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Quantification of ^{18}F-FDG PET Images Using Probabilistic Brain Atlas: Clinical Application in Temporal Lobe Epilepsy Patients

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Objective: A probabilistic atlas of the human brain (Statistical Probability Anatomical Maps: SPAM) was developed by the international consortium for brain mapping (ICBM). After calculating the counts in volume of interest (VOI) using the product of probability of SPAM images and counts in FDG images, asymmetric indexes (AI) were calculated and used for finding epileptogenic zones in temporal lobe epilepsy (TLE). **Methods:** FDG PET images from 28 surgically confirmed TLE patients and 12 age-matched controls were spatially normalized to the averaged brain MRI atlas of ICBM. The counts from normalized PET images were multiplied with the probability of 12 VOIs (superior temporal gyrus, middle temporal gyrus, inferior temporal gyrus, hippocampus, parahippocampal gyrus, and amygdala in each hemisphere) of SPAM images of Montreal Neurological Institute. Finally AI was calculated on each pair of VOI, and compared with visual assessment. If AI was deviated more than 2 standard deviation of normal controls, we considered epileptogenic zones were found successfully. **Results:** The counts of VOIs in normal controls were symmetric (AI <6%, paired t-test $p>0.05$) except those of inferior temporal gyrus ($p<0.01$). AIs in 5 pairs of VOI excluding inferior temporal gyrus were deviated to one side in TLE ($p<0.05$). Lateralization was correct in 23/28 of patients by AI, but all of 28 were consistent with visual inspection. In 3 patients with normal AI was symmetric on visual inspection. In 2 patients falsely lateralized using AI, metabolism was also decreased visually on contra-lateral side. Conclusions: Asymmetric index obtained by the product of statistical probability anatomical map and FDG PET correlated well with visual assessment in TLE patients. SPAM is useful for quantification of VOIs in functional images.

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The Preclinical Pharmacological Study of Dopamine Transporter imaging Agent [^{99m}Tc]Trodat-1

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Purpose: To develop ^{99m}Tc labeled dopamine transporter (DAT) imaging agent ^{99m}Tc-TRODAT-1 [TRODAT-1:2β -[[N,N'-bis(2-mercaptoethyl)ethylenediamino]methl],3β -(4-chlorophenyl)tropane], used in SPECT, for evaluating changes of DAT in patients with Parkinson's disease (PD). **Methods:** Using Stannous as reducing agent, and the present of Na-glucoheptonate, ^{99m}Tc-TRODAT-1 was successfully prepared. Preclinical pharmacological studies have been performed in rats, C57BL mice, normal and PD model monkeys and volunteers. **Results:** Radiochemical purity of ^{99m}Tc-TRODAT-1 was over 90%, and stable for 6 hours. The specific uptake in striatum was significantly diminished from 3.45 to 0.12 at 2 h by pretreated rats with a dose of competing DAT ligand β -CIT (1 mg/kg). Autoradiographic images in C57BL mice shows that the specific uptake has a good linear relationship with the quantity of neural-toxin (MPTP) which was given to the animals ($r=-0.9792$). Images of normal monkey's brain exhibited excellent localization in basal ganglia region, where dopamine neurons were concentrated, and the ratios of ST/CB were 1.56-2.0. In hemiparkinsonian model monkeys, the ratio of normal ST/CB and lesioned ST/CB were 1.56 and 0.94, respectively. Brain image studies in volunteers indicated that uptake and retention in the basal ganglia, the ratio of normal striatal to lesioned one was 1.15 measured by SPECT imaging at 2 h. The result of images was consistent with the clinical symptoms. **Conclusions:** Above-mentioned results showed the ^{99m}Tc-TRODAT-1 can be accumulated in the striatal area, where DAT are concentrated, high quality images were obtained. It is suggested that ^{99m}Tc-TRODAT-1 might turn to be a safe and effective tracer for monitoring the change in DAT associated with various neurodegenerative diseases.