The influence of the size of acute ischaemic myocardial lesions on coronary reserve and left ventricular function in the dog*)**)

Koronarreserve und linksventrikuläre Funktion bei unterschiedlicher Größe experimenteller Myokardischämien

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With 6 figures and 1 table

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Summary

Acute ischaemic lesions of 5 and 15% of the left ventricular mass were produced in 10 dogs by ligations of branches of the left anterior descending coronary artery. Under maximal coronary dilatation by Dipyridamole and at constant aortic pressure, an ischaemic lesion of 15% caused reductions of blood flow in the left anterior descending coronary artery of 50% (p < 0.05), the R. circumflexus of 36% and of total myocardial blood flow (Argon method) by 44% (p < 0.02).

Parameters of left ventricular function, dp/dt_{max} and V_{max} fell by 26 and 27%, respectively (p < 0.02). Ischaemic lesions of 5% LV mass were detected by 133 Xenon clearance estimations, but had no effect on any of the other variables measured. There was good agreement between estimations of total myocardial blood flow (Argon) and direct measurement of coronary flow with electromagnetic flowmeters (r = 0.957).

While clinical and experimental studies have demonstrated impairment of coronary reserve and left ventricular function after myocardial ischaemia (10, 14, 16, 17), the size of the ischaemic area has not been accurately estimated. Furthermore, there is little information on the effect of lesions of under 20% of left ventricular mass.

In this study therefore, the influence of the area of acute myocardial ischaemia on these variables was investigated. One of the difficulties encountered by previous workers in predicting the size of ischaemia has been due to the compensatory vasodilatation of the patent coronary arterial tree, tending to perfuse the ischaemic area from its periphery (1, 4, 5, 19). In order to avoid this unknown variable, maximal coronary

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dilatation was induced before ischaemia by Dipyridamole, an agent shown to have a potent effect on coronary arterioles.

The study also gave an opportunity to compare estimations of myocardial blood flow by the Argon method used in clinical practice to direct measurements of coronary flow by electromagnetic flowmeters. Regional blood flow of normal and ischaemic myocardium was also estimated using the Xenon washout technique.

**Method**

10 German shepherd dogs (weight 26.5 ± 4.8 kg) were anaesthetized with nembutal (15 mg/kg body weight) and ventitaled with nitrous oxide and oxygen (3:1). The chest was opened and two to three branches of the left anterior descending coronary artery (LAD) were ligated in sequence. These ligations were aimed to produce ischaemic areas of about 5 and 15% of the left ventricular muscle mass (LVMM). The precise extent of ischaemia was determined at post mortem from corrosion casts of the coronary vascular tree (15).

![Diagrammatic representation of the experimental model](image)

Fig. 1. Diagrammatic representation of the experimental model. 1 tipmanometer in the left ventricle; 2, 3 electromagnetic flowmeters; 5 coronary sinus catheter; 4, 6 arterial catheters; 7 adjustable snare around the aorta; hatched area: ischaemic area after acute ligations of branches of the left anterior descending coronary artery.

Dipyridamole (0.4 mg/kg) was given intravenously after each coronary ligation and flow in the left anterior descending and circumflex branches of the left coronary artery was then measured by electromagnetic flowmeters (Statham) and total myocardial blood flow by the Argon method (3, 18). Regional flow of normal and ischaemic myocardium was estimated by the Xenon washout technique. $^{133}$Xe (100 μCi in 0.1 ml normal saline) was injected into the myocardium at a depth of 7 mm and the radioactive clearance measured by an external scintillation counter via a focussing collimator (ICN-Tracer Lab). Blood flow calculated by the formula of Kety (8):