338

ASSESSMENT OF MYOCARDIAL AND RENAL BLOOD FLOW BY POSITRON TOMOGRAPHY USING STRONTIUM-RUBIDIUM GENERATOR

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Strontium-rubidium generator can elute rubidium-82 (Rb-82) (half life 75 sec) in every 10-20 minutes. Since this positron tracer Rb-82 distributes in the organ according to blood flow as potassium analogue as thallium-201, repeated organ perfusion study is feasible without in-house cyclotron. Accordingly, serial myocardial and renal perfusion images were obtained in canine model with brain PET camera (PC-384).

For myocardial imaging, PET scan was performed from one minute following bolus injection of 50mCi of Rb-82. At control, homogeneous tracer distribution in left ventricular myocardium was observed. After LAD ligation, perfusion defect was observed at the apex, which was partially recovered after the release of LAD.

For renal imaging, PET scan was performed during constant infusion of Rb-82. At control high tracer concentration was observed both at renal cortices. Unilateral renal artery occlusion revealed no tracer activity in the occluded kidney as well as mild decrease in activity in contralateral kidney. Non-linear correlation was observed between Rb-82 uptake in the kidney and microsphere mean renal blood flow.

We conclude that PET with RB-82 is a promising technique for serial assessment of perfusion in the heart and kidneys.

339

NONINVASIVE QUANTIFICATION OF REGIONAL MYOCARDIAL BLOOD FLOW AND AMMONIA EXTRACTION FRACTION USING TIME-ACTIVITY CURVES OF MYOCARDIUM AND CARDIAC CAVITY AFTER N-13 AMMONIA INJECTION.

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Nonivasive quantification of regional myocardial blood flow (RMBF) is necessary to facilitate detection and evaluation of cardiac pathophysiology. Ammonia extraction fraction (EF), which reflects ammonia metabolism in myocardium, may provide another important physiologic and diagnostic indicator of the celluar viablity in myocardium. However noninvasive separation of the two indicators was difficult until now. We tried to measure the two quantities from time-activity curves of myocardium and cardiac cavity, which were obtained with N-13 ammonia and dynamic PET. Our method is as follows. In a linear transfer system where an input function is the curve of cardiac cavity and an output function is the myocardial curve, the system transfer function is axe(-ct)+b and RMBF=a+b, EF=b/(a+b). The parameters a, b and c can be calculated by a deconvolution. Two patients with hypertrophic cardiomyopathy were employed to avoid partial volume effects and cross contaminations of activity. The results were RMBF=67ml/min/100g, EF=80% and RMBF=65 ml/min/100g, EF=81% for each patient.

340

EXERCISE ^{13}N-NH_3 POSITRON CT IN PATIENTS WITH ISCHEMIC HEART DISEASE.

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Early distribution of ^{13}N-NH_3 is considered to reflect a distribution of blood flow and positron CT (PCT) is said to be superior to ^{201}Tl scintigraphy in quantitative analysis. This study was undertaken to evaluate the usefulness of exercise ^{13}N-NH_3 PCT in assessment of myocardial ischemic and in evaluation of increments of ^{13}N-NH_3 uptake by exercise.

PCT in normal subjects demonstrated a homogeneous uptake of ^{13}N-NH_3 in the myocardium and frequently visualized the papillary muscles and right ventricular free wall. In patients with ischemic heart disease perfusion defects were well visualized in the area corresponding to the involved coronary vessels and appears to be determined more accurately than ^{201}Tl single photon emission CT.

Relative myocardial uptake of ^{13}N-NH_3 corrected by administration dose did not show any significant difference between at rest and on exercise in normal subjects, but reduced in patients with ischemic heart disease. Nitrates reduced the ischemic area and improved the relative myocardial uptake.

In conclusion, ^{13}N-NH_3 PCT is valuable in evaluation of ischemic heart disease.

341

RELATION BETWEEN GLUCOSE CONSUMPTION IN ISCHEMIC MYOCARDIUM AND SERUM FREE FATTY ACIDS CONCENTRATION.

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Glucose is a secondary but an important energy substrate for myocardium, and glucose consumption in normal myocardium has the large variations from the concentration of serum free fatty acids (FFA). We investigated the effect of FFA on myocardial glucose consumption (MGC) using F-18 and Headtome-III, and also studied the relation between MGC and myocardial blood flow (MBF) determined by O-15 water autoradiographic method in 24 cases with ischemic heart disease and in 3 normal volunteers.

MGC(y) was inversely correlated with FFA(x) in the normal myocardium ($y=6.26-4.30x$, $r=0.66$; $P<0.001$), but MGC had no correlation with FFA in ischemic myocardium. In 14/24 patients with abnormal hypoperfusion, MGC was increased compared with MBF. The areas of increased MGC were larger than those of decreased MBF.

These findings suggest that high level of FFA is suitable to detect the lesions of ischemic but viable myocardium with F-18 FDG and PET, and that GMC is an important role on detection of myocardial ischemic lesions.