Arterial transit time

Although perfusion imaging plays a key role in the management of steno-occlusive diseases, the clinical usefulness of arterial spin labeling (ASL) is limited by technical issues.

Amemiya et al. examined the effect of arterial transit time (ATT) prolongation on cerebral blood flow (CBF) measurement accuracy and identify the best CBF measurement protocol for steno-occlusive diseases.

Study type: Prospective.

Population: Moyamoya (n = 10) and atherosclerotic diseases (n = 8).

Field strength/sequence: A 3.0T/3DT1 -weighted and ASL.

Assessment: Hadamard-encoded multi delay ASL scans with/without vessel suppression (VS) and single-delay ASL scans with long-label duration (LD) and long post labeling delay (PLD), referred to as long-label long-delay (LLLD), were acquired. CBF measurement accuracy and its ATT dependency, measured as the correlation between the relative CBF measurement difference (ASL-single-photon emission computed tomography [SPECT]) and ATT, were compared among 1) Combo (incorporating multi delay and LLLD data based on ATT), 2) standard (LD/PLD = 1333/2333 msec), and 3) LLLD (LD/PLD = 4000/4000 msec) protocols, using whole-brain voxel-wise correlation with reference standard SPECT CBF. The effect of VS on CBF measurement accuracy was also assessed.

Statistical tests: Pearson's correlation coefficient, repeated-measures analysis of variance, t-test. P< 0.05 was considered significant.

Results: Pearson's correlation coefficients between ASL and SPECT CBF measurements were as follows: Combo = 0.55 ± 0.09 ; standard = 0.52 ± 0.12 ; LLLD = 0.41 ± 0.10 . CBF measurement was least accurate in LLLD and most accurate in Combo. VS significantly improved overall CBF measurement accuracy in the standard protocol and in moyamoya patients for the Combo. ATT dependency analysis revealed that, compared with Combo, the standard and LLLD protocols showed significantly lower and negative and significantly higher and positive correlations, respectively (standard = -0.12 ± 0.04 , Combo = -0.04 ± 0.03 , LLLD = 0.17 ± 0.03).

Data conclusion: By using ATT-corrected CBF derived from LD/PLD = 1333/2333 msec as a base and by compensating underestimation in delayed regions using multidelay scans, the ATT-based Combo strategy improves CBF measurement accuracy compared with single-delay protocols in severe steno-occlusive diseases.

Evidence level: 1 TECHNICAL EFFICACY: Stage 2¹⁾.

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Amemiya S, Watanabe Y, Takei N, Ueyama T, Miyawaki S, Koizumi S, Kato S, Takao H, Abe O, Saito N. Arterial Transit Time-Based Multidelay Combination Strategy Improves Arterial Spin Labeling Cerebral Blood Flow Measurement Accuracy in Severe Steno-Occlusive Diseases. J Magn Reson Imaging. 2021 Jul 15. doi: 10.1002/jmri.27823. Epub ahead of print. PMID: 34263988. From: https://neurosurgerywiki.com/wiki/ - **Neurosurgery Wiki**

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