MRI assessment of cerebral oxygen extraction fraction in the medial temporal lobe

Dengrong Jiang[1], Peiying Liu[1], Zixuan Lin[1], Kaisha Hazel[1], George Pottanat[1], Emma Lucke[2], Abhay Moghekar[3], Jay J. Pillai[1,4], Hanzhang Lu[1,5,6]

[1]Department of Radiology, Johns Hopkins School of Medicine, Baltimore, MD, USA
[2]Department of Biology, Johns Hopkins University School of Arts & Sciences, Baltimore, Maryland, USA
[3]Department of Neurology, Johns Hopkins School of Medicine, Baltimore, MD, USA
[4]Department of Neurosurgery, Johns Hopkins School of Medicine, Baltimore, MD, USA
[5]Department of Biomedical Engineering, Johns Hopkins School of Medicine, Baltimore, MD, USA
[6]F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Research Institute, Baltimore, MD, USA

1

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Declaration of Financial Interests or Relationships

Speaker Name: Dengrong Jiang

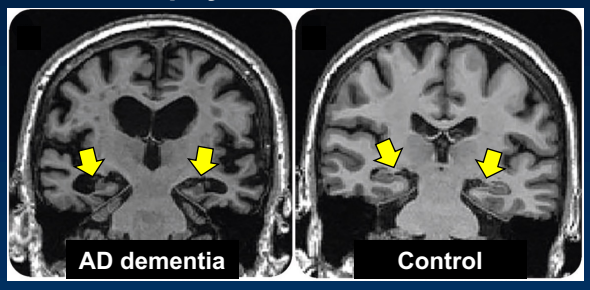
I have no financial interests or relationships to disclose with regard to the subject matter of this presentation.

2

Background

- Medial temporal lobe (MTL) is crucial for memory formation
- MTL is a key area implicated in many diseases:
  - Alzheimer's disease (AD)[1]
  - Epilepsy[2]
  - Schizophrenia[3]
- Functional biomarkers, e.g., oxygen extraction fraction (OEF) may be more sensitive at early stages

MTL atrophy is a biomarker for AD



Jack et al. Neurology 2016;87:539–547

[1] Berron et al. Brain 2020;143:1233-1248 [2] Bonilha et al. Arch Neurol. 2004;61:1379-1384
[3] Mathew et al. JAMA Psychiatry. 2014;71:769-777

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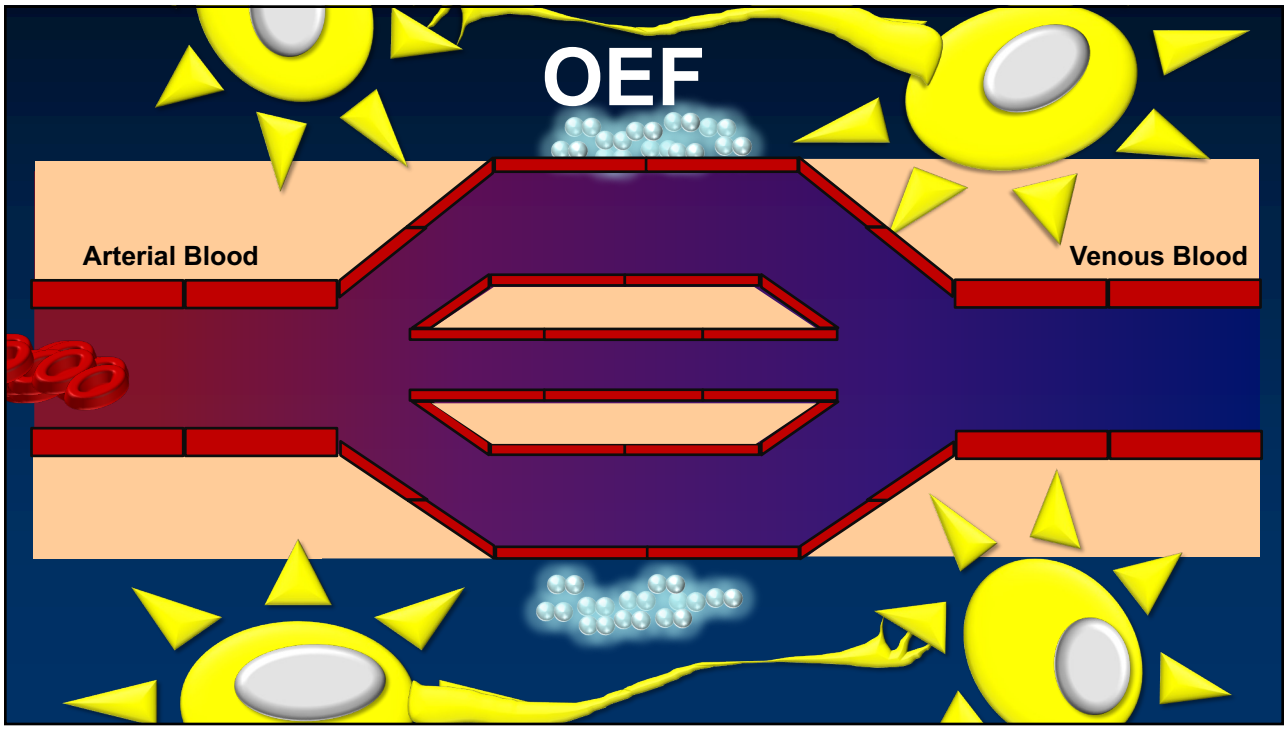
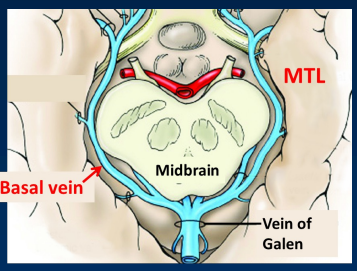


