

MAST CELLS OF THE MYOCARDIUM DURING DISTURBANCES  
OF THE CORONARY CIRCULATION

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Within 10 min after ligation of the descending branch of the left coronary artery, a distinct increase in the number of mast cells is found in the zone of ischemia, reaching a maximum 1 h after disturbance of the coronary blood flow. During the next 24 h the number of mast cells falls progressively. A high proportion of young, undifferentiated mast cells is found. Similar, although less marked changes are also observed in the intact zone of the myocardium of the left ventricle.

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Acute disturbance of the coronary circulation causes marked destructive changes in the connective-tissue skeleton of the heart and definite responses on the part of the connective-tissue cells [1, 2, 5].

This paper describes the results of histochemical analysis of the mast cells of the myocardium at different times after ligation of the coronary artery.

## EXPERIMENTAL METHOD

Acute experiments were carried out on 108 adult mongrel dogs weighing from 5 to 20 kg. The animals were anesthetized with ether and thiopental and the descending branch of the left coronary artery was ligated. The heart was removed from the chest between 10 min and 24 h after ligation of the artery. The myocardium was excised through the whole thickness of the wall of the left ventricle from the middle of the ischemic zone and also from the posterior wall of the ventricle with its circulation intact. The hearts of 10 healthy dogs were used as controls.

The material was fixed [4] in a 2% solution of anhydrous sodium acetate in 10% neutral formalin at 4° for 24 h. High-polymer sulfo-esters of carbohydrate-protein complexes contained in the cytoplasm of the mast cells were detected by metachromatic staining with toluidine blue [6] or with azure-II at pH 0.5-2.5 [9], and also by staining with alcian blue [8], basic fuchsin [10], basic brown [3], and aluminum sulfate-toluidine blue [7]. Control sections were methylated and then saponified, or treated with streptococcal hyaluronidase and a preparation of testicular hyaluronidase (lidase).

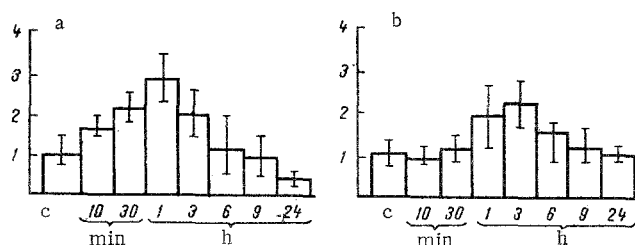


Fig. 1. Content of mast cells in myocardium of ischemic (a) and intact (b) zones of left ventricle. Abscissa, duration of ischemia, C—control; ordinate, mean number of mast cells per field of vision.

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The positively reacting mast cells were counted successively in all fields of vision from the endocardium to the epicardium. The total number of mast cells divided by the number of fields of vision was designated by the letter "i," characterizing the mean number of cells in the section studied.

## EXPERIMENTAL RESULTS

The mean value of the index  $i$  for the healthy dogs ( $M \pm m$ ) was  $0.97 \pm 0.16$ . The mast cells were mainly distributed in the subendocardial portion, where they lay between the bundles of muscle fibers. Some of them were constantly found in the perivascular connective tissue. The metachromatic staining reaction revealed  $\beta$ - and  $\gamma$ -metachromasia, and cells with degranulating cytoplasm.

During acute disturbance of the coronary blood flow, the number of mast cells showed definite changes in the ischemic zone and also in the myocardium with an intact circulation (Fig. 1). In the myocardium of the ischemic zone 10 min after ligation of the coronary artery the number was increased ( $i = 1.6 \pm 0.12$ ;  $P < 0.01$ ), to reach a maximum after 1 h ( $i = 2.76 \pm 0.3$ ;  $P < 0.001$ ). In tests carried out 3-12 h after ligation of the artery a sharp decrease was found in the number of mast cells, and 24 h after ligation their number in the zone of ischemia was about 50% of the control.

In the myocardium of the intact zone of the left ventricle the response was similar in character although less marked. The largest number of mast cells was observed 3 h after ligation of the artery ( $i = 2.1 \pm 0.3$ ;  $P < 0.01$ ). Toward the end of the first day the number of mast cells in the intact myocardium was practically back to normal.

In the zone of ischemia young mast cells were predominant, their cytoplasm exhibiting purple  $\gamma$ -metachromasia. The cells were distributed as irregular groups throughout the wall of the ventricle. During the formation of foci of myocytolysis, between 6 and 24 h after ligation, positively reacting mast cells were found in the myocardium of the subepicardial and subendocardial portions of the ischemic zone and also in the perivascular connective tissue of the subepicardial arteries and veins. The composition and distribution of the mast cells in the intact myocardium were not significantly different from those in the control.

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