ORAL PRESENTATIONS

Tissue Doppler and myocardial ischaemia

Saturday, 10 December 2005, 11:00–12:30

Location: Giotto

1202
Radial strain in 4 layers across the left ventricular wall. An experimental epicardial TVI study in pigs demonstrating the influence of ischaemia

K. Matto 1, T. Femmano 1, C.A. Moon 1, G.O. Dahl 1, K. Grong 2
1University of Bergen, Institute of Medicine, Bergen, Norway; 2University of Bergen, Department of Surgical Sciences, Bergen, Norway

Purpose: This study investigates the effect of graded ischaemia on strain measurements in 4 layers of the left ventricular wall using epicardial Tissue Velocity Imaging (TVI).

Method: Anaesthetised domestic pigs (n=9, 54±5 (SD) kg) were mechanically ventilated; a midline thoracotomy gave access to the heart. After heparinisation, an extracorporeal shunt with an inline flowprobe and two pressure ports from the proximal brachiocephalic artery to the left anterior decending coronary artery (LAD) was constructed in steps, thus allowing reduction of LAD perfusion pressure and blood flow. Global haemodynamic function was monitored by recording HR, LVP and CI. Short axis TVI images of the anterior LV wall were obtained at a position halfway between ventricular apex and equator, using a silicone rubber pad as offset. Microsphere injections and TVI images were recorded with 1) shunt fully open, 2) a non-significant stenosis (reduced perfusion pressure with no flow reduction), 3) a 20% reduction and 4) a 50% reduction in shunt flow. TVI images were analysed for radial peak ejection strain using 4 regions of interest (2x6 mm, strain length = 2 mm) across the myocardial wall. Tissue samples from the same 4 wall layers were used for estimation of regional tissue blood flow.

Results: We showed that strain values under each condition were reduced compared to the control group; however, in the second condition the reduction was more pronounced, and in the third condition it was comparable to the control group. Results indicate that strain values under each condition were reduced compared to the control group; however, in the second condition the reduction was more pronounced, and in the third condition it was comparable to the control group.

Conclusion: In spite of substantial inter-animal variations, it was possible to evaluate the effect of regional myocardial ischaemia on cardiac strain in the three inner layers decreased further to values not different from the low subepicardial strain levels.

1203
Strain and strain rate imaging to monitor the effect of intracoronary transplantation of labelled mesenchymal stem cells post myocardial infarction in a porcine animal model

D. Thijl 1, C. Dubois 1, P. Claus 1, W. Steen 2, P. Pokreisz 2, H. Gillijns 3, F. Rademakers 1, S. Janssens 1, K.U. Leuven, Cardiology Department, Leuven, Belgium; 2University Hospital Gasthuisberg, Cardiology, Leuven, Belgium; 3University of Leuven, Cardiology, Leuven, Belgium

Background: Allogeneic mesenchymal stem cells (MSCs) may differentiate to a cardiomyocyte-like phenotype in the adult murine healthy heart. The effect of intracoronary MSC transplantation on myocardial repair after acute myocardial infarction (AMI) remains unknown.

Methods: In a blinded, randomized, sham-controlled study, transplantation of allogeneic LentGFP-infected porcine MSCs (n = 13) or sham injection (n = 10) was performed in the infarct related artery (IRA) 1 week after AMI induced by 90 min balloon occlusion of the circumflex artery. Left ventricular function was analyzed invasively (dP/dtmax and dP/dtmin) and using echocardiography at baseline, at MSC/sham delivery (1 week after MI) and before sacrifice at 7 weeks. Echocardiographic M-mode RF-data (Powervision6000, Toshiba) of the infarct related artery (= segment at risk) was acquired in a SAX view a mid papillary level and processed for SRI. Inframural layer thickness and left ventricular internal diameter were measured at end-diastole. Maximal systolic rate of wall thickening (SRmax) and the total amount of wall thickening (Smax) were extracted from the MVI data for the infarct related wall. The former parameters has in previous studies been shown to be a sensitive marker of regional contractility while the latter is related to the local contribution to ejection. Differences in functional changes between the two groups were tested using repeated measure ANOVA.

Results: See table. Values are expressed as mean ± standard deviation.

