

Detection of hypoxic cells in glioblastoma using [¹⁸F]FRP-170 positron emission tomography: correlation with oxygen pressure within tumor bulk

T. Beppu¹, K. Terasaki², T. Sasaki², H. Matsuura¹, K. Ogasawara¹, R. Iwata³, Y. Takai⁴ and K. Sera²

¹Department of Neurosurgery, Iwate Medical University
Uchimaru 19-1, Morioka 020-8505, Japan

²Cyclotron Research Center, Iwate Medical University
348-58 Tomegamori, Takizawa 020-0173, Japan

³Cyclotron and Radioisotope Center, Tohoku University
Aoba 6-3, Sendai 980-8578 Japan

⁴Department of Radiology, Hirosaki University School of Medicine
5 Zaifu, Hirosaki 036-8562, Japan

Abstract

Positron emission tomography with 1-(2-[¹⁸F]fluoro-1-[hydryxymethyl]ehoxy)methyl-2- nitroimidazole (FRP-170 PET) is widely noticed as a novel examination for detecting hypoxic cell in cancer. To clarify the reliability of detecting hypoxic cells in glioblastoma using FRP-170 PET, we evaluated relationship between the findings on color maps from FRP-170 PET and the oxygen pressure within glioblastoma, measured during surgery for tumor resection. Six patients with glioblastoma underwent magnetic resonance image (MRI) with contrast medium and FRP-170 PET within 7days before tumor resection. PET scan was performed 60 min after intravenously injection of 370 MBq FRP-170. On color maps from PET, the mean of standardized uptake value (SUVmean) was calculated at interest of regions in the hot spot, cold spot, and normal white matter in the contralateral cerebrum, and then ratio of SUVmean (R-SUVmean), i.e., tumor/normal ratio, was calculated in each the hot spot and cold spot. During surgery, we measured the real oxygen pressure in both the hot and cold spots using oxygen electrodes. As a result, mean of R-SUVmean in the hot spots of all patients was significantly higher than that in the cold spots. Mean of oxygen pressure in the hot spots was significantly lower than that in the cold spots. Relationship between R-SUVmean and oxygen pressure in the hot spots was found a tendency of negative correlation in the hot spots, whereas there was entirely no correlation in the cold spots. In conclusion, the present study suggests that the hot spot on color map from FRP-170 PET really represents hypoxic tissue containing hypoxic cells in glioblastoma.