in animals with experimental atherosclerosis.

EXPERIMENTAL METHOD

Atherosclerosis was induced by oral administration of cholesterol to rabbits daily for three months; the blood cholesterol level varied between 870 and 2000 mg%. In the experiments of series I, the aorta was removed from animals with a marked degree of atheromatosis for investigation. The degree of contraction of a strip of aorta under the influence of adrenalin and serotonin was determined [8, 12]. In the experiments of series II contraction and respiration of an isolated strip of aorta under the influence of adrenalin were investigated by the method described previously [9]. Contraction of the strip of aorta was expressed as a percentage of its initial length (20 mm). The oxygen absorption was expressed in microliters of oxygen absorbed per milligram dry weight of aorta per hour. Adrenalin, the concentration of which in the blood vessel wall is increased in certain pathological states [11], was used in above-threshold (10^{-9} g/ml) and

TABLE 1. Degree of Contraction of Isolated Strip of Aorta from Control Rabbits and Rabbits with Experimental Atherosclerosis in Response to Vasoconstrictors

Drug	Concentration of drug (in g/ml)	Control		Atherosclerosis	
		No. of experiments	degree of contraction of strip (in %)	No. of expts.	degree of contraction of strip (in %)
Adrenalin	10^{-9}	13	7,3±0,95	6	3,3±0,8 $P<0,02$
	10^{-6}	10	12,1±0,10	6	7,7±2,2 $P<0,05$
Serotonin	10^{-4}	8	7,3±1,2	6	6,3±2,1 $P>0,5$

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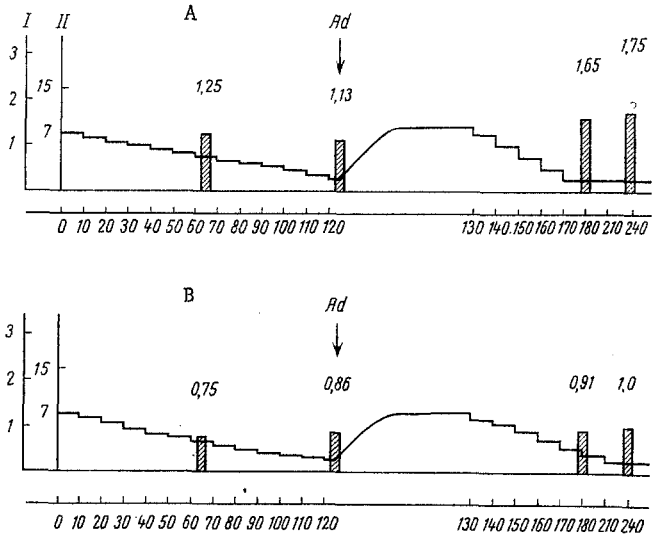

Fig. 1. Effect of adrenalin (Ad) on contraction and respiration of isolated strip of rabbits' aorta recorded simultaneously. Abscissa, time (in min); ordinate, I) oxygen consumption (in μl/mg) – columns; II) contraction of strip (in %) – continuous line; A) control; B) atherosclerosis.

submaximal (10^{-6} g/ml) concentrations while serotonin, with its important role in the pathogenesis of essential hypertension [18, 19, 21-24] with atherosclerosis, was used in the maximal concentration (10^{-4} g/ml).

EXPERIMENTAL RESULTS AND DISCUSSION

As Table 1 shows, a decrease in the contraction of the strip of aorta in response to adrenalin was observed in atherosclerosis. The response of the aorta of rabbits with atherosclerosis to serotonin was indistinguishable from the control.

The results of five experiments showed that in experimental atherosclerosis the intensity of the tissue respiration of the aortic strip fell (Fig. 1).

In the control, for instance, the oxygen consumption by the tissue was 1.25 ± 0.1 μl/mg during the first hour and 1.13 ± 0.1 μl/mg during the second hour. Respiration of the strips of aorta from rabbits with experimental atherosclerosis amounted to 0.75 ± 0.22 and 0.86 ± 0.27 μl/mg, respectively. The decrease was similar in all experiments although, because of scatter of the individual values, it was not statistically significant ($P > 0.05$). Adrenalin, in a concentration of 10^{-6} g/ml, increased the tissue respiration of the aortic strip of the control rabbits in the first hour to 1.65 ± 0.1 μl/mg ($n = 12$), whereas in experiments on strips of the aorta from rabbits with atherosclerosis the tissue respiration was 0.91 ± 0.11 μl/mg. This difference is statistically significant ($P < 0.05$), and it also continued during the second hour after administration of the adrenalin.

The writer is inclined to suppose that the decrease in the contractile response to adrenalin can be partly explained by the presence of the atheromatous plaques, preventing contraction of an area of the vessel wall.

Some of the decrease in the initial respiration could be the result of the fact that when the strip of aorta was weighed, the weight of the cholesterol deposits, which do not absorb oxygen, was included. However, the absence of stimulation of respiration by adrenalin suggests that in atherosclerosis activity of the oxidative enzymes is inhibited or they are partly destroyed. Previously [10] the writer obtained results showing a disturbance of the function of metal-containing enzymes in atherosclerosis.

The view expressed above is confirmed by the decrease in cytochrome oxidase activity [7] and in the combined content of NAD and NAD $\cdot H_2$ with a sharp decrease in the content of the oxidized form of NAD in atherosclerosis [2].

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