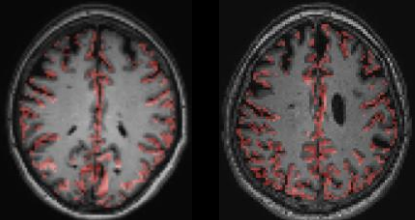


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# Evaluation of leptomeningeal collaterals by DSC-based signal variance and hemodynamic features in asymptomatic carotid artery stenosis

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High CoV mask



Session: **MRI in Stroke**  
**Vessels, Flow & Tissue Structure**  
Time: **Thursday, 20 May 2021**  
**16:00 – 18:00 (UTC)**  
Room: **Room: Concurrent 6**



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# Declaration of Financial Interests or Relationships

Speaker Name: Stephan Kaczmarz

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



## Motivation

### Background

Internal carotid artery stenosis (ICAS) is a major public health issue<sup>1</sup>

Known hemodynamic impairments<sup>1,2</sup> and increased stroke risk<sup>3</sup>

Protective vascular pathways by collateral blood supply<sup>4-6</sup>

### Issue

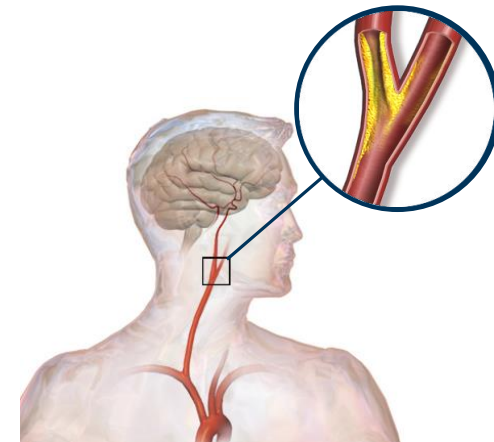
Primary collateral flow via CoW was indicated by territory shifts,<sup>7</sup>  
secondary leptomengial flow under sub-acute chronic hypoperfusion unclear<sup>8-11</sup>

### Hypothesis

DSC-based coefficient of variation (CoV) method for leptomeningeal collaterals<sup>12</sup>

