
The myocardial clearance constant $k_{mm}$ of $^{13}$C-acetate (Ace) is used to estimate cardiac oxygen utilization (MMRO) with PET. Recently a kinetic method has been developed to measure MMRO directly with inhaled $^{18}$O. We performed head to head comparison of the two methods in 13 patients with stable coronary disease and old myocardial infarction. Resting $^{13}$C, H, $^{18}$O and $^{13}$O studies were immediately followed by Ace study. The $^{18}$O-based kinetic studies yielded regional blood flow (MBF ml/min/g) and rMMRO (ml/min/g) which was compared with $k_{mm}$ on a segmental basis. Segments with MBF $>50\%$ of maximal MBF were considered as normal, segments with MBF $<50\%$ of maximum were considered as low-flow segments. rMMRO was significantly different ($p<0.051$) in the normal (0.085±0.021 ml/min/g, mean±SD), in the border (0.065±0.021 ml/min/g) and in the low-flow (0.044±0.014 ml/min/g) group, and MBF and rMMRO were correlated well when all the segments were analyzed (r=0.79, p<0.001). However, the ratio of $k_{mm}$/rMMRO was significantly higher in the low-flow segments than in the border segments or in the normal segments (1.285±0.418 vs. 1.095±0.328 and 0.941±0.183, p<0.001, respectively).

We conclude that, $^{18}$O, PET was feasible and accurate for assessing absolute regional myocardial oxygen consumption both in non-infarcted and infarcted myocardium. Furthermore, $k_{mm}$ of $^{13}$C-acetate seems to overestimate myocardial oxygen consumption in low-perfusion areas.


Quantitation of cardiac volumes from gated FDG positron emission tomography (PET) may provide additional diagnostic information in the assessment of myocardial viability. We therefore developed a new model-based tool for the calculation of cardiac volumes using gated PET and FDG. Methods: A semiautomatic computer algorithm based on profile analysis was developed to derive myocardial coordinates. The fitting algorithm was applied on 36 radial profiles for each plane. For each profile 5 parameters were estimated: the position of the endo- and pericardium, the blood pool, the myocardium and the extracardiac background activity. Cardiac volumes were calculated using Simpsons rule. The performance of this model was first tested using a heart phantom, and subsequently tested using gated PET images from thirteen healthy subjects. The PET derived cardiac volumes were compared with cardiac volumes calculated from gated MRI. Results: PET volume data were within 0.5% of the know phantom values. The mean difference (±SD) between PET and MRI was -2.4ml (±15ml) for diastolic volumes, -2.8ml (±10ml) for systolic volumes and 1% (±8%) for EF calculations. Conclusion: Using a model-based approach, measurement of cardiac dimensions with PET and FDG seems accurate and reliable in normal volunteers.


Recently we showed that cardiac output (CO) can be accurately estimated with N-13 ammonia and PET from a factor analysis derived right ventricular input function and the amount of injected tracer (Stewart-Hamilton principle). In this study we evaluated a simplified approach for accounting CO from a manually derived right ventricular input function. Methods: In 13 patients undergoing right sided cardiac catheterisation, the vigilance system (BaxterTM) for continuous cardiac output measurement was mounted. With this catheter in situ a N-13 ammonia PET scan was performed. During the scanning period, the cardiac output was continuously registered using the thermal film pulse delivering system. Right ventricular input function was calculated using factor analysis and by manually assigning regions of interest (ROI) to the right ventricle. Subsequently the area under the input function was calculated for estimation of the CO. Results: The mean difference (±SD) for ROI vs. Baxter were 1.5 l/min ±1.5 l/min (p<0.006) and 0.004 l/min ±2.5 l/min (p=NS) for Factor analysis vs. Baxter. Conclusion: Cardiac output determination with PET and a simple ROI assigning approach appears to be biased. In addition, there is a considerable variability in the individual measurements.

PET MYOCARDIAL PERFUSION IMAGING WITH CU-62 BIS(THIOSEMISARCABZONE) AGENTS. J. Lacy, N. Haynes, N. Nayak, C. J. Mathias, M. A. Green. Proportional Technologies, Houston, USA.

The PET agent Cu62 P TsM produced by an automated $Zn_{62}$/Cu62 generator yields high quality rest/dipyridamole/r/dipy) myocardial perfusion images, but exhibits a significantly lower stress/rest myocardial ratio (1.15) than N13 ammonia (1.6). A high liver/heart ratio of 2.0. This study explored the new agents Cu62 ETS and Cu62 nPrTs, designed to reduce albumin binding thought to attenuate high flow uptake. R/dipy PET studies were performed with generator-produced Cu62 ETS (n=5) and Cu62 nPrTs(n=2) in volunteers who previously had r/dipy Cu62 P TsM. The stress/rest myocardial ratios for P TsM and ETS were 1.35 ±0.16 and 1.58±0.11, respectively (p<0.03). N-PrTs showed a stress/rest ratio of 1.44 ±0.35 compared to 1.42±0.18 for P TsM (p<0.05). Liver/heart ratios for both agents were ≤1.0. Thus, the new generator-produced agents provide greatly improved liver contrast and likely would provide defect contrast similar to that of N13 ammonia.

PET MYOCARDIAL PERFUSION IMAGING WITH CU-62 BIS(THIOSEMISARCABZONE) AGENTS. J. Lacy, N. Haynes, N. Nayak, C. J. Mathias, M. A. Green. Proportional Technologies, Houston, USA.

The PET agent Cu62 P TsM produced by an automated $Zn_{62}$/Cu62 generator yields high quality rest/dipyridamole/r/dipy) myocardial perfusion images, but exhibits a significantly lower stress/rest myocardial ratio (1.15) than N13 ammonia (1.6). A high liver/heart ratio of 2.0. This study explored the new agents Cu62 ETS and Cu62 nPrTs, designed to reduce albumin binding thought to attenuate high flow uptake. R/dipy PET studies were performed with generator-produced Cu62 ETS (n=5) and Cu62 nPrTs(n=2) in volunteers who previously had r/dipy Cu62 P TsM. The stress/rest myocardial ratios for P TsM and ETS were 1.35 ±0.16 and 1.58±0.11, respectively (p<0.03). N-PrTs showed a stress/rest ratio of 1.44 ±0.35 compared to 1.42±0.18 for P TsM (p<0.05). Liver/heart ratios for both agents were ≤1.0. Thus, the new generator-produced agents provide greatly improved liver contrast and likely would provide defect contrast similar to that of N13 ammonia.