



CereFlow™ System

Medical Imaging Processing Software

Introduction Manual

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What is CereFlow™ V1.0 ?

CereFlow™ V1.0 is an imaging processing software package used by trained professionals including but not limited to physicians and medical technicians. The software runs on a standard “off-the-shelf” PC workstation and enables fast evaluation of many brain pathologies revealed by MR Perfusion-Weighted Imaging based on Arterial Spin Labelling (ASL) technology. The raw image data are acquired through DICOM-compliant MR imaging devices.

CereFlow™ V1.0 provides objective, quantifiable multi-parametric maps, aiming to assist with diagnosis and treatment planning as well as industry-sponsored drug trials. The versatile post-processing core of CereFlow™ V1.0 is applicable to a host of cerebrovascular conditions, which includes but not limited to:

- Ischemic Stroke (IS)
- Transient Ischemic Attack (TIA)
- Alzheimer’s Disease (AD)
- Chronic Ischemic Changes
- Brain tumor
- Epilepsy
- Migraine headaches
- Encephalitis
- Cerebrovascular malformations

CereFlow™ V1.0 can also serve as the platform for non-invasive and repeatable assessment of cerebrovascular reactivity (CVR) by providing quantitative accurate CBF data.

- Diamox challenge test

How does CereFlow™ V1.0 work?

1. Collect raw ASL images from a 1.5T or 3.0T MRI scanner by major manufacturers using designated ASL pulse sequences.
2. Push to send (from MRI scanner) or import (through a storage drive) the raw ASL images to the dedicated workstation installed with CereFlow™ V1.0.
3. The CereFlow™ V1.0 automatically retrieves the imported ASL image set and starts qualitative and quantitative analysis.
4. The CereFlow™ V1.0 reports are generated with pseudo-color maps and measurements on multiple perfusion parameters (Cerebral Blood Flow/CBF, Cerebral Blood Volume/CBV, Arterial Transit Time/ATT) using cerebral vascular territory¹ (by MNI) and ASPECTS² templates.

CereFlow System Integration



The installation of CereFlow™ V1.0 requires:

- MRI Scanner for ASL raw data collection: 1.5T or 3.0T models by major manufacturers (Siemens, GE, Philips)

- Dedicated name brand PC Workstation:

Intel i7 core processor

16 GB system RAM

4 GB Video RAM

MS Windows 10

1.0T HD

SSD HD cordially recommended for enhanced performance

Reference

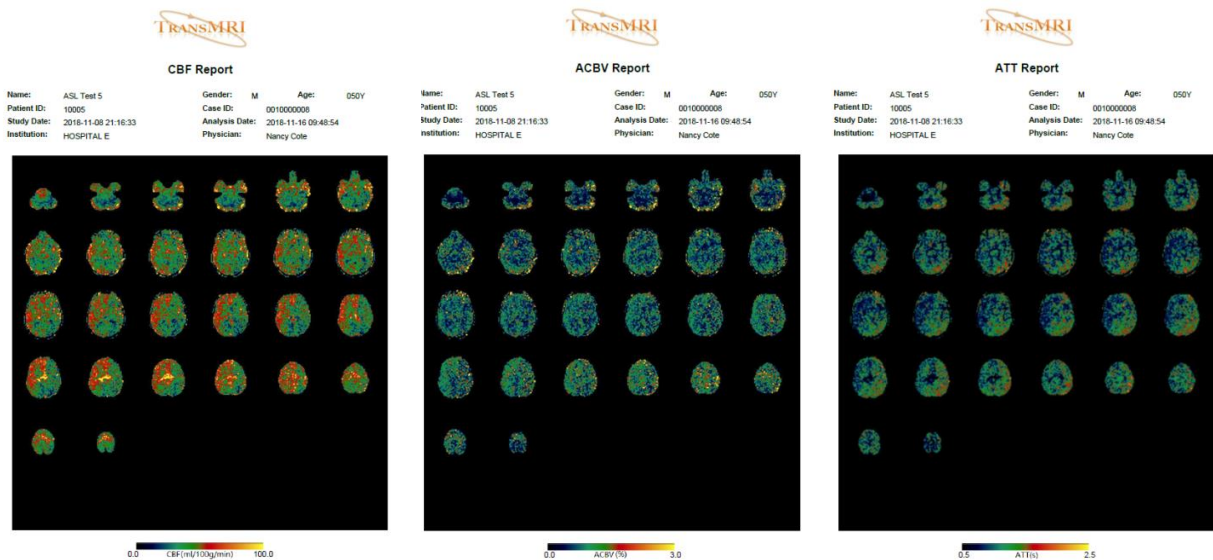
1. Tatu L, Moulin T, Bogousslavsky J, et al. Arterial territories of the human brain: cerebral hemispheres. *Neurology*. 1998; 50: 1699-1708.
2. Barber PA, Demchuk AM, Zhang J, et al. Validity and reliability of a quantitative computed tomography score in predicting outcome of hyperacute stroke before thrombolytic therapy. ASPECTS Study Group. Alberta Stroke Programme Early CT Score. *Lancet*. 2000;355 (9216): 1670-1674.