Application in asymptomatic ICAS patients

Evaluate hemodynamic characteristics within high CoV voxels



# Material & Methods

## Participants



- 3T Philips Ingenia
- Software release 5.1.8
- Custom patches

29 ICAS



70.3 ± 7.0 y



- No strokes or injuries
- Asymptomatic
- Unilateral
- NASCET > 70%

30 HC



70.2 ± 4.8 y

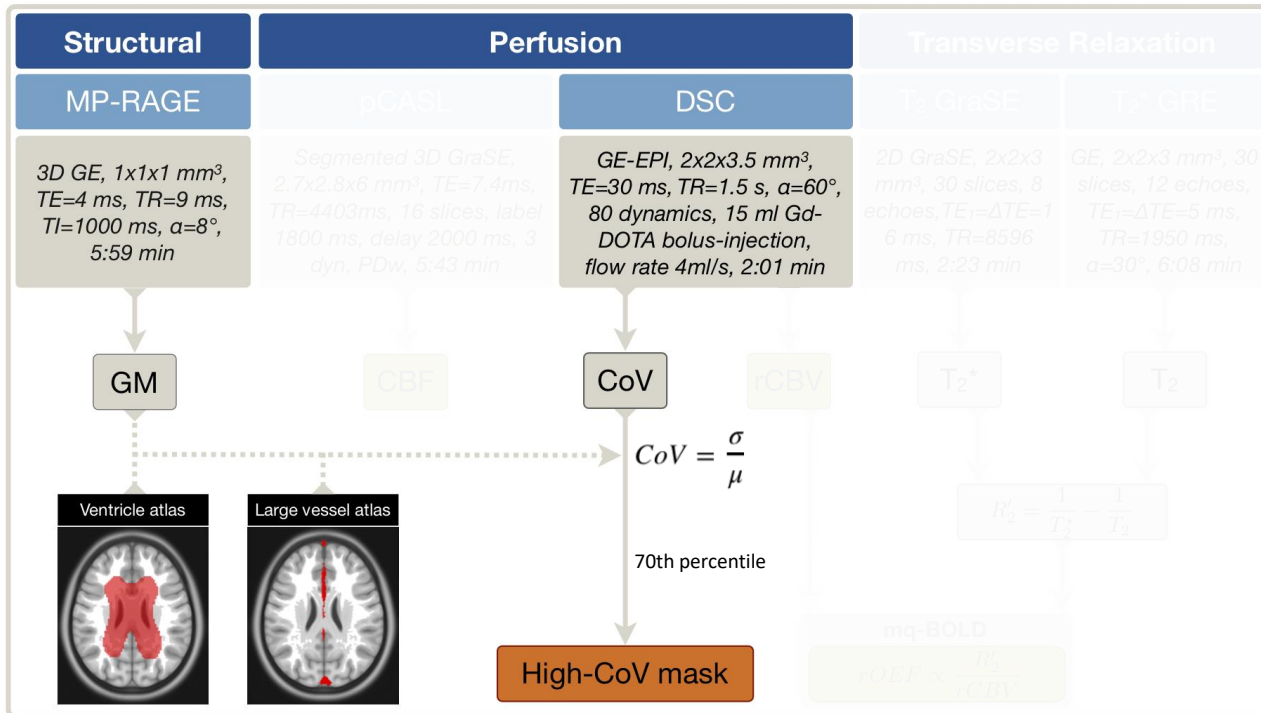


- No strokes or injuries



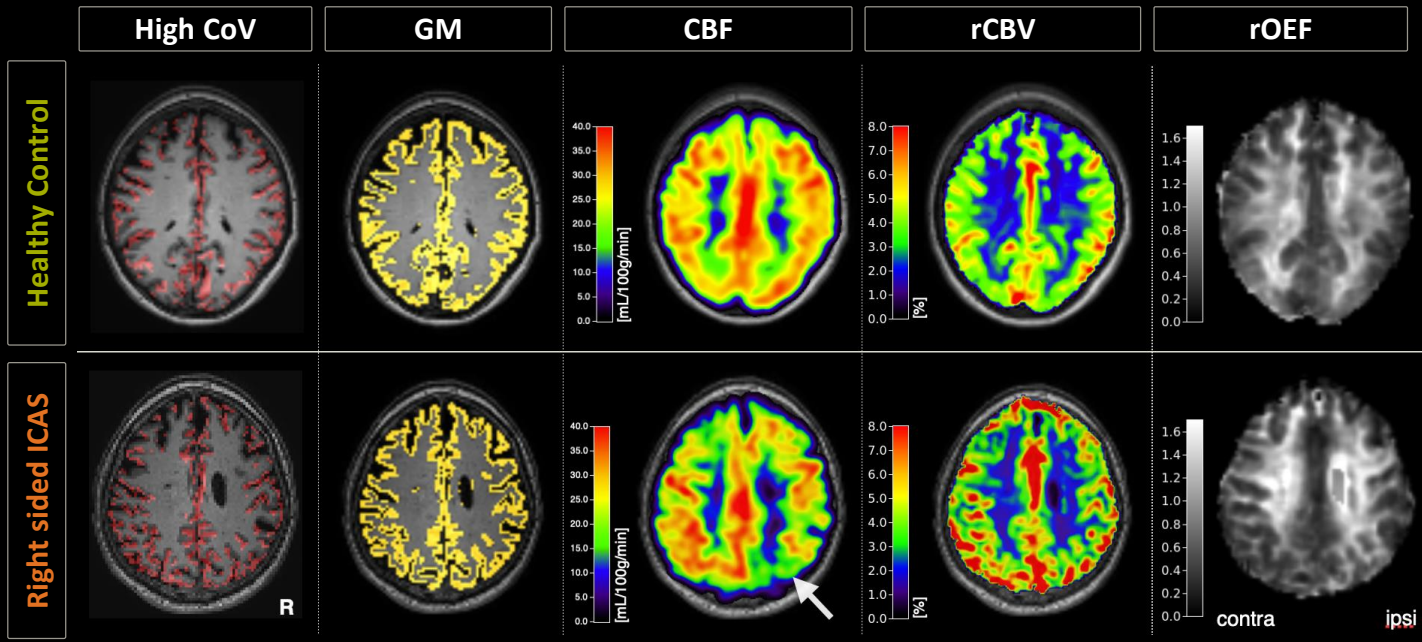
# Material & Methods

## MR imaging protocol



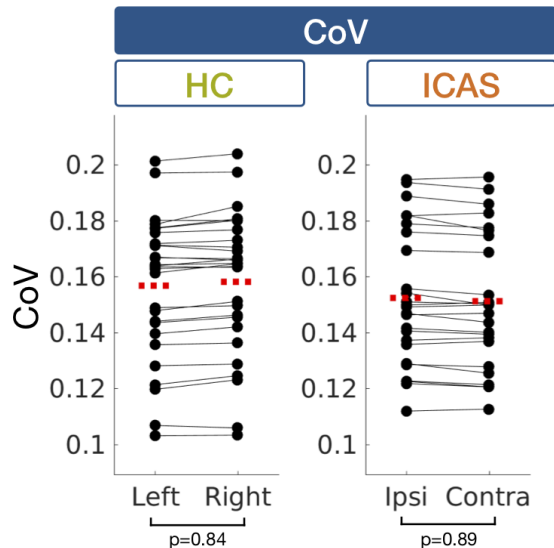
# Results

## Exemplary Data



## Results

### CoV Symmetry



### Method:

- Masks of high CoV within GM
- CoV values within masks compared between hemispheres

- Symmetrical CoV values between hemispheres in HC & ICAS patients
- No enhanced recruitment of leptomeningeal collaterals in asymptomatic ICAS indicated<sup>1,2</sup>  
Primary collateral flow via CoW<sup>3</sup> seems sufficient<sup>4</sup>

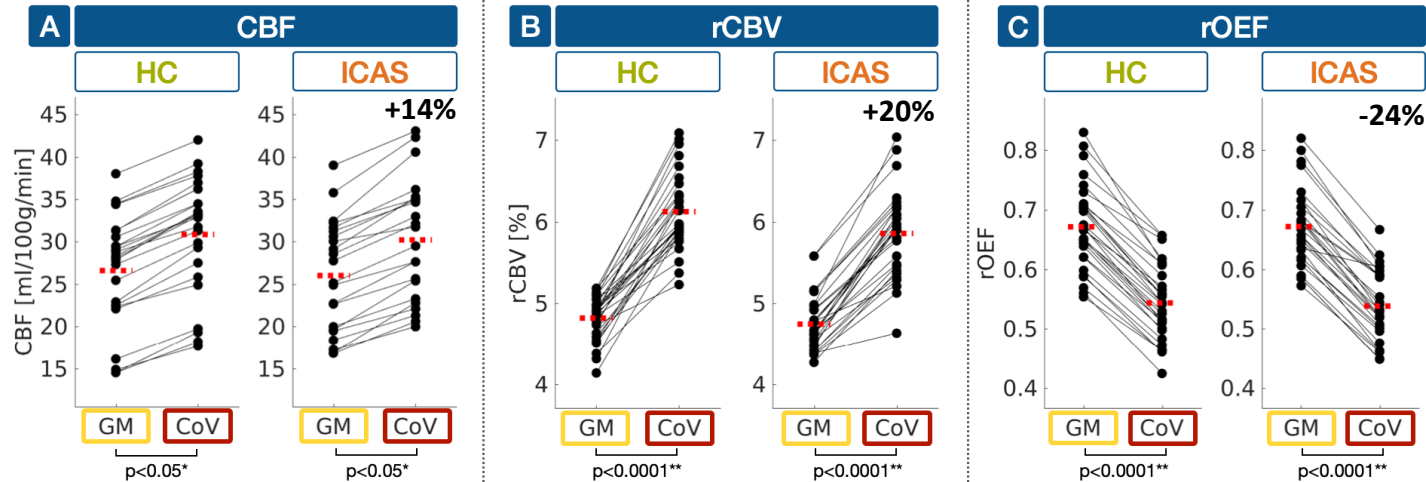


## Results

## Hemodynamics

## Method:

- Masks GM vs. high CoV within GM
- Applied to hemodynamic parameters



- Significant hemodynamics effects in high CoV voxels – in HC & ICAS
- Elevated density of arterioles in high CoV voxels in agreement with assumed preexisting<sup>1</sup> leptomeningeal collaterals arising from arterioles<sup>2-4</sup>
- Lower CBF to CBV ratio in high CoV voxels implying lower CPP<sup>5</sup> Supports potential identification of vessels at risk for future collateral recruitment<sup>6,7</sup>





## Summary

**Selective ASL in CVDS**  
Kaczmarz et al.  
Talk #871

### Collaterals after treatment

Schmitzer et al.  
Talk #823

### Oxygenation: MRI vs. PET

Kufer et al.  
Poster #1305

**Venous QSM**  
Berg et al.  
Poster #3973

No leptomeningeal collateral recruitment indicated in asymptomatic ICAS

Hemodynamic characteristics in high CoV voxels similar in HCs and ICAS patients

Points to identification of arterioles prone to future collateral recruitment

DSC-based CoV analysis may support early detection of critical collateral flow patterns



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Thank you very much  
for your attention!

 @SKaczmarz  
@NMRMgroup

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