

Application of Induced Pulmonary Arterial Collateral Circulation as Collateral Supply to the Heart.* (21050)

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Although the existence of an extracoronary blood supply to the heart has long been known (1), this has usually proved insufficient to prevent infarction after occlusion of a major coronary artery. Numerous attempts have been made to augment the collateral circulation, by inducing the formation of granulation tissue within the pericardial sac(2,3), by causing the heart to adhere to the pectoral muscle or omentum(4), by implanting an internal mammary artery into the myocardium (5,6), by creating a shunt between the coronary sinus and a systemic artery(7,8), and by pericardiopneumonopexy. Following the last named procedure Lezius(9) demonstrated the development of direct connections between the coronary and pulmonary artery. It is difficult to understand how the desaturated blood in the pulmonary artery could be of great benefit to the myocardium, even assuming that a flow from lung to heart would occur upon occlusion of a coronary artery.

Cardiopneumonopexy after ligation of a large pulmonary artery would seem a more logical procedure, for it has been abundantly demonstrated that such a lung soon receives an abundant collateral supply from the aorta (10-12).

Method. The left pulmonary artery was ligated in a series of dogs, and adhesions between this lung and the anterior and left lateral aspects of the heart were assured by cauterizing the surfaces to be apposed with a silver nitrate stick, and suturing them together through a surgically created defect in the pericardium. At the end of the experiment vinylite plastic corrosion casts of the coronary and pulmonary vessels and bronchial tree were made(13).

Results. In 5 of 7 animals sacrificed 9 to 20 weeks after the operation just described abundant transpleural vessels were found to

connect the coronary and bronchopulmonary arterial circulations (Fig. 1). Five percent vinylite in acetone, introduced into the left coronary artery, easily entered the greatly enlarged bronchial arterial collateral vessels of the lung. In most animals many of the pulmonary arteries were also injected, since they remain patent distally beyond the ligation, and now communicate with the bronchial arteries by means of large anastomoses in contrast with their state in the normal dog.

Discussion. In this way the myocardium now becomes connected with the aorta in two ways: 1) by the coronary arteries through their ostia in the sinuses of Valsalva, and 2) by means of the expanded bronchial arteries, with the thoracic aorta. It is probable that initially the blood flow is from the coronary arteries to the lung. Whether this can be reversed, to the benefit of the myocardium, after interruption of the coronary arterial circulation remains to be determined.

Summary. When adhesions are created between the heart and a lung the pulmonary artery of which has been ligated, abundant large connections develop between the coronary arteries and vastly expanded bronchial arteries. The efficiency of these connecting vessels as collateral blood supply to the heart is under investigation.

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FIG. 1. Anterior view of vinylite plastic cast of heart and lungs of dog 9 weeks after ligation of left pulmonary artery and cardiopneumonopexy. Large arteries (arrows) pass via adhesions to connect coronary arteries and enlarged bronchial collateral arteries of the left lung. The trachea is seen to descend in the midline, above. Anteriorly of the trachea is an accessory bronchial artery (black). The right auricle overlies the distal end of the trachea.

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