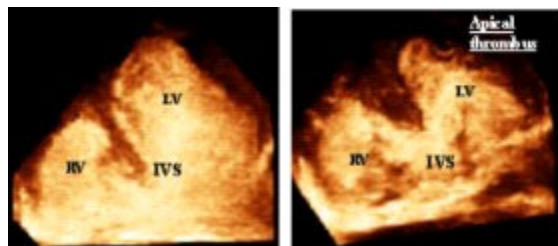


volume rendering in detecting and quantitating dyskinetic segments, defining intracavitary masses and measuring entire ventricular and atrial cavity volumes.



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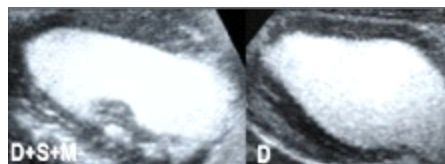
Will Combinations of Multiple Agents Produce More Robust Contrast Imaging? An In Vitro Study and In Vivo Studies in Dogs

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Background: Very high-speed microscopic optical imaging of contrast microbubbles oscillating in an ultrasound field suggests complex bubble interactions. We tested whether mixtures of contrast agents could enhance myocardial perfusion imaging.

Methods: Four contrast agents [Sonovue (S), Definity (D), Optison (O) and MP 1950 (M) a decalfluorobutane gas core and a lipid with PEG shell for improved longevity] were injected separately and in 2 triple-agent combinations in a flow phantom and in 6 closed chest dogs. Bolus injection of either S, D, O, or M was given at full dose, 1/3 dose of each agent for 2 mixtures of D + O + S or D + S + M were administered. We used a Siemens Antares™ ultrasound system with a 3 MHz curved probe receiving at harmonic plus sub-harmonic frequencies for real time perfusion at 0.1 to 0.4 MI imaging with high MI burst every 40 sec.

Results: There were significant differences in vivo of peak temporal video intensity for triple-agent mixtures and the pooled mean of each single agent in LV cavity (222.80 ± 1.54 vs 203.45 ± 16.28 , $p = 0.003$) and in myocardium (lateral wall) (136.28 ± 16.96 vs 111.18 ± 14.83 , $p = 0.003$). Perfusion was no longer well seen >1.5 minutes ($p > 0.005$) for the single agents, except for M which persisted >2.5 minutes; for both mixtures signals lasted 3-6 minutes ($p > 0.05$). The D + S + M mixture was most robust for time and intensity. In the water phantom study, the 2 combinations had higher signal strength and longevity than any single agent at full dose.



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Is the Contrast-Enhanced Border the True Endocardial Border? Comparative Study With Radionuclide Gated Spect

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Background: Intravenous contrast agents have been utilized to improve endocardial border visualization (EBV) in technically difficult patients. However, it is not known whether this contrast enhanced border is the true endocardial surface or whether its visualization improves the assessment of left ventricular (LV) systolic function. Accordingly, the purpose of this study is to determine whether contrast enhanced Echo improves evaluation of left ventricle volumes and ejection fraction (EF). **Methods:** Therefore, in total of 138 patients with suboptimal resting images, ejection fractions and volumes were measured before and after intravenous administration of contrast agent Optison. Confidence agreements between Gated Spect and echocardiographic measurements of volumes and ejection fractions were then compared. **Results:** (Table). Limits of agreement (95% confidence agreement) between Gated Spect and echocardiographic measurement of volumes and ejection fractions narrowed significantly after contrast administration. Likewise, significantly decreased interobserver differences were obtained with contrast versus none contrast measurements for volumes as well as ejection fractions respectively (18 ± 5 vs 11 ± 3 , $p = 0.001$; 19 ± 3 vs 10 ± 4 , $p = 0.001$; 15 ± 4 vs 8 ± 1.6 , $p = 0.001$). **Conclusion:** Contrast administration during echocardiography improves the ability to accurately assess left ventricular volumes and ejection fractions in human with two or more adjacent segments not seen at baseline.

Absolute Differences Between Echo and Gated Spect

| | Echo-Gated Spect | Contrast Echo-Gated Spect | P |
|----------------------|------------------|---------------------------|------|
| End Diastolic Volume | 16 ± 12 | 13 ± 12 | 0.02 |
| End Systolic Volume | 15 ± 11 | 11 ± 8 | 0.01 |
| EF | 8.4 ± 2.7 | 3.5 ± 2.1 | 0.01 |

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Contrast-Enhanced Echocardiography Improves Agreement on the Assessment of Ejection Fraction and Left Ventricular Volumes: A Multicenter Study

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Background: The use of contrast enhanced ultrasound (CE) with recent contrast specific imaging technology may improve interobserver-variability (IOV) and intermethod-agreement (ImeA) in the assessment of ejection fraction (EF) in patients with suboptimal image quality at unenhanced echocardiography (UE).