Table 1. Results

<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>Lent-GFP</th>
<th>Controls</th>
<th>Lent-GFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVd (mm)</td>
<td>37.0±4.3</td>
<td>37.0±5.7</td>
<td>46.0±5.6</td>
<td>41.3±5.1</td>
</tr>
<tr>
<td>LVFW (mm)</td>
<td>5.6±1.3</td>
<td>4.6±1.2</td>
<td>6.8±2.3</td>
<td>5.3±1.7</td>
</tr>
<tr>
<td>EF (%)</td>
<td>40.6±8.3</td>
<td>44.9±8.4</td>
<td>42.7±10.5</td>
<td>43.3±10.2</td>
</tr>
<tr>
<td>Smax (%)</td>
<td>122.0±26</td>
<td>103.0±32</td>
<td>40.9±31.1</td>
<td>60.8±27.3</td>
</tr>
</tbody>
</table>

No significant differences.

Conclusion: Gray scale imaging as well as strain rate imaging showed that after AMI global left ventricular function was decreased in all animals and that transplantation of MSCs failed to promote functional recovery of the myocardium.

1204
Non-invasive assessment of the contractile reserve in patients with non-severe coronary artery disease - a strain rate imaging study

F. Weidemann 1, D. Jung 1, C. Heyer 2, W. Voelker 2, G. Ent 2, C.E. Angermann 2, J.M. Strothmann 2, 1University Hospital, Medical Clinic, Dept. of Cardiology, Wurzburg, Germany; 2University Hospital Wuerzburg, Cardiology, Wuerzburg, Germany

In clinical work there is a need to evaluate the hemodynamic consequence of non-severe coronary artery stenosis during stress. The aim of this study was to compare the change of left ventricular (LV) deformation during dobutamine stress echocardiography (DSE) with the gold standard of myocardial fractional flow reserve (FFR).

Methods: In 20 patients with moderate coronary artery disease (50-75%) FFR measurement was performed during coronary angiography. A FFR of 0.75 is considered abnormal. At the following day longitudinal peak systolic strain rate and systolic strain of the region of interest and of a non-ischemic remote region were extracted at baseline and at peak DSE.

Results: Eleven patients had a FFR of higher than 0.75 and thus were defined as normal flow reserve (normal group). In contrast, the remaining 9 patients revealed significant stenosis defined as FFR<0.75 (pathological group). At baseline DSE strain rate and strain were not significantly different between both groups (strain rate=-1.2±0.2 s⁻¹; strain=-18±2%). In the pathological group strain decreased at peak stress to -8±2% and stayed stable in the normal group (-19±2%). In contrast,
1205 Prediction of mortality using strain rate in dobutamine stress echocardiography

C. Bjork Ingul1, E. Rozits2, T.H. Marwick2, 1Norwegian University of Science and Technology, Department of imaging and medical imaging, Trondheim, Norway; 2University of Queensland, Brisbane, Australia

Background: Abnormal wall motion (WM) at dobutamine stress echocardiography (DSE) is an independent predictor of mortality. However DSE continues to have problems relating to observer expertise. We hypothesized that quantification of DSE by peak systolic strain rate (SRs) and end-systolic strain (Ses) may be an alternative to WM analysis for predicting outcome.

Method: We studied 515 patients (61±13 years, 330 men) undergoing DSE. WM was scored by an experienced observer. SRs and Ses were measured in 18 segts using an automated method (Coacam: GE Vingmed, Norway) which tracks the segts longitudinally by tissue Doppler and laterally by speckle tracking. Results were expressed as the number of abnormal segts and the mean SR and Ses per pt. Total mortality was identified over 7 years (mean 4.8). Abnormal segts were defined using normal ranges defined in a separate angiographic group, and ROC curves to define the optimal mean SRs and Ses for prediction of death.

Results: Ischemia (new WMA) was detected in 329 pts. Death occurred in 88 pts (17%). Ischemia, SRs and Ses were all independent predictors of mortality (Table), but when combined with WM, only SRs and Ses were predictive. Defining normal pts based on SRs <-1.3 1/s or Ses <-9% in all segts led fewer pts to be identified as normal than with WM, but no difference in predictive power (Table).

Definition normal based on mean values of SRs <-1.8 1/s or Ses <-8% increased the proportion of studies identified as normal without increasing event rates in the normal group, while at the same time increasing the prognostic significance of an abnormal test (Table).

Conclusion: The use of strain rate imaging during dobutamine stress pathology and normal flow reserve can be differentiated in patients with non-severe coronary artery disease.