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

Saurabh Malhotra, MD, MPH, FASNC[a,b]

[a] Division of Cardiology, Cook County Health, John H. Stroger Hospital of Cook County, Chicago, IL
[b] Division of Cardiology, Rush Medical College, Chicago, IL

FDG PET/CT for Early Detection and Localization of Left Ventricular Assist Device Infection. Impact on Patient Management and Outcome.

Jongho Kim, Erika D. Feller, Wengen Chen, Yua-nyuan Liang and Vasken Dilsizian
Baltimore, MD
J Am Coll Cardiol Img 2019;12:722-729

Context 18F-fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) can aid in diagnosis of left ventricular assist device (LVAD) infection. Its role in clinical management of LVAD infection has not be studied.

Methods and Results The authors performed FDG PET/CT in 35 patients with heart failure patients and LVAD (24 with and 11 without clinical suspicion of infection). Microbiology and/or clinical follow-up were used as the final diagnosis standard. Survival rates were compared between patients with and without FDG evidence of infection, and in between those with peripheral (exit wound site or driveline) versus central (cannula or pump) device infection. Among the 35 patients, the authors noted metabolic evidence of LVAD infection in 28 (80%), among whom infection was limited to the periphery in 5 patients and extended into the central LVAD components in 23 patients. Seven patients showed no metabolic evidence of infection, which was confirmed by microbiology and clinical follow-up. When CT images were interpreted independently from the FDG PET and clinical information, only 4 of 35 (11%) suggested the possibility of infection. Fourteen of

28 (50%) infected patients died during a mean follow-up of 23 months: 12 (86%) with central infection and only two with peripheral infection. In contrast, none of the seven patients without FGD PET evidence of infection died ($p < 0.03$). Results of this study suggest that FDG PET/CT is can be employed for diagnosing LVAD infection and its location.

Significance Given the limited availability of donor heart, the use of destination LVAD therapy among patients with end-stage heart failure is on the rise. The increased LVAD use is accompanied by a higher prevalence of infections, that typically start superficially at the exit wound site and progress to deeper tissues resulting in fatal complications. This one of its kind study has shown the possible application of FDG PET/CT to identify the presence and location of LVAD infections, which can guide medical or surgical interventions.

Detection and Prediction of Bioprosthetic Aortic Valve Degeneration

Timothy R.G. Cartlidge, Mhairi K. Doris, Stephanie L. Sellers, Tania A. Pawade, Audrey C. White,a Renzo Pessotto, Jacek Kwiecinski, Alison Fletcher, Carlos Alcaide, Christophe Lucatelli, Cameron Densem, James H.F. Rudd, Edwin J.R. van Beek, Adriana Tavares, Renu Virmani, Daniel Berman, Jonathon A. Leipsic, David E. Newby and Marc R. Dweck
Edinburgh, United Kingdom
J Am Coll Cardiol 2019;73:1107-1119

Context Bioprosthetic valves are being increasing implanted for valvular heart disease, though markers of prosthetic valve dysfunction are lacking.

Methods and Results To determine the ability of 18F-fluoride positron emission tomography (PET)-computed tomography (CT) for detecting bioprosthetic aortic valve degeneration and predict valve dysfunction, the authors

