^{18}F-FET and ^{18}F-choline PET/CT in patients with newly diagnosed low-grade gliomas: a pilot study

M. Hodolič 1, A. Mišir Krpan 2, A. Golubić 3, M. Žuvić 3, M. Baučić 2, G. Mrak 4, J. Nemir 4, D. Huić 3

1 Nuclear medicine research department, IASON, Graz, Austria; Nuclear Medicine Department, Faculty of Medicine and Dentistry, Palacký University Olomouc, Czech Republic
2 Department of Oncology, University Hospital Centre Zagreb, Croatia
3 Department of nuclear medicine and radiation protection, University Hospital Centre Zagreb, Croatia
4 Department of Neurosurgery, University Hospital Centre Zagreb, Croatia

Background and aim:

Low grade gliomas (LGG) account for app. 15% of all gliomas, with incidence rate of 1/100,000 persons per year. Although traditionally considered benign, most LGG gradually evolve into high grade tumours. Within 5 years it will happen in app. half of the patients.

The diagnosis of LGG is challenging. Functional Magnetic Resonance Imaging (fMRI) results are often inconclusive, ambiguous or indeterminate. The definitive diagnosis can only be achieved by brain biopsy, which is invasive, sometimes inaccessible, associated with sampling errors because of tumours heterogeneity.

Hence, functional imaging modalities are useful in addition to structural information and pathohistological findings.

O-(2-[18F]-fluoroethyl)-L-tyrosine (18F-FET) has been recently approved in European Union as a PET radiopharmaceutical for characterisation of brain lesions suggestive of gliomas. 18F-FET has advantage of displaying a high tumour-to-background ratio and of not accumulating in inflammatory lesions. Because of low uptake of radiotracer in normal brain parenchyma, fluoromethyl-(18F)-dimethyl-2-hydroxyethyl-ammonium chloride (18F-FCH) has proven to be a good alternative in diagnostic centres where 18F-FET is not available.

No study has been published on the use of 18F-FCH and 18F-FET Positron Emission Tomography (PET/CT) in the primary diagnosis of LGG. Therefore, the objective of this pilot study was to determine accuracy of primary diagnosis of LGG with choosing the appropriate PET radiopharmaceutical.

Methods:

This pilot study comprised 8 patients (age 37-80 years) with suspected LGG, diagnosed with 3T MRI and/or stereotactic brain biopsy. After MRI and/or stereotactic brain biopsy all patients underwent 18F-FCH and 18F-FET PET/CT scanning within one week. Scans were performed 20 minutes after intravenous injection of 185 MBq 18F-FCH or 18F-FET. Patients underwent surgery within one to two weeks after PET/CT scanning. Pathohistological results were compared with 18F-FCH and 18F-FET PET/CT findings.

Results:

Seven out of eight patients with suspected LGG had full imaging diagnostics with final pathohistological findings after surgery: Five of them were MRI and pathohistologically diagnosed as LGG: four were positive on 18F-FET PET (SUVmax: 1.7; 2; 2.8 and 1.8 respectively) and negative on 18F-FCH PET/CT scan. One patient with pathohistologically proved LGG had negative 18F-FET and negative 18F-FCH PET/CT.

Two patients diagnosed as LGG on MRI were confirmed as glioblastoma multiforme after surgery: both of them were positive on 18F-FCH (SUVmax 3.9 and SUVmax 1.6) and 18F-FET (SUVmax 3.1 and SUVmax 3) PET/CT.

The last patient who entered this study had negative 18F-FCH scan and positive 18F-FET (SUVmax. 1.5) PET/CT scan but has no final pathohistological diagnosis yet.

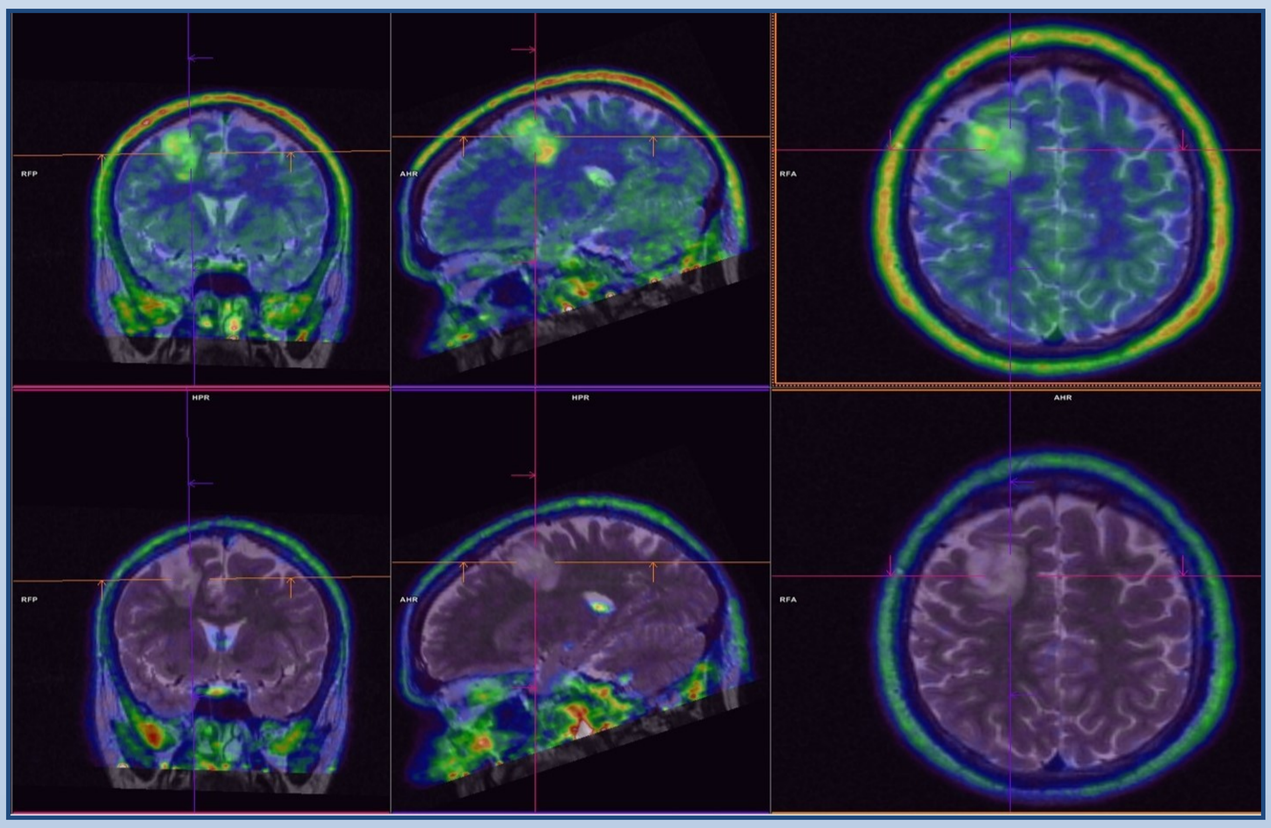

Fig. 18F-FET positive PET fused with MRI (upper row), and 18F-FCH negative PET fused with MRI (lower row) in a patient with LGG

Conclusion:

Preliminary results based on a small number of patients showed that appropriate radiopharmaceutical should be chosen before performing PET/CT scan in patients with newly diagnosed low grade gliomas.

18F-FCH seems not to be appropriate tracer in patients with newly diagnosed low grade gliomas.

Both tracers, 18F-FCH and 18F-FET, seems to be appropriate in primary diagnosis of high grade gliomas.

The study is ongoing.