Use of Diffusion-Weighted Imaging and MR Spectroscopy to Distinguish Brain Abscess from Intraparenchymal Cystic/Necrotic Tumors

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Purpose
To evaluate the role played by combination of diffusion-weighted imaging (DWI) and MR spectroscopy (MRS) in distinguishing brain abscess from other intraparenchymal necrotic masses.

Materials & Methods
Retrospective analysis of DWI and MRS was undertaken in 7 peripherally enhancing, predominantly cystic/necrotic intraparenchymal lesions: 2 biopsy proved pyogenic abscesses, 1 nocardia abscess, and 4 biopsy proved tumors (2 glioblastomas multiforme, 1 anaplastic astrocytoma, and 1 metastasis from unknown primary). DWI was performed using an axial echo-planar spin-echo 2D mode, single shot technique at 10,500 TR, a minimum TE, bandwidth of 62.50, 5 mm slice thickness, 2.5 mm interval, a 240 x 240 mm FOV; b value of 1000, gradients in the x, y and z directions, and a composite gradient. MRS was obtained from the necrotic centers using the PRESS sequence (1600 TR, 144 TE, 256 x 192 matrix, 8 NEX, 220 x 220 FOV). Choline, creatine, N-acetyl aspartate (NAA), lipid/lactate and amino acid peaks were ascertained and compared.

Results
Marked diffusion restriction was seen in both pyogenic abscess cavities. Moderate diffusion restriction was found in the nocardia abscess cavity. No diffusion restriction was seen in the 4 necrotic tumors, irrespective of their etiology. On MR spectroscopy, the abscess cavities demonstrated a small peak at 0.9 ppm representing amino acids, a lipid/lactate peak at 1.4 ppm, a variable decrease in the NAA peak, and a variable increase in the choline peak. The necrotic tumor cavities demonstrated no peak at 0.9 ppm. Two of the four necrotic tumors demonstrated a lipid/lactate peak. The tumor cavities showed a more marked decrease in the NAA peak and a more marked increase in the choline peak as compared with the abscess cavities.

Conclusion
In this series, pyogenic abscess cavities appeared bright on diffusion-weighted images, presumably due to the intrinsic characteristics of pus. Partial intracavitary hemorrhage may have been responsible for the less bright DWI signal of the nocardia abscess cavity. The necrotic tumors showed no restricted diffusion and no bright signal on the DWI. Presence of an amino acid peak at 0.9 ppm helps to confirm the presence of an abscess cavity and to rule out the possibility of a necrotic tumor. In combination, DWI and MRS can successfully distinguish abscess from necrotic intraparenchymal tumor.
References