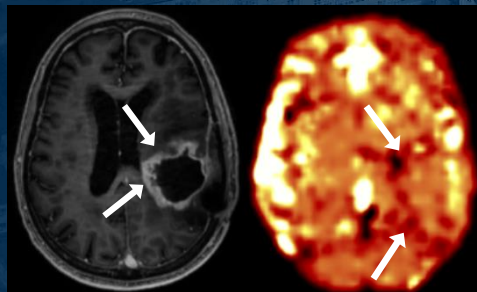




Non-invasive blood brain barrier mapping in tumor patients by time-encoded arterial spin labelling

Gabriel Hoffmann^{1,2,*}, Christine Preibisch^{1,2}, Matthias Günther³⁻⁵, Amnah Mahroo³, Matthias JP van Osch^{6,7}, Lena Václavů⁶, Lena Schmitzer¹, Claus Zimmer^{1,2}, Benedikt Wiestler¹ and Stephan Kaczmarz^{1,2,8}

Session: Brain Tumors: Acquisition
Abstract Nr.: 0141
Time: 13:45
Room: 713A/B



*gabriel.hoffmann@tum.de

¹ Technical University of Munich, School of Medicine, Department of Diagnostic and Interventional Neuroradiology, Munich, Germany

² Technical University of Munich, TUM-Neuroimaging Center, Munich, Germany

³ MR Physics, Fraunhofer Institute for Digital Medicine MEVIS, Bremen, Germany

⁴ MR-Imaging and Spectroscopy, University of Bremen, Bremen, Germany

⁵ mediri GmbH, Heidelberg, Germany

⁶ C.J. Gorter MRI Center, Department of Radiology, Leiden University Medical Center, Leiden, The Netherlands

⁷ Leiden Institute of Brain and Cognition, Leiden University, Leiden, The Netherlands

⁸ Philips GmbH Market DACH, Hamburg, Germany



Declaration of Financial Interests or Relationships

Speaker Name: Gabriel Hoffmann

I have no financial interests or relationships to disclose with regard to the subject matter of this presentation.

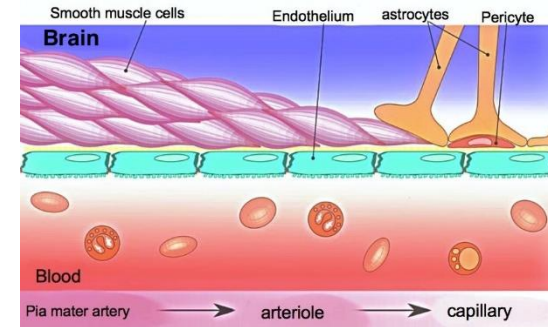
How can blood brain barrier (BBB) integrity be mapped?

Background

- BBB disruptions in high-grade Tumors¹⁻³
- Current methods limited

Purpose

- Non-invasive, highly sensitive BBB-mapping in clinical scantimes



1: Jain, Nature Rev Neurosc., 2007

2: Heye, Neuroimage-Clin, 2014

3: Keil, Clin. Neurorad., 2021

Image: https://commons.wikimedia.org/wiki/File:Blood_vessels_brain_english.jpg#/media/File:Blood_vessels_brain_english.jpg

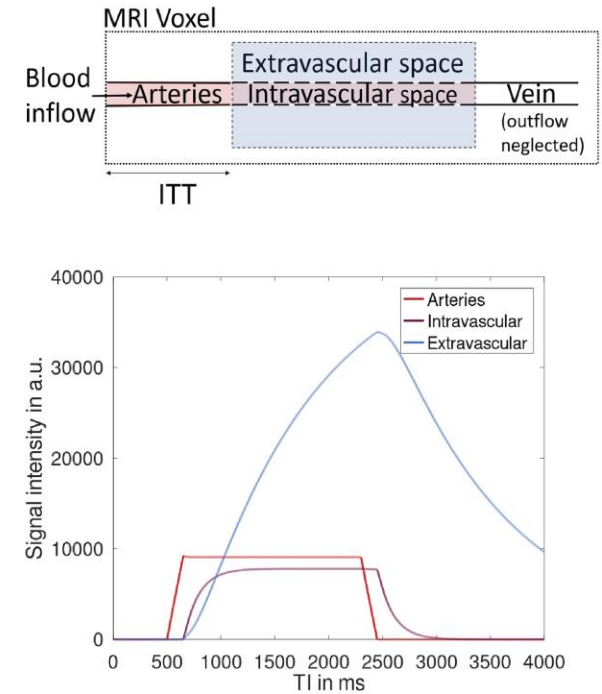
How can blood brain barrier (BBB) integrity be mapped?

