Accuracy of Gated Perfusion Single-Photon Emission Tomography for Left Ventricular Ejection Fraction Assessment in the Presence of Large Perfusion Defects. Correlation With Cardiac Magnetic Resonance

Karthik Chapp, Ru-San Tan, Felix Keng, Foong-Koon Cheah, Kain-Peng Tan, Eian-Doo Tan, Yean-Lang Lim, Terrance Chua, National Heart Center, Singapore, Singapore, Diagnostic Radiology, Singapore General Hospital, Singapore, Singapore.

Background. Gated perfusion single-photon emission computed tomography (SPECT) assessment of left ventricular ejection fraction (LVEF) and volumes has been well validated, but there is controversy about its accuracy in the presence of large perfusion defects. We aim to validate the accuracy of gated SPECT measurements in the presence of large perfusion defects, using cardiac magnetic resonance (CMR) as the gold standard.

Methods. 22 male subjects (mean age 53 ± 11 years; mean BMI 29.0 ± 5.9 kg/m²) with cardiac MRI studies were enrolled. MRI (1.5 T MRI scanner, cine MRI with segmented fast low-angle shot pulse sequence) was performed on each subject within a week of LVEF, left ventricular end-diastolic (LVEDV) and end-systolic (LVESV) volumes were determined using automated software (Autoquant, without semi-automated ARGUS) for CMR.

Results. There was excellent correlation (r = 0.94, p = 0.0006) between LVEF assessed by gated SPECT and MR (mean LVEF 41.6 ± 4.9% respectively). The trend of the difference was smaller than 1% (95% CI -1.6% to 1.7%) and was not statistically different (p = 0.07). The limits of agreement were excellent for LVEF, but were wider for LVEDV and LVESV.

Conclusions. There was an excellent correlation between gated SPECT and MR evaluation of LVEF, despite the presence of large rest perfusion defects on gated SPECT. The limits of agreement were excellent for LVEF, but were wider for LVEDV and LVESV.


John P. Ioannidis, Thomas A. Trikalinos, Peter G. Danias. Beth Israel Deaconess Medical Center, Boston, Massachusetts, University of Ioannina, Ioannina, Greece.

Background. Gated SPECT has been proposed as an accurate method for evaluating left ventricular (LV) end-diastolic volume (EDV), end-systolic volume (ESV) and ejection fraction (EF). Several comparisons against the gold standard of cardiac MRI have been performed but each study has left behind a number of unanswered questions. The frequency of discrepancies between the two methods.

Methods and Results

We performed a meta-analysis of data on 134 subjects from 8 studies comparing ECG-gated SPECT vs. cardiac MRI. Data were pooled in correlation and regression analyses relating ECG-gated SPECT and cardiac MRI measurements. The frequency of discrepancies of at least 20% in EDV, 20 ml in ESV and 5% or 10% in EF, and concordance for EF=30% were determined. There was an overall excellent correlation between the two methods for EDV (r = 0.34, p < 0.0001) and ESV (r = 0.36, p < 0.0001) assessed by gated SPECT and MR, but the respective mean differences (21.1 ml, 95% CI 7.7 to 34.5 ml; 14.9 ml, 95% CI 4.7 ml to 25.1 ml) and 95% limits of agreement by Bland-Altman analysis (-38.2 ml to 80.4 ml; -30.2 ml to 60 ml) were considerably wide.

Conclusions. There was an excellent correlation between gated SPECT and MR evaluation of LVEF, despite the presence of large rest perfusion defects on gated SPECT. The limits of agreement were excellent for LVEF, but were wider for LVEDV and LVESV.

Teboroxime Myocardial Perfusion Imaging: Preliminary Results

Ernest V. Gargas, James R. Gaitt, Russell D. Folke, Cesar A. Santanas, James Cullum, James A. Case, Timothy M. Bateman, Multi-Center Trial Investigators, Emory University School of Medicine, Atlanta, Georgia, Cardiovascular Consultants, Kansas City, Missouri.