The CereFlow™ V1.0 Report

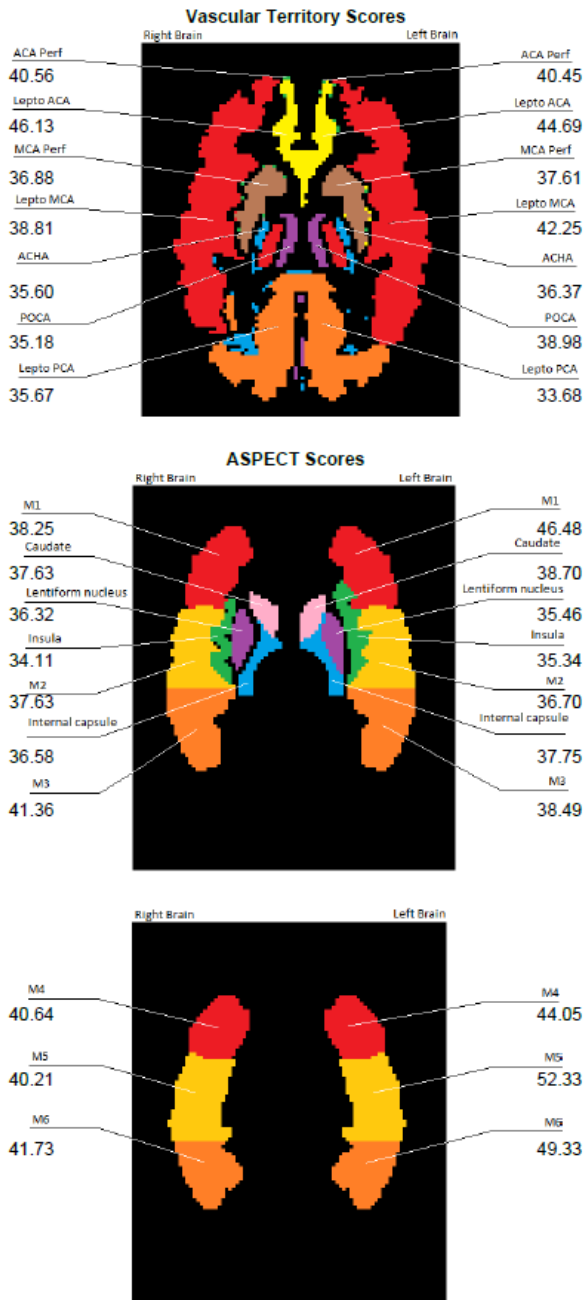
CereFlow™ V1.0 provides a comprehensive assessment of brain perfusion metrics by combining the qualitative pseudo-color maps with quantitative measurements on multiple perfusion parameters.

The CereFlow™ V1.0 reports are generated and displayed in the PDF format. For each ASL scan, there are three (3) report sets on CBF, CBV and ATT, respectively (In case of a single-delay scan, only CBF report is generated). Each report set includes two portions: The pseudo-color parametric map (Picture1), and the vascular territory scores and ASPECT scores (Template illustrations and data tables) (Picture2). The CereFlow™ V1.0 also generates another report with imaging quality assurance (QA) data which includes the graph of framewise fitting residuals, head motion graph of framewise displacement (FD), and normalization process curve (Picture3).

Picture 1.

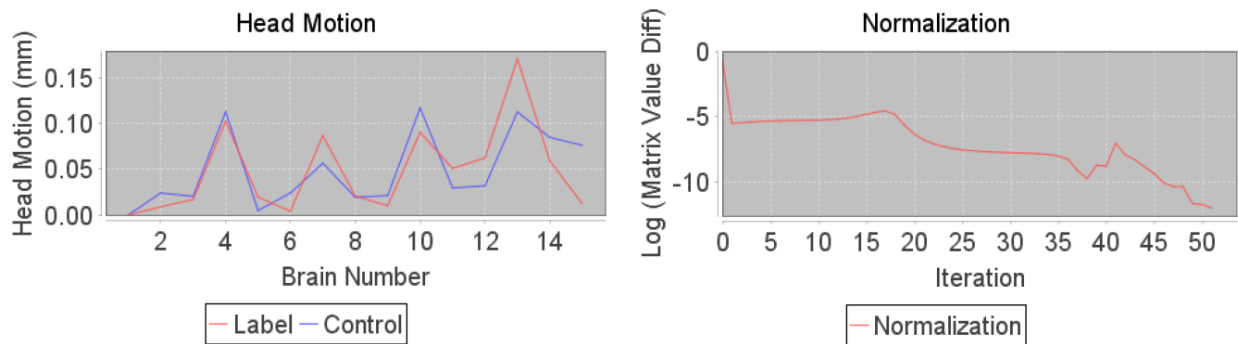


Picture 2.



