Pulse inversion technology - a new contrast specific imaging modality for myocardial perfusion imaging

Dept. of Cardiology, University of Bonn, Bonn, Germany

Introduction: Pulse Inversion Technology (PI) is a new contrast specific imaging modality. In PI two short consecutive pulses which are phase-shifted exactly about 180° are emitted to generate an image frame. The echo of the two reflected pulses are added to generate an image frame. In non moving tissue which contains no contrast signal both pulses result in a zero amplitude if added together. Non-linear signals from tissue or bubbles result in strong PI-signals. By its nature PI rejects the fundamental component of the signal without need of filter procedures. In 15 volunteers and 20 patients contrast effects in the LV-cavity (CC) and the myocardium (MC) of PI were compared to Contrast Harmonic Imaging.

Levovist® (400 mg/ml) was infused at a constant infusion speed (4 ml/min). Triggered imaging (every 5th cardiac cycle) was performed using both modalities. Off-line analysis of digitally stored raw data was performed using a calibrated software tool. Following background subtraction signal intensities in the standard segments were calculated. Results: Mean CC for PI was 34±5 dB and for PI 31±7 dB. MC for basal septum 7.9±2.2 (HI) 10.3±3, mid septum 12.3±4.1 (HI) and 17.4±4.3 (PI), apical septum 9.6±3.6 (HI) and 13.9±4.2 (PI). MC for basal lateral 2.5±0.2 (HI) and 3.9±1.2 (PI), mid lateral 8.6±1.9 and 12.1±5.4 (PI) finally apical lateral 7.3±2.7 and 10.0±3.2 (PI). Average contrast enhancement was significantly higher for PI (p<0.0001).

Conclusions: CC using PI is feasible. PI significantly improves the detection of myocardial contrast signals.

Pulse inversion technology - a new contrast specific imaging modality for myocardial perfusion imaging

Dept. of Cardiology, University of Bonn, Bonn, Germany

Introduction: Pulse Inversion Technology (PI) is a new contrast specific imaging modality. In PI two short consecutive pulses which are phase-shifted exactly about 180° are emitted to generate an image frame. The echo of the two reflected pulses are added to generate an image frame. In non moving tissue which contains no contrast signal both pulses result in a zero amplitude if added together. Non-linear signals from tissue or bubbles result in strong PI-signals. By its nature PI rejects the fundamental component of the signal without need of filter procedures. In 15 volunteers and 20 patients contrast effects in the LV-cavity (CC) and the myocardium (MC) of PI were compared to Contrast Harmonic Imaging.

Levovist® (400 mg/ml) was infused at a constant infusion speed (4 ml/min). Triggered imaging (every 5th cardiac cycle) was performed using both modalities. Off-line analysis of digitally stored raw data was performed using a calibrated software tool. Following background subtraction signal intensities in the standard segments were calculated. Results: Mean CC for PI was 34±5 dB and for PI 31±7 dB. MC for basal septum 7.9±2.2 (HI) 10.3±3, mid septum 12.3±4.1 (HI) and 17.4±4.3 (PI), apical septum 9.6±3.6 (HI) and 13.9±4.2 (PI). MC for basal lateral 2.5±0.2 (HI) and 3.9±1.2 (PI), mid lateral 8.6±1.9 and 12.1±5.4 (PI) finally apical lateral 7.3±2.7 and 10.0±3.2 (PI). Average contrast enhancement was significantly higher for PI (p<0.0001).

Conclusions: CC using PI is feasible. PI significantly improves the detection of myocardial contrast signals.

Interobserver variability of quantitative myocardial contrast-echocardiography (QMCE) studies in second harmonic B-mode (SH) and power (Doppler) angiography imaging (PAI) during intravenous stress-echocardiography (DSE)

J. Wanderlich1, G. Brand1, N. Pogacic1, H. Polz2, K. Wegscheider2
1Institute for Echocardiography and Stress-Echocardiography, Berlin, 2Fa. EchoTech, Munich, Germany

Introduction: Despite the fact that myocardial contrast echocardiography (MCE) can't be applied to detect coronary artery disease (CAD) into a routine clinical setting, numerous studies are underway which use MCE as a "routine method." The purpose of this study was to determine the interobserver-variability of two modes of imaging: SH1 and PAI during DSE.

Methods: 1. Since November 1998 until June 1999 in 213 consecutive patients DSE was performed with CMCE in addition. 2. An HP Sonos 5500 and an Image Vue for the cine loop analysis were used. Imaging was done in second harmonic mode (1.8/3.6 MHz). DSE was performed in a standardised protocol with atropine in addition. A 16-segment model was used for the wall motion analysis. Scoring was done for 1-normal; 2-hypokinetic; 3-akinetik, 4-dyskinetic. 3. The contrast studies were performed by bolus-injection of 0.3 ml Optison® at rest and peak stress. 108 consecutive patients were randomly allocated either to SHI or PAI. By use of a trigger 1:1 at the beginning of the P wave, and a mechanical index of 0.8 and approximately 2 minutes after injection of the contrast agent (at rest and peak) cardiac cycles were digitalized by use of QuantumSoftware in order to measure voldiointensity (Vl). Background subtraction signal intensities in the standard segments were calculated. Results: Mean CC for PI was 34±5 dB and for PI 31±7 dB. MC for basal septum 7.9±2.2 (HI) 10.3±3, mid septum 12.3±4.1 (HI) and 17.4±4.3 (PI), apical septum 9.6±3.6 (HI) and 13.9±4.2 (PI). MC for basal lateral 2.5±0.2 (HI) and 3.9±1.2 (PI), mid lateral 8.6±1.9 and 12.1±5.4 (PI) finally apical lateral 7.3±2.7 and 10.0±3.2 (PI). Average contrast enhancement was significantly higher for PI (p<0.0001).