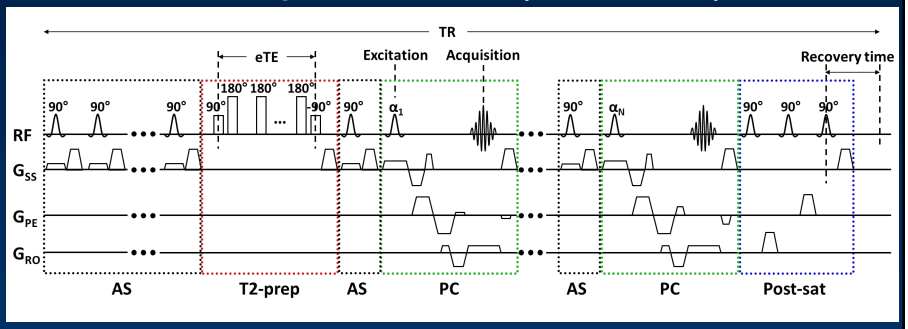
4

Measure OEF in medial temporal lobe

Arterial-suppressed accelerated T_2-relaxation-under-phase-contrast (AS-aTRUPC)



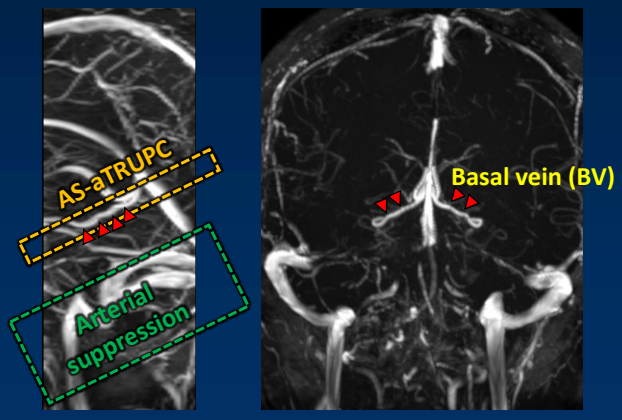
Tubbs et al. J Neurosurg 2007;106:900–902



