Assessment of Myocardial Viability

Date: 8/12/00, from 16:30 to 18:00

Location: Room 7A

Chairpersons:
T. Kukulski (Leuven/BE)
Z. Vered (Zerifin/IL)

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Assessment of resting perfusion with myocardial contrast echocardiography: a comparison with technetium single-photon emission computed tomography and dobutamine echocardiography

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The aim of this study was to perform a comparison between Myocardial Contrast Echocardiography (MCE) and Technetium Single-Photon Emission Computed Tomography (SPECT) for the detection of perfusion pattern in patients (pts) with reperfused Acute Myocardial Infarction (AMI). We also tried to determine the relation between MCE perfusion and contractile reserve on low-dose Dobutamine Echocardiography (DE). Forty-three pts (36 m, 7 f, mean age 5±11 years) with first AMI and successful TIMI flow grade 3 PTCA: 29 primary PTCA and 14 rescue PTCA underwent one month after AMI, intravenous MCE and TC-SPECT, within a week. A DE (5-10-20 ug/Kg/min) was also performed in 40 pts (3 pts showed no RWM abnormalities at one month 2D-Echo). MCE was carried out using Harmonic Power Doppler imaging after contrast agent venous injection. TC-SPECT was performed using stress-rest protocol. Left ventricle was divided in 16 segments, but only 70 were studied because 8 were excluded for inadequate gain setting or image quality with contrast agent.

RESULTS: In the comparison between MCE and TC-SPECT 430 segments were evaluated. Concordance between the two methods was 72 %. During DE 400 segments were evaluated: 238 normokinetic and 162 with RWM abnormalities at rest. Out of 162 segments with RWM abnormalities, 70 showed a contractile reserve during dobutamine infusion: in 63/70 of these segments by MCE. Out of 162 segments with RWM abnormalities, 99 segments showed no changes during dobutamine infusion: a severe perfusion defect was detected in 62/90 of these segments by MCE. Thus MCE sensitivity and specificity were 68 % and 90 %, respectively.

CONCLUSIONS: Although the discrepancies between MCE and TC-SPECT with regard to the definition of moderate perfusion defect requires further investigation, MCE seems to be a reliable non invasive clinical tool in detecting myocardial perfusion. MCE seems to be a non invasive diagnostic method with high accuracy for detecting segments still viable after AMI.

<table>
<thead>
<tr>
<th>MCE np</th>
<th>MCE moderate pd</th>
<th>MCE severe pd</th>
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</thead>
<tbody>
<tr>
<td>To-SPECT np</td>
<td>247</td>
<td>1</td>
</tr>
<tr>
<td>To-SPECT moderate pd</td>
<td>81</td>
<td>21</td>
</tr>
<tr>
<td>To-SPECT severe pd</td>
<td>16</td>
<td>5</td>
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</tbody>
</table>

np=normal perfusion; pd=perfusion defect

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Prediction of myocardial viability by adenosine contrast echocardiography in patients with single-vessel coronary artery disease: comparison with dobutamine stress echocardiography

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Detection of viable myocardium in the infarcted zone has both therapeutic and prognostic implications. Dobutamine stress echocardiography (DSE) is a well-accepted method to identify myocardial viability following acute myocardial infarction. Adenosine Contrast Echocardiography (ACE) is a new and accurate method to assess myocardial perfusion in pts with stable coronary artery disease (CAD). The aim of this study was to compare the ability of ACE with that of DSE for predicting myocardial viability in pts submitted to PTCA, associated or not to stent, to treat CAD.

Methods: 19 consecutive pts (12 male, 57±10, 39 to 74 years) were enrolled in this study. Myocardial viability was defined as an increment on wall motion segment (related to the treated artery) on a rest 2-D echo performed 3 months later. DSE (standard low and high-dose protocol) and ACE (venous infusion of PESDA at rest and after bolus injection of adenosine with fixed 1:1 triggered 2nd harmonic imaging) were obtained in the same day before and after (up to 7 days) PTCA. A segment was considered viable by ACE when it changed the contrast enhancement after adenosine. Images were obtained at the standard apical 4-chamber and 2-chamber views and were visually analyzed (2 independent investigators) in the territory of LAD, RCA and LCx arteries.

