Changes in Cerebral Blood Flow and Default Mode Network Connectivity Following mTBI Observed with Pulsed Arterial Spin Labeling





Natalie M. Wiseman¹, Armin Iraji², E. Mark Haacke^{2,3}, Zhifeng Kou^{2,3}

- 1. Department of Psychiatry and Behavioral Neurosciences, Wayne State University, Detroit, MI, USA
- 2. Department of Biomedical Engineering, Wayne State University, Detroit, MI, USA
- 3. Department of Radiology, Wayne State University, Detroit, MI, USA



BOLD



 \uparrow activity $\rightarrow \uparrow$ blood flow $\rightarrow \uparrow$ venous $O_2 \rightarrow \uparrow$ intensity

Biswal, 1995; Raichle, 2004

#0353 Wiseman et al.

Changes in cerebral blood flow and default mode network connectivity following mTBI observed with pulsed arterial spin labeling

ASL

 \uparrow activity \rightarrow \uparrow blood flow \rightarrow \uparrow intensity

 \downarrow Spatial resolution

↓ Measurements

↓SNR

 \downarrow Temporal resolution

Chuang, 2008; Jann, 2014

Already demonstrated:

Independent components analysis yields networks with **pseudocontinuous ASL**

Mapping resting-state functional connectivity using perfusion MRI

Kai-Hsiang Chuang,^a Peter van Gelderen,^a Hellmut Merkle,^a Jerzy Bodurka,^b Vasiliki N. Ikonomidou,^a Alan P. Koretsky,^a Jeff H. Duyn,^a and S. Lalith Talagala^{c,*}

^aLaboratory of Functional and Molecular Imaging, National Institutes of Health, Bethesda, MD, USA ^bFunctional MRI Facility, National Institute of Mental Health, National Institutes of Health, Bethesda, MD, USA ^cNIH MRI Research Facility, National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, MD, USA Functional connectivity in BOLD and CBF data: Similarity and reliability of resting brain networks

Kay Jann ^{a,*}, Dylan G. Gee ^b, Emily Kilroy ^a, Simon Schwab ^d, Robert X. Smith ^a, Tyrone D. Cannon ^c, Danny J.J. Wang ^a

^a Department of Neurology, UCLA, 90025 Los Angeles, USA
^b Department of Psychology, UCLA, 90025 Los Angeles, USA
^c Department of Psychology, Yale University, 06520 New Haven, USA
^d Department of Psychiatric Neurophysiology, University Hospital of Psychiatry, University Bern, 3000 Bern 60, Switzerland

What about an older method, pulsed ASL? Many people have old data that could provide new information, but it has lower resolution and SNR

Chuang, 2008; Jann, 2013

#0353 Wiseman et al. Changes in cerebral blood flow and default mode network connectivity following mTBI observed with pulsed arterial spin labeling

Independent components analysis yields networks with **pulsed ASL**, too

<u>Study Participants</u> 13 healthy controls 15 mild TBI patients Default mode network

Visual network

Frontal default mode network

Subcallosal network

Motor network

White matter

Vascular

















#0353 Wiseman et al.

Changes in cerebral blood flow and default mode network connectivity following mTBI observed with pulsed arterial spin labeling

PASL-derived networks look **similar** to BOLDderived networks

<u>Study Participants</u> 13 healthy controls 15 mild TBI patients

rsfMRI PASL Default mode network Visual network Frontal default mode network Subcallosal network Motor network White matter

🥱 🏶 🛞



Changes in cerebral blood flow and default mode network connectivity following mTBI observed with pulsed arterial spin labeling

Vascular

#0353 Wiseman et al.

Both methods showed **√functional connectivity** in the default mode network (DMN) in mild TBI patients as compared to controls



Left angular gyrus, 576 mm³ Left precuneus, 64 mm³

Right precuneus, 108 mm³

<u>Study Participants</u> 13 healthy controls 15 mild TBI patients

#0353 Wiseman et al.

Changes in cerebral blood flow and default mode network connectivity following mTBI observed with pulsed arterial spin labeling

PASL also showed ${\bf \downarrow CBF}$ that overlapped with the DMN



Right angular gyrus, 3,840 mm³

<u>Study Participants</u> 13 healthy controls 15 mild TBI patients

#0353 Wiseman et al.

Changes in cerebral blood flow and default mode network connectivity following mTBI observed with pulsed arterial spin labeling



Thank you!

Acknowledgements

Zhifeng Kou, PhD Armin Iraji

<u>MRI center</u> Zahid Latif MRI research group E. Mark Haacke

Yang Xuan

Yimin Shen

Pavan Jella

Funding: ISMRM seed grant (PI: Zhifeng Kou), NIH F30 HD084144 (PI: Natalie Wiseman) and DoD grant (W81XWH-11-1-0493; PI: E Mark Haacke)

#0353 Wiseman et al. Changes in cerebral blood flow and default mode network connectivity following mTBI observed with pulsed arterial spin labeling