846-3 Early Diastolic Mitral Annular Tissue Doppler Velocities Predicts the Degree of Left Atrial Appendage Stenosing Following Conversion to Sinus Rhythm After Short Duration Atrial Fibrillation in a Canine Model

Erwan Dowal, Hirotsugu Yamada, Yong Jin Kim, Neil L. Greenberg, Deborah A. Agler, Shawoel Zhuang, Youhua Zhang, Don W. Wallick, Kent A. Mowrey, Todor N. Mazgalev, James D. Thomas, Richard A. Grimm, Department of Cardiovascular Medicine, The Cleveland Clinic Foundation, Cleveland, Pennsylvania.

Background: It has been well documented that atrial stenting post-cardioversion occurs in patients with atrial fibrillation (AF) which could be responsible for thrombus formation. Unfortunately, it is currently not possible to reliably predict those patients likely to manifest atrial stenting. The aim of this study was to evaluate the relationship between mitral annular motion and flow in the left atrial appendage (LAA) in an attempt to predict atrial stenting post AF. Methods: AF was induced by burst stimulation and perpetuated with vagal nerve stimulation for 2 hours in 10 healthy open chest mongrel dogs. LAA flows and mitral annular DTI were obtained by transesophageal echocardiography. Mitral annular DTI was obtained from a color DTI cine-loop. Results: 1) Peak diastolic LAA emptying flow velocity decreased significantly immediately after cessation of AF (p<0.003 vs baseline sinus rhythm and p=0.04 vs AF). 2) Peak Ea [early diastolic mitral annular DTI before (0.56±0.24) and during AF (0.36±0.38) significantly correlated (table) with LAA emptying flow velocity after cessation of AF. 3) Peak Ea [late diastolic] DTI however revealed no correlation to LAA emptying post conversion to sinus rhythm. Conclusion: Early diastolic mitral annular motion by DTI both before and during AF correlated with the degree of stenuring after short duration of atrial fibrillation. The routine assessment of this parameter may prove useful in identifying patients at risk for post-cardioversion thromboembolism.

Baseline LA Diameter LAA Area(45 °) (cm2)

<table>
<thead>
<tr>
<th>LA Diameter</th>
<th>LAA Area(45 °) (cm2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0±0.9</td>
<td>5.0±0.9</td>
</tr>
<tr>
<td>5.2±0.6</td>
<td>5.2±0.6</td>
</tr>
<tr>
<td>5.9±1.4</td>
<td>5.9±1.4</td>
</tr>
</tbody>
</table>

p = 0.0002

846-4 Left Atrial Reservoir and Active Pump Function After Brief Duration of Atrial Fibrillation: An Acute Animal Study

Yong Jin Kim, Hirotsugu Yamada, Tomotsugu Tabata, Junko Watanabe, Erwan Dowal, Deborah A. Agler, Shawoel Zhuang, Youhua Zhang, Don W. Wallick, Kent A. Mowrey, Todor N. Mazgalev, James D. Thomas, Richard A. Grimm, The Cleveland Clinic Foundation, Cleveland, Ohio.

Impairment of atrial pump function after cardioversion of atrial fibrillation (AF) is believed to be a key factor in the risk for thromboembolism. However, the relative role and importance of left atrial (LA) reservoir function has not been fully evaluated. This study was performed to evaluate the LA reservoir and pump function after a brief duration of AF. Methods: AF was induced and maintained for 2-4 hours in 10 open chest dogs. We obtained pulmonary venous flow systolic and diastolic velocities (Sv, Dv and VTI (SvI and DvI)) as well as LA appendage emptying flow (LAFF) and tissue velocity (LAAT) using transesophageal or intracardiac echocardiography. LA pressure-area loop (P-A loop) was determined by simultaneous recording of epicardial echocardiography and LA pressure. Results: LAFF and LAAT decreased immediately after cessation of AF and partially improved after 30 minutes. Similarly, Sv, Dv, Av, SvI and DvI decreased immediately and partially improved, LA stiffness increased immediately and partially recovered after 30 minutes.

