

Myocardial Viability Assessment by Contrast-Enhanced MRI Before CABG Surgery - Impact of Late Enhancement Extent in MRI on Coronary Graft Flow

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Synopsis:

Late enhancement in contrast-enhanced cardiac MRI (CE-MRI) has been established for myocardial viability assessment and has proven to predict functional LV outcome after CABG surgery in patients with occlusive CAD. CABG flow measured by Doppler sonography predicts graft patency. In this study, intraoperative graft flow was correlated with the extent of late enhancement as measured by CE-MRI. Graft vessels supplying myocardial areas with higher percentage of scar provided lower bypass flow and, therefore, are prone to occlusion. Thus, beyond the prediction of functional recovery after revascularization, late enhancement might also predict the probability of bypass graft occlusion.

Introduction:

Contrast-Enhanced cardiac MRI (CE-MRI) has been established for myocardial viability assessment using the late enhancement (LE) concept¹. It has been proven to reliably detect myocardial scar and predict functional left ventricular (LV) outcome after revascularization in patients with occlusive coronary artery disease (CAD)². Coronary artery bypass graft (CABG) flow measured by Doppler sonography during surgery has been shown to predict graft patency³. Graft vessels supplying areas of myocardial scar with a corresponding lower perfusion are prone to occlusion. CE-MRI might, therefore, predict the probability of functional outcome and, additionally, graft patency after CABG surgery. Purpose of the present study was to determine the relation between the extent of myocardial LE in CE-MRI and intraoperative graft flow in CAD patients with severely impaired LV function undergoing CABG surgery.

Methods:

Thirty-three consecutive CAD patients with impaired LV function (mean EF, 29%) underwent CE-MRI using the LE technique before CABG surgery. LE scans were acquired 8-15 min after administration of 0.2mmol/kg BW of Gd-DTPA (Magnevist™, Schering, Germany) using a standard inversion-recovery TurboFLASH sequence (TR, 8ms; TE, 4ms; FA, 25°; TI, 200-260ms). The entire LV was covered by long axis and contiguous short axis scans (thickness, 8mm). Myocardial scar extent was evaluated using a LE score 1-4 (score 1, no LE; 2, LE <50% of wall thickness; 3, LE >50%; 4, transmural LE) based on the AHA 17-segment model⁴. A mean score was calculated for each coronary vessel territory (RCA, LAD, LCx). Intraoperative graft flow was determined by Doppler sonography. Flow in grafts supplying vessel territories with a score 1 or 2 (group A) was compared to flow in grafts supplying vessel territories with a score ≥3 (group B) which are not expected to improve function after revascularization.

Results:

Of the 99 vessel territories, 89 yielded score 1 or 2 (group A), 10 score ≥3 (group B). In group A, 68 of 89, and in group B, 9 of 10 territories were grafted using left intrathoracic artery (LITA) or venous grafts. Mean LITA graft flow was 54±6 in group A and 28±11 cc/min in group B (p<.04). Mean vein graft flow was 74±6 and 42±8 cc/min in groups A and B, respectively (p<.05). Figure 1 shows mean viability scores in groups A and B for the individual coronary territories. After a mean follow-up period of 21±2 months, survival and mean EF were 84% and 36±3% (preop 31±2%) in group A and 88% and 31±3% (preop 28±1%) in group B.

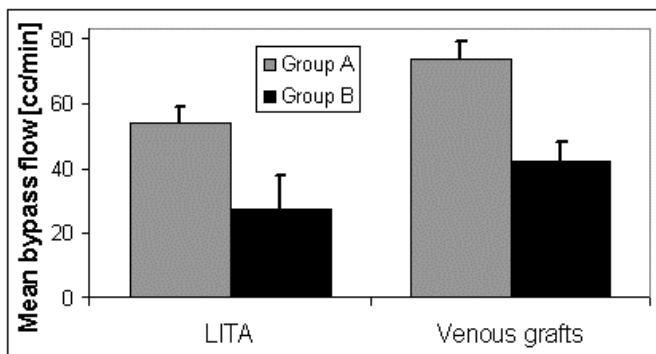


Figure 1: Mean bypass flow in left intrathoracic artery (LITA) and venous grafts. The differences in bypass flow between grafts to territories with higher viability scores (group A) and group B are statistically significant (p<.04 and p<.05).

Discussion:

In patients with impaired LV function undergoing CABG, graft flow to vessel territories with no or little scar tissue is higher than flow to vessel territories with more than 50% scar tissue as shown by CE-MRI. Since sufficient flow is a prerequisite for graft patency³, the long-term prognosis of those grafts may be better. Therefore, beyond the prediction of

functional recovery, CE-MRI might also predict graft patency based on late enhancement. However, intermediate-term survival and functional benefit was comparable in patients with higher and lower percentage of myocardial scar.

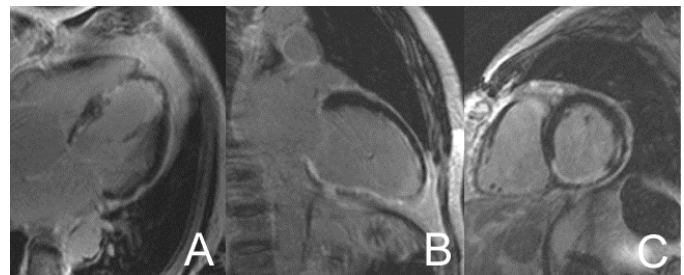


Figure 2: Contrast-enhanced TurboFLASH images in horizontal (A) and vertical long axis (B) and a basal short axis (C) orientation. Broad non-transmural or transmural late enhancement in segments 4, 10 (supplied by the RCA), 5 (LCx), and 17 (LAD) according to AHA⁴. All areas of late enhancement were classified in group B.

References:

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