

RELATIVE VOLUME OF FUNCTIONING CAPILLARIES IN SKELETAL MUSCLE IN REGIONAL HYPOTENSION

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Experiments on rats showed that 1 month after lowering the pressure in the blood vessels in the posterior half of the body by constricting the abdominal aorta the number of functioning capillaries in the gastrocnemius and soleus muscles was virtually the same as in the control. This suggests that a decrease in the hydraulic resistance of the resistive vessels in a region of chronic local arterial hypotension is not attributable to an increase in the number of simultaneously functioning vessels.

KEY WORDS: skeletal muscle; functioning capillaries; chronic arterial hypotension.

Previous investigations showed [2, 5] that lowering the blood pressure in the arteries of the posterior part of the body in rats for 14-90 days leads to a relative decrease in the hydraulic resistance of the resistive vessels of that region. Experimental analysis of this phenomenon showed that chronic regional hypotension causes a progressive increase in compliance of the resistive vessels due to a significant decrease in thickness of the vessel wall.

However, since only a small proportion of the precapillaries is known to be open at any one time in a resting muscle [1, 4], the possibility cannot be ruled out that the decrease in the total hydraulic resistance of the resistive vessels of the hind limb could be due not only to an increase in the compliance of their wall, but also to an increase in the number of simultaneously functioning vessels. The object of this investigation was to test this hypothesis.

EXPERIMENTAL METHOD

Experiments were carried out on two groups of rats, with seven animals in each group, weighing 180-250 g. Under ether anesthesia a Nichrome coil was applied to the abdominal aorta, constricting its lumen, distally to the point of origin of the renal arteries. Previous investigations showed that as a result of this operation the pressure in the vessels in the posterior part of the body is lowered by 30-50% [2, 5, 6]. The control group consisted of seven rats. One month after constriction of the aorta, pieces of the biceps, gastrocnemius, and soleus muscles were excised from the experimental and control animals under superficial ether anesthesia.

After fixation of the muscles in formalin for 3 days sections 2- μ thick were cut and stained with benzidine by Pickworth's method [3]. The reaction of benzidine with nitroprusside gave a black color in the capillaries filled with erythrocytes. Open (functioning) capillaries were thus revealed by this method.

The ratio between the volume of open capillaries and the volume of muscle tissue was determined in the control and experimental animals. The relative volume of the capillaries was determined by Chalkley's method [7]. A 20 \times objective, 7 \times ocular, and a grid with 256 squares were used for counting. Only capillaries in the squares of the grid were counted. Counting was carried out in 30 fields of vision.

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TABLE 1. Relative Volume of Functioning Capillaries in Skeletal Muscles

Group of animals	Soleus muscle (SM)	Gastrocnemius muscle (GM)	Ratio SM/GM	Biceps femoris muscle
Control	20,9	6,98	3,1	10,4
Experimental	20,6	6,8	3,1	6,8

EXPERIMENTAL RESULTS

The results in Table 1 show that the relative volume of the capillaries in the soleus muscle of the control animals was more than three times greater than in the gastrocnemius muscle. This fact is in agreement with observations showing that the blood flow at rest in the slow (tonic) soleus muscle is several times greater than in the fast (phasic) gastrocnemius muscle.

It will also be clear from Table 1 that the relative volume of the capillaries in the soleus and gastrocnemius muscles of animals with chronic regional hypotension was indistinguishable from their relative volume in the control rats.

The results of these experiments thus give no reason to associate the decrease in hydraulic resistance developing in vessels during prolonged local arterial hypotension with an increase in the number of simultaneously functioning resistive vessels. They suggest that chronic arterial hypotension leads to an increase in their compliance.

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