QUANTITATIVE IMPROVEMENTS OF HIGH RESOLUTION PET USING A HIGH RESOLUTION RESEARCH TOMOGRAPH (HRRT) IN COMPARISON WITH A CLINICAL PET CAMERA: A STUDY IN NORMAL SUBJECTS USING THE TRACERS [11C]RACLOPRIDE, [11C]FLUMAZENIL AND [11C]Verapamil.

Published: 11-08-2006
Last updated: 14-05-2024

The purpose of the study is to assess the quantitative accuracy of the experimental HRRT PET scanner and to assess the potential benefits of high resolution PET.

Ethical review	Approved WMO
Status	Pending
Health condition type	Neurological disorders NEC
Study type	Observational invasive

Summary

ID

NL-OMON31527

Source
ToetsingOnline

Brief title
Quantification using a high resolution research tomograph PET scanner

Condition

- Neurological disorders NEC

Synonym

neurological and psychiatric diseases

Research involving
Human

Sponsors and support

Primary sponsor: Vrije Universiteit Medisch Centrum
Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: high resolution, PET, quantification

Outcome measures

Primary outcome

Data sets obtained with both scanners will be used to derive quantitative PET pharmacokinetic parameters such volume of distribution and binding potential. These parameters provide quantitative information about binding of the administered tracer to the neuroreceptor or about the distribution of neuroreceptor density. These parameters can be determined at a regional level using the volumes of interest approach. However, also parametric kinetic methods will be applied to both datasets in order to derive 3D volumetric images representing the distribution of the PET pharmacokinetic parameters across the entire brain at best possible resolution. Parametric analysis will thus provide quantitative information with highest spatial detail.
Consequently, it will allow most accurate evaluation of PET quantification improvements with the high resolution PET camera. Finally, by reducing the resolution of the HRRT scans to that of the clinical HR+ scanner (smoothing) it is possible to determine whether observed differences in binding potential or volume of distribution are caused by differences in resolution alone or if

improvements of image reconstruction algorithms or acquisition parameters are

still required.

Secondary outcome

Determination of the quantitative accuracy of the HRRT PET scanner

Study description

Background summary

The high-resolution research tomography (HRRT) is a dedicated high resolution PET scanner designed for human brain imaging. The HRRT is a prototype PET scanner equipped with depth of interaction to yield a high resolution of ~2.5 full width at half maximum (FWHM) in the entire field of view (scan area). This resolution is more than a twofold improvement in resolutions of presently available clinical PET scanners. The higher resolution enables detection and quantitative assessment of neuroreceptor binding in small brain structures, such as the hippocampus, which cannot be assessed accurately using the coarser resolution of a clinical PET scanner (HR+ PET scanner, Siemens/CTI). Therefore, high resolution PET may become an important tool for evaluation of neuroreceptor changes for various neurological and psychiatric disorders.

Study objective

The purpose of the study is to assess the quantitative accuracy of the experimental HRRT PET scanner and to assess the potential benefits of high resolution PET.

Study design

The performance of the HRRT will be compared with the Siemens HR+ for the use of neuroreceptor studies. For this purpose three tracers will be used initially: the D2/D3 receptor tracer [11C]raclopride, the central type benzodiazepine receptor tracer [11C]flumazenil and the dopamine transporter tracer [11C]Verapamil. These tracers have been selected because for all these tracers reference tissue procedures are available for quantification of specific binding. Use of these tracers therefore allows evaluation of neuroreceptor PET for both reference and plasma input pharmacokinetic models thereby including the two most quantitative approaches applied in neuroreceptor PET imaging.

Study burden and risks

Risks associated with participation in this study are related to 1) radiation exposure; 2) idiosyncratic reaction to the tracer; 3) placement of intra-venous and intra-arterial catheters; 4) discomfort during scanning.
1) Radiation exposure
The effective dose equivalent (EDE) of 1 PET study with a bolus injection of 370 MBq [11C]raclopride is 2.5 mSv (Ribeiero, 2005), of 370 MBq [11C]Flumazenil 2.5 mSv and of 370 MBq [11C]Verapamil 2.5 mSv. For comparison, the natural background radiation dose in the Netherlands gives an annual dose of 2 - 2.5 mSv. Thus, the total radiation exposure of two PET studies with any of these tracers (i.e. maximal 5 mSv) is within an acceptable range. In case of previous exposure to radioactivity, subjects will be eligible if the yearly cumulative dose due to exposure to radiation remains below 10 mSv.
2) Idiosyncratic reaction to the tracer
The dose of these tracers used in this study is negligible. All these radiotracers have been used in humans previously. Side effects have never been reported at the tracer doses used in PET studies.
3) Intravenous and arterial cannulation
There is a very small risk of infection and bleeding associated with intravenous and arterial cannulation, which are prevented by proper techniques.
4) Discomfort during scanning
It may be uncomfortable to lie motionless in the cameras (both PET and MRI) and it may cause some subjects to feel anxious. Subjects will be made acquainted with the surroundings beforehand. Our staff will be available to provide support, reduce anxiety, optimise the comfort of the subject and remove the subject from the scanner if requested.
4) Blood sampling.
Adverse effects of blood sampling will be minimized by exclusion of subjects with low hemoglobin levels (Hb must be > 8 mmol / liter at the time of the scan for males and be > 7 mmol / liter for females). No more than 500ml blood will be withdrawn during the total PET procedure and screening. Subjects are excluded if 3 months before the PET procedure substantial blood loss or a blood donation has occurred. Subjects are advised not to give blood until 3 months after the scan has been completed.

Contacts

Public
Vrije Universiteit Medisch Centrum

de Boelelaan 1117
1081 HV Amsterdam
Nederland

Scientific
Vrije Universiteit Medisch Centrum

de Boelelaan 1117
1081 HV Amsterdam
Nederland

Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

age between 25 and 70 years
good physical health
RDC diagnosis never mentally ill
BMI between 20-25
scores on Mini mental state examination (MMSE) ><=27

Exclusion criteria

· Any clinical significant abnormality of any clinical laboratory test, including drug screening.
· Any subject who received any investigational medication within 30 days prior to the start of the study or who is scheduled to receive an investigational drug.
· Any major current psychiatric diagnosis on axis-1 of DSM-IV
· History of psychiatric or neurological illness
· History of psychiatric or neurological illness in first-degree relatives
· History of alcohol and/or drug abuse (DSM-IV criteria)
· Current use of any medication

Study design

Design

Study type: Observational invasive

Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Diagnostic

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	05-01-2006
Enrollment:	21
Type:	Anticipated

Ethics review

Approved WMO

Application type:	First submission
Review commission:	METC Amsterdam UMC

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL11990.029.06