World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:12, No:01, 2018

A Dynamic Cardiac Single Photon Emission Computer Tomography Using Conventional Gamma Camera to Estimate Coronary Flow Reserve

Authors : Maria Sciammarella, Uttam M. Shrestha, Youngho Seo, Grant T. Gullberg, Elias H. Botvinick

Abstract : Background: Myocardial perfusion imaging (MPI) is typically performed with static imaging protocols and visually assessed for perfusion defects based on the relative intensity distribution. Dynamic cardiac SPECT, on the other hand, is a new imaging technique that is based on time varying information of radiotracer distribution, which permits quantification of myocardial blood flow (MBF). In this abstract, we report a progress and current status of dynamic cardiac SPECT using conventional gamma camera (Infinia Hawkeye 4, GE Healthcare) for estimation of myocardial blood flow and coronary flow reserve. Methods: A group of patients who had high risk of coronary artery disease was enrolled to evaluate our methodology. A low-dose/high-dose rest/pharmacologic-induced-stress protocol was implemented. A standard rest and a standard stress radionuclide dose of ^{99m}Tc-tetrofosmin (140 keV) was administered. The dynamic SPECT data for each patient were reconstructed using the standard 4-dimensional maximum likelihood expectation maximization (ML-EM) algorithm. Acquired data were used to estimate the myocardial blood flow (MBF). The correspondence between flow values in the main coronary vasculature with myocardial segments defined by the standardized myocardial segmentation and nomenclature were derived. The coronary flow reserve, CFR, was defined as the ratio of stress to rest MBF values. CFR values estimated with SPECT were also validated with dynamic PET. Results: The range of territorial MBF in LAD, RCA, and LCX was 0.44 ml/min/g to 3.81 ml/min/g. The MBF between estimated with PET and SPECT in the group of independent cohort of 7 patients showed statistically significant correlation, $r = 0.71$ ($p < 0.001$). But the corresponding CFR correlation was moderate $r = 0.39$ yet statistically significant ($p = 0.037$). The mean stress MBF value was significantly lower for angiographically abnormal than that for the normal (Normal Mean MBF = 2.49 ± 0.61, Abnormal Mean MBF = 1.43 ± 0. 0.62, $P < .001$). Conclusions: The visually assessed image findings in clinical SPECT are subjective, and may not reflect direct physiologic measures of coronary lesion. The MBF and CFR measured with dynamic SPECT are fully objective and available only with the data generated from the dynamic SPECT method. A quantitative approach such as measuring CFR using dynamic SPECT imaging is a better mode of diagnosing CAD than visual assessment of stress and rest images from static SPECT images Coronary Flow Reserve.

Keywords : dynamic SPECT, clinical SPECT/CT, selective coronary angiograph, ^{99m}Tc-Tetrofosmin
Conference Title : ICMI 2018 : International Conference on Medical Imaging
Conference Location : Singapore, Singapore
Conference Dates : January 08-09, 2018