

E/II-15

CORONARY CT ANGIOGRAPHY WITH MINIMAL TRAINING: DOES ITERATIVE RECONSTRUCTION HELP?

Mihály Károlyi, Ildikó Kocsmár, Márton Kolossváry, Béla Merkely, Pál Maurovich-Horvat

Heart and Vascular Center, Semmelweis University, Budapest, Hungary

HAS-SU "Lendület" Cardiovascular Imaging Research Group, Budapest, Hungary

Purpose: To evaluate the effect of experience with coronary computed tomography angiography (CCTA) on the plaque quantification using a semiautomatic software tool and different image reconstruction algorithms.

Methods: In total 25 patients with significant coronary artery disease on CCTA were randomly selected. All CCTA images were acquired on a 256-slice scanner. Images were reconstructed with standard filtered-back projection (FBP) and iterative reconstruction (iDOSE) techniques. Proximal 40 mm of the left anterior descending (LAD) artery of all patients were analyzed by two readers: Reader 1 (R1) with 5 years of experience in CCTA, Reader 2 (R2) a medical student with minimal experience in CCTA. The plaque quantification was performed by using a semiautomatic software tool. Coronary segmentation, lumen and vessel wall delineation was performed automatically, and corrected manually, if necessary. Time for automated segmentation of the coronaries and segmented length of the LAD was registered. Plaque burden and plaque components (fibrous tissue, dense calcium) were quantified using an adaptive threshold setting.

Results: Coronary segmentation was faster with iDOSE as compared to FBP (54.9 vs. 58.6 sec, $p < 0.0001$). Importantly, automatic segmentation could not be performed in 5/25 cases with FBP and in 1/25 case using iDOSE. Longer path of the LAD was segmented automatically with iDOSE, than with FBP (144.7 vs. 121.9 mm, $p < 0.05$). The mean plaque burden by Reader 1 versus Reader 2 in FBR were: 0.40 vs. 0.44 ($p < 0.005$; bias 10.0%); in iDOSE: 0.39 vs. 0.40 ($p = 0.15$; bias 4.0%). Whereas, corresponding plaque volumes were 193.4 vs. 214.6 mm³ ($p < 0.005$; bias 19.7%) and

193.5 vs. 196.3 mm³ ($p = 0.11$; bias 1.4%), respectively. The fibrous tissue volumes by R1 versus R2 in FBR were: 64.9 vs. 76.6 mm³ ($p < 0.05$; bias 16.5%); in iDOSE: 59.6 vs. 63.9 mm³ ($p = 0.06$; bias 7.1%). The mean dense calcium volumes by R1 versus R2 in FBR were: 33.4 vs. 47.3 mm³ ($p < 0.0001$; bias 34.5%); in iDOSE: 36.0 vs. 40.8 mm³ ($p < 0.05$; bias 12.5%).

Conclusions: Coronary segmentation was more robust using iDOSE, than with FBP. The medical student with no experience in CCTA was able to perform coronary plaque analysis after minimal training. However, she has systematically overestimated the plaque burden and plaque components. Importantly, the overestimation was smaller using iDOSE as compared to FBR.

This research was supported by the European Union and the State of Hungary, co-financed by the European Social Found in the framework of TÁMOP 4.2.4. A/1-11-1-2012-0001 'National Excellence Program'

Doctoral School: Basic Medicine

Program: Cardiovascular disorders, Physiology and medicine of ischaemic circulatory diseases

Supervisor: Béla Merkely

E-mail: karoelyid@gmail.com