INTEGRATED EVALUATION OF THE FUNCTIONAL CONSEQUENCES OF CORONARY LESIONS: HOLISTIC APPROACH WITH NON-INVASIVE AND INVASIVE CARDIAC IMAGING TECHNIQUES

by Rudolf Kolozsvári, Institute of Cardiology
supervisor: Zsolt Kőszegi
Doctoral School of Laki Kálmán
Cardiovascular diseases

Summary

In Hungary, cardiovascular disease is responsible for the highest mortality and morbidity rates, placing a huge burden on people, society and health care. Recently, three-dimensional (3D) reconstruction software for data acquired from two-dimensional (2D) imaging devices has been developed. In our research we used and completed further development in a piece of software, which applies an integrated evaluation of the imaging results (ICA, echocardiography and SPECT) using the results from patients with coronary artery disease. This semi-quantitative registration of the coronary tree to a polar map focused on the relation between the supplying coronary branches and the myocardial regions of the 16-segment left ventricular model. All the recorded anatomical and functional data were related to these 16 left ventricular segments, which allowed the direct comparison and holistic synthesis of the results. In our project we have developed an integrating process for detections of any functionally significant coronary artery stenosis on the basis of the abnormalities associated to the supplying epicardial lesion, then comparing the results to those of echocardiography and SPECT as gold-standards, resulting in good provisioning force of the new approach.

In the second part of the research we investigated whether there was any correlation between the fractionated flow reserve (FFR) measurements and parameters of the coronary plaque measured by 3D reconstruction, finding good correlation between FFR and plaque volume and cross-sectional area decrease.

In our project we conclude the following as new results. With the software HCC designed by us we are able to integrate the coronary tree from ICA onto a polar map, thus able to foresee the area-at-risk segments coupled to the diseased coronary segment. The information gained can be now compared to the results from echocardiography and SPECT as gold-standards with good predictive value, thus employing a new technique for making the decision on whether PCI is needed or not.

Only a few studies have investigated the volumetric characteristics of coronary plaques, but none has made any comparison of 3D reconstruction parameters with FFR, previously only with data gained from 2D reconstruction. We have compared three 3D and two 2D plaque parameters with the FFR values, and found that plaque volume and cross-sectional area decrease showed good correlation, thus providing a new method for decision making with regards to the need of PCI when pressure-wire cannot be applied.

In both parts of the investigation we have tested new methods with the hope of finding new tools for ruling out significant coronary stenosis, thriving to make all efforts to avoid false results, thus providing the patients with the best care they need.