Learning, Memory and Networks in the Human Brain: Single Neuron Recordings in Depth-electrode Candidates for Epilepsy Surgery

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Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Nervous system neoplasms benign
Study type	Observational invasive

Summary

ID

NL-OMON38351

Source
ToetsingOnline

Brief title
Single Neuron Characteristics in Epilepsy Surgery Candidates

Condition

- Nervous system neoplasms benign
- Seizures (incl subtypes)

Synonym
epilepsy, seizures

Research involving
Human

Sponsors and support

Primary sponsor: Vrije Universiteit Medisch Centrum
Source(s) of monetary or material Support: NEF;NIN

Intervention

Keyword: epilepsy surgery, functional connectivity, neural networks, single neuron

Outcome measures

Primary outcome

The main study parameters are the macro- and microelectrode recordings,

assessing functional connectivity (SL and PLI) and neuronal brain networks

(cluster coefficient and path length), seizure frequency and epilepsy burden.

Secondary outcome

These includes the test results of the patients memory and attention tests.

Study description

Background summary

The present project proposes to investigate medial temporal lobe (MTL) structures that are often implicated in human epilepsy, by studying network behaviour in epileptic patients, using recordings from implanted depth macro- and microelectrodes. Additionally, we aim to use these recordings to study the MTL functions regarding memory and attention at the cellular level in the human brain.
Recent research advances concerning functional connectivity and network properties of the brain have indicated that these techniques may be used for epileptic source localization and to investigate factors that determine the frequency of epileptic seizures. Application of these methods in candidates for epilepsy surgery may lead to more effective treatment and improvement of surgical outcome.
Moreover, the medial temporal lobe (MTL) structures are critically involved in the functions of learning and memory. Significant research at the cellular level in animals, and with fMRI, PET and clinical cases in humans has revealed the fundamental role these structures play during memory formation and retrieval. However, studies of the mechanisms underlying these processes at the

single neuron level in conscious humans are all too scarce.
The present study aims to clarify these mechanisms by measuring single neuron activity using microelectrodes in candidates for epilepsy surgery. A subset of these patients require placement of depth macroelectrodes into temporal lobe structures for chronic invasive extraoperative video-EEG monitoring. These electrodes contain microwires for recording in vivo field potentials and single cell activity under a variety of conditions.

Study objective

The first goal of the present study is to elucidate the network topology of the MTL on both large-scale and micro-scale levels with the aim of further understanding epilepsy related changes to the network structure. Additionally we will also use the inserted microwires to also investigate the cellular basis for MTL functions in humans, specifically, the neuronal basis for learning associations between different stimuli, the role of the MTL in unconscious learning, its role in spatial navigation in humans, and the effects of visual attention on MTL neurons in these human participants.

Study design

This is a prospective observational study. We will record from both macro- and microelectrodes implanted in the brains of ten epileptic patients. The macroelectrodes will record continuously, thus recordings will take place during task performance and during resting state. Visual stimuli will be presented to patients on the screen of a laptop computer and require them to make simple behavioral responses. The neuronal data will be analyzed according to standard procedures employed in both human and non-human primates.

Study burden and risks

The burden for patients in this study consists of three neuropsychological tests per day during their stay at the Epilepsy Monitoring Unit. To our knowledge, no health risks are involved due to the implementation of microelectrodes, as depth macroelectrodes are already being used for clinical purposes.

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

Epilepsy patients with macroelectrode and microwire implants. No specific inclusion criteria for the study population apply additional to the standard clinical criteria for the indication of depth electrodes, other than written informed consent.

Exclusion criteria

Hypertension in the medical history of the patient or the use of anti-hypertensive medication.

Study design

Design

Study type: Observational invasive

Masking:	Open (masking not used)
Control:	Uncontrolled

Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	01-03-2010
Enrollment:	15
Type:	Actual

Ethics review

Approved WMO Date:	02-09-2009
Application type:	First submission
Review commission:	METC Amsterdam UMC
Approved WMO Date:	22-03-2011
Application type:	Amendment
Review commission:	METC Amsterdam UMC
Approved WMO Date:	31-05-2012
Application type:	Amendment
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	NL28453.029.09