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A METHOD OF SIMULATING ACUTE TRANSIENT CORONARY INSUFFICIENCY IN RATS

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The attention of cardiologists has been drawn to one typical form of pathology of cardiac activity, namely, acute transient coronary insufficiency (ATCI), which is characterized by reduction of the coronary blood flow followed by its (postischemic) renewal.

As a rule, experimental models of ATCI are formed in one of three ways: tightening and subsequent loosening of a ligature or application and tightening of a clamp on the coronary artery [2-5, 9, 13]; stimulation of sympathetic nerve endings or centers, or administration of sympathomimetics [8]; a combination of measured occlusion of the coronary artery (critical stenosis of the vessel) with a transient increase in the work load on the heart, for example, by imposing a high rate of cardiac contraction [14]. In acute experiments, the first method is used most often. However, it has at least two disadvantages. First, this method is accompanied by severe mechanical injury to the coronary artery and myocardium when the ligature is tightened and subsequently loosened, and second, it is impossible by this method to produce a reversible disturbance of the coronary blood flow because of trauma to the coronary artery by the ligature and subsequent thrombosis. The method suggested in this paper is largely free from these disadvantages.

To protect the coronary artery from mechanical injury, a rectangular plastic plate is applied to the myocardium. The plate is cut out of a sheet of stiff plastic (polystyrene or celluloid, for example), its corners are rounded by means of a saw, and two holes are drilled 1 mm from the edges and 3 mm apart (by means of an intramuscular injection needle, rotation of which creates a drilling movement). The plate can be used over and over again.

Preparation of the animal for the operation, thoracotomy, and access to the heart and coronary artery follow the procedure described in [1]. After the ligature has been taken beneath the coronary artery (silk or "supramide" threads with an atraumatic needle are best) its ends are taken through the holes in the plate, which is placed on the myocardium in the projection zone of the coronary artery (in rats, the artery runs in the substance of the myocardium at a depth of 0.5-1.0 mm). The ligature is tied with a double or triple slip knot on the upper surface of the plate. The lumen of the artery is closed by firm compression of the vessel with the thread against the undersurface of the plate when the knots of the ligature are tightened. Loosening the ligature (in the case of repeated occlusion) or its removal (in the case of a single occlusion) can be done by loosening the knots with forceps (in the first case) or cutting the ligature (in the second case) on the upper surface of the plate (Fig. 1B, C). Injury to the myocardium and artery is slight because all the most traumatic manipulations (tightening the knots of the ligature, loosening them or cutting) are carried out on the protective plate and not directly on the surface of the myocardium or the wall of the artery.

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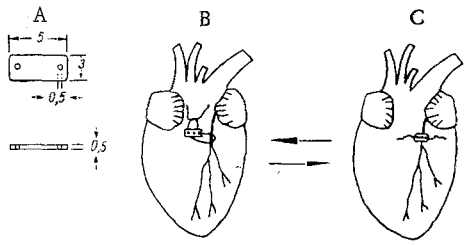

Fig. 1. Protective plate and method of its application to the coronary artery. A) Plan and dimensions of plate (in mm); B) ligature taken beneath artery and ends brought out through holes in plate, provisional slip knots applied; C) ligature drawn tight.

ATCI simulated by this method in rats closely resembles in the change in contractile function of the heart, time course of neuroeffector regulatory influences on the myocardium, and biochemical, histological, and electron-microscopic changes in the myocardium to those observed in ATCI simulated in other species of animals and by other methods [2, 8-14]. Transient coronary insufficiency produced by the method described above is an adequate model with which to study pharmacological and nonpharmacological measures aimed at correcting disturbances of the contractile function and rhythm of the heart, and it correlates satisfactorily with the results of clinical administration of cardiotropic drugs in patients with various forms of transient coronary insufficiency [7].

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