Methods: In 120 pts, evenly distributed within three EF-groups (>55%, 35-55%, <35%) based on results from angiographic ventriculography, UE with second harmonic imaging and CE at low Mechanical Index (MI) was performed (Sonos 5500, Philips Med. Systems, i.v. administration of SonoVue [Bracco, Milan]). Echocardiographic EF was determined from biplane projections (a4CV, a2CV) and from monoplane a3CV using Simpsons method. 56 pts underwent additional cardiac Magnetic Resonance Tomography (cMRI) at 1.5 T using a steady state free precession sequence. cMRI volumes and EF were calculated from subsequent short axis views. Blinded Offsite assessments by unaffiliated offsite readers (OR) were performed for ventriculography (2 OR), cMRI (1 OR) and UE/CE (2 OR). IOV between OR1 and OR2 was expressed by mean percentage of error (MPE). ImeA was determined by linear correlation and Bland Altman Plots with calculation of Limits of Agreement (LOA). Results from the initial evaluation of 50 pts (IOV) with available cMRI in 30 pts are presented.

Results: **IOV between OR1 and OR2:** MPE decreased significantly from 13.7% (CI 9.8-17.6) in UE to 4.8% CE (CI 3.0-6.5) in biplane assessment and from 17.8 (CI 11.8-24.2) to 5.2% (CI 3.5-6.9) in monoplane a3CV.

ImeA between UE and CE compared to cMRI: LOA decreased from 37.7% (-20.3 - 17.4) in UE to 29.1% (-21.2 - 7.9) for OR1 and from 38.4% (-22.5-15.9) to 30.5 (-21.2 - 9.3) for OR2. Linear correlation between EF from UE/CE and MRI increased for CE from 0.75 to 0.87 for OR 1 and from 0.69 to 0.82 for OR2.

Conclusion: Contrast enhanced echocardiography at low MI significantly improves inter-observer agreement and shows a trend towards improved agreement with cMRI in determination of EF when compared to unenhanced echocardiography.

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The Severity of Peripheral Vascular Disease Can Be Assessed by Skeletal Muscle Contrast-Enhanced Ultrasound

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Background: Current methods for evaluating peripheral vascular disease in patients are limited due to their ability to measure changes only in large vessels. We hypothesized that the severity of peripheral vascular disease can be accurately assessed by measuring microvascular blood flow (MBF) in limb skeletal muscle with contrast-enhanced ultrasound (CEU).

Methods: In 7 anesthetized dogs, an adjustable screw occluder and flow probe were placed on the common femoral artery. Catheters were placed in the ipsilateral lateral circumflex femoral artery and aorta for pressure measurement. CEU of the proximal anterior flexor muscle group was performed with intermittent ultraharmonic imaging during a continuous infusion of MP1950 microbubbles. MBF was calculated from the product of microvascular blood velocity (β) and volume (A-value). Measurements were made at rest and during electrostimulated contractile exercise (15 mA) at 1.5 Hz in the presence of no stenosis, mild stenosis (gradient 10-20 mm Hg), and severe stenosis (gradient >20 mm Hg).

Results: At rest, the mean pressure gradient for mild and severe stenoses were 14 ± 4 and 33 ± 13 mm Hg, respectively. Resting femoral artery blood flow was reduced to $84 \pm 8\%$ of baseline with mild stenosis and $49 \pm 15\%$ with severe stenosis. Resting skeletal muscle MBF measured by CEU was significantly reduced only with severe stenosis ($45 \pm 21\%$ of baseline, $p < 0.001$). Microvascular flow reserve during contractile exercise was 2.7 ± 0.3 at baseline, and was incrementally reduced ($p < 0.01$) with mild (2.0 ± 0.3) and severe (1.1 ± 0.1) stenosis. In the severe stenosis group, despite a reduction in resting MBF, flow reserve was > 1.2 in the majority of stages due presumably to collateral recruitment. A good correlation was found between the stenotic pressure gradient and MBF reserve ($r = 0.74$, $p < 0.001$), and between distal pressure and MBF reserve ($r = 0.67$, $p < 0.01$).

Conclusions: These data indicate that CEU of limb skeletal muscle can be used to assess the severity of peripheral vascular disease. This technique may provide a method to evaluate the combined effects of large and small vessel disease, and the impact of collateral perfusion.