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Evaluation of tumor FDG transport and metabolism in primary central nervous system lymphoma using [^{18}F]fluorodeoxyglucose (FDG) positron emission tomography (PET) kinetic analysis

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Objective: Although ^{18}F-fluorodeoxyglucose (FDG) positron emission tomography (PET) has been used as a promising tool to diagnose primary central nervous system lymphoma (PCNSL) because the tumor shows very high FDG accumulation, no data exist evaluating the extent of tumor FDG transport and metabolism. The aim of this study was to evaluate the feasibility of FDG-PET kinetic analysis in measurement of uptake parameters of FDG in the lymphoma tissues and in the assessment of treatment effects in patients with PCNSL. ***Methods:*** Dynamic FDG-PET examination was performed in 7 histologically proven PCNSL patients before and after methotrexate-based chemotherapy. ***Results:*** Before the chemotherapy, the highest CMRglc in the tumor for all 7 patients was 79.4 ± 27.2 μmol/100 g/min. This value was significantly higher than that observed in the normal cortex in 14 control patients (44.3 ± 6.0 μmol/100 g/min, $p < 0.001$). The phosphorylation (k_3) activity was also significantly higher in the tumor (0.093 ± 0.026 min^{-1}) compared with the normal cortex (0.064 ± 0.014 min^{-1}, $p < 0.05$). On the other hand, the transporter (K_1) activity in the tumor (0.079 ± 0.016 m*l*/min) was similar to that observed in the normal cortex (0.082 ± 0.012 m*l*/min). The chemotherapy significantly reduced the volume of the tumor in 6 of 7 patients and the highest CMRglc in the tumor examined 18.0 ± 5.5 days after the chemotherapy (34.0 ± 21.8 μmol/100 g/min) was significantly lower than that observed before the chemotherapy ($p < 0.01$). This reduction in FDG uptake was concomitant with a significant reduction in both the K_1 and k_3 values ($p < 0.05$). The reduction in the k_3 value after the chemotherapy was marked in 6 of 7 patients in whom the tumor responded to the first chemotherapy. ***Conclusions:*** Dynamic image acquisition can separate regional FDG uptake into FDG transport and phosphorylation activity in the lymphoma tissues. Tumor FDG uptake was significantly higher with accelerated phosphorylation activity compared with that observed in the normal cortex.

Keywords: glucose transport, glucose phosphorylation, fluorodeoxyglucose, PET (positron emission tomography), primary central nervous system lymphoma