Microvasculature-brain interaction in diabetes: an ultrahigh field MRI study

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Primary objectives: 1.1) To investigate to what extent the different functions of the cerebral microvasculature are impaired in type 1 diabetes; and 1.2) To investigate to what extent the different functions of the cerebral microvasculature are...

Ethical review	Approved WMO
Status	Recruiting
Health condition type	Diabetic complications
Study type	Observational invasive

Summary

ID

NL-OMON56689

Source
ToetsingOnline

Brief title
SMART-MICRO

Condition

- Diabetic complications
- Central nervous system vascular disorders

Synonym
Diabetes mellitus; sugar disease

Research involving
Human

Sponsors and support

Primary sponsor: Universitair Medisch Centrum Utrecht
Source(s) of monetary or material Support: Diabetes Fonds Nederland; European Foundation for the Study of Diabetes (EFSD)

Intervention

Keyword: Brain disease, Diabetes type 1, Diabetes type 2, Microvascular dysfunction

Outcome measures

Primary outcome

Primary outcome measures are 7T brain MRI microvascular markers, i.e., microvascular reactivity to a visual stimulus, microvascular reactivity to hypercapnia and microvascular blood flow velocity and pulsatility.

Secondary outcome

Secondary outcome measures are 3T brain MRI diffusion tension imaging (a sensitive marker of brain parenchyma damage) and cognitive performance (domain-specific cognitive test battery).

Study description

Background summary

Individuals with type 1 and type 2 diabetes have a two times higher risk of dementia. However, prevention of dementia in diabetes beyond conventional management has been unsatisfactory, likely because the underlying mechanisms are unknown. We propose that cerebral microvascular dysfunction is a key mechanism underlying dementia in both type 1 and type 2 diabetes. Experimental data indicate that the cerebral microvasculature has many functions that, when impaired, can lead to brain damage and contribute to dementia. However, data in human diabetes on cerebral microvascular dysfunction are largely missing.

Study objective

Primary objectives: 1.1) To investigate to what extent the different functions of the cerebral microvasculature are impaired in type 1 diabetes; and 1.2) To investigate to what extent the different functions of the cerebral microvasculature are impaired in type 2 diabetes. Secondary objectives: 2.1) To investigate the association between cerebral microvascular dysfunction and brain parenchyma damage; and 2.2) To investigate the association between

cerebral microvascular dysfunction and domain-specific cognitive performance

Study design

Cross-sectional nested case-control study.

Study burden and risks

The burden associated with participation is that participants will come to the UMC Utrecht to receive a brain MRI and a cognitive test battery. This will be an extra study visit next to the study visit for the other measurements in SMART. There is no direct personal benefit for the enrolled participants. Benefits in term of knowledge are potentially very valuable as the study findings will improve our understanding of cerebral microvascular pathophysiology. This will ultimately help to identify targetable factors for prevention of diabetes-related dementia. Risks are small, because there are no known risks associated with the MRI acquisition

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

- Age 50 years or older
- Understanding of the Dutch language

- For the diabetes subgroups: participation in UCC-SMART and diabetes mellitus, defined as a self-reported history of diabetes, use of oral glucose-lowering medication or insulin, or a fasting serum glucose concentration of >=7 mmol/L at study inclusion.
o Type 1 diabetes: diabetes in individuals who immediately needed insulin at onset and absence of oral glucose lowering medication.
o Type 2 diabetes: diabetes in individuals with a self-reported history of type 2 diabetes, with a referral diagnosis of type 2 diabetes, or use or oral glucose-lowering medication
- For controls, we will include age- and sex-matched controls without diabetes who have not been included in UCC-SMART.

Exclusion criteria

- Diabetes other than type 1 or type 2, e.g., maturity onset diabetes of youth, gestational diabetes or diabetes due to pancreatic disease
- Prediabetes
- Any general contra-indication for brain MRI, i.e., metallic objects in or around the body (e.g., cardiac implantable electronic device such as pacemakers and implantable cardioverter defibrillators), claustrophobia or pregnancy
- Other major neurological or psychiatric conditions affecting the brain and interfering with the study design, e.g., multiple sclerosis, epilepsy, Parkinson*s disease, prior stroke or vascular dementia
- Other factors that may limit the interpretation of the study results, i.e., uncontrolled hypertension (defined as systolic or diastolic blood pressure >160/110 mmHg with or without use of antihypertensive medication), current smoking or BMI >40 kg/m2

Study design

Design

Study type:	Observational invasive
Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)

Primary purpose: Basic science

Recruitment

NL

Recruitment status:	Recruiting
Start date (anticipated):	01-08-2024
Enrollment:	84
Type:	Actual

Ethics review

Approved WMO

Date:	23-04-2024
Application type:	First submission
Review commission:	METC NedMec

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	NL85830.041.23