Results: Coronary angiography showed successfully treated obstructions in LAD, RCA and CX arteries in 11, 7 and 1 pts respectively, with viable (V) segments in 8, 5 and 0 pts. Analysis by coronary territory (n=57) revealed 38 normal territories for both methods. Comparison between DSE and ACE is shown (table).

Conclusion: ACE could predict function recovery with comparable accuracy to DSE. Because ACE can be performed without risks and/or significant collateral effects, this result has of clinical importance.
602 Prediction of left ventricular function after acute myocardial infarction using markers of myocardial reperfusion

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Background: Several invasive and non-invasive parameters have recently been suggested to assess reperfusion on the myocardial tissue level and predict subsequent left ventricular function in patients soon after PTCA for acute myocardial infarction (AMI). The predictive value of different markers of reperfusion regarding subsequent left ventricular function is unknown.

Methods and Results: Five invasive and non-invasive markers of myocardial reperfusion were determined in 25 patients immediately after PTCA for first AMI. These markers were derived from angiographic myocardial blush grade (MBG), Doppler coronary flow reserve (CFR), normalised corrected TIMI frame count (nCTFC), persistent ST-segment elevation (STI) and i.v. myocardial contrast echocardiography (MCE) using Sonos 10D (NC100100), Nycomed-Amersham with intermittent harmonic imaging. Results of myocardial reperfusion were related to global wall motion index (GWI) at 4 week follow-up. Analysis of variance revealed MBG to be the best invasive predictor for GWI at 4 weeks (R2=0.2341, p<0.007). CFR and nCTFC were less predictive (R2=0.002, p=0.929 and R2=0.0378, p=0.247, respectively). The contrast defect size assessed by MCE was the best non-invasive predictor (R2=0.1735, p=0.004, STI: R2=0.1341, p=0.009). By univariate correlation between MCE and the MBG, the contrast defect size revealed to be the better predictor. Contrast defect size determined by MCE showed a high correlation with GWI at 4 weeks (r=0.65, p<0.001).

Conclusions: Assessment of myocardial reperfusion after PTCA for AMI using intravenous MCE allows a better prediction of left ventricular function at 4 week follow-up than other previously described invasive and non-invasive parameters for definition of myocardial reperfusion. MBG is the invasive parameter with greatest predictive value while coronary flow parameters are less predictive.

603 Prognostic and diagnostic importance of combined low dose dipyridamole-dobutamine stress echocardiography for myocardial viability in postinfarcted akinetic regions


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Background: Diagnostic and prognostic value of low dose stress echocardiography (LDE) tests for assessment of myocardial viability have recently been widely reported while the relation to the whole spectrum of patients (pts) with various degrees of dyskinesia is not clearly elucidated.

Objective: The aim of this study was to assess diagnostic and prognostic value of combined low dose dipyridamole-dobutamine (Dip-Dob) echo test for identification of myocardial viability in pts with akinetic infarcted regions.

Methods: Thirty-three pts (25 male, mean age 54±8 years) with resting akinesia, due to previous myocardial infarction (<3 months), underwent combined low-dose Dip-Dob (0.28 mg/kg for 4 min, plus 5 to 10 mcg/min for 3 min each step) echo test. A criterion for myocardial viability was improvement in systolic thickening of dysfuncional segments of >1 grade. Segments were graded at the end of Dip infusion and at the end of Dip-Dob. Coronary angiography was performed in 27 pts: 1-vascular CAD was present in 18 pts, 2-vascular in 4 pts and 3-vascular in 6 pts (diameter stenosis >50% of at least one major coronary artery). Follow up data (16±9 months) for adverse cardiac events were obtained in all pts. Results: Double product increased from 68±18, then 90±21 at low Dip, to 97±23 bpm x mmHg x 100 at low Dob-Dip (p<0.05 vs. rest and low Dob). Wall motion scoring index (WMSI) improved from 3.2±1.0 to 1.65±0.30 to 1.38±0.29 after low Dip (p<0.001), and to 1.33±0.30 at the end of Dip-Dob (p<0.001). In the follow-up period, 2 cardiac deaths and 1 reinfarction occurred, while revascularization was performed in 6 pts. Myocardial viability was assessed in 7 pts on low Dip, and in 22 pts on low Dip-Dob (p<0.01), whereas it was absent in 22 pts on low Dip, and in 11 pts on low Dip-Dob. Positive and negative predictive value of low Dip-Dob was 86% and 95% respectively. Presence of viability was associated with milder forms of CAD (p=0.03), whereas the absence of viability on low Dip-Dob was related to the occurrence of hard events in the follow up (low Dip-Dob negative, p=0.004; low Dip-Dob positive, p=NS).

