

REVASCULARIZATION OF THE HEART BY DIRECT ANASTOMOSES BETWEEN THE INTERNAL MAMMARY AND CORONARY ARTERIES

L. M. Nepomnyashchikh

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One method of revascularizing the heart muscle is by forming direct vascular anastomoses with the coronary arteries. Such operations have now been developed experimentally as methods of correcting the insufficiency of the coronary circulation.

This paper describes a study of the effect of direct anastomosis of the internal mammary and coronary arteries on the structure and histochemical parameters of the myocardium in dogs.

EXPERIMENTAL METHOD

The operations were performed by Dr. Med. Sci. V. S. Sergievskii and his collaborators [5]. The material (the hearts of 27 dogs) was studied at various times for 2 h until 1.5 years after the operation. Histochemical reactions and control methods [6] were used to determine glycogen, succinate dehydrogenase, cytochrome oxidase, acid and neutral mucopolysaccharides, DNA, and RNA in the myocardium. Structural changes were determined by staining the sections with hematoxylin-eosin and by Van Gieson's and Selye's methods, by impregnation (Gomori's method), and by polarization microscopy.

EXPERIMENTAL RESULTS

On the first day after the operation histochemical and morphological changes developed in the part of the myocardium lying near the anastomosis, and could be attributed to temporary local ischemia (hypoxia) of the tissue accompanied by disturbance of vascular permeability [4]. These changes were mainly caused by mobilization of the coronary arteries. In the later stages (4th-20th day) connective tissue de-

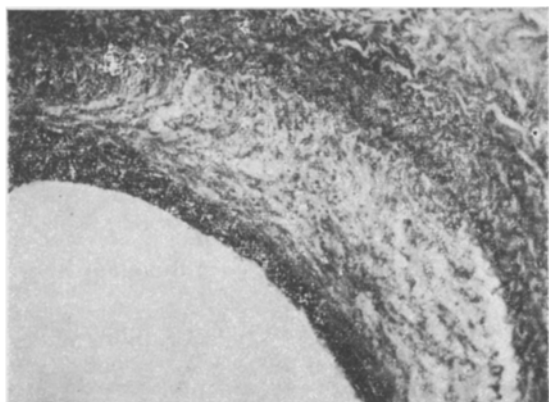


Fig. 1. Direct anastomosis between the right internal mammary and right coronary arteries. Wall of the anastomosis 1 year 13 days after the operation. Thickening of the intima. Van Gieson. Objective 10 \times , ocular 7 \times .

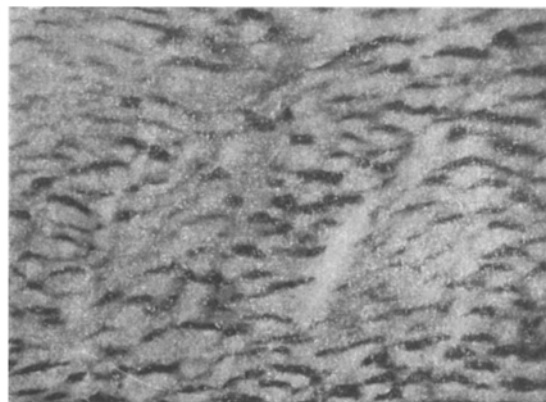


Fig. 2. Increased glycogen content in the muscle fibers of the heart after direct anastomosis of the internal mammary and coronary arteries. PAS reaction. Objective 20 \times , ocular 7 \times .

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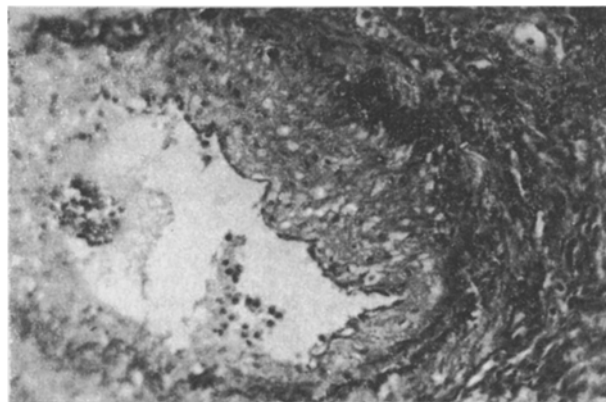


Fig. 3. Artery of "shunt" type in the myocardium of the left ventricle. Van Gieson. Objective 20 \times , ocular 7 \times .

veloped in the region of the anastomosis. The histochemical changes were characteristic of collagenogenesis [3]. The vascular disturbances of limited extent arising in the first 18 h in parts of the myocardium at a distance from the site of operation were evidently stressor in nature. This was shown by the fact that they could be detected by Selye's staining method [1, 7]. They were reversible, for they were not observed in the later periods. When the wall of the anastomosis and of the anastomosed arteries was investigated at intervals up to 1.5 years from the time of operation no necrobiotic changes were discovered in them, apart from in one or two isolated cases. The results of investigation of the anastomoses showed that they were patent in 24 of 27 cases. If the operation was performed correctly from the technical point of view, the anastomosed vessels joined together successfully and no stenosis developed (Fig. 1).

After formation of the anastomoses, the following changes in the myocardium resulting from the operation itself were observed. Starting with the 4th day after the operation an increase in the glycogen content of the muscle fibers was observed in various parts of the heart (Fig. 2). In these conditions neither atrophy nor hypertrophy of the muscle fibers took place at the later periods. From 1 to 2 months after the operation or later an increase in the number of vessels, structural changes in the vessels of medium and small caliber, and the presence of arteries of "shunt" type were observed (Fig. 3).

These findings, together with the results of investigations of other methods of revascularization of the heart [2], show that the effect of operations connected with changes in the hemodynamics has a common mechanism.

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