Correlation of amino-acid uptake using methionine PET and histological classifications in various gliomas

Kenji Torii,* Naohiro Tsuyuguchi,** Joji Kawabe,* Ichiro Sunada,**
Mitsuhiro Hara** and Susumu Shiomi*

*Department of Nuclear Medicine, Graduate School of Medicine, Osaka City University
**Department of Neurosurgery, Graduate School of Medicine, Osaka City University

Objective: The uptake of L-methyl-^{11}C-methionine (MET) by gliomas is greater than that by intact tissue, making methionine very useful for evaluation of tumor extent. If the degree of malignancy of brain tumors can be evaluated by MET-PET, the usefulness of MET-PET as a means of diagnosing brain tumors will increase. ***Methods:*** We performed this study on 67 glioma patients between 3 and 69 years of age (36 males and 31 females). Tumors included diffuse astrocytoma, anaplastic astrocytoma, glioblastoma, ependymoma, oligodendroglioma, medulloblastoma, dysembryoplastic neuroepithelial tumor, choroid plexus papilloma, central neurocytoma, optic glioma, gliomatosis cerebri, pleomorphic xanthoastrocytoma, and ganglioglioma. Tumor activity and degree of malignancy were evaluated using Ki-67LI (LI: labeling index) and Kaplan-Meier survival curves. The correlations between methionine uptake and tumor proliferation (tumor versus contralateral gray matter ratio (T/N) and Ki-67LI) were determined for the group of all subjects. The existence of significant correlations between T/N and Ki-67LI and between SUV and Ki-67LI was determined for astrocytic tumors. Receiver operating characteristics (ROC) analysis of T/N and standardized uptake value (SUV) was performed for the group of astrocytic tumors. We also determined the ROC cut-off levels to ensure high accuracy of the analysis. ***Results:*** For the 67 cases of glioma, the degree of accumulation was variable. Ki-67LI differed significantly between the high-grade group and low-grade group at T/N levels between 1.5 and 1.8 on analysis using tumor proliferative potential ($p = 0.019$–0.031). The prognosis differed significantly between the high-grade and low-grade groups when T/N was in the range of 1.6–1.8 ($p = 0.028$–0.032). The accuracy thus calculated was highest (85.7%) when T/N was 1.5 as determined by ROC analysis. ***Conclusions:*** When analysis was confined to cases of astrocytic tumor, a correlation was noted between methionine accumulation and Ki-67LI. For the astrocytic tumors, T/N ratio seemed to be more useful as a diagnostic indicator than SUV. The cut-off level of T/N ratio for distinction between high-grade and low-grade astrocytoma appears to lie between 1.5 and 1.6.

Key words: ^{11}C-methionine-PET, Ki-67LI, glioma