

Title : NITROGLYCERIN DECREASES AORTOCORONARY GRAFT FLOW DURING CARDIOPULMONARY BYPASS

Authors : E.S.Greene, M.D., H.Y.Arandia, M.D., J.I.Gerson, M.D.
E.L.Bove, M.D., M.A.Marvasti, M.D., F.B.Parker, Jr., M.D.

Affiliation: Departments of Anesthesiology and Surgery, State University of New York,
Upstate Medical Center, Syracuse, New York 13210

INTRODUCTION. Patients with ischemic heart disease benefit from nitroglycerin (NTG) by reduced myocardial oxygen demand and possibly by improvement in or redistribution of blood flow to ischemic areas. Following aortocoronary grafting recovery of myocardial function depends on satisfactory myocardial reperfusion. The effects of NTG during recovery from ischemic hypothermic cardioplegic arrest during cardiopulmonary bypass (CPB) have not been adequately studied. After CPB continuous intravenous NTG generally decreased mean antegrade graft flow (\bar{Q}).¹ However, with continuous NTG during CPB only retrograde flow in the proximally unattached graft has been measured; flow either remained constant or increased.² The purpose of this study was to investigate the effects of a systemic NTG infusion on \bar{Q} , collateral perfusion and myocardial ischemia during CPB. The advantages of studying \bar{Q} during CPB were 1) NTG effects could be evaluated immediately after revascularization during the critical reperfusion period and, 2) venting the left ventricle provided constant preload and afterload to facilitate constant myocardial oxygen demand. Thus changes in \bar{Q} and myocardial oxygen supply could be evaluated more accurately.

METHODS. All 10 patients studied were undergoing elective aortocoronary bypass surgery (informed consent and institutional approval were obtained). Fentanyl, oxygen and metocurine were supplemented with diazepam or halothane. After aortic cross clamp release the ascending aortic pressure tracing confirmed the vented ventricle was not ejecting. Proximal vein anastomosis and systemic rewarming were completed. Arterial blood gases and electrolytes were normal. Perfusion pressure was mean ascending aortic blood pressure (\bar{BP}). An electromagnetic flow probe measured \bar{Q} in the graft to the left anterior descending artery. Leads II and V₅ of the electrocardiogram (ECG) were recorded at 25 mm/sec with amplitude 1 mv = 10mm. After confirming stable \bar{BP} , \bar{Q} and ECG in a control period of 2-3 minutes, NTG 0.5 $\mu\text{g}/\text{kg}/\text{min}$ was infused in the venous circulation of the CPB pump. When the change in \bar{Q} stabilized, typically after 3-5 minutes of NTG, simultaneous \bar{BP} and HR were measured. Control and NTG data were analyzed with the paired Student's t-test. ECG ST segments during NTG were compared to control for significant changes ($> 1 \text{ mm}$).

RESULTS. For all patients average control \bar{Q} was 87.3 ml/min. The average change in \bar{Q} during NTG was a decrease of 7.4% from

control ($p < 0.02$). Figure 1 shows \bar{Q} for individual patients. The percent \bar{Q} decrease was similar over a wide range of control flows. Average control 1) \bar{BP} was 55 mmHg (range 45-75) and 2) HR was 75/min (range 58-92). \bar{BP} and HR changes during NTG were not significant ($p > 0.05$). ST segments during NTG did not change significantly from control.

DISCUSSION. This study indicates \bar{Q} decreases with continuous systemic NTG in the vented heart on CPB. Since HR, preload and afterload remained constant and contractility was unlikely to have changed, myocardial oxygen demand remained constant. Since there was no ECG evidence for a change in the balance of myocardial oxygen supply and demand decreased \bar{Q} implies NTG increased the blood supply via native collateral vessels or proximally stenosed coronary arteries or both. Although \bar{Q} decreased slightly, further study is indicated to determine if NTG is beneficial to global myocardial perfusion immediately after revascularization.

REFERENCES.

1. Klein RC, et al: Evaluation of the effects of systemic nitroglycerin on perfusion of ischemic myocardium in coronary heart disease assessed intraoperatively by antegrade blood flow through intact saphenous vein bypass grafts. *Am Heart J* 101: 292-299, 1981
2. Goldstein RE, et al: Intraoperative coronary collateral function in patients with coronary occlusive disease. *Circ* 49:298-308, 1974

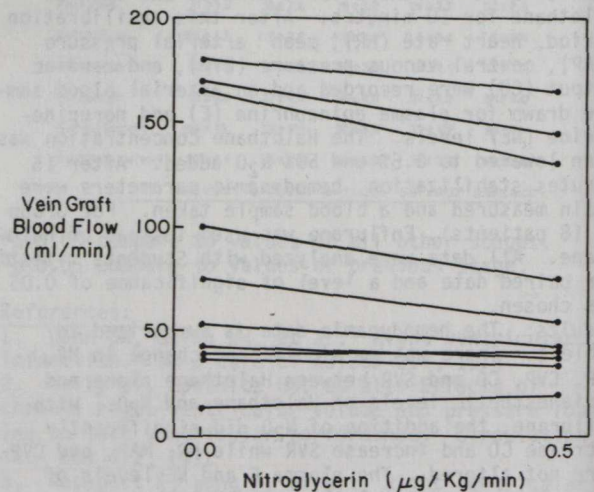


Figure 1. Effect of NTG on \bar{Q} in Individual Patients