Baseline SR- instantaneous LA Angle LAA Area(45 °) (cm2)

<table>
<thead>
<tr>
<th>Baseline</th>
<th>SR- instantaneous (°)</th>
<th>LA Angle</th>
<th>LAA Area(45 °) (cm2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5±0.9</td>
<td>6±0.9</td>
<td>5±0.9</td>
<td>5±0.9</td>
</tr>
<tr>
<td>5±0.6</td>
<td>5±0.6</td>
<td>5±0.6</td>
<td>5±0.6</td>
</tr>
<tr>
<td>5±1.4</td>
<td>5±1.4</td>
<td>5±1.4</td>
<td>5±1.4</td>
</tr>
</tbody>
</table>

p <0.005 vs baseline, p=0.03 vs SR-I, SR-II immediately after, SR-30= 30 minutes after the cessation of AF.

Conclusion: Similar to atrial pump function, LA reservoir function was also impaired immediately following the cessation of AF and recovered toward baseline after 30 minutes. This transient increase in stiffness along with impaired pump function may contribute to stasis of flow following termination of AF. These data will help to advance our insights into mechanisms for, and prevention, of thromboembolism.

846-5 Is the Ratio of Transmural Peak E Wave Velocity to Color Flow Propagation Velocity Useful for Evaluating Severity of Heart Failure in Atrial Fibrillation?

Rikimaru Oyama, Kazuya Mura, Nobuki Tanaka, Kayo Ueda, Jinyao Liu, Yasuaki Wada, Nozomu Hamada, Youko Hamada, Yemaguchi University, Ube, Japan.

Background: Analysis of transmural inflow (TMI) pattern is widely used for evaluating LV diastolic function and provide valuable information for management of heart failure (HF) in sinus rhythm. However, utilization of TMI in patients with atrial fibrillation (AF) is not established. Recently, usefulness of the ratio of early transmural peak E-wave velocity (Ecm/s) to flow propagation velocity (Vp:cm/s) for evaluating the severity of HF in sinus rhythm was reported. To evaluate the clinical utility of the ratio of E to Vp (E/Vp) in patients with HF in AF, we assessed the relation between E/Vp and severity of HF. Methods: E and Vp were recorded separately in the same cardiac cycle with dual Doppler system in 46 consecutive patients with AF. E/Vp was calculated and averaged for 10 cardiac cycles and compared with NYHA functional class or plasma BNP level as a neuroendocrine marker of cardiac dysfunction. Results: Neither E nor Vp was correlated with NYHA functional class. In patients with moderate severity heart failure (NYHA III-IV), the values of E/Vp were significantly higher than that in patients with mild heart failure (NYHA I-II) (2.1±0.7 vs 1.2±0.4, p<0.0001). If the optimal cut off value of E/Vp defined as E/Vp>1.5 moderate to severe heart failure (NYHA III-IV) could be predicted with a sensitivity of 88% and a specificity of 87%. The level of plasma BNP was significantly higher in patients with E/Vp>1.5 than in E/Vp<1.5 (p=0.0229, 6±1430 vs 7.8±285 pg/ml, p<0.05). Conclusions: E/Vp was well associated with NYHA functional class and plasma BNP level. Analysis of Doppler-derived TMI combined with the measurement of Vp was useful for evaluating severity of HF even in patients with AF.

848-6 Comparison of Cardiac Three-Dimensional Computed Tomography With Transesophageal Echocardiography in the Evaluation of the Left Atrial Appendage in Patients With Atrial Fibrillation

Wael A. Jaber, Richard D. White, Janet M. Boyle, Irmien Vasaaka, Natalie Andrea, Craig R. Althor, Cleveland Clinic Foundation, Cleveland, Ohio.

Background: Transesophageal echocardiography (TEE) is the gold standard for assessment of the left atrium (LA) and the left atrial appendage (LAA). However, TEE is occasionally not feasible in patients (pts) with esophageal disease, hiatal hernia and other pts where it is poorly tolerated. We sought to determine the potential use of 3D contrast enhanced multidetector computed tomography (3D-CT), as an alternative to TEE. Methods: We prospectively evaluated 28 pts in atrial fibrillation (AF) undergoing TEE (mean age 54±10.1 years, 6 females) to exclude LA or LAA thrombi. Standard protocol for TEE assessment of the LA and LAA was used. All pts underwent a 3D-CT focusing on the LA and LAA. Reviewers of the 3D-CT were blinded to the result of the TEE. Results: TEE identified 2 LA thrombi and 1 LAA thrombus all of which were visualized by 3D-CT. No false positive identification of LA or LAA thrombus was reported by 3D-CT. Comparison of maximal LA and LAA dimensions is shown in table. The LA area was statistically significantly larger measured by 3D-CT. Conclusion: This initial observation demonstrates the potential utility of cardiac 3-D contrast enhanced multidetector CT with retrospective gating as an alternative means for exclusion of LA and LAA thrombi. Identifying comparable tomographic views between the 2 imaging techniques requires further evaluation.
Conclusions: The mortality in the abnormal dobutamine group was 7.7% compared to 3.2% in the normal dobutamine group. (Table) Conclusions: The NPV of DE in predicting 30-day cardiac death in diabetic renal transplant recipients is high but less than that of other high risk prognostic groups (i.e., vascular surgery). Larger studies to confirm our data and further assess other modalities of prognostic screening are ongoing.