Method

- Hadamard-encoded¹ Arterial Spin Labelling (ASL) with multi-TE readout
- Two-compartment model → **Texch**^{2,3}

Hypothesis

- Texch is proxy measure for BBB
- Reduced Texch in Tumors

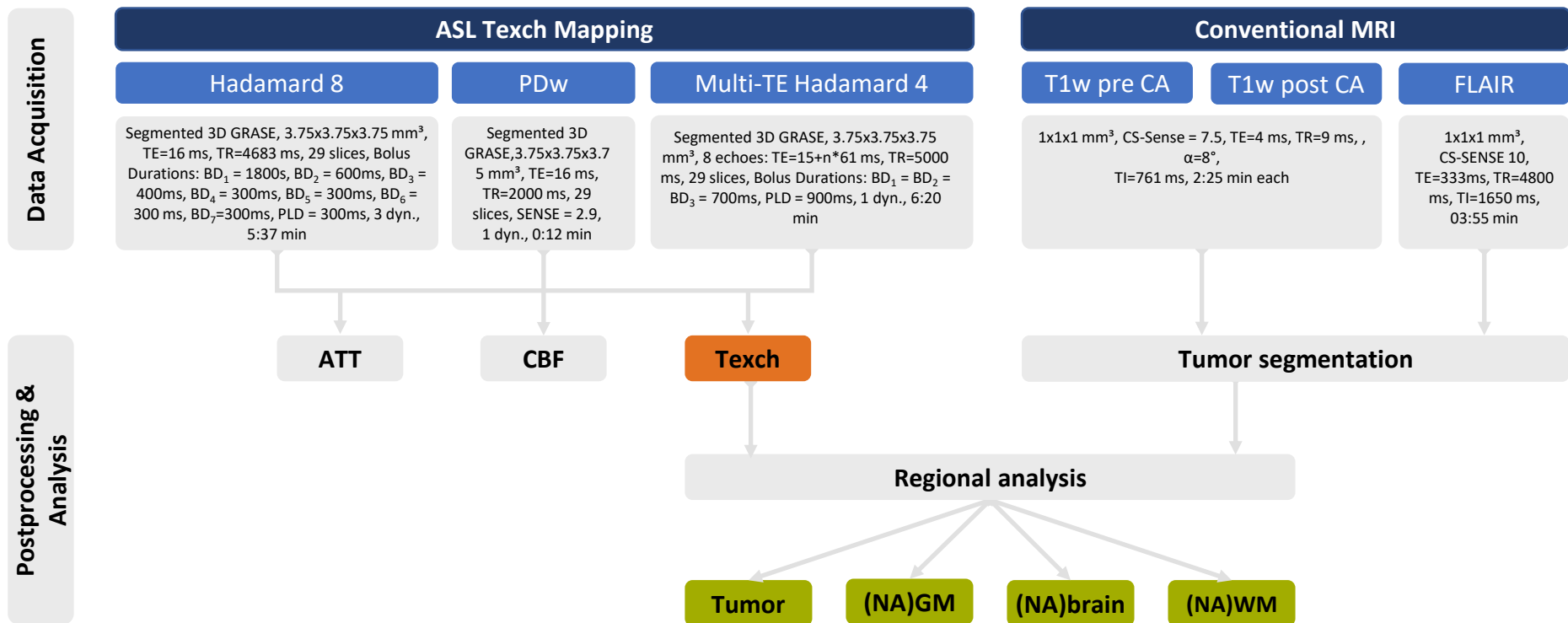


1: Günther, Proc ISMRM, 2007
Image taken from Reference 2

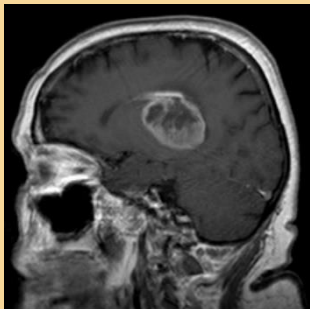
2: Mahroo, Front Neurosci., 2021

3: Gregori, JMRI, 2013

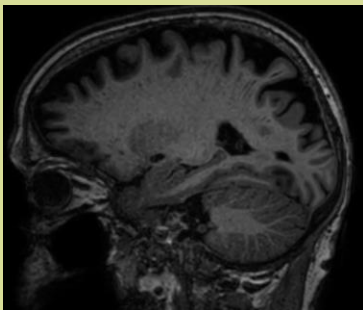
Imaging protocol includes conventional MRI and ASL-BBB mapping



