# Nuclear cardiology in the literature: A selection of recent, original research papers

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**The Prognostic Value of Diastolic and Systolic Mechanical Left Ventricular Dyssynchrony Among Patients with Coronary Heart Disease**

*Durham, NC*

Marat Fudim, Mouhammad Fathallah, Linda K. Shaw, Peter R. Liu, Olga James, Zainab Samad, Jonathan P. Piccini, Paul L. Hess, and Salvador Borges-Neto

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***Context*** While systolic left ventricular dyssynchrony (LVD) is known to predict adverse clinical outcomes, the prognostic role of diastolic LVD in predicting clinical outcomes among those with coronary artery disease (CAD) is not known.

***Methods and Results*** To determine the prognostic value of systolic and diastolic LVD among patients with CAD, the authors identified all patients who underwent gated SPECT myocardial perfusion imaging (MPI) between 2003 and 2009, and who also had $\geq$ 50% stenosis in at least one epicardial coronary artery. LVD was assessed by phase analysis of gated SPECT using Emory Cardiac Toolbox. Systolic or diastolic LVD was said to be present when the values of histogram bandwidth (HBW) and phase standard deviation (PSD) were $>$ 2 SD above mean, determine in a cohort of normal patients with normal LV ejection fraction, normal perfusion, and no known CAD. These cutoffs were systolic HBW = 135 ms, diastolic HBW = 156 ms, systolic PSD = 52 ms, and diastolic PSD = 47 ms. Cox proportional hazards modeling was used to determine the association between LVD indices and mortality. The authors identified 1310 patients meeting their inclusion criteria (median age of 64 years; 70% men; median follow-up of 7 years). Overall, 241 (18.4%) and 238 (18.2%) patients had significant systolic and diastolic mechanical dyssynchrony, respectively, and 211 (16.1%) had both. During the follow-up period, there were a total of 543 deaths. At 5 years, 21% of those with normal diastolic LVD and 42% of those with abnormal diastolic LVD died ($P < 0.001$). Addition of diastolic LVD to a model consisting of comorbidities, electrical dyssynchrony, and systolic LVD resulted in incremental prediction of cardiovascular mortality (global Chi-square statistic of 222.8 vs 211.9; 2 degrees of freedom; $P < 0.004$). In a model that also included LV ejection fraction, the addition of diastolic LVD to systolic LVD maintained an incremental prognostic value (global Chi-square statistic of 234.8 vs 241.8; $P < 0.030$). Adjustment for baseline ischemia and scar burden did not change this relationship. Results of this study suggest that both systolic and diastolic LVD, as measured by phase analysis of gated SPECT MPI, predict adverse clinical outcomes. Diastolic LVD may provide incremental predictive value over clinically relevant variables.

***Significance*** The application of phase analysis for measuring LVD is largely limited to high-risk heart failure populations and is used predicting response to CRT and possibly arrhythmogenesis. The association of LVD with mortality among patients with CAD highlights the fact that LVD can be present in varied clinical situations and not just heart failure. The incremental value of LVD in predicting outcomes in a CAD population also brings forth an intriguing concept—whether LVD needs to be accounted for prior to reporting gated SPECT MPI has being 'normal.'

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**Diagnostic Impact of 18F-Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography and White Blood Cell SPECT/Computed Tomography in Patients with Suspected Cardiac Implantable Electronic Device Chronic Infection**

*Paris, France*

Jérémie Calais, Aziza Touati, Nathalie Grall, Cédric Laouénan, Khadija Benali, Besma Mahida, Jonathan Vigne, Fabien Hyafil, Bernard Iung, Xavier Duval, Laurent Lepage, Dominique Le Guludec, and François Rouzet

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***Context*** Diagnosis of cardiac implantable electronic devices (CIEDs) infection remains challenging due to the low sensitivity of clinical risk scores.

