

# Assessment of Vascular Supply of Hypervascular Extra-axial Brain Tumors with MR Regional Perfusion Imaging at 3T

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**Purpose:** Regional perfusion imaging (RPI), one of arterial spin labeling (ASL) MR imaging, which provides selective information on the vascular territory of the individual brain-feeding arteries has been reported (1-4). To our knowledge, however, assessment of vascular supply from the external carotid artery in extra-axial brain tumors with RPI has not been reported. The purpose of this study was to determine whether RPI MR imaging is feasible for assessing the vascular supply of hypervascular extra-axial brain tumors.

**Materials and Methods:** We prospectively studied conventional MR, MR angiography, conventional ASL and RPI in 7 consecutive patients (4 women, 3 man; 42 - 73 years; mean, 57 years) with hypervascular extra-axial brain tumors. The MR images were obtained using an 8-channel head coil and a 3T MR scanner (Philips, Achieva, Best, the Netherlands). On the basis of the MR angiography, RPI was performed by placing a selective labeling slab over the external carotid artery by using a single-shot echo-planar imaging sequence (TR/TI/TE = 4000/1500/9.2 ms; sensitivity encoding factor = 2.5; matrix = 64 x 64; 60 dynamics; 5 sections; section thickness = 7 mm; scanning time = 4 minutes). All underwent surgical treatment after the MR studies; 3 of 7 patients underwent digital subtraction angiography (DSA) prior to surgery. The tumors included 6 meningiomas and 1 endolymphatic sac tumor. On DSA and/or surgery, the main feeding arteries of the all the tumors were the branches of the external carotid artery. For the conventional ASL and RPI study, a total of 40 images which were obtained by subtracting labeled images from non-labeled images were analyzed by two neuroradiologists. They evaluated overall image quality, the degree of tumor perfusion, and the extent of tumor vascular territory on the conventional ASL and RPI studies. The extent of tumor vascular territory on RPI was compared with that on conventional ASL images. The observers recorded the extent of tumor vascular territory on the conventional ASL and RPI images using a 3-point scale system: coincided (grade 2), similar (grade 1), or different (grade 0). Each neuroradiologist performed the initial evaluations independently; disagreements regarding final conclusions were resolved by consensus. The  $\kappa$  statistic was used to assess interobserver variability.

**Results:** For all conventional ASL images, the overall image quality was assessed as sufficient image quality for interpretation. In 7 RPI studies, the overall image quality was assessed as sufficient image quality in 6 and fair image quality in 1 study. The patient classified as fair image quality had posterior fossa meningioma. In 6 conventional ASL studies of 6 cases, 2 observers graded tumor perfusion as higher than of the normal-appearing cortex (Fig 1). The remaining 1 case with posterior fossa meningioma had tumor perfusion equivalent to the normal-appearing cortex. In the assessment of the extent of tumor vascular territory on the conventional ASL and RPI images, the tumors were classified as grade 2 for 3 lesions and grade 1 for 4. One case with grade-2 lesion, who underwent DSA, had the feeding arteries only from the external carotid artery. For all the 4 grade-1 lesions, the depiction of extent of tumor vascular territory on RPI was smaller than that on conventional ASL images (Fig 1). In the 2 cases with grade-1 lesions, who underwent DSA, DSA showed parasitic supply from the internal carotid artery territory to the tumor. The  $\kappa$  values for interrater variability between observers showed excellent agreement ( $\kappa = 0.86$ ).

**Conclusion:** In this investigation, RPI with selective labeling of the external carotid artery was feasible for assessing the vascular supply of hypervascular extra-axial brain tumors. Further studies with large population would be useful to define the potential role of RPI for brain tumors.

## References:

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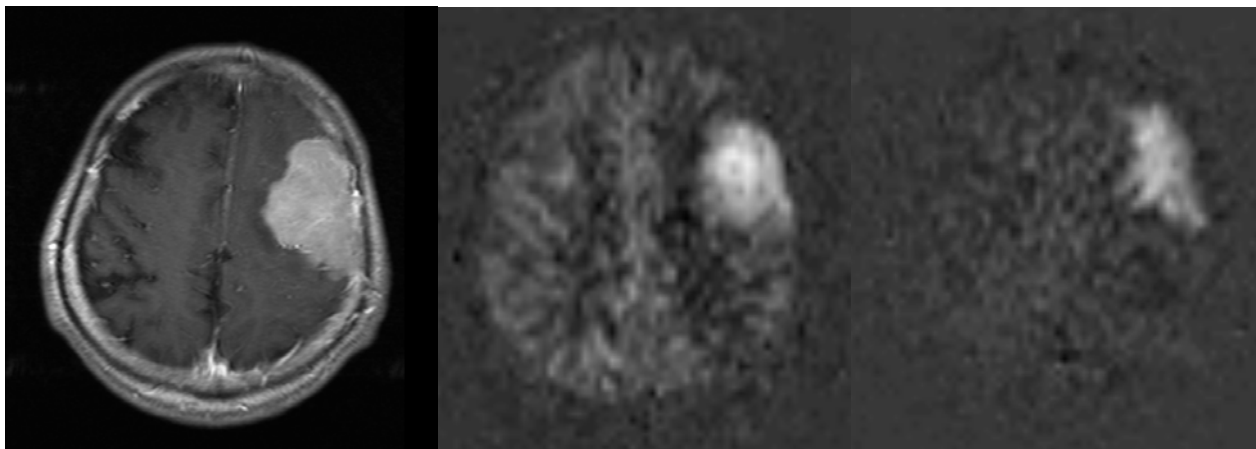


Fig 1A.

Fig 1B.

Fig 1C.

Fig 1A. Contrast-enhanced T1-weighted image shows a well-enhanced mass lesion.

Fig 1B. Conventional ASL image demonstrates a mass lesion with hyperperfusion.

Fig 1C. RPI image with a selective labeling slab over the external carotid artery shows a relatively smaller hyperperfused area compared to Fig 1B. This case was classified as grade 1.