5

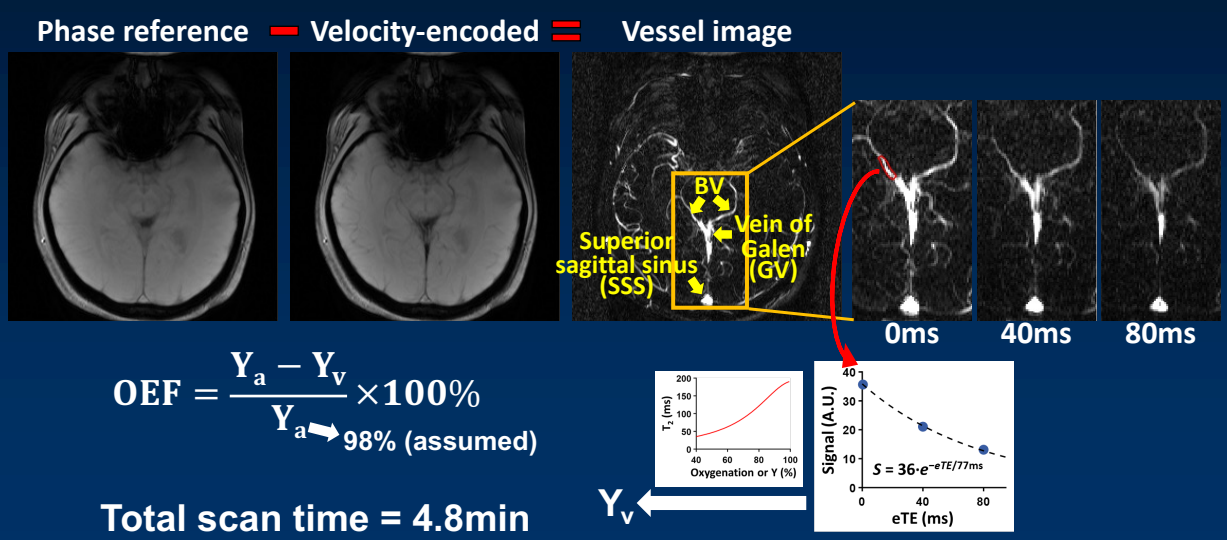
Scan procedure

TOF Sagittal MIP **TOF Coronal MIP**



6

AS-aTRUPC to measure MTL-OEF



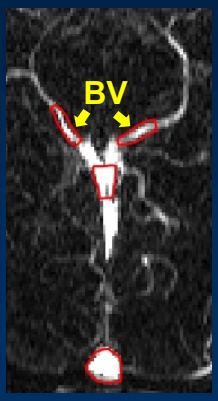
7

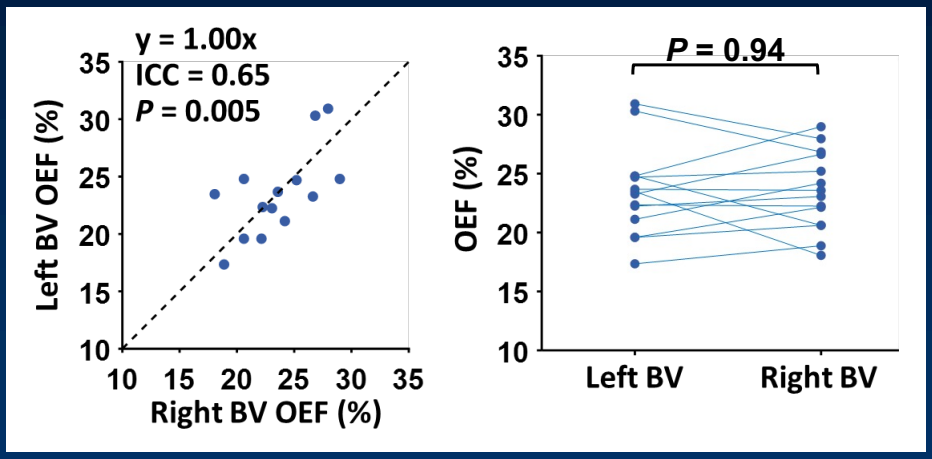
AS-aTRUPC to measure MTL-OEF

- Study 1: MTL-OEF in young healthy adults
- Study 2: Caffeine challenge
- Study 3: Aging effect