ACAperf, Anterior Cerebral Artery perforators; LeptoACA, Leptomeningeal branches of Anterior Cerebral Artery; MCAperf, Middle Cerebral Artery perforators; LeptoMCA, Leptomeningeal branches of Middle Cerebral Artery; AChA, Anterior Choroidal Artery; PoCA, Posterior Communicating Artery perforators; LeptoPCA, Leptomeningeal branches of Posterior Cerebral Artery.

Picture3.



The Export Options of CereFlow™ V1.0

- In PDF, the entire report sets
- In CSV spread sheet, quantitative data of vascular territory scores and ASPECT scores
- In DICOM format, quantitative CBF, CBV and ATT maps

Publications

- Multi-delay multi-parametric arterial spin-labeled perfusion MRI in acute ischemic stroke - Comparison with dynamic susceptibility contrast enhanced perfusion imaging. Wang DJ, Alger JR, Qiao JX, et al. *Neuroimage Clin.* 2013 Jul 6; 3:1-7.
- Perfusion deficits detected by arterial spin-labeling in patients with TIA with negative diffusion and vascular imaging. Qiao XJ, Salamon N, Wang DJ, et al. *AJNR Am J Neuroradiol.* 2013 Nov-Dec; 34(11):2125-30.
- Accuracy of vessel-encoded pseudocontinuous arterial spin-labeling in identification of feeding arteries in patients with intracranial arteriovenous malformations. Yu SL, Wang R, Wang R, et al. *AJNR Am J Neuroradiol.* 2014 Jan; 35(1):65-71.
- Arterial spin-labeling perfusion MRI stratifies progression-free survival and correlates with epidermal growth factor receptor status in glioblastoma. Qiao XJ, Ellingson BM, Kim HJ, et al. *AJNR Am J Neuroradiol.* 2015 Apr; 36(4):672-7.
- Post-ischemic hyperperfusion on arterial spin labeled perfusion MRI is linked to hemorrhagic transformation in stroke. Yu S, Liebeskind DS, Dua S, et al. *J Cereb Blood Flow Metab.* 2015 Mar 31; 35(4):630-7.
- Arterial Spin Labeling Magnetic Resonance Imaging Estimation of Antegrade and Collateral Flow in Unilateral Middle Cerebral Artery Stenosis. Lyu J, Ma N, Liebeskind DS, et al. *Stroke.* 2016 Feb; 47(2):428-33.
- Patterns of post-ictal cerebral perfusion in idiopathic generalized epilepsy: a multi-delay multi-parametric arterial spin labelling perfusion MRI study. Chen G, Lei D, Ren J, et al. *Sci Rep.* 2016 Jul 4; 6:28867.
- ASPECTS-based reperfusion status on arterial spin labeling is associated with clinical outcome in acute ischemic stroke patients. Yu S, Ma SJ, Liebeskind DS, et al. *J Cereb Blood Flow Metab.* 2018 Mar;38(3):382-392.
- Multi-delay ASL can identify leptomeningeal collateral perfusion in endovascular therapy of ischemic stroke. Lou X, Yu S, Scalzo F, et al. *Oncotarget.* 2017 Jan 10;8(2):2437-2443.
- Application of arterial spin labeling perfusion MRI to differentiate benign from malignant intracranial meningiomas. Qiao XJ, Kim HG, Wang DJJ, et al. *Eur J Radiol.* 2017 Dec;97:31-36.
- Multi-phase 3D arterial spin labeling brain MRI in assessing cerebral blood perfusion and arterial transit times in children at 3T. Hu HH, Rusin JA, Peng R, Shao X, Smith M, Krishnamurthy R, Selvaraj B, Wang DJJ. *Clin Imaging.* 2018 Nov 6;53:210-220.

Regulatory Compliance

USA	FDA 510K pending
Europe	CE pending

Technical Support

The installation and upgrade service of CereFlow™ will be provided by TransMRI team via remote desktop connection, with the aid of IT staff from user institutions.

For any questions or trouble with the performance of CereFlow™, please contact:
support@transmri.com

Our support team will respond within 12 to 24 hours.