Quantitation of volume differences in 3D SPECT stress / rest images in Myocardium Perfusion Imaging

N. Lagopati[a], M. Sotiropoulos[a], M. Gavrilleli[a] and M. Lyra*[a]

[a]Areteion Hospital, School of Medicine, University of Athens, Greece

nefeli.lagopati@gmail.com

Aim: Left ventricle contractile abnormalities constitute an important indication of coronary artery disease. The aim of this work consists of modelling the heart left ventricle at stress and rest situation, using the myocardial scintigraphic data and focuses on the possibility of quantification of the differences, obtained in 3D stress/rest images.

Methods: 15 cardiac patients had completed stress (Tc-99m tetrofosmin at stress peak) and rest tests by Tc99m tetrofosmin in one-day protocol by a GE-Starcam-4000 gamma-camera; 3D myocardium images were reconstructed by GE Volumetrix software in the GE Xeleris processing system, by FBP reconstruction method, Hanning frequency 0.8 filter and a ramp filter and transferred in a Dicom format, by advanced algorithms which integrate 3D visualization. Tomographic image reconstruction in a SPECT (Single Photon Emission Computed Tomography) camera produces a series of parallel transverse images, or transaxial images, perpendicular to the long axis of the patient. The myocardial perfusion was estimated by comparing SPECT slices and the suspicion of an ischemia was indicated. The Dicom file, for each patient and each phase is imported to MATLAB (R2011b). A series of isocontour surfaces were studied, in order to identify the appropriate threshold value, which isolates the myocardium surface from the rest area of the image. Based on the previously calculated threshold value, the myocardium volume was evaluated and be reconstructed in a 3D image. The possible difference relating to the rest and stress data of the 3D images, in voxels, was calculated, using MATLAB image processing analysis; the quantification and analysis of differences was followed. An Index of Quantification (IQ) was determined to define the global quantitative defect size as a fraction of the myocardial volume area in 3D images that could give confidence in cardiac perfusion efficiency recognition by SPECT.

Results: 3D images irregularities give visual and quantitative evaluation of myocardium perfusion. The topographic segmentation for analysis of myocardial images gives the opportunity of a better evaluation of small myocardial defects.

Conclusion: 3D volume visualization increases the reliability of myocardium perfusion diagnosis by SPECT imaging. It is expected that further significant improvement in image quality will be attained, which, in turn, will increase the confidence of image interpretation. The development of algorithms for analysis of myocardial images may allow better evaluation of small and non transmural myocardial defects. This method decreases the effects of operator variability and increases the reliability of diagnoses of organ irregularities. For the diagnosis and treatment of heart diseases the accurate visualisation of the spatial heart shape, 3D volume of the left ventricle, and the heart wall perfusion play a crucial role for the diagnosis and treatment of heart diseases.