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# Preoperative impairment in the cleaning function of the brain: Predictive of postoperative delirium?

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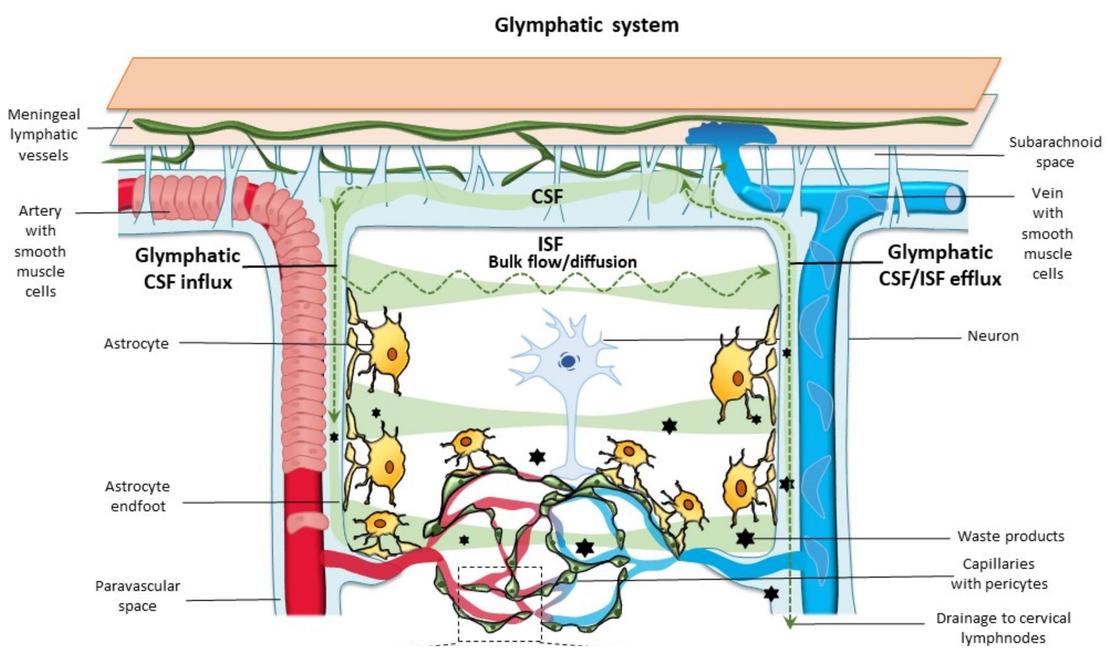
## Background

- **Postoperative delirium (POD):** fluctuating neurocognitive disturbance following surgery with general anesthesia (GA)
- Most common complication in elderly patients with 10-fold risk dementia; 2-fold risk of death
- Glymphatic system is a newly-discovered waste clearing system of the brain
- **Theory: Glymphatic impairment → impaired clearance of waste and pro-inflammatory cytokines from the brain → exacerbated neuroinflammation → POD**
- Glymphatic impairment may exist already preoperatively
- Locus coeruleus-driven norepinephrine is a key regulator of the glymphatic system and known to degenerate with age




## Research questions

<u>Primary:</u> Can preoperative glymphatic system function in elderly patients undergoing surgery provide predictive information on their risk of POD?

<u>Secondary:</u> Before surgery, is structural degeneration of the locus coeruleus a significant driver of a glymphatic system impairment?

## Aims

1. Investigate whether preoperative glymphatic system function in elderly patients is predictive of POD occurrence
2. Investigate whether preoperative structural density in the locus coeruleus is predictive of glymphatic system function

Preoperative imaging:
1. Glymphatic system function
2. Locus coeruleus stuctural density

## Design (n=100)
## Patient's day of surgery:

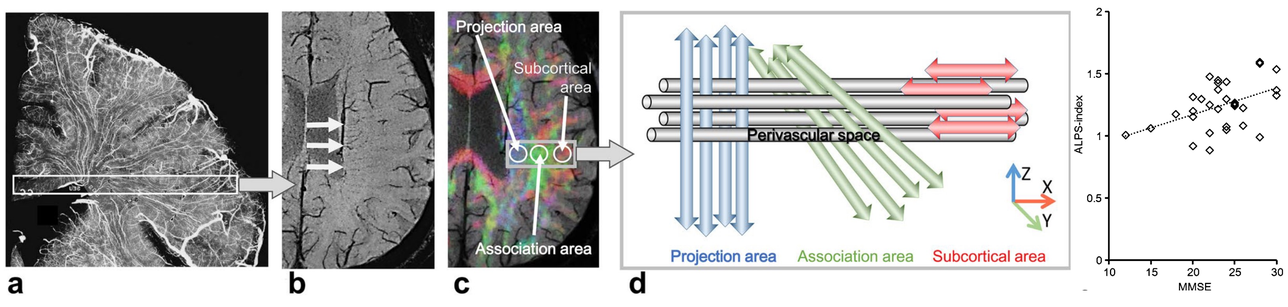
Surgery

Postoperative assessment of delirium:
CAM-ICU questionnaire

## Methods

<u>Measuring glymphatic system function:</u>

1. MR-diffusion tensor imaging along the perivascular space[1]
ALPS-index = mean(Dx*proj*, Dx*assoc*)/mean(Dy*proj*,Dz*assoc*)




2. BOLD-fMRI imaging of CSF flow at the fourth ventricle:
relationship with global GM BOLD signal[2]

*BOLD-fMRI will be acquired simultaneously with electroencephalography (EEG) to allow for future analyses of clinically accessible markers of glymphatic system function (not part of this project)

<u>Measuring locus coeruleus structural density:</u>

Melanin-weighted T1 imaging[3]


## Tasks of the student

1. Theoretical work: gaining expertise knowledge in the applicable fields of research
2. Patient recruitment and coordination with clinic departments
3. Data collection: Imaging (EEG+MR) protocol and training in CAM-ICU questionnaire
4. Analysis of the MR data
5. Writing of manuscript for publication

## What we offer

- Full support throughout the entire project timeline
- Motivating and fun work environment amongst many other medical students
- Training in MATLAB programming, use of MR analysis packages
- First-authorship publication

**What we expect:** Nothing but motivation!

**Finance**: secured
**Ethics**: in progress

**References** 1 Taoka 2017 Jpn J Radiol; 2 Han 2021 PLoS Biol; 3 Sasaki 2006 Neuroreport