Study population contains patients and age matched HCs

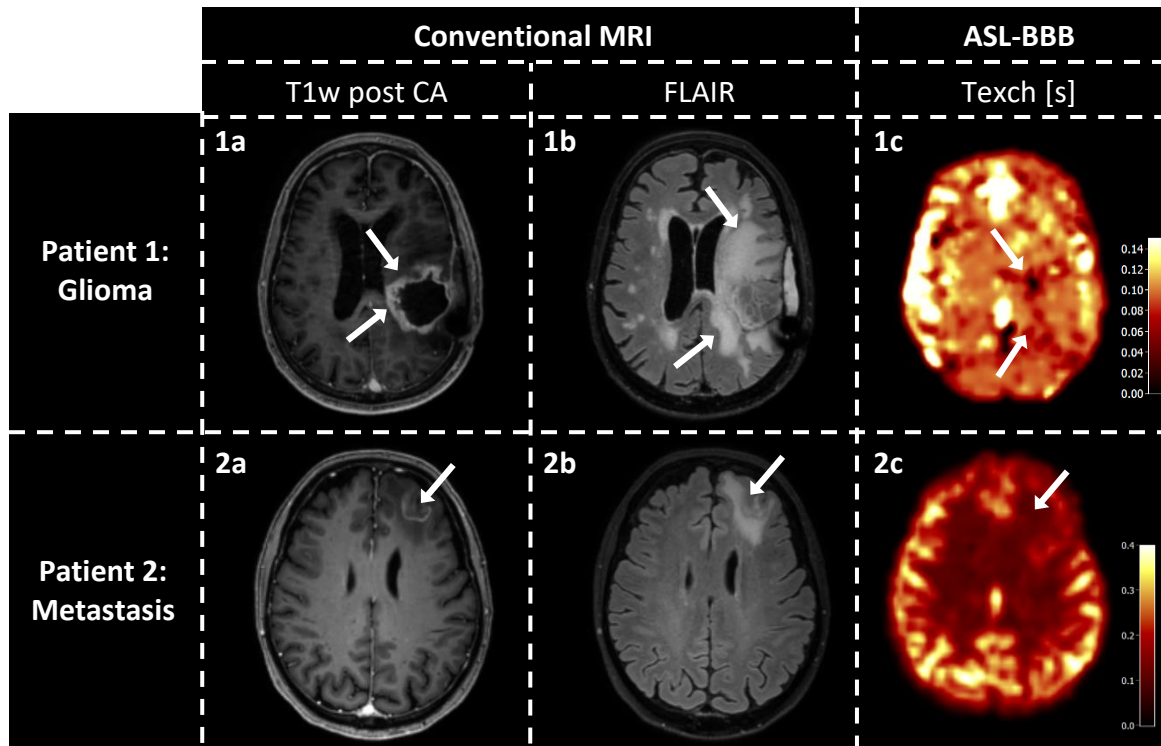


- 14 patients (59.9 ± 15.1 y)
- 4 female / 9 male
- High-grade (WHO 3&4) Glioma & Metastasis



