Time activity curve

Aim of Blanc-Durand et al., of the Lausanne University Hospital in Switzerland was to develop a full automatic clustering approach of the time-activity curves (TAC) from dynamic 18F-FET PET and evaluate its association with IDH1 mutation status and survival in patients with gliomas.

Thirty-seven patients (mean age: 45±13 y) with newly diagnosed gliomas and dynamic 18F-FET PET before any histopathologic investigation or treatment were retrospectively included. Each dynamic 18F-FET PET was realigned to the first image and spatially normalized in the Montreal Neurological Institute template. A tumor mask was semi-automatically generated from Z-score maps. Each brain tumor voxel was clustered in one of the 3 following centroids using dynamic time warping and k-means clustering (centroid #1: slowly increasing slope; centroid #2: rapidly increasing followed by slowly decreasing slope; and centroid #3: rapidly increasing followed by rapidly decreasing slope). The percentage of each dynamic 18F-FET TAC within tumors and other conventional 18F-FET PET parameters (maximum and mean tumor-to-brain ratios [TBRmax and TBRmean], time-to-peak [TTP] and slope) was compared between wild-type and IDH1 mutant tumors. Their prognostic value was assessed in terms of progression free-survival (PFS) and overall survival (OS) by Kaplan-Meier estimates.

Twenty patients were IDH1 wild-type and 17 IDH1 mutant. Higher percentage of centroid #1 and centroid #3 within tumors were positively (P = 0.016) and negatively (P = 0.01) correlated with IDH1 mutated status. Also, TBRmax, TBRmean, TTP, and slope discriminated significantly between tumors with and without IDH1 mutation (P range 0.01 to 0.04). Progression occurred in 22 patients (59%) at a median of 13.1 months (7.6-37.6 months) and 13 patients (35%) died from tumor progression. Patients with a percentage of centroid #1 > 90% had a longer survival compared with those with a percentage of centroid #1 < 90% (P = 0.003 for PFS and P = 0.028 for OS). This remained significant after stratification on IDH1 mutation status (P = 0.029 for PFS and P = 0.034 for OS). Compared to other conventional 18F-FET PET parameters, TTP and slope were associated with PFS and OS (P range 0.009 to 0.04).

Based on dynamic 18F-FET PET acquisition, they developed a full automatic clustering approach of TAC which appears to be a valuable noninvasive diagnostic and prognostic marker in patients with gliomas [1].

1)
Blanc-Durand P, Van Der Gucht A, Verger A, Langen KJ, Dunet V, Bloch J, Brouland JP, Nicod-Lalonde M, Schaefer N, Prior JO. Voxel-based 18F-FET PET segmentation and automatic clustering of tumor voxels: A significant association with IDH1 mutation status and survival in patients with gliomas. PLoS One. 2018 Jun 28;13(6):e0199379. doi: 10.1371/journal.pone.0199379. eCollection 2018. PubMed PMID: 29953478.