SIMBA study: Seven Tesla Imaging Biomarkers of Cognitive Outcomes after Treatment for Pediatric Brain Tumor

Published: 11-03-2022
Last updated: 17-01-2025

The primary objective is to examine relationships between neurocognitive performance and MRI parameters of brain vasculature, metabolism, and white matter diffusion in children who have been treated for posterior fossa tumor. Secondary objectives...

Ethical review	Approved WMO
Status	Recruiting
Health condition type	Nervous system neoplasms malignant and unspecified NEC
Study type	Observational non invasive

Summary

ID

NL-OMON51677

Source
ToetsingOnline

Brief title
SIMBA study

Condition

- Nervous system neoplasms malignant and unspecified NEC
- Nervous system neoplasms malignant and unspecified NEC

Synonym
Neuropsychological deficits, pediatric brain tumor

Research involving
Human

Sponsors and support

Primary sponsor: Prinses Máxima Centrum voor Kinderoncologie
Source(s) of monetary or material Support: Core funding onderzoeksgroep

Neuropsychologie

Intervention

Keyword: 7 Tesla, Cognitive outcomes, Imaging, Pediatric brain tumor

Outcome measures

Primary outcome

Age-standardized performance on a sustained attention task (K-CPT-2/CPT-3 measure) is the endpoint of the main analysis. The 7T MRI metrics measuring vasculature, metabolism, and white matter diffusion in the brain will be used to predict performance on this task.

Secondary outcome

Age-standardized performance on other neuropsychological measures (estimated IQ, working memory, processing speed, executive functioning, memory, visual-motor, questionnaires), clinical data (demographic, treatment, RT dose, complications), and premorbid history (birth, health, school, SES).

Study description

Background summary

Treatment advances have increased survival rates for children with brain tumors. However, many survivors experience neurocognitive problems after treatment that significantly impact their quality of life and unfortunately there are few evidence-based interventions to improve cognitive deficits after they occur. These impairments are most prominent for children who were treated at a younger age or with cranial radiation therapy (RT), and thus, methods to prevent RT-related damage are an ongoing field of research.

There is increasing evidence that the early neurobiological changes that occur after brain tumor treatment are predictive of cognitive functioning in the long term. In this manner, assessment of changes in the brain may provide a marker of vulnerability for future cognitive dysfunction, although knowledge of early

and sensitive biomarkers of cognitive decline is limited in children with brain tumors. Therefore, these results indicate that there is a critical need to identify early (bio)markers of neurocognitive decline, so that potential preventative strategies can be implemented prior to the onset of impairments.

This study addresses this knowledge gap by using newly developed, high field 7Tesla (T) Magnetic Resonance Imaging (MRI) techniques measuring vascular health, metabolism, and diffusion in the brain. Previous research has shown that 7T MRI can visualize brain structure and function in an unprecedented manner, including vascular lesions with resolutions of <1mm and brain pulsatility and metabolism in patients across the age range. Also, small vessel degeneration and low glutamate levels assessed with 7T MRI have previously been associated with worse cognitive performance in adult and pediatric populations. Furthermore, 7T MRI methods have been developed to assess microinfarcts in neurodegenerative diseases, which were then subsequently applied to 3T MRI scanners used in the clinic. These results suggest that 7T MRI techniques can detect brain structural or functional changes in a highly sensitive manner, which can then be applied to clinical settings. These techniques could be developed as an early predictive tool for cognitive deficits, although this has not yet been established for children with brain tumors. Results from the current study will inform future longitudinal research examining whether changes in brain vasculature, metabolism, and diffusion precede or accelerate cognitive decline over time. Ultimately, knowledge from this research can be used to direct treatment and prevent cognitive decline in pediatric brain tumor.

Study objective

The primary objective is to examine relationships between neurocognitive performance and MRI parameters of brain vasculature, metabolism, and white matter diffusion in children who have been treated for posterior fossa tumor. Secondary objectives are to examine relationships between RT dose distribution and neurocognitive outcomes and to evaluate whether the combination of multiple imaging modalities can distinguish between survivors who had relatively better versus poorer neurocognitive functioning.

Study design

Single center observational pilot study

Study burden and risks

Participants will come to the research facility at University Medical Center Utrecht (UMCU) to complete MR imaging at 7T (1 hr) and to the Princess Máxima Center to complete neuropsychological testing (2 hr). These appointments will be completed on the same day when possible. MRI is a non-invasive imaging

modality, involving high magnetic fields, which in general is not associated with adverse events other than possible claustrophobia due to lying in the small MR bore. Additionally, some patients may experience some dizziness or nausea. All participants will already have an MRI during normal clinical routine; therefore, we can exclude patients with severe claustrophobia. Patients and parents/caregivers will also be asked to complete neuropsychological tests and questionnaires. Some patients will complete these tests as part of standard care, which therefore minimizes time burden. Furthermore, appointments will be combined with regularly scheduled appointments as much as possible, and there will be opportunities for breaks if needed. Most questionnaires can be completed at home through the secure online KLIK portal. There are no anticipated risks for participation. One potential benefit is that parents will receive a summary of results from the assessments (and will be referred for services when needed). Otherwise, there are no direct benefits for participation and results will be used to optimize care for future patients.

Contacts

Public
Prinses Máxima Centrum voor Kinderoncologie

Heidelberglaan 25
Utrecht 3584 CS
NL
Scientific
Prinses Máxima Centrum voor Kinderoncologie

Heidelberglaan 25
Utrecht 3584 CS
NL

Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adolescents (12-15 years)
Adolescents (16-17 years)
Adults (18-64 years)
Children (2-11 years)

Inclusion criteria

- Age between 6 and 23 years old
- Have been treated for a posterior fossa brain tumor with surgery/chemotherapy only, focal proton radiotherapy, or cranial-spinal proton radiotherapy
- At least 6 months and up to 5 years after diagnosis, and completed treatment
- Able to complete MRI without anaesthesia

Exclusion criteria

- No signed informed consent (either by patient and/or parents/legal guardian)
- Insufficient knowledge of the Dutch language to perform the neuropsychological assessment or complete questionnaires
- Significant visual, motor, or developmental problems and thus alternative neuropsychological assessments would be needed (e.g., blindness, deafness, profound developmental delay)
- MRI-specific exclusion criteria, such as metal implants. Screening for MRI specific exclusion criteria will be done using the typical 7-Tesla MRI safety screening.

Study design

Design

Study type: Observational non invasive

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

Recruitment

NL

Recruitment status:	Recruiting
Start date (anticipated):	23-08-2022

Enrollment:	30
Type:	Actual

Medical products/devices used

Generic name:	Philips Achieva 7.0T MRI
Registration:	No

Ethics review

Approved WMO Date:	11-03-2022
Application type:	First submission
Review commission:	METC NedMec
Approved WMO Date:	02-08-2024
Application type:	Amendment
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	NL79739.041.21