The effect of chemotherapy on rat brain PET: preliminary study

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1. Introduction

Chemotherapy was widely used for the therapy of cancer patients. When chemotherapy was performed, transient cognitive memory problem was occurred. This cognitive problem in brain was called as chemobrain. In this study, we have developed rat model for chemobrain. Cerebral glucose metabolism after chemotherapy was assessed using animal PET and voxel based statistical analysis method.

2. Methods and Results

2.1 rat model for chemobrain

5 mg/kg of doxorubicin and 100 mg/kg of clophosphamide were used for construction of rat model for chemobrain.

2.2 PET acquisition

Siemens Inveon PET scanner was used throuput [1]. 1 head of chemobrain model was constructed. Before and after 2 months of construction of rat model for chemobrain, F-18 FDG PET was performed for the assessment of cerebral glucose metabolism. For the comparison, 10 heads of normal rat brain PET was performed. 1 mCi of FDG was injected. 30 min of emission PET data was acquired. For the attenuation correction, transmission PET was performed before the acquisition of emission PET data. Energy window was set to 350~650 keV.

Listmode PET data was histogrammed into 3D sonogram. 3DRP method was then performed for reconstruction. In addition, for efficient spatial normalization, individual PET data was also reconstructed using MAP reconstruction method.

2.3 Voxel based statistical analysis

For the analysis of chemobrain model for rat brain PET, voxel based statistical analysis was performed [2-4]. For the efficient spatial normalization, only brain region was extracted using rectangular masking. At first, rat brain template for spatial normalization was constructed. For the construction of rat brain template, target image with best image quality was selected. Individual PET data was spatially normalized onto target image. Spatially normalized PET data were then averaged and smoothed with 2 mm FWHM gaussian kernel. Averaged and smoothed rat brain PET was used for rat brain template. After that, individual PET data was spatially normalized onto rat brain template using affine transformation. 3 mm FWHM gaussian kernel was then applied for smoothing.

Paired *t*-test was performed to identify the difference between normal control and chemobrain.

Figure 1. shows that the result of difference of cerebral glucose metabolism between normal control and chemobrain. We found that the decrease of cerebral glucose metabolism in the region of hippocampus *($p < 0.005$).*

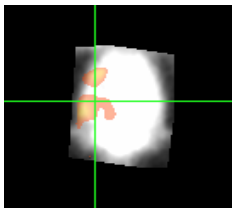

Fig. 1 Decrease of cerebral glucose metabolism was found in the region of hippocampus

3. Conclusions

We constructed the chemobrain rat model. In this preliminary study, although the number of chemobrain was so limited, decrease of cerebral glucose metabolism in the region of hippocampus was founded. Decrease of cerebral glucose metabolism in the region of hippocampus would the reason of cognitive memory problem when chemotherapy was performed.

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