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ABSTRACT

NASCI AHA Young Investigator awards 2018

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Each year, the North American Society of Cardiovascular Imaging (NASCI) through its partnership with the American Heart Association Council on Cardiovascular Radiology and Intervention (CVRI) awards the NASCI-AHA Young Investigator Awards, which are amongst the top abstracts presented at the NASCI annual meeting. All residents, postdoctoral students, medical students and fellows are eligible for these awards.

The International Journal of Cardiovascular Imaging proudly publishes the following abstracts from the finalists that were presented in full at the Annual Meeting in Charleston, South Carolina on September 22–25, 2018.

The 2019 Meeting will be held in September 14–17, Seattle, WA. Learn More at https://www.nasci.org/future-meetings.

For information about NASCI, and to register to attend the annual meeting, go to www.nasci.org.

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2018 NASCI-AHA Young Investigator Awards:

Dr. Bradley Allen

Myocardial tissue phase mapping detects early cardiac dysfunction in a mouse model of chemotherapy-induced cardiotoxicity

Purpose: The purpose of this study is to explore the potential of advanced cardiac MR (CMR) myocardial tissue characterization with tissue phase mapping (TPM) in a mouse model of chemotherapy-induced cardiotoxicity. We hypothesize that myocardial functional characterization will allow for the identification of chemotherapy-induced cardiotoxicity prior to cardiac myocyte apoptosis and reduction of ejection fraction (EF).
Methods: A cumulative dose of 25 mg/kg doxorubicin was administered over three weeks using subcutaneous pellets in n = 14 female C57BL/6 mice. A subgroup of n = 6 mice also had a total of 10 mg/kg trastuzumab administered via intraperitoneal injection. Mice were imaged at baseline, at 5–6 weeks and 10 weeks post-treatment on a 7 T MRI. The protocol including short-axis cine MRI covering the LV and a single mid-ventricular short-axis 2D cine TPM. EF was calculated from cine images and peak radial and longitudinal velocities were measured using TPM. Four mice were sacrificed for histopathologic assessment of apoptosis at 6 weeks.
Results: There were no significant differences in EF at any time point. Global systolic longitudinal velocity (Vz-sys) was significantly reduced at 6 weeks ($p = 0.01$) and 10 weeks ($p = 0.02$). Global diastolic longitudinal velocity (Vz-dia) was significantly reduced at 6 weeks ($p = 0.01$) but not at 10 weeks ($p = 0.02$). There was no difference in radial velocities. Histopathologic results demonstrated minimal apoptosis in all mice (~1 apoptotic cell/high power field), suggesting early-stage cardiotoxicity.
Discussion: In a mouse model of chemotherapy-induced cardiotoxicity using doxorubicin and trazstuzumab, advanced CMR functional assessment with TPM shows promise in identifying treatment-related decrease in myocardial

longitudinal systolic and diastolic velocity prior to the onset of cardiomyocyte apoptosis and reduction of ejection fraction.

Dr. Markus Goeller

Relationship between changes in pericoronary adipocyte lipid content and plaque burden by coronary CTA

Purpose: We sought to evaluate the relationship between changes in plaque composition and changes in PCAT CT attenuation in stable patients who underwent sequential coronary CT angiography (CTA).
Methods: We analyzed CTA data sets of stable patients with CAD (N = 110, age 59.2 ± 9.8, male 76%) who underwent sequential CTA (at a mean time interval of: 3.4 ± 1.6 years). The mean PCAT CT attenuation (HU) was measured around the proximal segment of the right coronary artery RCA (pRCA) (taken from 10 to 50 mm from RCA ostium) in 3D cylindrical layers within a diameter equal to the average pRCA diameter. Quantification of total, calcified, non-calcified and low-density non-calcified plaque volume (mm3) (TPV, CPV, NCPV and LD-NCPV) and corresponding plaque burden (plaque volume × 100%/vessel volume) in the pRCA was performed using semi-automated software.
Results: Age, gender and risk factors were similar between patients with an increase (group A, N = 58) and decrease of NCP burden (group B, N = 52) within the pRCA (each $p > 0.05$).Compared to group A, patients in group B had a greater reduction of serum levels of cholesterol (mg/dl) (6.5 ± 40.9 vs. 27.2 ± 45.2, $p = 0.013$) and LDL (8.8 ± 34.3 vs. 26.3 ± 35.1, $p = 0.009$).An increase in NCP burden within pRCA was associated with an increase of PCAT CT attenuation ($\beta = 0.27$, $p = 0.01$).After adjusting for age, gender, risk factors, statin use, baseline PCAT CT attenuation, change in LDL and change in BMI, PCAT CT attenuation in group A increased by 1.85 ± 0.96;whereas mean PCAT CT attenuation in group B decreased by 1.04 ± 0.99 ($p = 0.04$).
Discussion: An increase in PCAT CT attenuation surrounding the proximal RCA is independently associated with an increase in NCP burden within the proximal RCA. Components of NCP such as oxidized lipids, macrophages and smooth muscle cells may potentially play a prominent role in modulating adipocyte differentiation and size in PCAT.

Dr. Marly vanAssen

Predicting MACE in patients with coronary artery disease using a combination of CT myocardial perfusion and CT-FFR

Purpose: To determine the prognostic value of dynamic CT perfusion and CT-derived fractional flow reserve (CT-FFR) for the prediction of major adverse cardiac events (MACE).
Methods: Patients who underwent CCTA and stress dynamic myocardial perfusion CT (CTMPI) with 18 months of follow up or until MACE were included from four institutions. On-site CT-FFR was computed for each coronary lesion. A myocardial blood flow (MBF) index was calculated, for which each vessel territory was normalized to global MBF. The CT-FFR and MBF-index for each patient was selected for further analysis. The optimal threshold was determined with the Youden index. The prognostic value of CCTA, CT-FFR, MBF-index, and a combination of all three was evaluated for the prediction of MACE using binary logistic regression and diagnostic accuracy.
Results: Of the 81 patients included, 25 (31%) experienced MACE. CCTA had an area under the curve (AUC) of 0.655 with a sensitivity and specificity of 56% and 75%, respectively. CT-FFR had an AUC of 0.703 with a sensitivity of 64% and specificity of 80%. The threshold was determined at 0.75. MBF-index had an AUC of 0.812 with a sensitivity and specificity of 88% and 75%, respectively. The threshold was 0.88. In cases with a negative MBF-index and positive CT-FFR, MBF-index was most predictive (83% of patients). The combination of CCTA, CT-FFR, and MBF-index resulted in an improved AUC of 0.857.
Discussion: Combined CT-FFR and dynamic CTMPI analysis based on cardiac CT imaging is a promising approach for the prediction of MACE in patients with coronary artery disease. While both techniques individually demonstrate good diagnostic accuracy, an integrated approach using both modalities improves the diagnostic accuracy for predicting MACE.