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Metabolic delineation of IDH1 wild-type glioblastoma surgical anatomy: how to plan the tumor extent of resection

Roberto Altieri ^{1 2}, Francesco Certo ^{3 4}, Daniela Pacella ⁵, Giacomo Cammarata ³, Marco Garozzo ³, Giuseppe Broggi ⁶, Rosario Caltabiano ⁶, Gaetano Magro ⁶, Giorgio Russo ⁷, Sebastiano Cosentino ⁸, Massimo Ippolito ⁸, Giuseppe Barbagallo ^{3 4}

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Abstract

Purpose: Magnetic resonance imaging (MRI) is the current standard for preoperative planning of glioblastoma (GBM) surgery. However, recent data on the use of ¹¹C-methionine positron emission tomography (¹¹[C]-MET PET) suggest its role in providing additional information beyond MRI. The purpose of this study is to establish if there is a correlation between anatomical and metabolic data.

Methods: We retrieved all GBM cases treated from 2014 to January 2021. Preoperative MRI (Enhancing Nodule -EN-, FLAIR and Total Tumor Volume -TTV-), PET volumes and histological samples obtained from the different tumor regions were evaluated to analyze potential correlations between anatomical, metabolic and pathological data.

Results: 150 patients underwent surgery for GBM and 49 of these were also studied preoperatively with ¹¹[C]-MET PET; PET volume was evaluated in 47 patients. In 33 patients (70.21%) preoperative ¹¹[C]-MET PET volume > preoperative EN volume and in 11 (23.4%) preoperative ¹¹[C]-MET PET volume > preoperative TTV. We found a significant correlation between preoperative TTVs and PET volumes ($p = 0.016$) as well as between preoperative EN volumes and PET volumes ($p = < 0.001$). Histologically, 109 samples were evaluated. ENs samples exhibited the conventional GBM morphology while samples from the FLAIR regions showed white matter tissue, with focal to diffuse tumor cells infiltration and areas of reactive astrogliosis.

Conclusion: We submit that ¹¹[C]-MET PET volume generally overcome EN. The presence of neoplastic cells confirm these metabolic data. It should be considered in the surgical planning to achieve a Supra Total Resection (SupTR).

Keywords: ¹¹[C]-MET PET; Glioblastoma; High Grade Gliomas; MRI; PET.

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