

Poster Session 127

Technology Tracers Instrumentation Software and Other

Thursday September 5 2024 5:30pm – 6:30pm

127-01

Cardiotoxicity Detection Tool for Breast Cancer Chemotherapy: A Retrospective StudyAhmad T. Alenezi PhD¹, Fergus McKiddie, PhD², Nath Mintu, PhD³, Ali Mayya, PhD⁴, Andy Welch, PhD³¹ Kuwait University Kuwait Kuwait ² NHS Grampian Aberdeen United Kingdom ³ University of Aberdeen Aberdeen United Kingdom ⁴ Tishreen University Latikiya Syrian Arab Republic

Background: Patients with breast cancer undergoing biological therapy and/or chemotherapy undergo multiple radionuclide angiography (RNA) or multigated acquisition (MUGA) scans to assess cardiotoxicity. The association between RNA imaging parameters and left ventricular (LV) ejection fraction (LVEF) remains unclear. **Objectives:** This study aimed develop novel processing toolbox to extract and evaluate the association of several novel imaging biomarkers to detect changes in LVEF in patients with breast cancer undergoing chemotherapy.

Methods: This study developed and optimized a novel set of code routines to extract parameters from RNA images. The code was optimized using various statistical tests (e.g., ANOVA, Bland-Altman, and intraclass correlation tests). Images were quantitatively analyzed to determine the association between these parameters using regression models and receiver operating characteristic (ROC) curves.

Results: The code was reproducible and showed good agreement with validated clinical software for the parameters extracted from both packages. The regression model and ROC results were statistically significant in predicting LVEF (R^2 0.4, $F(5,97)$ 15, P 0.001) (AUC 0.78). Some time-based, shape-based, and count-based parameters were significantly associated with post-chemotherapy LVEF (P 0.09, P 0.001), LVEF of phase image (P 0.03), approximate entropy (ApEn) (P 0.001), ApEn (D S) (P 0.002) and LV systole size (P 0.03, P 0.01).

Conclusions: Despite the limited sample size, evidence of associations between several parameters and LVEF were observed. These parameters will be more beneficial than the current methods for patients undergoing cardiotoxic chemotherapy. Moreover, this approach can aid physicians in evaluating subclinical cardiac changes during chemotherapy, and in understanding the potential benefits of cardioprotective drugs.

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127-02

Usefulness of Myocardial Ischemia Detection Using Dynamic Perfusion CZT-SPECT and Quantitative Assessment of Myocardial Perfusion Reserve in Patients With New Onset Left Bundle Branch BlockDenis Agostini MD PhD¹, Clement Guery, MD¹, Vincent Roule, MD PhD¹, Damien Legallois, MD PhD¹, Alain Manrique, MD PhD²¹ University Hospital CAEN France ² University Caen Normandie CAEN France

Introduction: The search for underlying coronary artery disease is recommended in the management of patients with LBBB. Non-invasive diagnosis of coronary artery disease in this population remains difficult, as the accuracy of functional imaging is not optimal. The technological innovation of CZT SPECT cameras dedicated to cardiology has improved myocardial perfusion imaging, enabling dynamic perfusion acquisition and quantitative analysis of MBF and MFR (Agostini D et al 2018). The aim of this retrospective study was to assess the ability of this new modality to detect coronary artery disease in patients with LBBB without apparent cardiac disease.

Materials and methods: Retrospective study evaluating results, in all LBBB patients without history of CAD, who underwent dynamic myocardial SPECT in our Nuclear Medicine department (CHU de Caen) from April 2018 to February 2022. A perfusion SPECT was considered as positive for CAD in case of a reversible perfusion defect in at least 2 myocardial segments or in case of myocardial scar; cut off value for abnormal global MFR was defined as 2.1. Coronary angiography was carried out at Caen University Hospital or at Hospital Prive Saint Martin (Caen, France).

Results: Out of the 174 patients in our cohort, SPECT abnormalities were found in 14/174 (8 %) including 2 patients (1 %) with a significant ischemia, myocardial infarction in 13 patients (7 %) with 8 additional patients with altered MFR and normal perfusion SPECT suggesting balanced ischemia. The mean global left ventricular function was normal but segmental wall motion was impaired in the septum compared to all others territories. Dynamic SPECT data demonstrated a decrease in both stress and rest MBF in the septum compared to the anterior, lateral and apical walls (p 0.0001) as well as in the inferior wall. The resulting MFR was similar in all myocardial walls. Significant coronary lesions were found in only 4/174 patients (2 %).

Conclusion: Dynamic myocardial perfusion SPECT used for screening CAD in LBBB patients led to identify a higher rate of significant ischemia compared to conventional SPECT. However, the low rate of CAD finally demonstrated in this study questions the relevance of routine screening for CAD in patients with LBBB.

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127-03

Absolute Quantification in Nuclear Cardiology: Moving From “I Think” to “I Know.”

Richard M. Fleming PhD MD JD

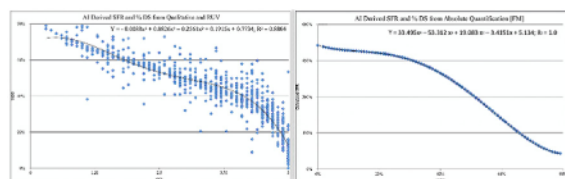
Absolute Quantification in Nuclear Cardiology: Moving from “I think” to “I know.”

