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[18F]DOPA PET for lesion definition and contouring using different thresholds in patients with gliomas

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Abstract

Background: Amino-acid (AA) PET has recently been endorsed by the ESTRO-EANO guidelines for RT-planning in glioblastomas, with recommended lesion-to-brain-ratio thresholds (1.6-1.8) derived from a biopsy-controlled FET-PET study. We aimed to compare target definition at [18F]DOPA-PET between the ESTRO-EANO thresholds and other biological-tumor-volume (BTV) thresholds (derived from the striatum) typically used in [18F]DOPA-PET.

Methods: A retrospective analysis was conducted on glioma patients scanned with [18F]DOPA-PET/CT at our center between April 2021 and January 2024. 3D BTV was semi-automatically computed using a dedicated workstation (Philips HealthCare) with four thresholds: $1.6 \times \text{SUV}_{\text{mean}}$ of background, $1.8 \times \text{SUV}_{\text{mean}}$ of background, SUV_{mean} and SUV_{max} of the contralateral striatum. The delineation accuracy of different thresholds was visually evaluated and a t-test was used to compare the different VOIs volumes (0.05 significance-level).

Results: 50 patients were included (36 previously received surgery). Volume definition based on the striatum SUV_{max} was significantly smaller compared to other thresholds (2.1 cm³), resulting in inaccurate VOIs at visual inspection in 21/50 patients. No significant differences were highlighted in BTV defined based on 1.6 or $1.8 \times \text{SUV}_{\text{mean}}$ of background (15.7 vs. 12.7 cm³; VOIs accurate in 49/50 and 46/50 patients, respectively). BTV based on striatum SUV_{mean} was significantly smaller compared to the $1.6 \times \text{SUV}_{\text{mean}}$ threshold only in surgically-treated patients ($p=0.04$), while no significant differences were highlighted compared to the $1.8 \times \text{SUV}_{\text{mean}}$ threshold regardless of the patients' group.

Conclusions: The ESTRO-EANO FET-PET thresholds proved to be interchangeable in patients scanned with [18F]DOPA-PET, while the use of a threshold based on the contralateral-striatum SUV_{mean} provided partially overlapping results prompting further investigation.

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