Validating AI-based Pre-operative Prediction of Glioblastoma Recurrence Location

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Background and Hypothesis: Glioblastomas (GBM) are aggressive brain cancers with poor prognoses and an average survival of 18 months. Surgical resection is the most effect treatment, but GBM is characterized by recurrence. Artificial intelligence (AI) can identify abnormalities in imaging imperceptible to humans. We plan to utilize a pre-operative MRI-based algorithm that identified regions of higher rates of cancer infiltration where recurrence is likely to occur. The goal is to use this model to guide extra tumor resection of high-risk regions. This model has yet to be validated with an external system, an essential step for machine learning studies. Here, we are working to validate our AI-based model.

Methods: We identified patients with pathology-confirmed glioblastoma from 2021 and prior. These patients then were screened by the following requirements: pre-operative MRI scans of T1, T1+Contrast, T2, T2 FLAIR, ADC, DTI, and DSC sequences; initial gross-total resection; and neuro-oncology diagnosed recurrence by change in treatment. The pre-operative scans for patients are pre-processed with NFTI conversion, skull stripping, and noise reduction. Scans are used to validate the AI-based recurrence model by comparison with post-recurrence scans.

Results: Results from the multi-institutional consortium of which the model was trained have shown an overall odds ratio of 12.0 and area under curve of 0.80 at 99% confidence intervals. Within our selected patient population of recurrent GBM, we have identified that 63% are male, 50% are over the age of 60 years old, 100% are IDH-wild type, and 63% have demonstrated MGMT promoter methylation.

Future Impact: We are currently in the process of collecting and segmenting a large validation cohort. The AI model's prediction accuracy and robustness is validated with this data outside of the institutions of which the model was trained. The future purpose is to direct supramarginal resection and targeted radiation therapy to areas with higher probability of GBM infiltration.