PROJECT: REPRODUCIBILITY OF CEREBRAL AQUEDUCT FLOW MEASUREMENTS

BACKGROUND

Cerebrospinal fluid (CSF) is produced in the lateral ventricles in the brain. Via the cerebral aqueduct CSF can flow between the ventricles and the spine. Over the cardiac cycle, blood flows into and out of the brain, resulting in a variable blood volume in the brain over the cardiac cycle. Since the total intracranial volume is constant, the variable blood volume is compensated by pulsatile flow of the CSF occurs towards the spine (during systole) and back to the ventricles (during diastole). [1]

Intergrating the pulsatile CSF flow over the cardiac cycle results in a net CSF flow directed towards the spine. This net CSF flow equals the CSF production in the ventricles. Using cardiac triggered velocity-encoded (2D-Qflow) MRI of the aqueduct (figure 1) the CSF velocity in the aqueduct can be measured at different time points of the cardiac cycle.

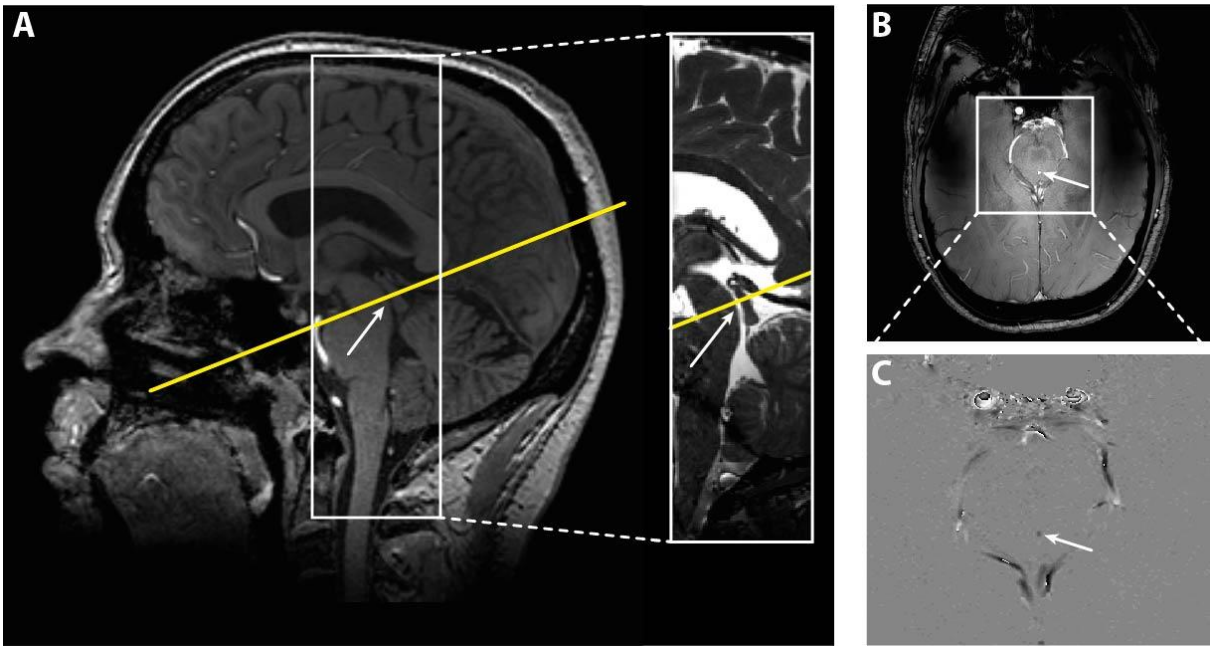

Figure 1: Slice planning of the 2D-Qflow scan (single slice, yellow) for one volunteer (A), with respect to a whole-brain 3D T_1-weighted TFE scan and a 3D T_2-weighted scan, and the magnitude (B) and phase (C) image of the 2D-Qflow scan, for v_{enc} = 13 cm/s. The cerebral aqueduct is indicated by the white arrow.

PROJECT GOALS

The goal of this project is to determine the reproducibility of high-resolution CSF flow measurements at 7 Tesla MRI in 20 healthy volunteers. During the scanning protocol the volunteers will be repositioned, and a comparison can be made between the net CSF flows measured before and after repositioning.

For data processing a MATLAB GUI is used to perform background correction on the acquired scans, and to find aqueduct voxels where velocities significantly larger than the noise floor are measured. A separate function is used to determine the net CSF flow in these aqueduct voxels. In this project the background correction will be optimized, and the net CSF flow calculation will be integrated in the GUI. Also automatic detection of phase wraps will be included in the GUI.

Statistical analysis will be performed to find the reproducibility between the separate CSF flow measurements

1. Wåhlin A et al. "Phase contrast MRI..." J Magn Reson Imaging. 2012;35:1055–1062.