AbstractID: 8890 Title: Design rules for the coronary arterial tree system based on CT images of a swine heart

Purpose: To investigate various design rules in the coronary arterial tree system by using cone-beam CT images of swine heart.

Method and Materials: The left anterior descending (LAD), left circumflex (LCX), and right coronary arteries (RCA) were casted with a radio-opaque polymer. Cone-beam CT was used to generate volumetric data. Vessel and myocardium segmentation, centerline extraction, tree tracking procedure were implemented to determine vessel branch dimension and geometry. Diameters and lengths of each detected branch were computed where the procedure was validated by using phantoms with known dimensions. The data from the arterial tree was combined with that from the myocardial tissue where each tissue voxel was assigned to its corresponding arterial branch. The sum of the distal coronary arterial branch lengths and volumes were correlated to the regional myocardial mass.

Results: The correlation of the logarithm of the total distal arterial lengths (L) to the logarithm of the regional myocardial mass (M) were $\log(L) = 0.730\log(M)+0.332$ (R=0.872), $\log(L) = 0.801\log(M)+0.341$ (R=0.924), and $\log(L) = 0.736\log(M)+0.554$ (R=0.886) for the LAD, LCX and RCA, respectively. The correlation of the logarithm of the total distal arterial lumen volumes (V) to logarithm of the regional myocardial mass were $\log(V) = 0.885\log(M)-2.318$ (R=0.827), $\log(V) = 1.043\log(M)-2.064$ (R=0.882), and $\log(V) = 0.904\log(M)-1.927$ (R=0.848) for the LAD, LCX and RCA, respectively.

Conclusion: The implemented image processing procedures successfully extracted information from a large 3D dataset of the coronary arterial tree to reveal the coronary artery design rules and provide prognostic indications in the form of arterial tree parameters and anatomical area at risk.

Conflict of Interest (only if applicable):