Introduction: From the inception of Blumgart's investigation into physiologic assessment of the heart disease using nuclear isotopes, a major limitation in Nuclear Cardiology has been loss of signal through Fourier transform and modulation transfer function [MTF] with image interpretation using either qualitative or semi-quantitative methods; e.g. "relative" uptake values [RUV], based upon Fourier and MTF limitations. To address this limitation and provide for absolute quantification of isotope activity, "absolute quantification" [Fleming Method for Tissue and Vascular Differentiation and Metabolism; FM] was patented in 1917. The pandemic of 2019 saw the use of this method for treating COVID patients and cancer.

Methods: Injection of nuclear isotopes with absolute quantification was carried out in 2000 men and women with results compared to (a) qualitative image assessment, and (b) semi-quantitative relative uptake values. Perfusion imaging included PET, SPECT and planar imaging results. The results were then compared with physiologic measurement of coronary flow reserve findings using patented AI.

results: Absolute quantification of isotope distribution and redistribution beginning immediately following pharmacologic stress injection, was compared with results obtained using either qualitative or RUV. Based upon these results, AI generated measurements of coronary flow reserve were derived. Further AI calculations of percent diameter coronary artery lumen narrowing (DS) were compared with quantitative coronary artery (QCA) analysis. The comparison graphics are shown.

Conclusion: Absolute quantification of nuclear isotopes provided proof of isotope redistribution when sequential absolute quantification was carried out. Absolute quantification allowed for lower patient radioisotope exposure, accurate measurement and AI calculated regional and global coronary flow limitations; with the elimination of semi-quantitative and qualitative interpretation errors. By integrating absolute quantitative regional blood flow and metabolic parameters with high-resolution anatomical information, FM enables comprehensive characterization of tissue viability and disease pathology, facilitating early detection and personalized treatment planning in patients with ischemic heart disease.



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127-04

Improvement of MBF Using a Personalized Dosing Model

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Introduction: Variations in myocardial blood flow (MBF) assessment are dependent on multiple factors including post-processing techniques and type of vasodilators. In an effort to standardize MBF assessment, tracking of the peak input value on the time activity curve and overall shape of the curve was performed at our institution as a means of assessing quality of MBF assessment. When this was reviewed in detail, we found a large degree of variability when fixed, block proportional dosing was used. We evaluated a personalized dosing model to ensure consistent peak values and shape of the time activity curve to account for wide differences in body mass indexes (BMI).

Methods: We reviewed 129 consecutive patients who had a prior PET/CT with MBF assessment comparing personalized dosing (using the formula of $0.9 \text{ mCi} \times \text{BMI}$) with fixed block dosing. All imaging was performed at Intermountain Medical Center using a Siemens MCT Biograph 20 with Rubidium 82 delivered by a Brocco system. Regadenoson was used as the vasodilator stress agent on all patients. In addition to measuring milliSieverts received and overall milliCuries, we compared image quality and both the shape and peaks of the MBF time activity curves at rest and stress.

Results: We demonstrated a significant reduction in Millicurie dosing required per scan with the exception of BMI (greater than 40+), which received an increase in administered millicuries. This has led to consistent and predictable peak activity curves both at stress and rest with exceptional image quality across a range of BMIs.

Conclusions: Our personalized dosing model incorporating BMI demonstrated improved image quality as well as absolute peak values on MBF, leading to consistent and reproducible MBF values while reducing overall milliCuries administered.

Fixed Block Dosing					Personalized Proportional Dosing					
BMI (kg/m ²)	mSv	RE _{TD} (Bq/mi)	STRESS (Bq/mi)	DOSE (mCi)	BMI (kg/m ²)	mSv	RE _{TD} (Bq/mi)	STRESS (Bq/mi)	DOSE (mCi)	Absolute CHANGE (mCi)
LESS than 25	1.09	6.42E+05	5.08E+05	22.9	LESS than 25	.89	6.01E+05	5.04E+05	19	-3.9
25-30	1.28	5.91E+05	4.62E+05	26.8	25-30	1.14	6.09E+05	5.01E+05	24	-2.8
30-35	1.46	5.43E+05	4.69E+05	30.7	30-35	1.33	5.88E+05	5.22E+05	27.8	-2.9
35-40	1.61	5.53E+05	4.07E+05	33.5	35-40	1.54	5.68E+05	4.62E+05	32.5	-1.0
40+	1.94	4.59E+05	3.89E+05	40.6	40+	2.02	4.72E+05	4.02E+05	42.6	+2.0

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127-05

Four Year Validation of Intermountain s PET/CT Risk Scores for 90-Day and 1-Year Major Adverse Cardiac Events and Revascularization Shows High Predictability of the Scores

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Introduction: In 2023 we published (McCubrey et al, J. of Nuclear Cardiology 30:(1)) a highly predictive cardiac positron emission tomography (PET) risk score for 90-day and 1-year major adverse cardiac events and revascularization (MACE-Revasc). We prospectively evaluated the predictive value of this score over the past four years.

Methods: We evaluated patients undergoing cardiac PET/CT testing at Intermountain Medical Center from 2019-2022 (n = 21915). We examined the risk scores predictability of 90-day MACE-Revasc (all-cause death, myocardial infarction, and revascularization) and the 1-year MACE-Revasc (all-cause