

# Amide Proton Transfer and 3D Pseudo-continuous Arterial Spin Labeling MRI in Grading Cerebral Gliomas

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**Target audience:** Scientists and clinicians who are interested in APT and ASL imaging to glioma.

**Purpose:** Amide Proton Transfer (APT) is a new molecular MRI method which can detect endogenous mobile proteins and peptides (1). We aimed to evaluate the diagnostic accuracy of single-slice GRE APT and 3D pseudo-continuous arterial spin labeling (pCASL) MRI in grading gliomas.

**Materials and Methods:** 23 patients with high-grade gliomas and 16 with low-grade gliomas confirmed with histopathology were examined using 3D pCASL MRI and GRE APT with 21 frequency offsets from +5 to -5 ppm (TR/TE = 3200/2.87 ms, FA = 10 degree, slice thickness = 5 mm, four RF saturation pulses with power of 3.0  $\mu$ T) at 3T MR scanners. The magnetization transfer asymmetry at the offset of 3.5 ppm is calculated for APT images. The cerebral blood flow (CBF) was obtained from 3D pCASL MRI. The values of APT and CBF in the solid parts of gliomas were compared between high-grade and low-grade gliomas. Their normalized values to the corresponding values of contralateral normal-appearing white matter were also compared between the two groups. Correlation between APT value and CBF was assessed using Pearson's correlation.

**Results and Discussion:** The values of APT and CBF in high-grade gliomas were higher than in low-grade gliomas ( $p < 0.01$ ). The normalized values also demonstrated significant differences between the two groups ( $p < 0.01$ ). The Pearson correlation coefficient between the values of APT and CBF was 0.787 in gliomas ( $p < 0.05$ ). The signal intensity of high-grade gliomas on APT were usually higher than low-grade gliomas as they have more proteins and/or faster transfer rate between amide proton and water (2).

**Conclusion:** There is a positive correlation between endogenous mobile proteins and CBF in gliomas. The parameters derived from APT and 3D pCASL MRI are useful in grading cerebral gliomas.

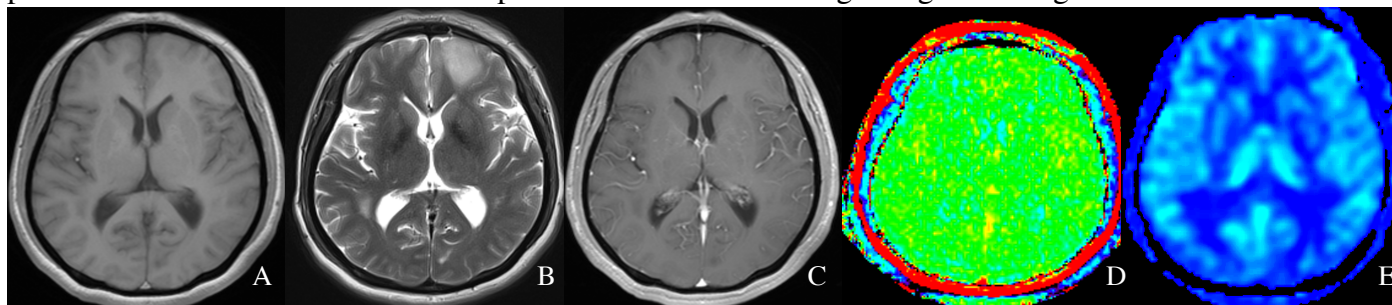


Figure 1. A 51-year-old female patient with astrocytoma (WHO grade II) in the left frontal lobe. The tumor shows isointensity on T1w image (A) and hyperintensity on T2w image (B). No enhancement is revealed on Gd-T1w image (C). Both APT map (D) and CBF map (E) demonstrate the tumor is isointense.

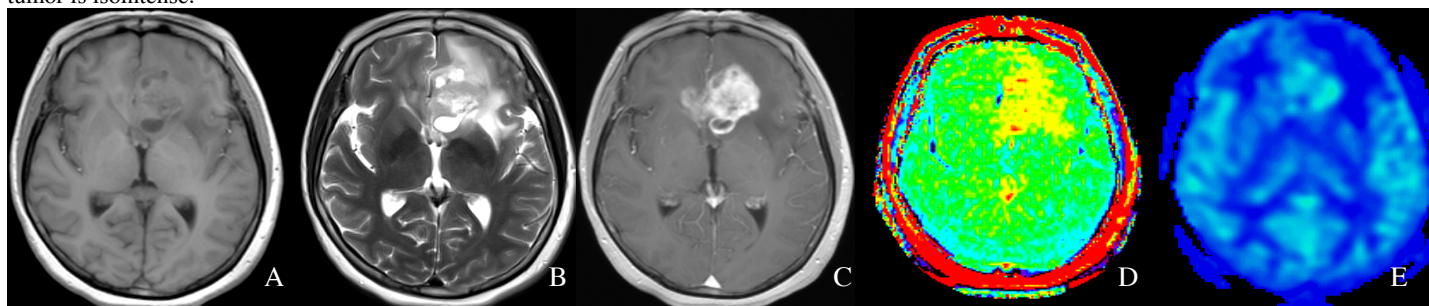


Figure 2. A 59-year-old man with glioblastoma (WHO IV grade) in the left frontal lobe. The tumor shows hypointensity on T1w image (A) and heterogeneous hyperintensity on T2w image (B). Irregular enhancement is revealed on Gd-T1w image (C). Both APT map (D) and CBF map (E) demonstrate the tumor is hyperintense.

References: (1) Zhou et al. Nat. Med. 9(2003)1085. (2) Zhou et al. J Magn Reson Imaging. 11(2013)1119-28.