4:45

810-4 Remodeling of the Vascular Endothelium Following PTCA in Rabbit Iliac Arteries with Fibrin Adhesive/Endothelial Cell Matrix

John E. Baker, Victor Nikolaychik, Harry Sahota, Richard Komarowski, Sean D. Keane, Michael H. Keelan, Nicholas Kipshidze *Medical College of Wisconsin, Milwaukee, WI*

We proposed that a possible cause of acute and chronic complications of Percutaneous Transluminal Coronary Angioplasty (PTCA) is the loss of the endothelial cell lining of the arterial wall. The objective of this study was to reattach endothelial cells to the arterial wall at the time of PTCA. We devised a unique process utilizing a delivery device whereby a fibrin adhesive reattaches endothelial cells to denuded vessel walls at the time of PTCA. Following *in vitro* definition of optimal conditions required for the adhesive matrix to successfully reattach endothelial cells to an inert plastic surface and subsequent demonstration of viability of these cells after delivery through the infusion catheter system, studies were carried out on iliac arteries (n = 6/group) of New Zealand White rabbits subjected to balloon angioplasty-induced endothelial cell denudation. The Wolinsky infusion balloon (USCI, C.R. Bard) and double balloon was used to deliver the fibrin adhesive/endothelial cell matrix labelled with red fluorescent dye to denuded areas over a 3–5 min period. Immediately following treatment blood was allowed to perfuse the seeded artery for four hours to expose the iliac segments with newly attached endothelial cells to physiologic shear forces. Histological examination demonstrated the ability of this novel method to circumferentially reattach the adhesive/endothelial cell matrix to 70–90% of the denuded arterial wall segments in comparison with 5–8% reattachment following seeding with endothelial cells alone. We conclude that endothelial cells can be successfully reattached to denuded vessel walls with a fibrin adhesive matrix following PTCA.

811 Perfusion and Ventricular Function — Myocardial Infarction/Unstable Angina

Wednesday, March 22, 1995, 4:00 p.m.–5:00 p.m.
Ernest N. Morial Convention Center, Room 24

4:00

811-1 Evolution of Left Ventricular Function, Myocardial Perfusion and Metabolism in Infarct Patients After Coronary Thrombolysis

Alex F. Maes, Johan L. Nuyts, Luc A. Mortelmans, Guy M. Bormans, Alfons M. Verbruggen, Frans Van de Werf *University Hospital Gasthuisberg, Belgium*

Follow-up of regional myocardial blood flow, metabolism and function was studied in a population of thrombolysed patients. Fifty one patients with an acute myocardial infarction were prospectively enrolled. All patients received thrombolytic therapy within 6 hours after the onset of symptoms. Coronary angiography, 2D-echocardiography and $^{13}NH_3/^{18}FDG$ PET were performed 5 days after the acute event. Three months after the infarction, 2D-echocardiography and $^{13}NH_3/^{18}FDG$ PET studies were repeated.

Thirty six patients (62% with TIMI III, 7% with TIMI II) revealed a concordant decrease of flow and metabolism in the infarct area (PET match). Fifteen patients (33% with TIMI III, 13% with TIMI II) revealed a decrease of flow with preservation of metabolism (PET mismatch). Twelve patients received further treatment (PTCA or CAGB) after the first PET scan. Myocardial blood flow improved significantly in both match (71 ± 17 ml/min/100 g at 3 months versus 60 ± 17 ml/min/100 g at 5 days, $p < 0.01$) and mismatch groups (71 ± 26 ml/min/100 g at 3 months versus 63 ± 18 ml/min/100 g at 5 days, $p < 0.05$). Blood flow in remote areas did not change significantly (84 ± 18 ml/min/100 g at 3 months versus 82 ± 19 ml/min/100 g at 5 days, p = NS). In 4 patients with a match pattern at 5 days, a mismatch pattern had developed 3 months after the acute event.

Functional follow-up was performed in 30 patients, 23 with a match pattern and 7 with a mismatch pattern. A variable outcome was observed: In 3 out of 7 mismatch areas contractility did not improve. On the contrary, 9 out of 23 match areas revealed functional improvement.

It can be concluded that in this population of early thrombolysed patients, few mismatches were observed (29%). Flow values improved significantly in both match and mismatch groups 3 months after the acute event. In some patients, a mismatch pattern was found after 3 months, suggesting the need for further treatment. Functional outcome was variable, probably due to a variety of pathophysiologic processes such as stunning shortly after reperfusion with functional improvement after 3 months, reocclusion or progression of coronary artery disease resulting in reinfarction or hibernation.