Conclusion: In resting akinesia due to previous myocardial infarction, complete absence of viability on low Dip-Dob echo test is associated with severe form of CAD, and worse outcome in pts predominantly medically treated. In addition, these findings highlight the prognostic importance of borderline viability elicited by low Dob in low negative pts.

604 Can myocardial viability be predicted by clinical variables?

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Stress echocardiography and nuclear cardiology are the currently used methods for assessment of myocardial viability (MV) in patients with coronary artery disease(CAD)and left ventricular systolic dysfunction. The aim of this study was to evaluate the possibility of predicting MV in selected cases, by several clinical parameters avoiding the use of the above mentioned tests.

In a population of 93 pts (mean age 62±10 years, 10 women) with CAD and LV systolic dysfunction (ejection fraction 5-15%)(Globetha stress echocardiogram (DSE) for assessment of MV, the predictive value (PV)of several clinical factors for the detection of MV was evaluated in comparison with the result of DSE. In 60 pts there was significant MV at a decrease >4 points in wall motion score after dobutamine stimulation while in 33 there was no DSE evidence of MV. For each group of pts – with and without MV- we evaluated the presence of the following parameters: typical angina, heart failure NYH class III or IV, resting LV ejection fraction and wall motion score (WMS), previous myocardial infarction, previous myocardial revascularization procedures and extension of CAD(number of diseased vessels). Mean age was similar in the 2 groups.

Angina was more frequent in the MV group (68%) than in the group without MV (99%), (p=0.01), whereas heart failure was more frequent in the group without MV (84% versus 37%, p=0.02). There were no significant differences between the 2 groups with respect to LV ejection fraction, WMS, extension of CAD, number of previous MI and previous revascularization procedures. The positive PV of angina for MV was 76% (increasing to 78% in pts with both angina and no heart failure).The negative PV of the presence of heart failure for MV was 48% (increasing to 62% in pts with both heart failure and no angina). These results suggest that although some clinical variables can be related with the presence or absence of MV, its relatively low predictive value does not preclude the need for the currently used tests.

605 Contrast-enhanced MRI vs dobutamine echocardiography in myocardial viability assessment

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Contrast-enhanced MRI has been proposed to assess myocardial viability in ischemic left ventricular (LV) dysfunction. However, data on the meaning of different contrast patterns after acute myocardial infarction (AMI) are controversial. To define the role of contrast-enhanced MRI in myocardial viability assessment, we compared this technique with Dobutamine Echocardiography (DE).

Methods: 12 consecutive patients with first AMI (63±9 yrs, 12 anterior, 5 primary PTCA, 5 thrombolysis) underwent MRI and DE within 5 days after onset. MRI was performed on short-axis views, firstly by a FSE and cine MRI assessment of the whole LV, followed by first-pass perfusion study (iv Gd-DTPA, Magnevist® 10 ml, 3 ml/s) on a single slice (chosen on the basis of maximum SI in T2 w by FSE) and delayed SE or FGRE of the whole LV. Analysis was performed in each segment of a 16-segments LV model. Segments were defined as Type 1 (normal at first pass and absent or delayed hyperenhancement), Type 2 (hyperenhancement at first pass followed by hypoenhancement), Type 3 (persistent hypoenhancement). Segments out of single slice first-pass imaging were defined as normal, hyperenhanced and hypoenhanced. Demonstration of contractile reserve at DE was considered indicative of viable myocardium.

Results: all 20 Type 1 segments, 10 of 36 Type 2 or hypoenhanced segments and 2 of 10 Type 3 or hypoenhanced segments had contractile reserve at DE. Thus, the sensitivity and the specificity in detecting myocardial viability were 65%, 31%, 6% and 100% 24%, 76% for Type 1, Type 2 and Type 3 respectively.

Conclusion: in our patients, as compared with contractile reserve at DE, MRI Type 1 pattern correctly identifies viable myocardium and Type 3 pattern is indicative of non viable myocardium; conversely, Type 2 pattern, although more frequently predictive of non viable myocardium, seems to be less useful in viability identification.

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