The Utilization of Quantitative Analysis Software to Characterize Changes in Regional Brain Metabolism due to Metastatic Disease

Arjun B. Ashok[1], Eric M. Teichner[1], Robert C. Subtirelu[2], Chitra Parikh[1], Sahithi Talasila[1], William Y. Raynor[3]

1. Sidney Kimmel Medical College of Thomas Jefferson University, Philadelphia, PA, USA
2. Perelman School of Medicine of the University of Pennsylvania, Philadelphia, PA, USA
3. Hospital of the University of Pennsylvania Department of Radiology, Philadelphia, PA, USA

Introduction

Metastatic lesions of the brain are capable of causing significant neurological dysfunction varying based on the functional anatomy of lesion location. 18-Fluorodeoxyglucose (FDG) PET/CT imaging can be used to identify regions of altered brain metabolism in the setting of metastatic disease - however, further software-based regional quantitative analysis of scans may aid in presurgical planning and postsurgical tracking of recovery. This study pioneers the utilization of MIMneuro (MIM Software, Inc., Cleveland, OH, USA) for the regional characterization of changes in global brain metabolism in the setting of brain metastasis.

Methods

Our study participant is a 58-year-old male patient with a history of stage IIB melanoma of the upper back. The patient underwent a baseline CT and a subsequent 18-FDG PET/CT scan 2 months after baseline. We utilized MIMneuro version 7.1.5 (MIM Software, Inc., Cleveland, OH, USA) with an integrated anatomic atlas to conduct a comprehensive regional brain metabolism analysis in 70 distinct brain regions. Regions within or spatially adjacent to the site of the lesion were excluded.

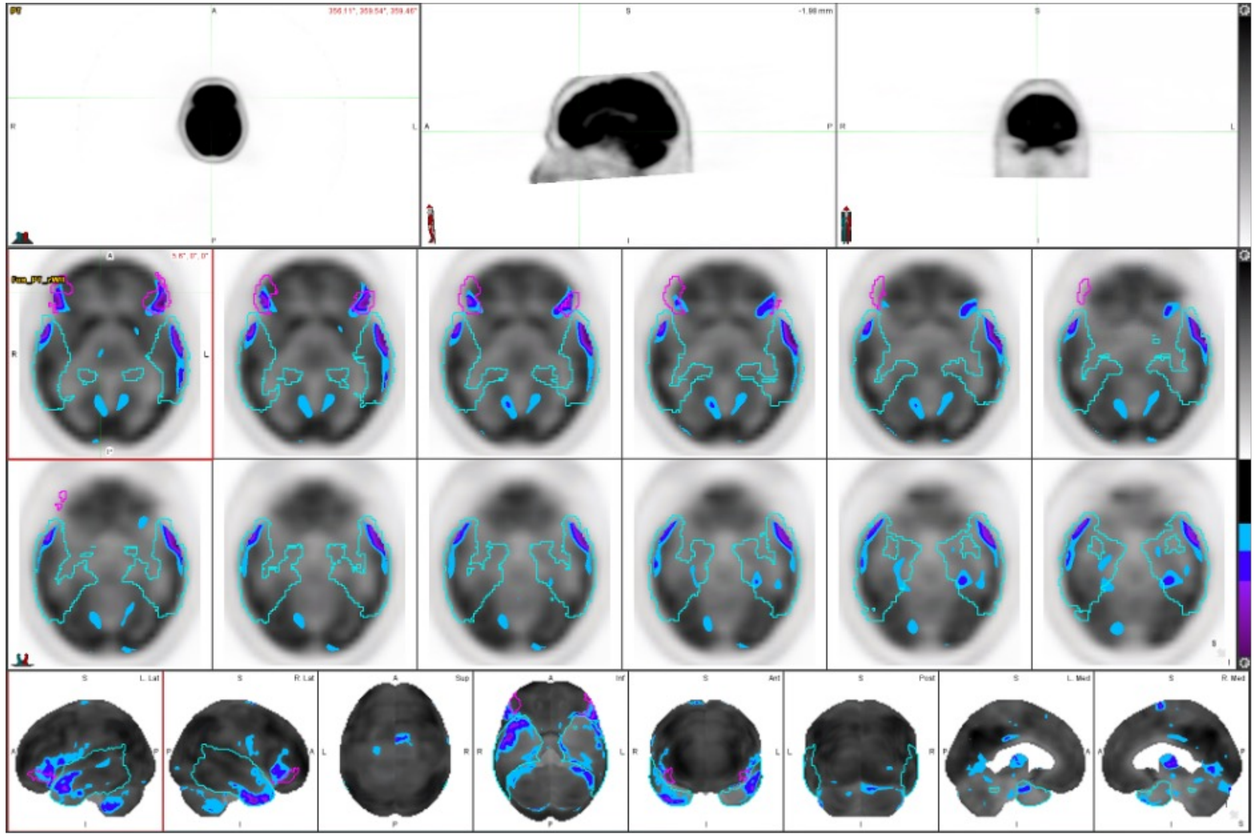

Figure 1 – Evaluation of 18-FDG-PET through quantitative analysis using MIMNeuro version 7.1.5 (MIM Software, Inc., Cleveland, OH, USA). Low 18-FDG uptake is represented by purple and blue contours. The temporal lobe (light blue) and pars orbitalis (pink) have been delineated as regions of interest in this patient.

Results

Baseline CT showed no evidence of metastatic disease in the central nervous system. 18-FDG PET/CT revealed a focus of hyperdensity within the posterior limb of the right internal capsule concerning for hemorrhagic metastasis, although not FDG-avid. PET/CT additionally demonstrated significant bilateral hypometabolism in the temporal lobe (z=-2.37), lateral temporal lobe (z=-1.97), temporal pole (z=-2.22), and pars orbitalis (z=-2.51).

Conclusions

Significantly decreased metabolism in regions responsible for auditory processing and language function may reflect the detrimental effect of metastatic disease to the acoustic sensory fibers of the posterior limb of the internal capsule.

Our results demonstrate the potential of MIMneuro software to characterize functional changes in brain metabolism due to metastasis using 18-FDG PET/CT scans. This may further aid in presurgical planning of tumor resection, and correlate with clinical findings of neurologic and sensory function before and after surgery.

References:
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2. Costa M, Braga VL, Yağmurlu K, Centeno RS, Cavalheiro S, Chaddad-Neto F. A Technical Guide for Fiber Tract Dissection of the Internal Capsule. Turk Neurosurg. 2018;28(6):934-939.