Background. Teboroxime is a myocardial perfusion tracer with a high extraction fraction and fast clearance, optimal for flow imaging. A dynamic SPECT acquisition, where 30 second detectors are fanned every 38 seconds for up to 4 minutes, was implemented. All the fanned projections were mathematically combined to yield a "static" acquisition to reduce artifacts by accounting for both changing concentration and increasing liver activity. The purpose of this investigation is to test the quality and accuracy of the images from this protocol.

Methods: Patients were imaged using a thallium-rest/teboroxime-stress protocol (20 with fanning and adenosine stress) and correlated with results from conventional myocardial perfusion rest-stress protocols. Either the results of the conventional SPECT studies of the patients' likelihood for CAD were used as the gold standard. One observer interpreted the teboroxime studies and another independent observer blindly interpreted the conventional SPECT studies. Teboroxime images were evaluated for technical quality (free of inferior wall liver artifact) and accuracy of the stress study to detect CAD and localize it to the LAD, LCX, and RCA vascular territories.

Results: The teboroxime studies demonstrated high technical quality by protocol: 90% (243/257 slices) for adenosine-stress fanning, and 74% (196/265 slices) for conventional SPECT. The teboroxime studies using the fanning protocol resulted in 60% accuracy for detecting CAD and 78% and 78% and 86% for localizing disease to the LAD, LCX, and RCA vascular territories respectively.

Conclusions: These preliminary results show that dynamic SPECT fanning acquisition and processing of To-99m teboroxime can yield high quality, accurate studies for diagnosing coronary artery disease. These results should be verified in a larger, prospective clinical trial.

A Simple Technique to Reduce Scatter in Myocardial Perfusion Imaging

Syed Iqbal, Robert Bonsignore, Mohammad Khalil, Basish Lon, Steve Blum, Edith N. Heller, Bron-Lubronson Hospital Center, Bronx, New York, Montefiore Medical Center, Bronx, New York.

Background. Scatter reduces image quality in 99mTc-sestamibi myocardial perfusion imaging (MPI). Cardiac oral contrast (IOC) absorbs X-rays and has been used to outline bowel in X-ray imaging. However IOD also absorbs gamma rays. This study tested our hypothesis that IOD given during MPI would absorb gamma rays from 99mTc-sestamibi and reduce scatter artifacts and improve the quality of MPI images.

Methods. Twenty consecutive patients undergoing To-99m SestaMIBI MPI were randomized to receive either IOD or no contrast (controls). Patients had one-day rest stress MPI using the adenosine stress protocol. 12 patients (66%) had 1st stress images done 45 minutes after the stress test. The 10 subjects in IOD group were given the iodinated oral contrast to drink over 30 minutes and then had their 2nd set of stress images. The control subjects waited 30 minutes and then had their 2nd set of stress images. Images were analyzed using image quality parameters of the scatter counts from a scatter win.
Scatter counts: Controls 8.0 ± 3.0, IOC 6.8 ± 2.8, 1.05 ± 0.4
p-value: 0.75, 0.7, 0.02

Image contrast: Controls 72.2 ± 11, IOC 73.9 ± 15, 76.8 ± 15, 77.3 ± 9.2
p-value: 0.7, 0.043, 0.007

Image variability: Controls 17.8 ± 3.5, IOC 17.7 ± 3.5, 17.9 ± 1.3
p-value: 0.9, 0.008, 0.0001

Counts are in millions, mean ± SD.

## ORAL CONTRIBUTIONS

### 875 Three-Dimensional Echocardiography

#### 875-2

**Geometric Differences of Mitral Valve Apparatus Between Ischemic and Dilated Cardiomyopathy With Significant Mitral Regurgitation: Real-Time Three-Dimensional Echocardiography Study**

**Jun Kaw, Takanori Shiotaka, A. Marc Gillinov, Deborah A. Ayger, Jun Xin Qian, Yong Jin Kim, James D. Thomas. The Cleveland Clinic Foundation, Cleveland, Ohio.**

**Background:** The aim of this study was to elucidate the geometric differences of mitral valve (MV) apparatus in patients with ischemic MR caused by posterior infarction (IMR) and functional MR due to idiopathic dilated cardiomyopathy (DCM), compared to normal control (NL). We used real-time 3D echocardiography (RT-3DE) to quantitate the geometric parameters.