***Methods and Results*** In this study, the authors aimed to determine the diagnostic value of 18F-fluorodeoxyglucose positron emission tomography/computed tomography (18F-PET/CT) and radiolabeled white blood cells single-photon emission computed tomography/CT (WBC-SPECT/CT) among patients undergoing both scans for suspected CIED infection and inconclusive routine investigations. Forty-eight consecutive patients with suspicion of CIED infection who underwent both 18F-PET/CT and WBC-SPECT/CT within 30 days were retrospectively included. The final diagnosis of CIED infection by the endocarditis expert team was based on the modified Duke-Li classification at the end of follow-up. 18F-PET/CT and WBC-SPECT/CT were independently analyzed blinded to the patients' medical record. In the overall study population, the diagnostic sensitivity, specificity, positive predictive value, and negative predictive value were, respectively, 80%, 91%, 80%, and 91% for 18F-PET/CT and 60%, 100%, 100%, and 85% for WBC-SPECT/CT. Addition of a positive nuclear imaging scan as a major criterion markedly improved the Duke-Li classification at admission. Semiquantitative parameters did not allow discrimination between definite and rejected CIED infection. Prolonged antibiotic therapy before imaging tended to decrease the sensitivity for both techniques. These results indicate that radionuclide imaging has the ability to improve the diagnostic performance of clinical risk scores in predicting CIED infection among patients suspected of the Duke-Li score at admission in a selected population of patients with suspected CIED infection, particularly when the infection was initially graded as possible. Whenever possible, imaging should be performed before or early after antibiotic initiation.

***Significance*** Hybrid PET/CT and SPECT/CT have been shown to improve the sensitivity of clinical risk score for infective endocarditis, and could potentially do the same for CIED infections, in selected patients. However, delaying imaging till after antibiotic therapy has been initiated can result in lower diagnostic sensitivity.

**Myocardial blood flow reserve assessed by positron emission tomography myocardial perfusion imaging identifies patients with a survival benefit from early revascularization**

*Kansas City, MO*

Krishna K. Patel, John A. Spertus, Paul S. Chan, Brett W. Sperry, Firas Al Badarin, Kevin F. Kennedy, Randall C. Thompson, James A. Case, Iain McGhie, and Timothy M. Bateman

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***Context*** The value of myocardial blood flow reserve (MBFR) on positron emission tomography (PET) myocardial perfusion imaging (MPI) in predicting survival benefit after revascularization is not known.

***Methods and Results*** To determine the prognostic value of MBFR among patients after revascularization, the authors conducted a retrospective study of 12,594 consecutive patients who had undergone $^{82}$Rubidium rest/stress PET MPI from January 2010 to December 2016. Patients with cardiomyopathy, prior coronary artery bypass grafting (CABG), and missing MBFR were excluded. MBFR was calculated as the ratio of stress to rest absolute myocardial blood flow. Cox regression analysis was performed to determine the association of MBFR with all-cause mortality, after adjusting for patient and test characteristics, early revascularization (percutaneous coronary intervention or CABG $\leq$ 90 days of MPI), and the interaction between MBFR and early revascularization. The authors found that after a median follow-up of 3.2 years, 897 patients (7.1%) underwent early revascularization and 1699 patients (13.5%) died. Ischemia was present in 4051 (32.3%) patients, with 1413 (11.2%) having $\geq$ 10% ischemia. Mean MBFR was 2.0 ± 1.3, with 39% patients with MBFR < 1.8. On multivariable analysis, every 0.1 unit decrease in MBFR was associated with 9% greater hazard of all-cause mortality (hazard ratio 1.09, 95% confidence interval 1.08-1.10; $P < 0.001$). Patients with MBFR $\leq$ 1.8 had a significant survival benefit with early revascularization ($P < 0.001$), regardless of the type of revascularization or degree of ischemic burden. Results of this highlight the prognostic value of MBFR, and its ability to possibly guide coronary revascularization.

***Significance*** This large observational study provides critical insight into the role of MBFR on PET MPI in predicting mortality following revascularization. While prior PET MPI studies have shown a prognostic benefit from revascularization guided by ischemic burden, results of this study suggest (not statistically significant) that revascularization among those with lower ischemic burden, but low MBFR, could provide additive mortality benefit. Similarly, among those with high ischemic burden but 'preserved' MBFR, revascularization may not provide mortality benefit.

## Disclosures

*Dr. Malhotra serves on the speakers bureau of Pfizer.*