Low Power Myocardial Contrast Echocardiography
Accurately Discriminates Between Grades of Coronary Artery Stenosis

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Background: Low power myocardial contrast echocardiography (MCE) is a new technique for the assessment of myocardial perfusion. We hypothesised that this technique can be used to accurately assess myocardial blood flow (MBF) and coronary flow reserve (CFR).

Methods: Accordingly, 36 patients scheduled for coronary angiography underwent low power MCE using infusions of intravenous Sonazoid® at rest and following vasodilator stress. MBF was assessed offline using QLab™ quantification software and CFR was calculated.

Results: There was no significant difference in resting MBF in the 8 patients with no significant LAD stenosis (9.4 ± 4.7), the 6 patients with moderate (50-75%) LAD stenosis (10.6 ± 5.8) and the 15 patients with severe (>75%) LAD stenosis (9.5 ± 3.7). A significantly lower MBF was seen in the 7 patients with previous myocardial infarction (MI) (2.7 ± 1.2; p=0.004). Following vasodilator stress, there was an increase in MBF in patients with no significant LAD stenosis (26.4 ± 14.8), no change in those with moderate stenosis (9.0 ± 3.5), and a decrease in those with severe disease (4.5 ± 4.1). In patients with previous MI, there was a slight increase in MBF (4.4 ± 4.1). These changes were reflected in the CFR in these groups (Fig). The persistence of CFR in patients with previous MI may indicate retention of collaterals.

Conclusion: Low power MCE accurately discriminates between grades of coronary artery stenosis and can assess myocardial viability.

Impact of Myocardial Contrast Echocardiography on Vascular Permeability: Comparison of Three Different Contrast Agents

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Background: Microvascular permeabilization, petechial hemorrhage and premature vascular contractions (PVCs) have been demonstrated in an in vivo rat model of myocardial contrast echocardiography (MCE). The purpose of this study was to compare these effects for three approved ultrasound contrast agents (USCA): Optison, Definity and Ima-geon.

Methods: Evans blue dye, an indicator of microvascular permeability, and a contrast agent were injected intravenously via a tail vein in anesthetized rats suspended in a water bath to mimic scanning depths seen in clinical cardiology. B mode scans with 1:4 end-systolic triggering were performed at 1.7 MHz with a cardiac phased array scanner to provide a short axis view of the left ventricle. Protocols varied the dose of USCA, the ultrasound pulse peak rarefractional pressure amplitude (PRPA), and the use of a pharmacological stress agent (245/1067). There was no correlation between induced cardiac arrhythmias and presence or absence or coronary disease (p=0.154) or the use of a pharmacological stress agent (p=0.26).

Results: There were no apparent differences in the three USCA agents' microvascular damage potential at low doses, when expressed in terms of the number of stabilized microbubbles (rather than as a simple volume dose per kg). However, the tendency for PVC induction appeared to be somewhat less for Definity. The effects increased strongly with PRPA, with apparent thresholds for petechiae at 0.4 MPa and PVCs at about 1.0 MPa.

Conclusion: All three agents appear to have approximately the same potential for causing microvascular leakage with the same gas body microbubble-dose (rather than the recommended volume doses). The potential for the induction of PVCs was less for Definity than for the other two agents. These results should be of value for maximizing benefits of USCA in diagnosis and optimizing efficacy in therapeutic applications.

Does Real-Time Myocardial Contrast Echocardiography Cause Cardiac Arrhythmias in Humans? A Comparative Study at Rest and During Pharmacological Stress

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Background: Real-time myocardial contrast echocardiography (RTMCE) is being used in many centers around the world. There have been isolated reports of RTMCE induced cardiac arrhythmias.

Aim: To study the occurrence and potential triggers to cardiac arrhythmias during RTMCE.

Methods: We prospectively evaluated 67 RTMCE studies in 42 patients (Mean age 58±12 y, 21 men) performed only at rest (9) and at rest and during pharmacological stress (26 Dobutamine-atropine, and 32 Adenosine 140mcg/kg/min for 6 min.). A 5-frame high mechanical index (MI) flash was used (MI=1.5). All studies were stored on videotape and digitally. Coronary angiography was performed in all pts.

Results: There were only 2 patients with premature ventricular contractions (PVC) at baseline and there were no severe side effect during any study. The incidence of cardiac arrhythmias is depicted in table 1 (between all stages/studies). All cardiac arrhythmias depicted in table 1 occurred at end systole (T wave) immediately after the use of Flash. There were also 21 PVC unrelated to Flash. Clinically each 4 Flash’s triggered 1 cardiac arrhythmia (245/1067). There was no correlation between induced cardiac arrhythmias and presence or absence or coronary disease (p=0.154) or the use of a pharmacologic stress. (p=0.26).

Conclusion: PVC are common during RTMCE imaging and are induced by high power Flash mode. It is therefore recommended that manufacturers set the flash mode to be triggered by the EKG R wave and a minimum number of flash frames should be set.