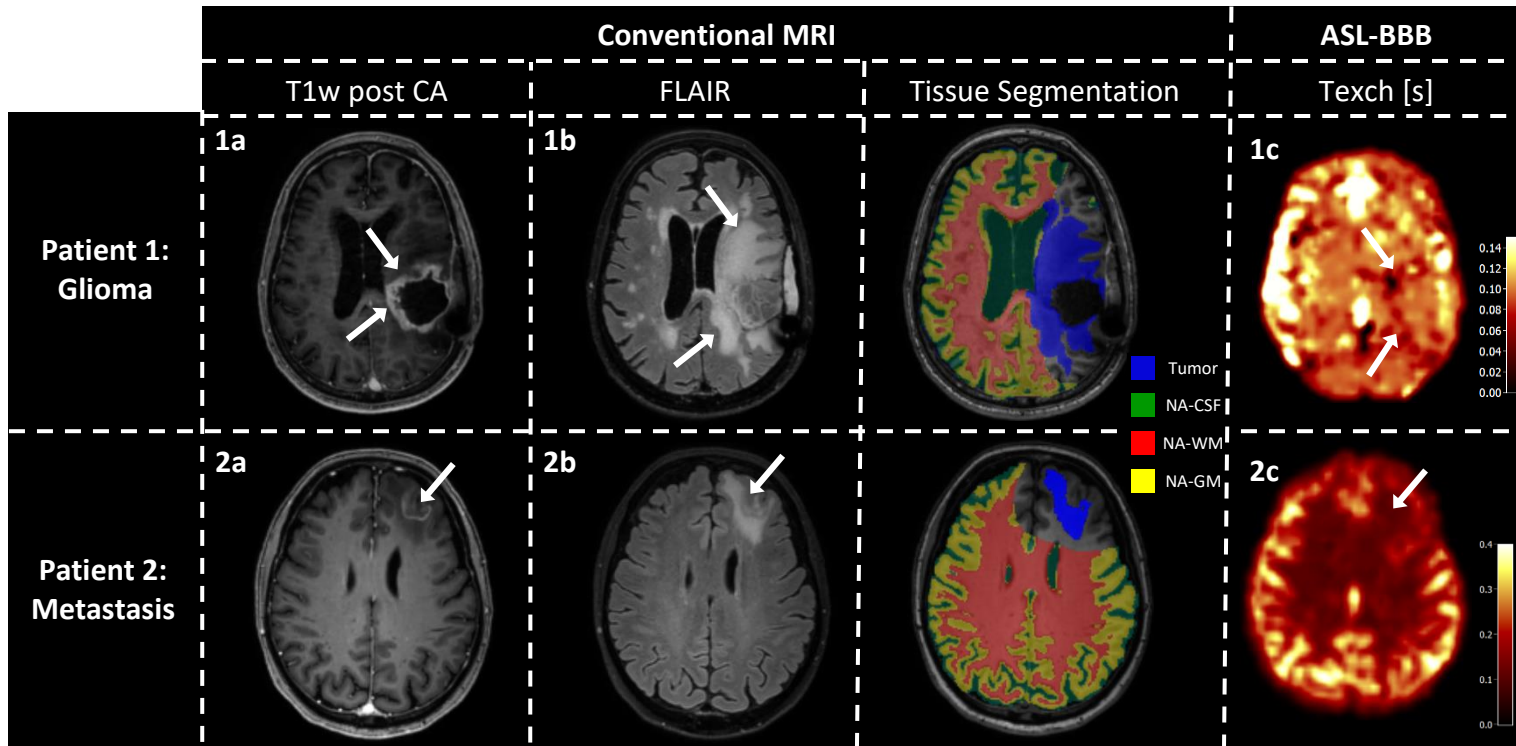
- 12 HC (55.5 ± 16.5 y)
- 7 female / 5 male

