18F FET PET case series

A total of 6 healthy controls (age = 19-25 years, 3 males and 3 females) with brain Positron emission tomography images and radiation dosimetry and 12 patients (median age = 60 years, 6 males and 6 females) with primary (n = 5) or metastatic brain tumor (n = 7) were enrolled. Moon et al. acquired 60-minute dynamic brain PET images after injecting 370 MBq of D-18F-FMT. Time-activity curves of D-18F-FMT uptake in normal brain versus brain tumors and tumor-to-background ratio were analyzed for each PET data set.

Normal cerebral uptake of D-18F-FMT decreased from 0 to 5 minutes after injection, but gradually increased from 10 to 60 minutes. Tumoral uptake of D-18F-FMT reached a peak before 30 minutes. Tumor-to-background ratio peaked at less than 15 minutes for 8 patients and more than 15 minutes for 4 patients. The mean effective dose was calculated to be 13.2 μSv/MBq.

Using D-18F-FMT as a PET radiotracer is safe. It can distinguish brain tumor from surrounding normal brain tissues with a high contrast. Early-time PET images of brain tumors should be acquired because the tumor-to-background ratio tended to reach a peak within 15 minutes after injection [1)].

A total of 169 18F FET PET scans were performed in 97 prospectively and consecutively included patients with known or suspected childhood CNS tumors. Scans were performed at primary diagnosis, before or after treatment, or at relapse.

Adding [18F]FET PET to MRI impacted clinical management in 8% [95% confidence interval (CI): 4-13%] of all scans (n=151) and in 33% [CI: 17-53%] of scans deemed clinically indicated due to difficult decision-making on MRI alone (n=30). Using pathology or follow-up as reference standard, the addition of [18F]FET PET increased specificity (1.00 [0.82-1.00] vs. 0.48 [0.30-0.70], p=0.0001) and accuracy (0.91 [CI: 0.87-0.96] vs. 0.81 [CI: 0.75-0.89], p=0.04) in 83 treated lesions and accuracy in 58 untreated lesions (0.96 [CI:0.91-1.00] vs 0.90 [CI:0.82-0.92], p<0.001). Further, in a subset of patients (n=15) [18F]FET uptake correlated positively with genomic proliferation index.

The addition of [18F]FET PET to MRI helped discriminate tumor from non-tumor lesions in the largest consecutive cohort of pediatric CNS tumor patients [2)]

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47 patients were included in the study of whom 15 had confirmed glioma and seven had confirmed alternative diagnosis. 18F FET PET shows significantly higher uptake in high-grade glioma than in non-glioma. Lesions with TBRmax >2.5 should be considered suspicious for glioma and biopsy considered. Threshold TBRmax > 3.0 is useful for differentiating high-grade glioma from Low-grade glioma. This may be a particularly useful tool for directing management in eloquent areas, such as brainstem glioma [3)].

Schebesch et al., from the University Medical Center Regensburg, Germany published five patients (3 female, 2 male; mean age 45.4 years) who underwent fluorescence-guided surgery for supratentorial, intracerebral lesions which showed no contrast-enhancement in the preoperative MRI but were, however, strongly suspicious for gliomas. Accordingly, all patients received a preoperative FET-PET

scan and detailed histopathological workup was performed. After giving written informed consent, all patients received 5 mg/kg of FL at the induction of anesthesia. Surgery was conducted under white light and under the YELLOW 560 nm filter. They reviewed the surgical protocols, navigational storage and the image databases of our surgical microscopes for evidence of intraoperative fluorescence that corresponded to the FET-PET positive area.

In all patients they found distinct accordances between the FET-PET positive areas and the fluorescing regions within the targeted lesions. Histopathological workup of the fluorescent tissue revealed anaplastic oligodendroglioma, IDH-mutant and 1p/19-codeleted (WHO grade III) (n = 2), anaplastic astrocytoma, IDH-mutant (WHO grade III) (n = 1), oligodendroglioma, IDH-mutant and 1p/19q-codeleted (WHO grade II) (n = 1) and pilocytic astrocytoma (WHO grade I) (n = 1). No adverse events were noted.

Despite the lack of gadolinium-enhancement in the preoperative MRI, all patients intravenously received FL to guide resection. Irrespective of the final grading, FL was extremely helpful in detecting the lesions and in identifying their border zones. In selected patients with NEG, but strong metabolic activity according to the FET-PET, FL may significantly increase the accuracy of surgery [4].

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MRI and FET-PET were performed preoperatively and postoperatively in 62 patients undergoing 63 operations. FET-PET was performed in 43 cases within 72 hours after resection and in 20 cases >72 hours after resection. Detection and measurement of volume of residual tumors were compared. Correlations between residual tumor detection and timing of PET after resection and recurrence were examined.

Complete resection was confirmed by both imaging modalities in 44% of cases, and residual tumor was detected consistently in 37% of cases. FET-PET detected residual tumor in 14% of cases in which MRI showed no residual tumor. MRI showed residual tumors in 5% of cases that were not identified by PET. Average PET-based residual tumor volume was higher than MRI-based volume (3.99 cm(3) vs. 1.59 cm(3)). Detection of and difference in volume of residual tumor were not correlated with timing of PET after resection or recurrence status.

Postoperative FET-PET revealed residual tumor with higher sensitivity than MRI and showed larger tumor volumes. In this series, performing PET >72 hours after resection did not influence the results of PET. We recommend FET-PET as a helpful adjunct in addition to MRI for postoperative assessment of residual tumor [5].

1)
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