Example of Artificial Intelligence–Based Decision Support for Amino Acid PET: Early Prediction of Suspected Brain Tumor Foci for Patient Management

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A 43-y-old man with equivocal findings on anatomic MRI underwent additional *O*-(2-[^{18}F]fluoroethyl)-L-tyrosine (^{18}F-FET) PET for further diagnosis of a suspected glioma. MRI showed no contrast enhancement, but fluid-attenuated inversion recovery (FLAIR) hyperintensities were apparent in the left thalamus and frontoparietal region (Fig. 1A). In spatial correspondence with the FLAIR signal alterations, only the left thalamic region segmented by an experienced nuclear medicine physician showed a slightly increased ^{18}F-FET uptake (mean tumor-to-brain ratio, 1.5) (Fig. 1B).

The baseline ^{18}F-FET PET was subsequently analyzed using the artificial intelligence (AI)–based segmentation tool JuST_Brain-PET (*1*). Surprisingly, a second lesion in the frontoparietal region, not segmented by the expert, was identified by the AI algorithm (Fig. 1B).

Although the left thalamic lesion showed no progression in the follow-up imaging 4 mo later, the additional frontoparietal lesion, initially considered a false-positive, progressed to become a small contrast-enhancing and metabolically active lesion (mean tumor-to-brain ratio, 2.1) (Fig. 1C). Neuropathologic analysis of tissue obtained from stereotactic biopsy revealed a molecular glioblastoma (central nervous system World Health Organization grade 4, isocitric dehydrogenase wild type, telomerase reverse transcriptase promoter mutant) without typical histologic findings such as microvascular proliferation and necrosis (*2*).

Although neither the thalamic nor the frontoparietal lesion showed pathologically increased ^{18}F-FET uptake on the baseline scan, the AI tool correctly predicted a pathologic process at an early disease stage and could have potentially influenced diagnostic and treatment decisions, such as biopsy guidance and target volume definition for radiotherapy.

This incidental finding highlights the potential of AI-based decision support for patient management in terms of diagnostic and treatment planning based on amino acid PET.

The study was approved by the local ethics committees (EK 055/19), and the subject gave written informed consent.

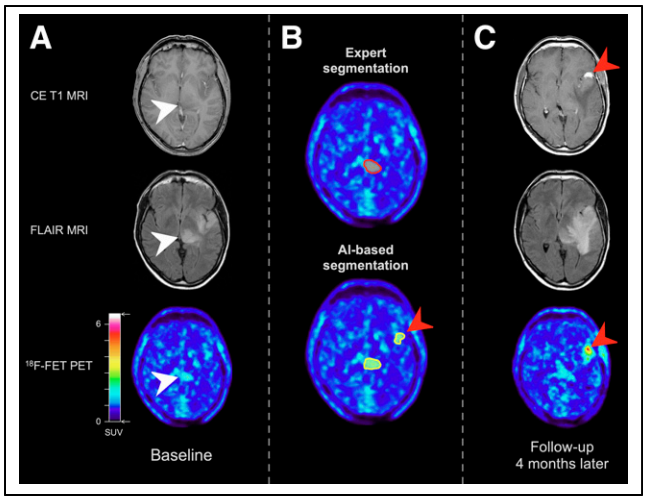

FIGURE 1. Baseline scan (A), segmentation results (B), and follow-up scan (C) from patient with molecular glioblastoma. Baseline MRI showed FLAIR hyperintensities in left thalamus and frontoparietal region (white arrowheads). In contrast to expert segmentation, in which only left thalamic region showed slightly increased uptake (red contour), AI algorithm identified additional frontoparietal lesion on baseline PET that subsequently progressed to contrast-enhancing and metabolically active lesion (red arrowheads). CE T1 = contrast-enhanced T1-weighted.

DISCLOSURE

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