Exemplary data of glioma and metastasis patients



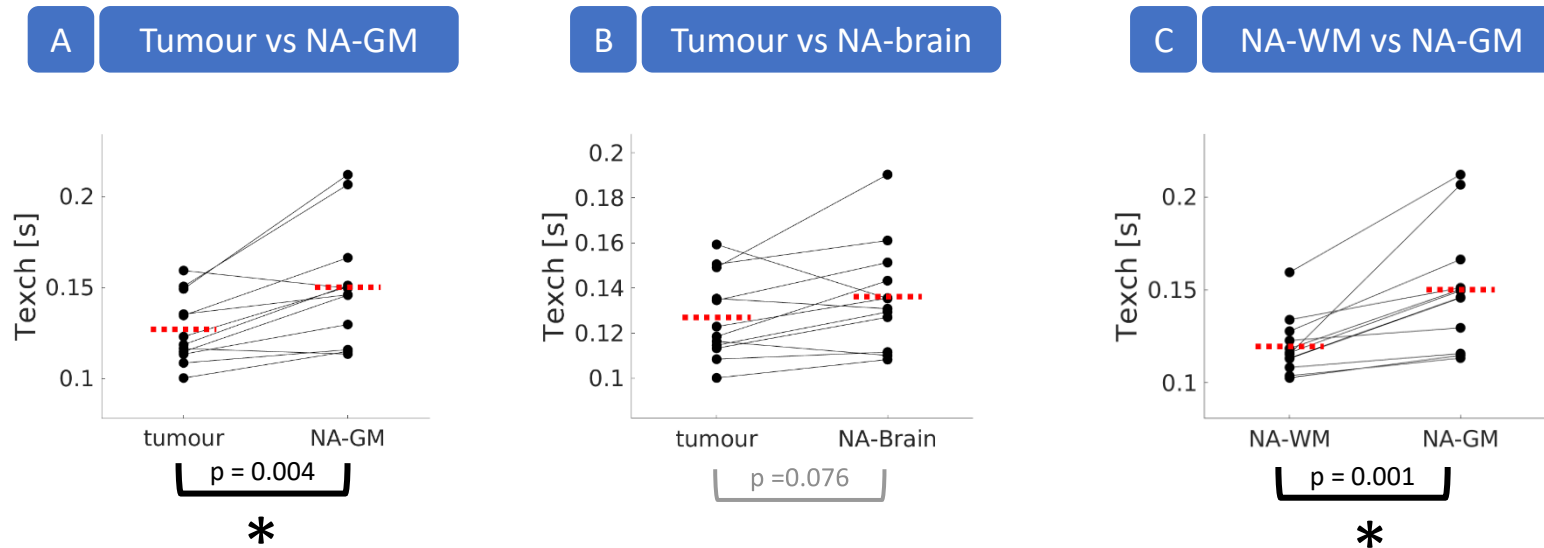
→ Visible concordance of T1w & FLAIR data with Texch maps

Exemplary data of glioma and metastasis patients



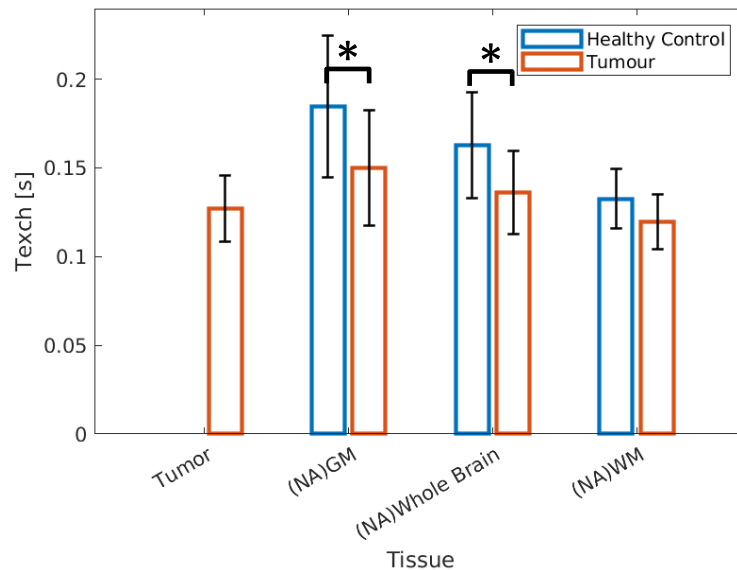
→ Visible concordance of T1w & FLAIR data with Texch maps

How does Texch vary in tumor patients?



→ Reduced Texch in tumorous tissue

Does Texch differ in patients compared to HCs?



→ Patients' Texch reduced even in normal appearing tissue

Is the Texch a reliable proxy for BBB impairments?

Discussion

Decreased Texch in tumor agrees well with literature¹⁻³

Texch values in agreement with previous studies^{2,4}

Reduced Texch in NA-Tissue → subtle impairments?

Summary

ASL-based Texch mapping sensitive

Texch proxy for BBB integrity

Promising for detecting more subtle impairments (e.g., Alzheimer, small vessel disease)^{5,6}

1: Jain, Nature Rev. Neurosc., 2007
4: Mahroo, Front Neurosc., 2021

2: Heye, Neuroimage-clinical, 2014
5: Starr, Psychiatry Res., 2009

3: Keyl, Clinical Neurorad., 2021
6: Thrippleton, Alzheimers Dement., 2019

Thank you for your attention!

We want to highly appreciate the support by:

German Research Foundation (DFG)
Ev. Studienwerk Villigst

