Noninvasive Antioxidant Quantification in the Human Brain under Oxidative Stress

https://www.neurodegenerationresearch.eu/survey/noninvasive-antioxidant-quantification-in-the-human-brain-under-oxidative-stress/

Principal Investigators

TERPSTRA, MELISSA J.

Institution

UNIVERSITY OF MINNESOTA

Contact information of lead PI
Country

USA

Title of project or programme

Noninvasive Antioxidant Quantification in the Human Brain under Oxidative Stress

Source of funding information

NIH (NIA)

Total sum awarded (Euro)

€ 1,513,713.76

Start date of award

01/09/2012

Total duration of award in years

5

The project/programme is most relevant to:

Alzheimer's disease & other dementias

Keywords

Acquired Cognitive Impairment... Aging... Alzheimer's Disease... Alzheimer's Disease including Alzheimer's Disease Related Dementias (AD/ADRD)... Bioengineering... Brain Disorders... Clinical Research... Clinical Research - Extramural... Dementia... Neurodegenerative... Neurosciences... Prevention

Research Abstract

DESCRIPTION (provided by applicant): The objective of this proposal is to advance the mission of improving the health and well-being of older Americans by augmenting ongoing dementia prevention and treatment initiatives. It undertakes research on dementia associated with both normal aging and AD. A new scientist will develop a novel and powerful human brain antioxidant assay using state-of-the art instrumentation. The approach will be translated to the clinical environment so that it can be disseminated for use with new research. Specifically, the concentrations of two important antioxidants, ascorbate (Asc) and glutathione (GSH) will be measured noninvasively in the human brain. One aim is to measure whether a recent finding of lower brain GSH concentration in the occipital cortex of cognitively normal elder subjects is also found in the posterior cingulate cortex, and whether human brain Asc homeostasis persists in both brain regions. A complementary specific aim is to determine whether lower brain GSH concentration also occurs under the oxidative stress associated with Alzheimer's disease (AD). At the same time, data measured in subjects with AD have potential to advance this powerful new technology toward discovering an early stage biomarker. A sub aim is to make this technology available to a wide range of physicians and investigators. As such, data processing will be fully automated using commercially available software. This novel noninvasive technology facilitates a paradigm shift from systemic assays to quantifying antioxidants directly in the affected brain region. The approach will take advantage of state of the art 7 T instrumentation while developing analogous methods on a clinical 3 T scanner. The process of optimizing magnetic resonance spectroscopy (MRS) for quantification of brain Asc and GSH concentrations necessitated reliable quantification of an extensive neurochemical profile (i.e. 19 brain metabolites), which includes the four compounds that are typically observed. Spectra acquired in stimulated echo acquisition mode (STEAM) will be de-convolved quantitatively into contributions from the metabolites that contribute discernable resonances using a linear combination model approach (LCModel). Reliable quantification of brain GSH and Asc concentrations will first be achieved using ultra high field MRS with multiple transmit coil technology and accompanying radiofrequency (B1) shimming, then translated to a lower field clinical platform. Successful completion will determine whether low brain glutathione concentration is widespread in the elder human brain and whether this difference is exacerbated by AD.

Lay Summary
Antioxidants are important for having a good memory and for smart thinking when people get old, and that is important for everyone's quality of life. This research will find out if normal aging and Alzheimer's disease use up brain antioxidants. It will develop a new imaging tool that can help doctors to stop cognitive decline.

Further information available at:

Types:
Investments > €500k

Member States:
United States of America

Diseases:
Alzheimer's disease & other dementias

Years:

2016

Database Categories:
N/A

Database Tags:
N/A