

200 mg/100 ml. Apart from slight nausea there were no undesirable side-effects. Rapid destruction of the drug explains why repeated single injections are more effective than continuous infusion. (Murtaugh, J. G., et al.: *Hemodynamic Effects of Glucagon*, *Brit. Heart J.* 32: 307 (May) 1970.)

#### CORONARY SHOCK: RESPONSE TO CATECHOLAMINES

Hemodynamics and myocardial metabolism were studied in 18 patients in cardiogenic shock following acute myocardial infarction. Responses to l-norepinephrine were studied in seven patients and responses to isoproterenol in four. Cardiac indexes (CI) were found to be low, and mean arterial pressures ranged from 40 to 65 mm Hg, while systemic vascular resistance values varied. Coronary blood flow (CBF) was decreased in all but three patients. Myocardial oxygen consumption was normal or increased. Myocardial oxygen extraction was above 70 per cent and coronary sinus oxygen tension below 22 mm Hg in most patients. Detection of an abnormal oxygen pattern within a sample of mixed coronary venous blood indicates the severity of myocardial hypoxia. In 15 studies myocardial lactate production was demonstrated. In the remaining three, lactate extraction was below 10 per cent. Excess lactate was present in 12 patients. During infusion of l-norepinephrine (1.4-4.0  $\mu\text{g}/\text{min}$ ) CI increased insignificantly, while in all patients increased arterial pressures were associated with increases in CBF, averaging 28 per cent. Myocardial metabolism improved. Myocardial lactate production shifted to extraction in three patients, and extraction increased in three. During infusion of isoproterenol (2.0-3.0  $\mu\text{g}/\text{min}$ ) CI's increased uniformly, averaging 61 per cent. Arterial pressures remained unchanged, but diastolic arterial pressures fell. CBF increased in three patients, secondary to decreases in CVR. Myocardial lactate metabolism deteriorated uniformly. In the acute state of coronary shock the primary therapeutic concern should be directed toward the myocardium, not the periphery. Since forward and collateral flows through the severely diseased coronary bed depend mainly on perfusion pressure, l-norepinephrine appears to be

superior to isoproterenol; phase-shift balloon pumping may be considered early when pharmacologic treatment is unsuccessful. (Mueller, H., Ayres, S. M., Gregory, J. J., et al.: *Hemodynamics, Coronary Blood Flow, and Myocardial Metabolism in Coronary Shock; Response to l-Norepinephrine and Isoproterenol*, *J. Clin. Invest.* 49: 1885 (Oct.) 1970.)

EDITOR'S COMMENT: These investigators have come to an unpopular conclusion, namely that l-norepinephrine is more efficacious than isoproterenol in treating coronary shock, based on cardiac metabolic criteria. Therapy in this area may require "middle of the road" pharmacology, since one cannot ignore the effect of l-norepinephrine on peripheral circulation, particularly the kidney. This is particularly important in view of the authors' finding that anaerobic myocardial metabolism is uniformly observed in coronary shock but myocardial metabolism appears normal in hemorrhagic, septic and non-coronary cardiogenic shock.

#### MYOCARDIAL BLOOD FLOW

Myocardial blood flow, measured by  $\text{N}_2\text{O}$  clearance in five patients with chronic complete heart block at the idioventricular rate (mean = 37 min) and at two elevated rates (mean = 80 and 100/min) increased as heart rate increased. The myocardial arteriovenous  $\text{O}_2$  content difference, i.e.,  $\text{O}_2$  extraction/100 ml coronary blood flow, did not change, although myocardial oxygen consumption increased. As the heart rate increases mean coronary perfusion pressure increases along with a decrease in coronary vascular resistance. (Hedworth-Whitly, R. B., Haisley, E., and Abraham, A. S.: *The Relationship between Myocardial Blood Flow and Bradycardia in Man*, *Cardiovasc. Res.* 4: 301 (July) 1970.)

EDITOR'S COMMENT: There is a price to be paid for tachycardia: increased myocardial  $\text{O}_2$  consumption.

#### VENOUS PRESSURE

When the blood volumes of anesthetized dogs were reduced 7 and 25 per cent, cardiac outputs were reduced from 116 ml/kg/min to 69 and 50, and mean aortic pressures from 119 mm Hg to 104 and 78, respectively. Pressure in the right atrium decreased more than did pressure in the external iliac vein, so the pressure gradient be-