8

Study 1: MTL-OEF in young healthy adults

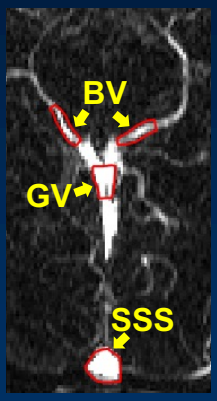


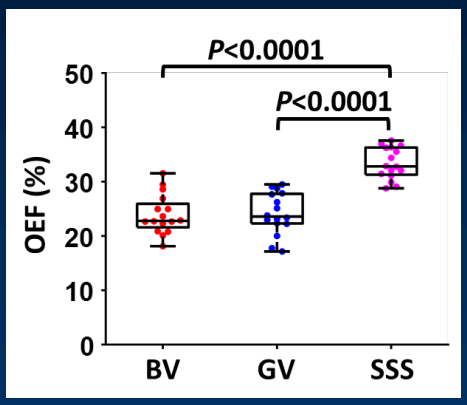


7M 9F, 29 ± 8 years old

9

Study 1: MTL-OEF in young healthy adults





7M 9F, 29 ± 8 years old

10

Study 2: Caffeine challenge

4M 6F, age 26 ± 4

Baseline: TRUST

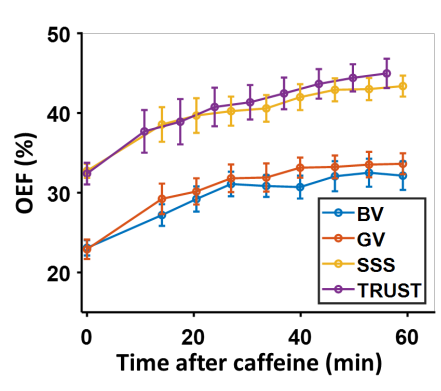
Baseline: AS-aTRUPC

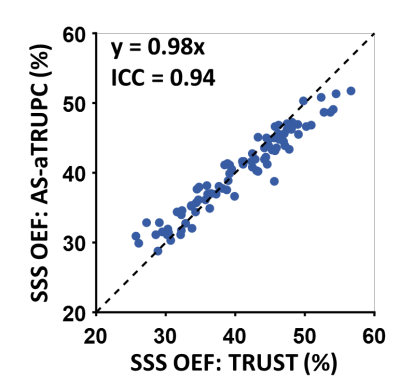
Take 200mg caffeine tablet

TRUST

AS-aTRUPC

×8



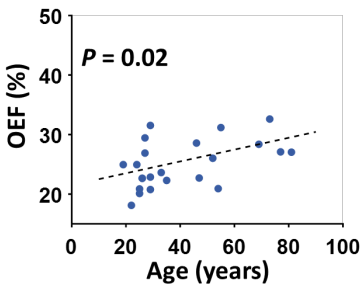


11

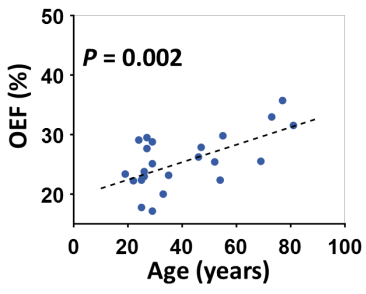
Study 3: Aging effect

Cohort: 7 older adults (4F, age 66 ± 12) + 16 younger adults (9F, age 29 ± 8)
Age range: 19 − 81 years old

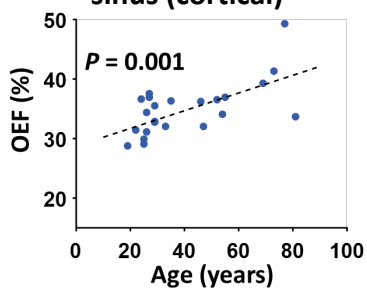
Basal vein (MTL)



Vein of Galen (subcortical)



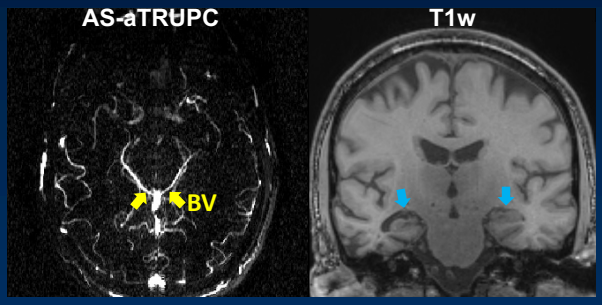
Superior sagittal sinus (cortical)



12

MTL-OEF in Alzheimer's disease

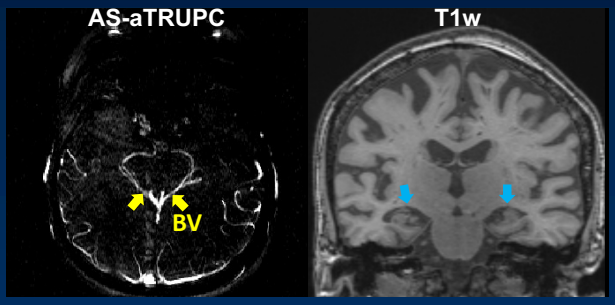
Control, age 66, male



MTL-OEF = 33.8%

PiB cDVR = 1.08

MCI, age 73, female



MTL-OEF = 28.3%

PiB cDVR = 2.09

MCI: mild cognitive impairment
PiB: [^{11}C]-Pittsburgh compound B tracer
cDVR: mean cortical distribution volume ratio

13

Summary

- We developed a non-invasive technique: AS-aTRUPC to measure MTL-OEF in less than 5min
- MTL-OEF is lower than cortical OEF in healthy adults
- Caffeine challenge study demonstrated the sensitivity of our technique in detecting OEF changes
- MTL-OEF increased with age
- Future work: clinical applications, e.g., Alzheimer's disease

14

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15