Contrast echocardiography in coronary artery disease

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Location: Poster Area

1077 Manual thrombus-aspiration reduces microvascular obstruction after PCI in unselected STEMI patients: MCE substudy of the randomized REMEDIA trial and insight into the pathogenesis of no-reflow

B. Garramone 1, F. Burzotta 1, M. De Vita 2, R. Mongiardo 2, M.A. Mazzari 2, A.G. Rebuluzi 2, F. Creia 2, L. Gallo 2 on behalf of REMEDIA Investigators.

1 Policlinico A. Gemelli Rome, Italy, Cardiology Department, Rome, Italy; 2 Policlinico Gemelli, Cardiology, Rome, Italy

Background: The effective role of microembolization in the genesis of no-reflow after PCI is still unclear. We designed a prospective randomized trial (REMEDIA) in order to assess the role of a new thrombus-aspiration device in preventing distal microembolization after PCI. A subgroup of consecutive patients entered the myocardial contrast echocardiographic (MCE) substudy, thus deriving further insight into the pathogenesis of no-reflow.

Methods: A total of 34 patients with first STEMI were enrolled in the MCE substudy of the REMEDIA trial at the time of PCI: 17 were randomized to be pretreated with thrombus-aspiration with the Diver CE device before primary stenting of the culprit lesion and 17 were treated with standard PCI. At day 1 and 7 after PCI, myocardial contrast echocardiography (MCE) was performed using continuous infusion of Sonovue® (Bracco) and real-time imaging by CPS technology (Sequoia, Siemens). Regional wall motion score index (WMSI), contrast score index (CSI), endocardial length of wall motion abnormality (WML) and of contrast defect (CDL) were calculated.

Results: While at day 1 no differences between the two study groups were observed, at 7 days WMSI, CSI, WML and CDL were significantly lower in patients treated with thrombus-aspiration filter device (2±0.5 vs 1.6±0.6, p<0.05; 2.4±0.5 vs 1.9±0.8, p<0.02; 5.5±2.9 vs 2.8±3.8, p<0.02; 3.6±2.3 vs 1.4±2.5, p<0.05, respectively).

Conclusions: Thrombus-aspiration used at the time of PCI significantly reduces the extent of microvascular obstruction and myocardial dysfunction. This beneficial effect is not evident 1 day after PCI, but it appears after 7 days. These observations bear important therapeutic implications and also shed light into the pathogenesis of no-reflow. In fact, not only microembolization plays a role in the genesis of no-reflow, since the phenomenon is reduced by filters, but additional factors, such as microvascular constriction, are responsible for the initial extent of no-reflow, that is similar despite the use of filters and it is then spontaneously reversible.

1078 Myocardial perfusion as determined with real-time myocardial contrast echocardiography correlates with positron emission tomography in healthy volunteers

P.A. Dijkmans 1, P. Knapen 1, O.T. Giessens 1, E. Azezian 1, C.A. Visser 1, A.A. Lammertsma 1, F.C. Visser 1, O. Kamp 1, 1 VUMC, Cardiology Dept, Amsterdam, Netherlands; 2 VUMC, Nuclear Medicine and PET Research, Amsterdam, Netherlands

Purpose: Intravenous myocardial contrast echocardiography (ivMCE) is becoming an increasingly valuable technique that creates the opportunity of measuring myocardial perfusion. Purpose of this study was to test whether ivMCE can be used for the assessment of coronary artery stenoses and to determine whether ivMCE can be used as a truly quantitative approach is desired. The hemodynamic relevance of coronary artery stenoses can be determined quantitatively by the coronary vasodilator response (CVR) defined as the ratio of myocardial blood flow (MBF, ml/min/g) during hyperemia to MBF at rest. Recently, we have shown that MBF and CVR can be obtained from quantitative myocardial contrast echocardiography (qMCE). Objective of this study was to test whether qMCE can be used for the assessment of coronary artery disease in humans.

Methods: 25 patients (18 men) eligible for pharmacologic stress testing underwent qMCE at rest and during adenosine-induced hyperemia (140μg/kg/min), and subsequently quantitative coronary angiography. MBF of septal, lateral and inferior regions was calculated from ultrasound contrast destruction/refill sequences using the volumetric model of contrast agent kinetics.

