ON-LINE APPENDIX

Material and Methods

In the study, 24 patients underwent both multiparametric mTI-ASL and DSC-MR imaging. DSC-MR imaging scans were acquired by using a gradient-echo echo-planar imaging sequence with an intravenous bolus injection of gadolinium contrast agent (0.1 mL/kg) with the following parameters: TR/TE = 160/30 ms, FOV = 230 × 230 mm^2, matrix size = 128 × 128, section thickness = 4 mm, gap = 50%, 20 sections, 60 measurements. In addition to conducting correlation analysis of both the absolute and normalized values between mTI-ASL and DSC-MR imaging in the 24 patients, we also evaluated the signal-to-noise ratio of the tumor and contralateral normal-appearing white matter and the contrast-to-noise ratio for the BAT and TTP mapping. We used an artifact-free region outside the brain as the background to estimate image noise. The SNR and CNR were calculated as follows[1-3]:

1) $$SNR_{tumor} = BAT_{tumor}\ (TTP_{tumor})/SD_{bg}$$

2) $$SNR_{NAWMc} = BAT_{NAWMc}\ (TTP_{NAWMc})/SD_{bg}$$

3) $$CNR_{(BAT\ or\ TTP)} = SNR_{tumor} - SNR_{NAWMc},$$

where NAWMc is contralateral normal-appearing white matter, BAT_{tumor} (TTP_{tumor}) is the absolute value of the tumor in terms of the BAT (TTP), and SD_{bg} is the SD of the background signal intensity.

Results

On-line Table 2 lists the Spearman correlation coefficients between each pair of normalized parameter values generated by the mTI-ASL and DSC-MR imaging methods. The mTI-ASL estimation of nBAT was moderately correlated with the normalized value of TTP ($r = 0.483$, $P = 0.017$).

On-line Table 3 lists the Spearman correlation coefficients between each pair of absolute parameter values generated by the mTI-ASL and DSC-MR imaging methods. However, no correlation was detected between the absolute BAT and absolute TTP, which were different from the normalized value.

The CNR of the BAT map was significantly higher than that of the TTP map (median, 0.69; range, 0.06–1.36, versus 0.10, 0.01–1.10; $P < .001$) (On-line Fig 2).

On-line Fig 3 shows the fitting curve acquired by taking territories of the middle cerebral artery as volumes of interest by using the Buxton model.

REFERENCES

1. Biswas J1, Nelson CB, Runge VM, et al. **Brain tumor enhancement in MR imaging comparison of signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) at 1.5 versus 3 T.** *Invest Radiol* 2005;40:792–97 CrossRef Medline
2. Wintersperger BJ, Runge VM, Biswas J et al. **Brain tumor enhancement in MR imaging at 3 T: comparison of SNR and CNR gain by using TSE and GRE techniques.** *Invest Radiol* 2007;42:558–63 CrossRef Medline
3. Tselikas L, Souillard-Scemama R, Naggara O, et al. **Imaging of gliomas at 1.5 and 3 T: a comparative study.** *Neuro Oncol* 2015;17:895–900 CrossRef Medline

On-line Table 1: The ICCs between the 2 observers when scoring the conventional MR imaging features and ASL parameters

	ICCs	95% CI
Edema	0.909	0.833–0.951
Mass effect	0.976	0.955–0.987
Enhancement	0.976	0.955–0.987
Borders	0.899	0.815–0.945
Heterogeneity	0.913	0.839–0.953
Necrosis	0.872	0.765–0.931
Hemorrhage	0.821	0.669–0.903
Flow void	0.815	0.660–0.900
nCBF-sTI	0.854	0.730–0.921
nCBF-mTI	0.800	0.630–0.891
nBAT	0.876	0.771–0.933

Note:—ICC indicates intraclass correlation coefficient.

On-line Table 2: Spearman correlation coefficients between each pair of normalized parameter values generated by the mTI-ASL and DSC-MRI methods[a]

	nCBF-mTI	nBAT	nCBF-DSC	nMTT	nTTP
nCBF-mTI	1.000	−.201	.768[b]	.122	−.010
	–	.347	.000	.571	.965
nBAT	−.201	1.000	−.163	.253	.483[c]
	.347	–	.445	.233	.017
nCBF-DSC	.768[b]	−.163	1.000	.127	−.027
	.000	.445	–	.554	.900
nMTT	.122	.253	.127	1.000	.350
	.571	.233	.554	–	.093
nTTP	−.010	.483[c]	−.027	.350	1.000
	.965	.017	.900	.093	–

Note:—nCBF-DSC indicates the normalized value of CBF derived from DSC-MRI; nMTT, the normalized value of the MTT; nTTP, the normalized value of TTP.

[a] For each parameter, the first row is the correlation coefficient and the second row is the significance (2-tailed).

[b] $P < .01$.

[c] $P < .05$.

