Functional MRI methodology for the Basal Ganglia -- a comparative study into paradigms and analytical methods

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Ethical review	Approved WMO
Status	Pending
Health condition type	Other condition
Study type	Observational invasive

Summary

ID

NL-OMON29821

Source
ToetsingOnline

Brief title
fMRI in the Basal Ganglia

Condition

- Other condition

Synonym
na

Health condition

Dit is een methodisch onderzoek; de uitkomsten zullen worden toegepast in toekomstige studies naar bewegingsstoornissen en andere neurologische aandoeningen

Research involving
Human

Sponsors and support

Primary sponsor: Academisch Medisch Centrum
Source(s) of monetary or material Support: NWO (Vidi-beurs)

Intervention

Keyword: Basal, fMRI, ganglia, methods

Outcome measures

Primary outcome

The choice of paradigm is one important research variable. The other variables

comprise of different choises in the analysis. The effects of using differrent

paradigms and analytical methods will be assesed using ANOVA.

Secondary outcome

nvt

Study description

Background summary

The basal ganglia (BG) are structures in central areas of the brain and form the central part in a network. They interconnect with cortical areas of the brain and play an important role in the initiation, alteration or inhibition of movements. Furthermore, the BG play are involved in the adaptation to novel circumstances, learning of a new cognitive or motor skill, and reward actions. The BG network of interconnected structures consists of different nuclei, such as the Globus Pallidus (GP), Substantia Nigra (SN), Putamen, Caudate Nucleus (CN), Sub Thalamic Nucleus (STN) and the Thalamus. Malfunctioning of this network can lead to movement disorders such as Parkinson*s disease or dystonia.

Functional magnetic resonance imaging (fMRI) is a technique to measure brain activity. It allows visualization of activity in the deeper areas of the brain such as the BG. It relies on local differences in image intensities of repetitive functional scans caused by cognitive processes. These functional scans are known as EPI scans and are taken every two to three seconds. In addition to the EPI scans, an anatomical scan is performed, known as a T1 scan.

In a functional MRI experiment, there is no pre-fixed protocol and the choice of the different parameters is determined by the researcher. The most important choices are the tasks the subject has to perform while in the scanner (paradigm) and the processing of fMRI data sets afterwards.

fMRI of the BG is more difficult than functional imaging of cortical areas as there are three reasons the functional signal in the BG is reduced:

1. The BG are relatively small, compared to the typical voxel size used in fMRI studies.
2. The BG have more iron deposits, which interferes with the contrast used with fMRI.
3. Tissues that surround the BG, such as the ventricles, deform the magnetic field. This leads to deformation of the anatomy measured by the functional scans 6.

Study objective

The aim of our study is to investigate the effect of different paradigms and analysis methods on the final result of functional MRI BG data. The second aim is to determine the most optimal paradigm and analysis method for further research in patients with movement disorders.

Study design

Scanner details
A high resolution of 128x128 will be used. This will allow a smaller voxel size, to compensate for the small size of the BG. With a special sequence, a magnetic field map will be measured. With this map, a correction for magnetic field can be performed which will compensate for the magnetic field in homogeneity caused by the ventricles surrounding the BG.

Paradigms
Four different paradigms, each chosen with the goal of generating activation patterns in the BG, will be performed. Each paradigm lasts for about 15 minutes.

1. Serial Reaction Time (SRT). This is a cognitive task which measures the neural correlates of implicit learning. A previous study showed that using this task yields activation in the BG.

2. Go-NoGo. The Go-noGo is a motor inhibition task. Local Field Potential (LFP) recordings with intra-cerebral electrodes inside the STN and GP show a different electrical response when subjects have to inhibit a motor task. We will translate the same tasks to a functional MRI setting.

3. 'Cognitive' Switch Task This is a cognitive task which measures the neural correlates of switching between two tasks, namely identifying colors and identifying letters. A previous study showed activation patterns in the BG.

4. Fingertap-Switch Task. This includes different types of motor tasks of the hands. The activation pattern will be studied during each task, but also during the switching periods between the different motor tasks.

Study burden and risks

nvt

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

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

Inclusion criteria

Subjects need to be right-handed.

Exclusion criteria

Claustrophobia or the use of medication.

Study design

Design

Study type: Observational invasive

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

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	08-01-2006
Enrollment:	18
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	NL13232.018.06