Conclusions: CC using PI is feasible. PI significantly improves the detection of myocardial contrast signals.

Interobserver variability of quantitative myocardial contrast-echocardiography (QMCE) studies in second harmonic B-mode (SH) and power (Doppler) angiography imaging (PAI) during intravenous stress-echocardiography (DSE)

J. Wanderlich1, G. Brand1, N. Pogacic1, H. Polz2, K. Wegscheider2
1Institute for Echocardiography and Stress-Echocardiography, Berlin, 2Fa. EchoTech, Munich, Germany

Introduction: Despite the fact that myocardial contrast echocardiography (MCE) can't be applied to detect coronary artery disease (CAD) into a routine clinical setting, numerous studies are underway which use MCE as a "routine method." The purpose of this study was to determine the interobserver-variability of two modes of imaging: SH1 and PAI during DSE.

Methods: 1. Since November 1998 until June 1999 in 213 consecutive patients DSE was performed with CMCE in addition. 2. An HP Sonos 5500 and an Image Vue for the cine loop analysis were used. Imaging was done in second harmonic mode (1.8/3.6 MHz). DSE was performed in a standardised protocol with atropine in addition. A 16-segment model was used for the wall motion analysis. Scoring was done for 1-normal; 2-hypokinetic; 3-akinetik, 4-dyskinetic. 3. The contrast studies were performed by bolus-injection of 0.3 ml Optison® at rest and peak stress. 108 consecutive patients were randomly allocated either to SHI or PAI. By use of a trigger 1:1 at the beginning of the P wave, and a mechanical index of 0.8 and approximately 2 minutes after injection of the contrast agent (at rest and peak) cardiac cycles were digitalized by use of QuantumSoftware in order to measure voldiointensity (Vl). Background subtraction signal intensities in the standard segments were calculated. Results: Mean CC for PI was 34±5 dB and for PI 31±7 dB. MC for basal septum 7.9±2.2 (HI) 10.3±3, mid septum 12.3±4.1 (HI) and 17.4±4.3 (PI), apical septum 9.6±3.6 (HI) and 13.9±4.2 (PI). MC for basal lateral 2.5±0.2 (HI) and 3.9±1.2 (PI), mid lateral 8.6±1.9 and 12.1±5.4 (PI) finally apical lateral 7.3±2.7 and 10.0±3.2 (PI). Average contrast enhancement was significantly higher for PI (p<0.0001).

Conclusions: CC using PI is feasible. PI significantly improves the detection of myocardial contrast signals.

The Effect Of Quantitative Perfusion On Sensitivity And Specificity Of Dobutamine Contrast Echocardiography In Technically Difficult Patients

St. Louis University, St. Louis, MO, USA

Optison, a recently approved echo contrast is, improves endocardial visualization during Dobutamine Stress Echocardiography (DSE); whether this improvement leads to improvement in sensitivity and specificity of DSE is not well known. Therefore we studied a total of 64 patients with technically difficult studies that underwent intravenous contrast administration during DSE. All patients (pts) underwent coronary angiography and nuclear imaging. Color coded perfusion analysis, regional wall thickening (WT) and percentage of endocardial border visualization (EBV) were performed off-line. Overall characteristics of the study group: 40% of patients had 3 vessel disease, 45% had history of myocardial infarction, 56% had LAD lesion, and 61% had resting wall motion abnormalities. During DSE, EBV improved from 52±6% to 67±7% after contrast injection.

<table>
<thead>
<tr>
<th>SENSITIVITY</th>
<th>SPECIFICITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSE/Qualitative</td>
<td>93%</td>
</tr>
<tr>
<td>DSE/WT &amp; Perfusion</td>
<td>88*</td>
</tr>
<tr>
<td>Nuclear</td>
<td>91*</td>
</tr>
<tr>
<td>P*</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Sensitivity of DSE for detecting coronary artery disease ≥70% was significantly perfusion and wall thickening analysis (73% versus 85%, p=0.01), however still similar to sensitivities obtained with nuclear imaging (88% versus 90%, p=NS). Likewise, specificity was improved with contrast administration during DSE (80% versus 86%).

Optison administration during DSE combined with perfusion analysis in technically difficult studies leads to improved sensitivity and specificity similar to that obtained with nuclear imaging.

Eur J Echocardiography Abstracts Supplement, December 1999