A predictive model for improved myocardial mass estimation by SPECT

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Abstract

**Objectives** Left ventricular myocardial mass (LVM) is an important prognostic indicator of cardiovascular risk. Although SPECT is well-established for assessing cardiac perfusion and function, LVM estimated by SPECT is known to be biased due to low spatial resolution and partial volume effects. In this work we utilize high resolution cardiac CT data to develop a predictive model for LV mass that incorporates geometric and functional attributes of the myocardium and provides more accurate and precise LV mass estimates by SPECT.

**Methods** Consecutive patients referred to the University of Michigan Medical Center for coronary CT angiography (CTA) and standard gated myocardial perfusion SPECT (MPS) were selected (N=105). For each patient, the CTA data was used to estimate LVM twice by a single operator using semi-automated commercial software and the mean of these two estimates was used as the LVM reference standard (CTA-LVM). Standard processing of MPS data, including LVM estimation (MPS-LVM) assuming a mean wall thickness of 10 mm at end-diastole, was performed with Corridor4DM software (INVIA). A model was developed using multiple linear regression to predict CTA-LVM given MPS-LVM, patient age, sex, and BMI as well as seven geometric and functional LV parameters derived from the MPS data. Repeated 10-fold cross-validation was employed to validate the model and assess prediction error.

**Results** The mean/SD of CTA-LVM was 139.2+/−34.9 grams. The mean bias between CTA-LVM and MPS-LVM was -15.9 grams with an RMS error of 23.7 grams. Using the predictive model determined by cross-validation the mean bias between CTA-LVM and predicted LVM was reduced to 0.6 grams with an RMS error of 13.5 grams (43% reduction compared to MPS-LVM). In addition the number of patients for which the absolute error of the LVM estimate was greater than 25 grams was reduced from 33/105 (MPS-LVM) to 4/105 (predicted LVM).

**Conclusions** We conclude that a predictive model based on high resolution cardiac CTA paired with standard gated MPS can effectively correct the inherent bias of LV mass estimated by SPECT.