**Methods:** Fourteen patients (9: posterior infarction: 5: anterior and inferior infarction) with IMR, 13 patients with DCM, and seven NL were studied. RT3DE volumetric images of MV apparatus were digitized into a personal computer. Three different imaging long axis planes (Medial (M), Central (C) and Lateral (L)) of MV were generated at mid-systolic by 3D computer software (TomTec). Commisural-commisural (CC) and septo-lateral (SL) distances were measured. Angles between annular plane and both posterior (P) and anterior mitral leaflet (A) were measured in all three planes (M, C, L) (NL, C, L). Results: In medial and central planes, M and L of both IMR and DCM significantly increased compared to NL. In lateral plane, of both groups significantly increased, while P of IMR was not significantly different from NL.

### 875-3

**Detection of Proximal Functional Occlusion of Three Major Coronary Arteries by Contrast-Enhanced Transesophageal Doppler Echocardiography**

**Masami Nishino, Shiro Hashida, Shinichiro Sama, Massayuki Tanikie, Yasuyuki Egami, Toshihiro Takeda, Ryu Shuta, Masayuki Kanawada, Hideo Tanahashi, Jun Tanouchi, Yoshiho Yamada, Osaka Rosai Hospital, Osaka, Japan.**

**Background:** Recently, transesophageal Doppler echocardiography (TDE) has been useful for detecting coronary flow at the distal left anterior descending artery (LAD), and it is very difficult to detect the proximal LAD coronary flow, also left circumflex (LCX) and right coronary artery (RCA) flow using "t-1'DE. It is clinically more important to evaluate proximal coronary lesions as compared to distal lesions. On the other hand, usefulness of Levovist to enhance various Doppler signals has been reported. Thus, in this study, we investigated whether transesophageal Doppler echocardiography using Levovist can evaluate coronary flow in the proximal sites in LAD, LCX, and RCA.

**Methods:** We studied consecutive 45 patients with suspected coronary artery disease who underwent TDE with 5-MHz multplane transesophageal probe after intravenous injection of a small amount of Propofol. Within one week after TDE, diagnostic coronary angiography was performed in each patient. Using TDE, color Doppler flow mapping was detectable in 100% at proximal LAD, 79% at proximal RCA, and 75% at proximal RCA before and it was detectable in 100% at each coronary artery after injection of Levovist (30 ml/kg in 2ml). Coronary angiography revealed proximal LAD occlusion in two patients, proximal LCX occlusion in three patients, and proximal RCA occlusion in two patients that were all accompanied with collateral flow. In these patients, contrast enhanced TDE evaluated abrupt disappearance of color Doppler flow with retrograded distal flow (which supplied by collateral flow from the other coronary arteries) clearly, and these patients of abrupt disappearance of color Doppler flow correctly detected the occlusion using the vessel that were shown by coronary angiography. However, TDE without Levovist could not detect abrupt disappearance of color Doppler flow. Conclusion: Transesophageal Doppler echocardiography can detect proximal LAD, LCX, and RCA functional occlusion with collateral flow accurately.

### 875-4

**Spatio-Temporal Brushlet Denosing Improves Real Time Three-Dimensional Calculation of Right Ventricular Function in Primary Pulmonary Hypertension Patients**

**Deborah R. Moss, Elka D. Angelini, John Doria, Claudio Dimyagia, Rotem J. Barst, Hoda Saoud, Marco R. Di Tullio, Andrew F. Laine, Shneider Homma, Columbia University, New York, New York.**

**Background:** Assessment of right ventricular (RV) function is clinically relevant in the follow-up of patients with primary pulmonary hypertension (PH). A single echocardiographic approach has gained wide acceptability as being both reliable and accurate. We compared 2-dimensional (2D) and real-time three-dimensional (RT-3D) echocardiographic imaging to magnetic resonance imaging (MRI). Comparison was made both...