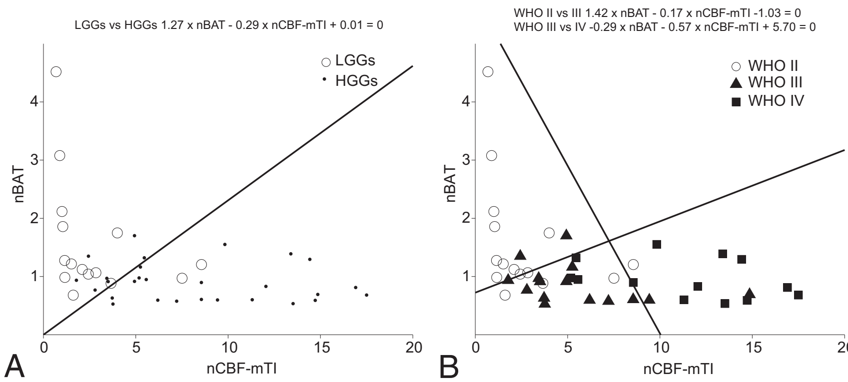
On-line Table 3: Spearman correlation coefficients between each pair of absolute parameter values generated by the mTI-ASL and DSC-MRI methods[a]

	CBF-mTI	BAT	CBF-DSC	MTT	TTP
CBF-mTI	1.000	−.327	.605[b]	.202	.297
	–	.119	.002	.344	.159
BAT	−.327	1.000	−.025	.006	.278
	.119	–	.907	.977	.188
CBF-DSC	.605[b]	−.025	1.000	.373	.047
	.002	.907	–	.073	.828
MTT	.202	.006	.373	1.000	.430[c]
	.344	.977	.073	–	.036
TTP	.297	.278	.047	.430[c]	1.000
	.159	.188	.828	.036	–

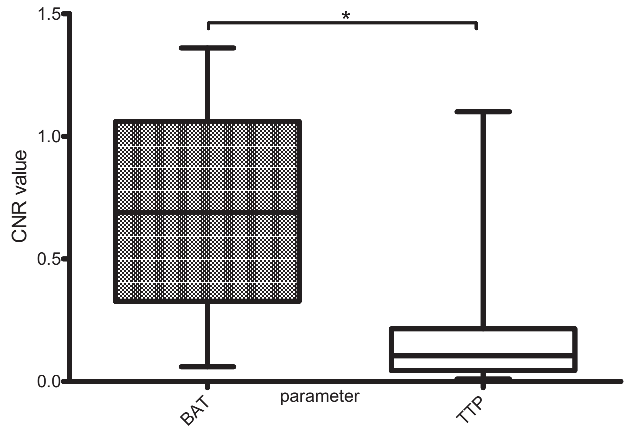
[a] For each parameter, the first row is the correlation coefficient and the second row is the significance (2-tailed).

[b] $P < .01$.

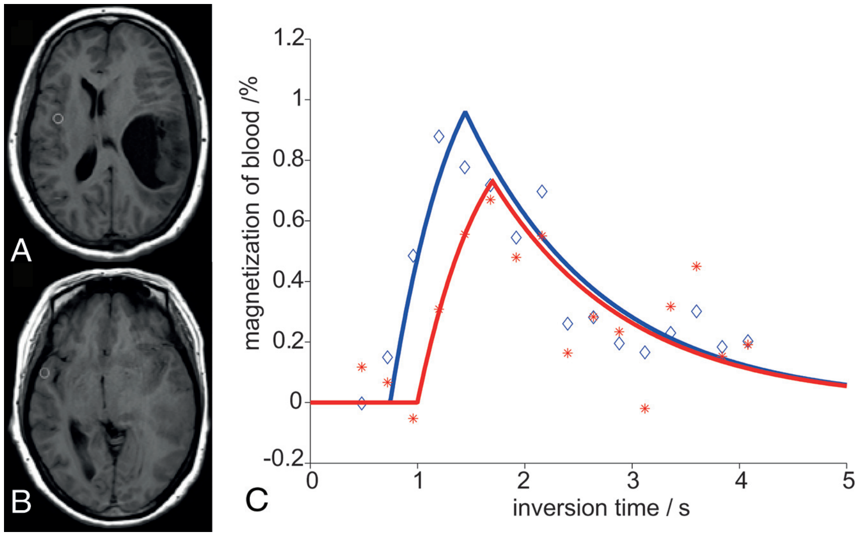
[c] $P < .05$.



ON-LINE FIG 1. Scatterplot of the nCBF-mTI values versus the nBAT values shows the WHO II group (LGGs) as *hollow circles*, the WHO III group as *black triangles*, the WHO IV group as *black squares*, and the HGG (WHO III and IV) group as *black dots*. The classification planes are plotted as *black lines*, and the calculation equations for the diagnostic accuracy are indicated at the top of the graphs. *A*, The figure demonstrates that the nCBF-mTI and nBAT values are good predictors for discriminating the LGG and HGG groups. *B*, The figure demonstrates the ability of the nCBF-mTI and nBAT values to differentiate WHO grades II, III, and IV simultaneously.



ON-LINE FIG 2. The boxplot demonstrates the significant difference in the CNR between the BAT and TTP maps. The *box* represents the interquartile range (25%–75%); *whiskers*, extreme values; and the *black bar* in the box, the median. A significant difference between the 2 groups is indicated by the *asterisk*.



ON-LINE FIG 3. The fitting curves of the CBF-mTI and BAT maps. The anatomic axial T1-weighted image displays the 2 territories of the right middle cerebral artery, which we adopted as volumes of interest. *A*, The proximal territory of the right middle cerebral artery. *B*, The distal territory of the right middle cerebral artery. *C*, The fitting curve demonstrates that the proximal territory has a relatively high CBF value, but a short BAT (*blue line*); conversely, the distal territory has a low CBF value, but a longer BAT (*red line*).