### Table 1: Results of Preoperative Tests and Subsequent 30 Day Cardiac Outcomes

<table>
<thead>
<tr>
<th>Type of Stress</th>
<th>Number</th>
<th>Abnormal Cardiac Events</th>
<th>Positive Predictive Value</th>
<th>Normal Cardiac Events</th>
<th>Negative Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dobutamine</td>
<td>106</td>
<td>13</td>
<td>31%</td>
<td>93</td>
<td>4%</td>
</tr>
<tr>
<td>Exercise</td>
<td>19</td>
<td>1</td>
<td>0%</td>
<td>18</td>
<td>94%</td>
</tr>
<tr>
<td>Treadmill</td>
<td>19</td>
<td>4</td>
<td>0%</td>
<td>15</td>
<td>93%</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>13</td>
<td>6</td>
<td>0%</td>
<td>7</td>
<td>100%</td>
</tr>
</tbody>
</table>

**9:00 a.m.

### 848FO-3

**Use of Stress Echocardiography to Predict Death in Diabetic Patients**

Thomas H. Marwick, Colin Case, Stephen Sawada, Charles Vasey, James D. Thomas, University of Queensland, Brisbane, Australia.

**Background:** Coronary artery disease is a major cause of mortality in patients with diabetes mellitus (DM). However, symptom evaluation may be limited because of silent ischemia, and the use of standard exercise (Ex) testing in DM may be difficult because of vascular disease, neuropathy or visual problems. We sought whether stress testing (Ex-, when feasible) or dobutamine echo (DoC) could be used to identify DM pts at risk.

**Methods:** We studied 937 DM pts (age 59±13.9, 529 men): only 18% (200) had chest pain, the majority of tests being performed for prognostic evaluation (276 (30%) had prior myocardial infarction and 103 had past revascularization). ExE was performed in 533 pts able to exercise maximally (8.2±3.2 METS). DoE using a standard dobutamine stress was used in 604 pts. Pts were followed for up to 9 years (aver 3.9±2.3), for death and revascularization.

**Results:** Normal studies were obtained in 567 (60%); 29% had resting LV dysfunction and 25% had ischemia. Abnormalities were confined to one territory in 183 pts (20%), and to multiple territories in 187 pts (20%). Death (in 275 pts, 29%) was predicted for referral for pharmacologic stress (hazard ratio 3.89, p<0.0001), number of ischemic territories (HR 1.2, p<0.0001), age (HR 1.02, p<0.001), and heart failure (HR 1.51, p<0.01). In stepwise models replicating the sequence of clinical evaluation, the predictive power of independent clinical predictors (age and heart failure, model chi2 39.6) was significantly enhanced by addition of LV dysfunction data (model chi2 60.9) and further enhanced by ischemia (model chi2 79.4). However, pts with a normal DoE had a higher event-rate (6% per yr) than those with normal ExE (1.2% per yr). Conclusion: Results of stress echo are independent predictors of death in DM pts with known or suspected CAD. Ischemia adds risk that is incremental to clinical risks and LV dysfunction. Inability to exercise is a powerful negative feature and a negative DoE does not necessarily signify low risk in this group.

**9:15 a.m.

### 848FO-4

**Detection of Coronary Disease Using Dobutamine Stress Myocardial Contrast Echocardiography Compared to 99mTc-Sestamibi Single Photon Emission Computed Tomography**

Bharati Shivalika, Diana Rinkевич, Sanjiv Kaul, Todd Belcik, Kevin Kei, University of Virginia, Charlottesville, Virginia.