Results: Mean±SD patient age was 60±9 years; 7 patients had no CAD; one and two vessel disease was present in 11 and 7 patients, respectively. No patient had three vessel disease. Stenosis severity varied between 0-95% (29±35%) diameter reduction. qMCE was successfully performed in 73 of 75 territories. MBF at rest and during hyperemia ranged between 0.40±1.76ml/min/g (0.959±0.339ml/min/g), and 0.695–6.735ml/min/g (2.450±0.989ml/min/g). CVR varied be-
between 0.72-6.04 (2.61 ±0.98) and progressively decreased with increasing stenosis severity (r=0.84, r²=0.53, r²=0.51, P<0.001). Using a regional CTV threshold below 2.13, a significant stenosis of the respective coronary artery defined as ≥50% diameter stenosis was detected with 88% sensitivity and 89% specificity. A CTV below 2.04 in any of the three territories detected the presence of relevant CAD with 94% sensitivity and 89% specificity.

**Conclusion:** Quantitative stress testing based on myocardial blood flow measurements derived from myocardial contrast echocardiography is a new method for the noninvasive and reliable assessment of coronary artery disease in humans.

### 1080 How power settings influence signal enhancement varying dilutions of experimental phospholipidic contrast agent

**R. Palmizio, E. Di Bella, L. Galiuto, V. Di Bello, M. Pascotto, E. Le, J. Sklenar, R. Jayaweera, S. Kauf, University of Virginia, Cardiology, Charlottesville, United States of America**

**Introduction:** Absolute quantification of myocardial blood flow (MBF) by myocardial contrast echocardiography (MCE) has not been validated in chronic ischemic cardiomyopathy.

**Aim:** To validate MCE-derived MBF by comparing with radio-labelled microspheres (RM) at rest and during dobutamine stress in the setting of chronic ischemic cardiomyopathy.

**Methods:** Chronic myocardial ischemia was induced in 6 mongrel dogs by placing ameroid constrictors around the proximal LAD and LCx coronary arteries and their major branches. The first septal perforator was spared and thus supplied by myocardial tissue. 2D transthoracic echocardiography was performed 6 weeks after surgery when maximum left ventricular (LV) dysfunction had developed in both the LAD and LCx regions. MCE and RM-derived MBF were analyzed in the viable and endocardial layers both at rest and during dobutamine stress (30 μg kg⁻¹ min⁻¹).

**Results:** In the normal myocardial region, MCE-derived resting endocardial and epicardial MBF were 1.590.76 and 1.570.83 mL min⁻¹ g⁻¹, respectively. During peak dobutamine stress, resting and stress MBF increased to 5.88192 and 5.21181 mL min⁻¹ g⁻¹, respectively. In the ischemic region, MCE-derived endocardial and epicardial MBF were reduced at rest, 1.490.76 and 1.140.82 mL min⁻¹ g⁻¹, respectively. During dobutamine, hyperemia was blunted in the ischemic region compared to the normal region (endocardial 3.430.80, epicardial 3.261.46 mL min⁻¹ g⁻¹, p<0.05). There was no significant difference between endocardial and epicardial RM-derived MBF and MCE-derived MBF. When all resting and stress MBF data were pooled, MCE-derived and RM-derived MBF showed excellent correlation in both the endocardial (r=0.93, r²=0.82 < 0.001) and epicardial (r=0.95, r²=0.93, p<0.001) layers.

**Conclusion:** MCE can accurately quantify endocardial and epicardial MBF with high spatial resolution in both normal and chronic ischemic myocardium.

### 1081 No association between coronary collateral flow index and relative myocardial perfusion reserve

**A. Indemmiel, R. Vogel, P. Meier, C. Seiler. University Hospital, Cardiology, Bern, Switzerland**

**Background:** Coronary collaterals have been shown to reduce infarct size, prevent left ventricular aneurysm formation, preserve ventricular function, and improve survival. Clinical trials are currently under investigation aimed at promoting collateral vessel growth. The gold standard of collateral flow measurement is invasive and whole tested dilution range.

**Methods:** A new phospholipidic contrast agent was used to prepare eighteen CA dilutions analyzed by means of MultisizerTM 3 Coulter Counter®. They were pumped at a constant flow rate of 5 ml/min through 1-mm diameter cavities of a new tissue mimicking phantom having a sound propagation velocity very close to 1560 m/s. Flowing dilutions were insonified by a linear array transducer connected to a commercially available echograph at 3.3 MHz and at four EEP values (37%, 50%, 60% and 100%). The echograph was externally linked to a prototype (FEM-NIA, Fast Echographic MultiParametric Multi Image Novel Apparatus), able to get the full raw signal of the probe. For every dilution and setting 100 data frame sequence of RF raw data was acquired and analyzed offline by means of ad hoc implemented algorithm developed with Fortezza software, supplied by Florence University. Mean signal amplitude was calculated in a region of interest (ROI) for each acquired frame sequence.