4:15

811-2 Evidence that Myocardial Stunning Occurs in Humans Following Unstable Angina

William Wijns, Jean L. Vanoverschelde, Bernhard Gerber, Joszef Bartunek, Bernard De Bruyne, Guy R. Heyndrickx, Jacques A. Melin. *University of Louvain, Brussels, Belgium; Cardiovascular Center, Aalst, Belgium*

Reversible postischemic dysfunction, or myocardial stunning, is a well defined experimental entity which is characterized by the presence of a perfusion-contraction mismatch, i.e. the persistence of segmental dysfunction despite complete restoration of nutritive perfusion. Reversible dysfunction occurs following ischemic syndromes such as non-Q wave infarction, unstable angina, cardio-pulmonary bypass. Definite demonstration that reversible dysfunction indeed represents myocardial stunning is lacking, owing to the difficulty of measuring myocardial blood flow (MBF) in absolute terms. Therefore, we measured regional wall motion (by 2D echo) and absolute MBF with ^{13}N-ammonia and positron emission tomography (PET) in 11 patients with unstable angina. Despite successful PTCA of the culprit lesion on the left anterior descending coronary artery, all patients showed persistent anterior wall dysfunction at the time of the PET study (within 48 hours after PTCA). As judged from the changes in segmental wall motion (in 6 ± 2 abnormal segments, mean ± sd, out of 16 in each patient) from the time of PET study to 4–8 weeks later, regional dysfunction was entirely reversible in 9/11 patients. In these 9 patients, the segmental wall motion score improved from 2.4 ± 0.3 to 1.2 ± 0.1 at late follow-up. With PET, ^{13}N-ammonia MBF was within the normal range in 8/9 patients (95 ± 21 ml/min/100 g, range 60–124 ml/min/100 g), while it was decreased (33 ml/min/100 g) in the remaining patient. On average, in the 9 patients, absolute MBF was similar among stunned and remote normally contracting myocardial segments (88 ± 28 vs 85 ± 25 ml/min/100 g, p = ns). Our data thus show perfusion-contraction mismatch, confirming that myocardial stunning can occur in humans following attacks of unstable angina.

4:30

811-3 Beneficial Effect of β-Blockade on Myocardial Blood Flow and Vasodilator Capacity in Humans

Morten Bottcher, Johannes Czernin, Michael Phelps, Heinrich Schelbert. *UCLA School of Medicine, Los Angeles, CA*

β_1-receptor blockade reduces cardiac work and might thereby lower myocardial blood flow (MBF) at rest. However, the effect of β_1-blockade on hyperemic MBF is unknown. To evaluate the net effect of β_1-receptor blockade (Metoprolol, 50 mg p.o. 12 hours and 1 hour prior to the study) on MBF at rest and during dipyridamole (DIP) induced hyperemia 10 healthy volunteers (mean age: 24 ± 5 years; 8 males, 2 females) were studied with serial N-13 ammonia PET (2 compartment model) at control and again after β_1-receptor blockade. The resting rate pressure product (RPP) declined from 6621 ± 555 at control to 5168 ± 975 ($p < 0.05$) during Metoprolol. Resting heart rate (HR) decreased from 63 ± 6 to 54 ± 5 beats/min ($p < 0.05$). Similarly, the RPP declined from 10193 ± 1330 during baseline DIP to 8575 ± 1770 ($p < 0.05$) during DIP + Metoprolol. Resting MBF declined in proportion to cardiac work by 20% from 0.61 ± 0.10 to 0.51 ± 0.11 ml/g/min ($p < 0.05$). Overall, resting MBF was linearly related to the RPP ($y = 0.00003x + 0.134$; $r = 0.67$; $p < 0.005$). Thus, resting MBF normalized to the RPP *(10^5) did not change from baseline to β_1-blockade (0.91 ± 0.1 vs 0.99 ± 0.19; p = NS). Hyperemic MBF increased from 1.86 ± 0.28 to 2.40 ± 0.70 ml/g/min during ($p < 0.05$). The decrease in resting MBF together with the increase in hyperemic MBF during β-blockade resulted in a significant increase in the myocardial flow reserve (MFR) from 3.16 ± 0.80 to 4.74 ± 0.73; ($p < 0.01$) Coronary vascular resistance (mean arterial blood pressure/MBF) did not differ at rest (140 ± 27 vs 127 ± 22 mmHg/ml/g/min) but declined during DIP from 42 ± 7 to 32 ± 7 mmHg/ml/g/min during DIP + Metoprolol ($p < 0.05$). Thus, resting MBF decreases with β_1-blockade in proportion to the decrease in cardiac work which contributes to the improvement in flow reserve. At the same time, β_1-blockade modulates hyperemic MBF most likely because of a) β_1-blocker induced negative inotropy which reduces extravascular compressive forces, and/or b) decreases in heart rate which increases the duration of the diastolic flow phase.

4:45

811-4 Coronary Doppler Flow Velocity and PET Myocardial Blood Flow are Highly Correlated and Predict Post-Infarction Perfusion in Patients with TIMI 3 Flow

Richard E. Stewart, Terry R. Bowers, Richard Ponto, D. Douglas Miller, William W. O'Neill, Cindy L. Grines, Robert D. Safian, Jack E. Juni *William Beaumont Hospital, Royal Oak, Michigan*

TIMI flow grades are used to assess the degree of coronary flow during acute