Super-selective pseudocontinuous ASL MRI and angiography in Moyamoya disease

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I. Introduction

Moyamoya disease (MMD) is a rare condition that requires constant monitoring of hemodynamic parameters, especially before can after treatment[1]. For this, non-invasive imaging techniques are necessary.
Super-selective pseudocontinuous arterial spin labeling (ss-pCASL)[2] appears as an alternative that allows perfusion territory mapping and angiography of the vessels of interest without using an exogenous contrast agent. Here, ss-pCASL perfusion territories and angiography of specific vessels are investigated in a Moyamoya patient.

II. Materials and Methods

- In-house implementation of ss-pCASL in a 3T clinical system (Ingenia CX, Philips Healthcare, The Netherland)
- TE: 13 ms, TR: 3.7 s, FOV: 240 x 240 x 96 mm^3, LD: 1.8 s, PLD: 2 s

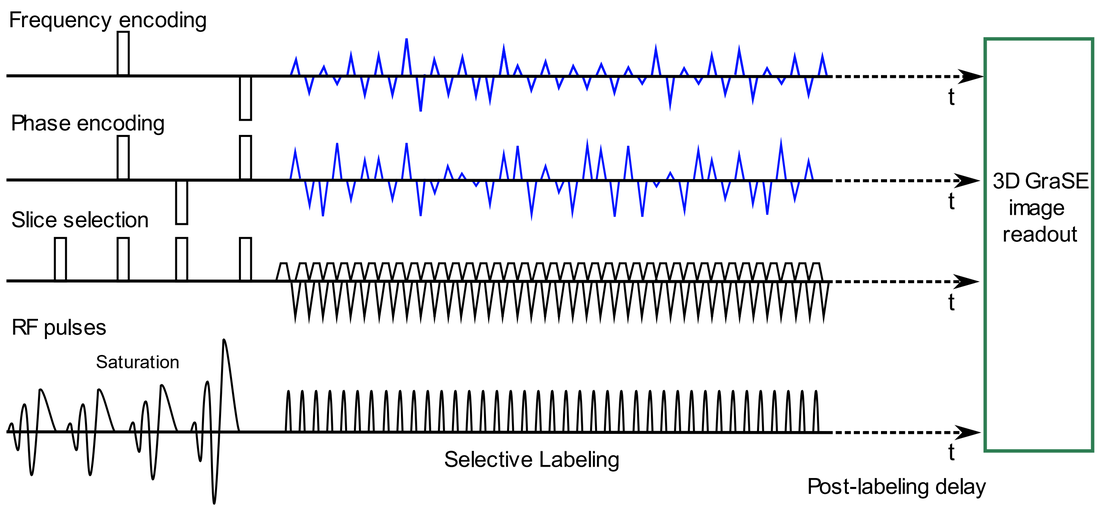
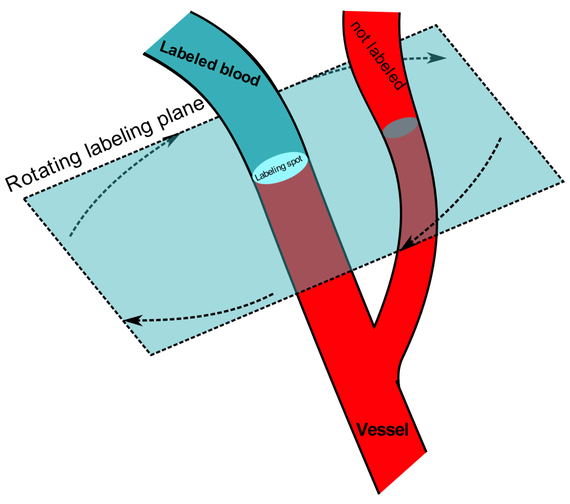


Fig 1: ss-pCASL pulse sequence diagram. A gradient pseudo-random scheme is applied in frequency and phase encoding direction (in blue) in order to achieve super-selectivity.

Fig 2: By applying a gradient pulse after every RF pulse, its azimuthal angle changes. This creates efficient inversion in the targeted vessel. The vessel positioned in the center and perpendicular to the labeling plane is labeled.



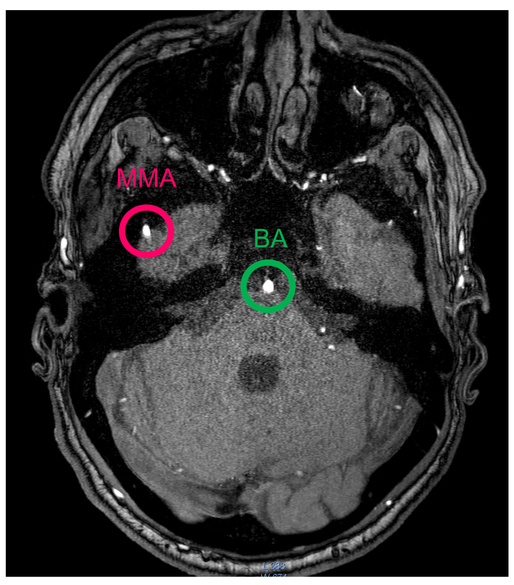


Fig 3: ToF image of MMD patient (male, 36 y). Labeling positioning in the right middle meningeal artery (MMA) and basilar artery (BA).

