

EFFECT OF CHANGES IN THE CORONARY BLOOD FLOW ON THE TONE OF THE PULMONARY VESSELS

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V. S. Kupriyanov

Department of Normal Physiology (Head—Professor V. V. Petrovskii),
Bashkir Medical Institute, Ufa

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Experimental and clinical investigations have shown that ligation, compression, or occlusion of the coronary arteries is accompanied by reflex changes in the coronary circulation [2, 7, 8, 11, 27, 28]. A disturbance of the coronary blood flow also causes reflex changes in various regions of the systemic circulation [3, 4, 18, 20, 22, 23,]. The object of the present study was to examine the effect of changes in the coronary blood flow on the tone of the pulmonary vessels.

EXPERIMENTAL

In cats lightly anesthetized with urethane and maintained on artificial respiration the fourth left rib was removed, the pericardium was opened, and fine silk ligatures were passed under the vessels of the heart. The change in the coronary blood flow was produced by compression of the right coronary artery, the anterior descending and circumflex branches of the left coronary artery, and also the trunk of the great and middle cardiac veins at various levels. The duration of compression of the vessels varied from 1 to 20 sec. The changes in the tone of the pulmonary vessels were investigated by the method of resistography or by perfusing under constant pressure the humorally

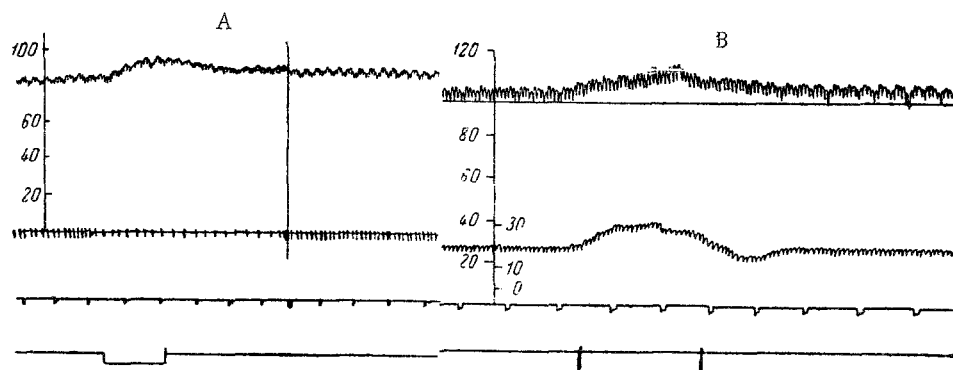


Fig. 1. Changes in the tone of the pulmonary vessels and in the arterial pressure during compression of the descending (A) and circumflex (B) branches of the left coronary artery. Significance of the curves (from top to bottom): arterial pressure; rate of perfusion (in drops) through vessels of the posterior lobe of the left lung (A); resistogram of these same vessels (B); time marker (5 sec); marker of compression of the branches of the coronary artery. The vertical line (A) denotes stopping of the kymograph for 30 sec.

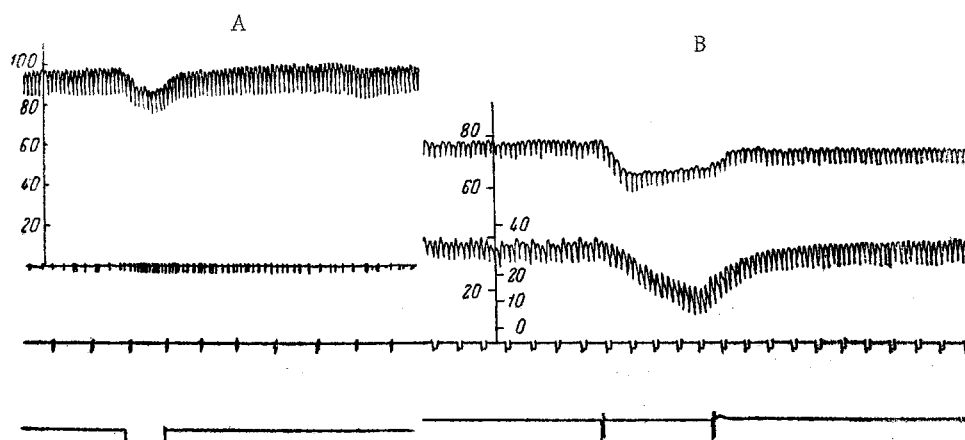


Fig. 2. Effect of compression of the great (A) and middle (B) cardiac veins on the tone of the pulmonary vessels and the arterial pressure. Significance of curves (from top to bottom): arterial pressure; rate of perfusion (in drops) through the vessels of the posterior lobe of the left lung (A); resistogram of the vessels of this lobe (B); time marker: 5 sec (A), 2 sec (B); marker of compression of the cardiac veins.

isolated vessels of the posterior lobe of the left lung. Simultaneous recordings were made of the pressure in the common carotid artery. In 34 experiments the effects of 480 changes in the coronary blood flow were studied.

RESULTS

Local ischemia of the myocardium arising as a result of compression of the coronary arteries for 1-20 sec in the overwhelming majority of cases caused an increase in the tone of the pulmonary vessels, expressed by a decrease in the outflow from the veins of the isolated lobe of the lung or by an increased perfusion pressure in the artery of this lobe (Fig. 1). As a rule, in these circumstances the pressure in the vessels of the systemic circulation was increased.

The reflex nature of the changes in the tone of the pulmonary vessels was suggested by experiments in which constriction of the vessels of the posterior lobe of the left lung ceased after its denervation. Deepening of the anesthesia led to a decrease in the tone of the pulmonary vessels during compression of the coronary arteries. Meanwhile bilateral vagotomy in the neck did not abolish the constrictor reaction of the pulmonary vessels during transient local ischemia of the myocardium.

The results of these experiments are in agreement with clinical observations. It has been found [5, 10, 12, 15, 16, 21] that the onset of attacks of angina pectoris may be accompanied by a considerable increase in the general blood pressure (especially of its minimal value), presumably in connection with an increase in the tone of the peripheral vessels [1, 9, 17, 24-26].

Compression of the cardiac veins for 1-20 sec caused a reflex dilatation of the pulmonary vessels. At the same time the general blood pressure fell (Fig. 2). The changes described developed within 0.5-3.0 sec of compression of the cardiac veins and continued for some time after compression had ceased.

It must be remembered that compression of the vein gives rise not only to stasis and to an increase in the blood pressure in the drainage area of that vein, but also to changes in the blood flow which may arise in all the vessels of the myocardium because of their abundant anastomoses [13, 14, 19].

It may be assumed that the reflex increase in the tone of the pulmonary vessels arising during local ischemia of the myocardium may be protective in character. A disturbance of the coronary blood flow is known to be accompanied by stasis of the blood in the pulmonary vessels, on account of the developing cardiac failure [6]. The increase in the tone of the pulmonary vessels described above may be directed towards removing this stasis.

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