**Results:** Data were plotted versus CA dilution (fig. 1). Each plotted curve shows a slight growth of backscatter amplitude with CA concentrations, while it is more evident a direct relationship between CA backscatter amplitude and EEP in the whole tested dilution range.

**Conclusion:** Backscatter amplitude of the investigated ultrasound CA at very high dilutions can be considered almost independent by CA concentration, while it is clearly influenced by incident acoustic pressure values.

### 1082 Validation of absolute quantification of transmural myocardial blood flow using myocardial contrast echocardiography in a canine model of chronic ischemia

**M. Pascotto, E. Le, J. Sklenar, R. Jayaweera, S. Kauf, University of Virginia, Cardiology, Charlottesville, United States of America**

**Introduction:** No association between coronary collateral flow index and relative myocardial perfusion reserve

**Background:** Among clinical criteria, only the incidence of HC was significantly higher among patients with one- and two-vessel disease compared to those with three-vessel disease (27% vs. 66%, 55%, and 9%). A CVR below 2.04 in any of the three territories detected the presence of relevant CAD with 94% sensitivity and 89% specificity.
higher in group B than group A (p<0.05), the EF% was lower in group B (p<0.05),
while the EDV was similar in both groups. At follow-up, WMA% significantly de-
creased (p<0.01) and the EF% improved (p<0.01) in group A, while in group B they did not change. By stepwise multiple regression analysis LVR was predicted
by TIMI grade, CDL% and WMA% after repertusion and by the presence of HC
(p<0.00001).
Conclusion: Our data suggest a correlation between dyslipidemia, microvascu-
lar damage and LV remodelling after AMI. Further studies are needed to better understand the independent role of HC in reducing microvascular perfusion and
myocardial salvage after AMI.

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Diurnal variability of QT dispersion parameters in patients with acute
anterior myocardial infarction treated with primary PTCA: relationship
with the myocardial perfusion
K. Wita, K. Szydło, D. Urbanczyk, Z. Tabor, A. Rybicka, M. Nowak, W. Orszulak,
M. Truszk-Gluza. Katowice, Poland
The purpose of the study was to analyse if any differences in parameters of repo-
larization dispersion obtained during morning and evening periods might be found
in pts with acute anterior myocardial infarction (AMI) treated with primary PTCA
depending on the presence of microvascular integrity of the left ventricle.
Methods: The study population consisted of 50 pts with first anterior AMI treated
with primary PTCA (<6 hours from the onset of AMI symptoms) with TIMI 3 flow
in LAD artery after the procedure. They were divided into two groups according to
the presence of the myocardial perfusion assessed by contrast echocardiography
(MCE) performed in the 2nd day after procedure. There were 24 pts (P-) without
perfusion in the risk area (16 males, age: 59±9 yrs, EF: 39±7%) and 26 pts (P+)
with the presence of perfusion (18 males, age: 55±11 yrs, EF: 45±8%). There
were no differences in gender, age, treatment, time from the onset of symptoms of
AMI to PTCA and extent of lesions in coronary arteries in both groups. Data
were obtained from 3-channel Holter recordings performed in the 5th day after
AMI, taken from two periods: at evening (6-8 p.m.) and at morning (6-8 a.m.). Dis-
persion of QT (QTd) and TapeXtend were used. Correction according to Bazett's
formula was performed. QTd without correction was also used to evaluated the
number of pts with QTd>30 ms.
Results: The comparison of parameters revealed differences between P- and P+
groups: at evening- QTd 36±11 vs. 26±7 ms (p<0.001); QTdc 40±12 vs. 27±8
ms (p<0.001); TapeXtend 110±12 vs. 98±8 ms (p<0.005), and at awaking- QTd
35±8 vs. 26±7 ms (p<0.001); QTdc 37±10 vs. 27±7 ms (p<0.001); TapeXtend
106±11 vs. 95±10 ms (p<0.005), respectively. Moreover, QTd>30 ms differenti-
nated P- and P+ pts in both periods: 13/17 pts P- vs. 3/22 pts in P+ (p<0.005), as
well QTC>460-15/17 P- pts vs. 9/10 P+ pts (p<0.05).
Conclusions: Patients with the presence of microvascular integrity of the left ven-
tricle were characterized by significantly lower values of QT dispersion parameters,
what may indicate higher spatial and transmural homogeneity of this process after
successful primary PTCA. These findings were independent of the analysis period.