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# Semiquantitative analysis of C-11 methionine PET may distinguish brain tumor recurrence from radiation necrosis even in small lesions.

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## Abstract

**OBJECTIVE:** (11)C-Methionine positron emission tomography (MET-PET) has been used to distinguish brain tumor recurrence from radiation necrosis. Because the spatial resolution of conventional PET scanners is low, partial volume effect (PVE) may decrease the detectability of small tumor recurrence. The aim of this study is to investigate the diagnostic value of MET-PET upon semiquantitative analyses in particular PVE-affected small lesions.

**METHODS:** First, we performed a phantom experiment to investigate what size lesion is affected by PVE. This study included 29 patients (33 lesions) suspected of recurrent brain tumors by magnetic resonance imaging (MRI) after radiation therapy. All of them received MET-PET. Semiquantitative analysis was performed using maximum standardized uptake value (SUVmax) and lesion-versus-normal ratio (L/N ratio). ROC analysis was also assessed about the diagnostic value of MET-PET.

**RESULTS:** From the result of the phantom experiment, lesions smaller than 20 mm in brain mode or smaller than 30 mm in whole-body mode were defined as PVE-affected lesions. Histological analysis or clinical follow-up confirmed the diagnosis of tumor recurrence in 22 lesions, and radiation necrosis in 11 lesions. L/N ratios of recurrence and necrosis for overall lesions were 1.98 ± 0.62 and 1.27 ± 0.28, respectively ($p < 0.01$). In the PVE-affected lesions, L/N ratio for recurrence (1.72 ± 0.44) was also significantly higher than that for necrosis (1.20 ± 0.11) ($p < 0.01$). On the ROC analysis for the PVE-affected lesions, the area under the curve for L/N ratio (0.897) was significantly higher than that for SUVmax (0.718) ($p < 0.05$). These areas under the curve were almost equal to that of overall lesions for L/N ratio (0.886) and for SUVmax (0.738).

**CONCLUSIONS:** Semiquantitative analysis of MET provided high diagnostic value even for PVE-affected small lesions. MET-PET enables early diagnosis of recurrence of brain tumor in the follow-up after the radiation therapy.

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