**Background:** Dobutamine stress (DS) echocardiography detects coronary stenosis by inducing transient wall thickening abnormalities (BWMA) in patients with known or suspected CAD. BWMA are induced that DS-induced perfusion defects on myocardial contrast echocardiography (MCE) precede the development of WTA. We also sought to determine the specificity and sensitivity of DSE with and without MCE compared to 99mTc-sestamibi single photon emission computed tomography (SPECT) and DS-WTA for detecting perfusion abnormalities compared to SPECT and DS-WTA for perfusion defects versus WTA was greater (kappa=1.0) than that between SPECT and DS-WTA (kappa=0.45), and analysis by perfusion bed also showed excellent concordance between DS-MCE and DS-WTA (kappa=0.46, positive kappa=0.69). At mid dose, MCE detects were seen in 88% of patients, compared to WTA in only 67%.

**Conclusion:** DS-MCE combined with WTA may be a reliable test for detection of CAD.

**848FO-5

**Diabetes With Positive Diagnostic Stress Echocardiography and No History of Coronary Heart Disease Have a Higher Incidence of Baseline Wall Motion Abnormalities Than Nondiabetics**

Pete J. Curran, Janine Kriukovich, University of California, Los Angeles, Los Angeles, California.

**Background:** The Third Adult Treatment Panel of the National Cholesterol Education Program recently revised the status of diabetes without coronary heart disease (CHD) to the level of CHD equivalent. Introduction: Diabetes is recognized as a significant risk factor for CHD, which is the leading cause of mortality in this population. Exercise and dobutamine stress echocardiography (SE) is frequently used diagnostically in patients considered to be at risk for CHD, and has been validated to have a high positive predictive value in the diagnosis of CHD. In support of the revised classification of diabetes from CHD risk factor to CHD equivalent, we hypothesized that diabetics without history of CHD and positive SE have a higher incidence of baseline wall motion abnormalities (BMAW) than non-diabetics.

**Methods:** A retrospective analysis of 718 consecutive positive SE was performed at a tertiary care hospital between July 1999 and July 2000. Diabetics were over-sampled to include a third year of analysis to more evenly match the numbers of non-diabetics. Patients were classified into four groups: Diabetics vs. non-diabetics without history of CHD, and diabetics vs. non-diabetics with a history of CHD. Baseline characteristics compared age, sex, exercise double product, ekg changes, use of cardiac medications including beta blocker, ace inhibitor, aspirin, and other cardiac risk factors including hyperlipidemia and hypertension. SE were interpreted by three experienced ultrasonographers.

**Results:** 62% of diabetics without history of CHD (n=107) and positive SE had BMAW, compared to 31% of non-diabetics without history of CHD (n=318, p<0.05). In patients with history of CHD, 82% of diabetics with positive SE had BMAW (n=396), compared to 80% of non-diabetics (n=203, p<0.05).

**Conclusion:** Diabetics without history of CHD and positive SE have a higher incidence of BMAW than non-diabetics, signifying silent cardiac ischemia or infarction. This trend persists in diabetics previously diagnosed with CHD, and suggests that diabetics may benefit from earlier non-invasive screening and irradation of primary prevention.

**9:45 a.m.

### 848FO-6

**Prognostic Value of Dobutamine Echocardiographic Variables in Diabetic Patients**


**Background:** Diabetes mellitus is a major risk factor for cardiovascular morbidity and mortality. The role of dobutamine stress echocardiography in risk stratification and prognosis of diabetic patients remains unclear.

Methods: We evaluated a cohort of 310 diabetic patients (age 62±10 years, 46% male) undergoing dobutamine stress echocardiography. The left ventricle (LV) was divided into a standard 16-segment model and a 5-point scale was used to evaluate wall motion. Resting LV ejection fraction (LVEF) (mean 55±16) and ischemia (any new wall motion abnormality or wall segments with biphasic response) were assessed by a consensus of 2 echocardiographers. One year follow up (mean 2±0.7 years) was obtained for confirmed non-fatal myocardial infarction (n=9) and cardiac death (n=11).

**Results:** The presence of ischemia increased the probability of cardiac events by 6.14 (p=0.014) by multiple logistic regression (95% CI: 1.77-17.93; p=0.0012). LVEF<45% increased the probability of cardiac events by 3.64 (p=2.75) by multiple logistic regression (95% CI: 1.49-9.03; p=0.03). By univariate analysis, ischemia (p=0.0002) and LVEF<45% (p=0.0003) were found to be significant predictors of cardiac events. In a multivariate logistic regression model, ischemia was the only independent predictor of hard events (p<0.0001).

**Conclusion:** The presence of ischemia by dobutamine stress echocardiography is a significant independent predictor of poor prognosis in diabetic patients. Furthermore, ischemia is a better predictor of cardiovascular mortality than LVEF in diabetic patients.