III. Results

- Generated perfusion maps show generalized abnormal perfusion.
- Chronic occlusion of bilateral internal carotid arteries.
- Collateralization of middle cerebral arteries by BA.

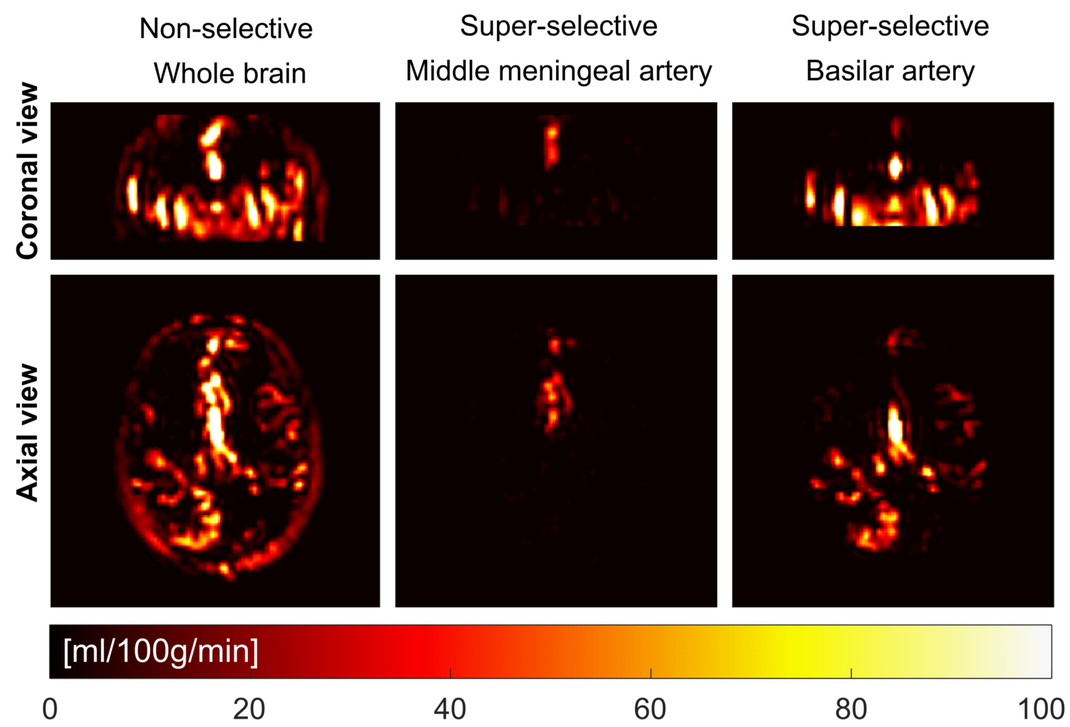


Fig 4: ss-pCASL generated perfusion maps.

- In the ss-angiogram MMA is dilatated on its course to anterior territories and vertebra basilar is extended to both middle cerebral artery territories.

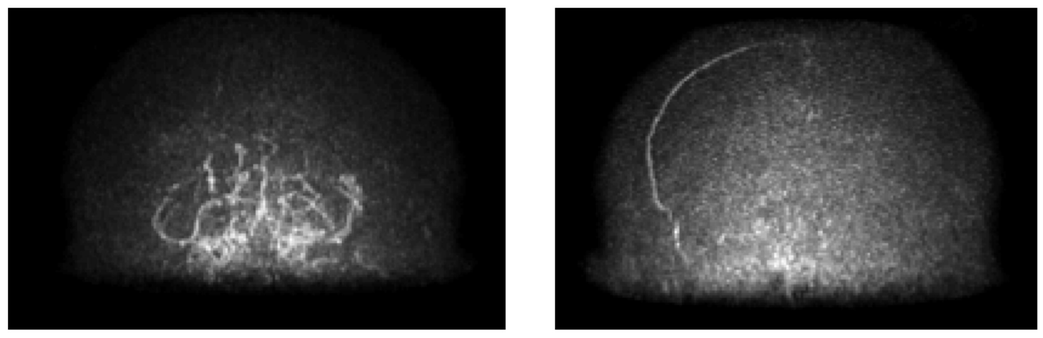


Fig 5: ss-pCASL generated angiograms.

IV. Discussion and Conclusion

- In MMD, the assessment of brain perfusion territories is critical and an active field of research[3].
- Here, we prove the applicability of ss-pCASL perfusion territory mapping and angiography in the non-invasive continuous monitoring of MMD.
- Ss-pCASL can be applied multiple times without risk for the patient.
- It does not require advanced knowledge for correct planning.

References
(1) Fujimura et al. Moyamoya Disease. *Front. Neurol. Neurosci.* **2016**, *40*, 204--220. (2) Helle et al. Superselective Pseudocontinuous Arterial Spin Labeling. *Magn. Reson. Med.* **2010**, *64* (3), 777–786. (3) Sollmann et al. Super-Selective ASL and 4D ASL-Based MR Angiography in a Patient with Moyamoya Disease: Case Report. *Clin. Neuroradiol.* **2020**.

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