Dynamic Glucose-Enhanced MRI of Metabolic Connectivity in Huntington's Disease Mouse Models

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Purpose: Understanding the coordination of glucose metabolism across brain regions can provide insights into energy distribution in cerebral function. This study aims to explore the interregional connectivity of glucose metabolism in wild-type (WT) and Huntington’s Disease (HD) mouse models using Dynamic Glucose-Enhanced (DGE) MRI. Procedure: Using DGE MRI, metabolic connectivity was analyzed in WT and R6/2 KI HD mouse models. Pearson correlation coefficients of regional glucose metabolism were calculated, and temporal dependency was assessed. A glucose analog, 2-deoxy-D-glucose (2DG), was used to distinguish metabolic coordination from transport processes. Results: Significant differences in glucose metabolism coordination were observed between WT and HD mice. Temporal analysis revealed distinct patterns of metabolic connectivity across pre- and post-peak glucose injection intervals. The introduction of 2DG confirmed that the observed metabolic coordination was driven by both glucose metabolism and transport processes. Conclusions: This research highlights the altered metabolic connectivity in HD models and emphasizes the role of temporal dynamics in glucose metabolism. These findings could inform biomarker identification for HD and contribute to understanding brain energy distribution mechanisms.

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