The role of [18 F]FDOPA PET as an adjunct to conventional MRI in the diagnosis of aggressive glial lesions

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Abstract

Background: Amino acid PET is recommended for the initial diagnosis of brain lesions, but its value for identifying aggressive lesions remains to be established. The current study therefore evaluates the added-value of dynamic [18 F]FDOPA PET as an adjunct to conventional MRI for determining the aggressiveness of presumed glial lesions at diagnosis.

Methods: Consecutive patients, with a minimal 1 year-follow-up, underwent contrast-enhanced MRI (CE MRI) and dynamic [18 F]FDOPA PET to characterize their suspected glial lesion. Lesions were classified semi-automatically by their CE MRI (MRI-/+), and PET parameters (static tumor-to-background ratio, TBR; dynamic time-to-peak ratio, TTP_{ratio}). Diagnostic accuracies of MRI and PET parameters for the differentiation of tumor aggressiveness were evaluated by chi-square test or receiver operating characteristic analyses. Aggressive lesions were either defined as lesions with dismal molecular characteristics based on the WHO 2021 classification of brain tumors or with compatible clinico-radiological profiles. Time-to-treatment failure (TTF) and overall survival (OS) were evaluated.

Results: Of the 109 patients included, 46 had aggressive lesions (45 confirmed by histo-molecular analyses). CE MRI identified aggressive lesions with an accuracy of 73%. TBR_{max} (threshold of 3.2), and TTP_{ratio} (threshold of 5.4 min) respectively identified aggressive lesions with an accuracy of 83% and 76% and were independent of CE MRI and clinical factors in the multivariate analysis. Among the MRI-lesions, 11/56 (20%) were aggressive and respectively 55% and 50% of these aggressive lesions showed high TBR_{max} and short TTP_{ratio} in PET. High TBR_{max} and short TTP_{ratio} in PET were significantly associated to poorer survivals ($p \leq 0.009$).

Conclusion: Dynamic [18 F]FDOPA PET provides a similar diagnostic accuracy as contrast enhancement in MRI to identify the aggressiveness of suspected glial lesions at diagnosis. Both methods, however, are complementary and [18 F]FDOPA PET may be a useful additional tool in equivocal cases.

Keywords: Amino acid; Dynamic; Fluorodopa F 18; Glioma; Magnetic resonance imaging; Positron emission tomography.

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