18 F-DOPA PET SCAN MAPPED WITH RADIOTHERAPY DOSIMETRY FOR THE MANAGEMENT OF TUMOR RECURRENCE VERSUS RADIATION NECROSIS IN HIGH GRADE GLIOMAS: AN INSTITUTIONAL EXPERIENCE

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Abstract

Objectives:

Patients with High grade glioma (HGG) who underwent chemoradiation usually have routine Magnetic Resonance Imaging (MRI) every 2-3 months for surveillance. Quite often, the treatment related changes including radiation necrosis (RN) and pseudo-progression (PP) are indistinguishable from tumor recurrence (TR), which can cause significant dilemma to the treating physician. The main aim of this study is to investigate the utility of Fluoro-dihydroxyphenylalanine Positron Emission Tomography ( 18 F - DOPA PET) scan mapped with radiotherapy planning dosimetry in differentiating true progression from RN and PP during follow up, and the potential application in further treatment management.

Methods and Materials:

We retrospectively reviewed ten accrued HGG patients over a duration of 12 months, who were initially treated with concurrent chemoradiation and found to have clinical and/or MRI changes suggesting TR or RN on follow up. Each patient underwent a 18 F-DOPA PET scan and the images were mapped with the corresponding CT and MRI radiotherapy plan. We then analyzed the overlap of fused images with the contours of primary tumor and target volumes. Descriptive analysis was used to identify TR and RN, and patterns of correlation with dosimetry.

Results:

18 F-DOPA PET scan identified TR in eight patients and RN in two patients. Majority of scans identified progression based on PET metabolic uptake. Tumor progression was identified inside the PTV target volume in four patients. Tumor progression outside the high dose volume was identified in one patient and at marginal borders of targets in three patients. We found the mirror symmetry of PET finding inside the brain, baseline extent of tumor, and uptake changes over time useful in recognizing a differentiating pattern when compared with the initial planning scan. Also, utility of 18 F-DOPA PET scan may go beyond identification of necrosis in Radiation Oncology. It can reveal early metabolic uptake in irradiated area upon recurrence and identify potential re-treatment opportunities upon mapping of low-dose areas.

Conclusion:
18 F-DOPA PET scan has significant utility for future CNS practice in Radiation Oncology, indicating not just necrosis from prior radiotherapy, but identifying early tumor progression, its location and opportunity for re-treatment based on the mapped dosimetry.