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EVALUATION OF A PET-ISOTOPE LABELLED A_{2A} ADENOSINE RECEPTOR LIGAND

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We report on the biological evaluation of an A_{2A} specific adenosine receptor antagonist developed in our laboratory.
The (E)-8-(3-jódsztiril)-1,3,7-trimetilxantin (ISC) receptor ligand was labeled with ^{11}C isotope. Results of contractility and relaxation studies also supported the high specificity and selectivity of this A_{2A} receptor ligand. The A_{2A}/A_{2B} and A_{2A}/A_1 selectivity was found to be 15 and > 200, respectively. Specific binding of [^{11}C]ISC to adenosine receptors was investigated on DDT1 MF-2 cells and competition between labeled and unlabelled ISC was documented. [^{11}C]ISC-receptor binding was effectively blocked by CSC (an A_{2A} antagonist) while DCPCX (A_1-type antagonist) did not affect the ISC-receptor interaction. Tissue accumulation of [^{11}C]ISC was followed ex vivo in Balb C mice. Remarkably high accumulation was found in the intestine, stomach, heart and kidneys. Dynamic PET scans were carried out on rabbits to elaborate detailed accumulation kinetics of [C^{11}]ISC in heart, lung, liver, kidney, spleen and brain. The labeled ligand can serve as a useful tool in in vivo studies of adenosine receptor regulation.
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EFFECTS OF NA^+/CA^{2+} EXCHANGE ON THE ACCUMULATION OF TUMORDIAGNOSTIC PET TRACERS IN CANCER CELLS

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The Na^+/Ca^{2+} exchanger (NCX) plays crucial role in the calcium homeostasis of cells. In the present paper we describe the effects of NCX blockers on the ^{18}FDG and ^{11}C-choline accumulation in different cancer cells. We demonstrated that the NCX is expressed at a remarkable level in the cytoplasmic membrane of the examined cells. Incubation of the cells with NCX blockers (bepridil, KB-R7943, 3,4-dichlorobenzamil hydrochloride) resulted in an increase of the intracellular Ca^{2+} with a simultaneous decrease of the intracellular Na^+ concentration. In addition the treatment with the blockers increased the energy consumption of the tumour cells by 30–80%. The increased energy demand is explained by the higher activity of the sarco-endoplasmic reticulum Ca^{2+}-ATPase. Preincubation in sodium free environment or thapsigargin (an effective blocker of the Ca^{2+}-ATPase) pretreatment abolished the increased FDG accumulation of the cells. The applied NCX blockers decreased the ^{11}C-choline accumulation by 40–80% relative to the control. Our results indicate that NCX medication protocols have to be taken also into account while interpreting tumour tracer accumulations.
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DEVELOPMENT OF A CALIBRATION SOFTWARE TO STUDY SMALL ANIMAL -PET DETECTOR MODULES

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Background: We have developed a PET camera for small animal studies at the PET Center of the University of Debrecen. We apply LSO scintillation crystals in the detectors that are arranged in 8x8 matrices in each module, and use a position sensitive photomultiplier tube with an appropriate optical connection.
The corner signals of PMT contain the crystal position and energy data of the events. We constructed four such detector-blocks and rotating them we will achieve tomographical PET projection.
Material and methods: The aim of our work is to develop special software in order to determine the detector parameters (such as energy discrimination levels, pin-crystal positions, etc.). The software will be capable of visualizing the calculated detector properties and restore them for a data acquisition software unit. The development has been assisted using a MATLAB software package because it contains a lot of useful predefined methods, such as segmentation, high-level optimization algorithms, 2D and 3D visualization tools needed to achieve our goals.
Results: During data processing, the deviation of parameters of individual crystal elements turned out to be considerably high, so it was essential to perform the appropriate normalization prior to starting small animal studies.

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THE ROLE OF FDG PET IN ACCURATE DIAGNOSIS OF VASCULAR GRAFT INFECTION

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Background: The diagnosis of vascular graft infection relies on a combination of clinical symptoms and imaging findings. Labeled leukocyte scan are the most used diagnostic tool. The usefulness of FDG PET is not yet evaluated. We report two cases of vascular graft suppuration where the patients were examined by leukocyte scan and FDG PET.
Material and methods: The first patient underwent a femoro-popliteal bypass in 1997 (Case No. 1). By the other patient aorto-bifemoral bypass had been carried out previously (Case No. 2). 99m-technetium labeled leukocyte scintigraphy was performed. Planar images were obtained. PET images were obtained 40 min after the intravenous administration of 0.15 mCi × kg^{-1} of FDG. There was no correction to tissue attenuation.
Results: The grafts were found to be infected in both cases during surgical revision. PET imaging gave the correct diagnosis in both cases as it demonstrated abnormal FDG uptake in areas corresponding with the vascular graft. In contrast with PET, white blood cell scan gave false negative result in Case No. 2. where retroperitoneal graft infection was suspected. The leukocyte scan demonstrated abnormal uptake in the left thigh corresponding with the graft in Case No. 1.
Conclusion: There are only few articles that describe the use of FDG PET in diagnosis of vascular graft infection. We recognize that FDG PET was 100% accurate in diagnosing both the fact of the graft infection and its extent. Further evaluation in a large group of patients is indicated to assess whether FDG PET could become the imaging of choice when graft infection is suspected and other means of imaging result in ambiguous diagnosis.