performed ex vivo and in vivo examinations of bioprosthetic valves. Fifteen explanted degenerated bioprosthetic valves were examined ex vivo by 18F-fluoride PET, and 78 patients with bioprosthetic aortic valves (with and without valve dysfunction) were examined via in vivo contrast-enhanced CT angiography, 18F-fluoride PET, and serial echocardiography over a 2 years follow-up period. All ex vivo, degenerated bioprosthetic valves displayed 18F-fluoride PET uptake that colocalized with tissue degeneration on histology. Among 71 patients without known bioprosthesis dysfunction, 14 had abnormal leaflet pathology on CT, and 24 demonstrated 18F-fluoride PET uptake (target-to-background ratio [TBR] = 1.55; interquartile range [IQR] = 1.44 to 1.88]). Patients with increased 18F-fluoride uptake exhibited more rapid deterioration in valve function compared to those without (annualized change in peak transvalvular velocity 0.30 [IQR = 0.13 to 0.61] vs. 0.01 [IQR = $-$ 0.05 to 0.16] ms^{-1}/year; $P < 0.001$). 18F-fluoride uptake correlated with deterioration in all the conventional echocardiographic measures of valve function assessed (e.g., change in peak velocity, $r < 0.72$; $P < 0.001$). Ten patients developed new bioprosthesis dysfunction during follow-up, and all of them had evidence of 18F-fluoride uptake at baseline (TBR = 1.89; IQR = 1.46 to 2.59). On multivariable analysis, 18F-fluoride uptake was the only independent predictor of future bioprosthetic dysfunction. This seminal report identifies 18F-fluoride PET-CT to have the ability for diagnosing subclinical bioprosthetic valve degeneration and predicting subsequent valvular dysfunction.

Significance There is an increasing implantation of bioprosthetic valves, driven by the availability of transcatheter valves, some of which are now also approved for low risk populations. Identification of valvular dysfunction with 18F-fluoride PET-CT may prompt enhanced longitudinal surveillance of these patients and may potentially improve clinical outcomes.

Vascular Inflammation in Subclinical Atherosclerosis Detected by Hybrid PET/MRI

Leticia Fernández-Friera, Valentín Fuster, Beatriz López-Melgar, Belén Oliva, Javier Sánchez-González, Angel Macías, Braulio Pérez-Asenjo, Daniel Zamudio, Juan C. Alonso-Farto, Samuel España, José Mendiguren, Héctor Bueno, Jose M. García-Ruiz, Borja Ibañez, Antonio Fernández-Ortiz and Javier Sanz

Madrid, Spain
J Am Coll Cardiol 2019;73:1371-1382

Context While inflammation is known to contribute to atherosclerosis, there is limited data on the prevalence of arterial inflammation in subclinical atherosclerosis.

Methods and Results To characterize vascular inflammation in atherosclerosis, the authors performed hybrid 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography/magnetic resonance imaging (PET/MRI) on a subset of 755 patients belonging to the PESA (Progression of Early Subclinical Atherosclerosis) study. Carotid, aortic, and ilio-femoral 18F-FDG PET/MRI was performed in these patients who were between 40 and 54 years of age (84% males), and had known atherosclerotic plaques detected by 2-/3-dimensional vascular ultrasound and/or coronary calcification. Presence, distribution, and number of arterial inflammatory foci (increased 18F-FDG uptake) and plaques with or without inflammation (coincident 18F-FDG uptake) was evaluated. The authors found evidence of arterial inflammation in 48.2% of individuals (24.4% femorals, 19.3% aorta, 15.8% carotids, and 9.3% iliacs) and plaques in 90.1% (73.9% femorals, 55.8% iliacs, and 53.1% carotids). 18F-FDG arterial uptakes and plaques, significantly increased with cardiovascular risk factors ($P < 0.01$). Coincident 18F-FDG uptakes were present in 287 of 2605 (11%) plaques, and most uptakes were detected in plaque-free arterial segments (459 of 746; 61.5%). Plaque burden, defined by plaque presence, number, and volume, was significantly higher in individuals with arterial inflammation than vs. those without ($P < 0.01$). The number of plaques and 18F-FDG uptakes showed a weak positive correlation ($r = 0.25$; $P < 0.001$). Results of this unique study show that arterial inflammation is highly prevalent in middle-aged individuals with known subclinical atherosclerosis, and that large-scale multiterritorial PET/MRI allows for characterization of atherosclerosis-related arterial inflammation.

Significance The high prevalence of atherosclerotic plaques in this middle-aged, asymptomatic population is not surprising given the inclusion criteria for presence of atherosclerosis for this sub-study. Interestingly, arterial inflammation was mainly noted in areas free of plaque, suggesting that inflammation likely precedes plaque formation. This concept will require confirmation in longitudinal studies of serial imaging to document plaque formation in regions of arterial inflammation.

Disclosure

Nothing to disclose.