

Advanced fiber tractography aids in maximizing extent of resection while preserving eloquent networks in low grade glioma surgery: A single center experience

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Abstract

Introduction: Advanced tractography has emerged as a critical tool in identifying relevant white matter networks. Now seamlessly integrated into current neurosurgical workflows, Quicktome machine-learning analysis has enabled subject specific parcellation maps to be computed based on diffusion tensor imaging. The aim of this study is to determine the utility of Quicktome machine-learning analysis in guiding extent of resection and preserving eloquent networks in low grade glioma.

Methods: Patients from 2021-2024 who have undergone histopathologically confirmed low grade glioma tumor resection with both pre- and post-operative Quicktome tractography maps were retrospectively reviewed.

Results: Among 17 total patients (median age 35 years, 88.2% female), the majority were diagnosed with astrocytoma (n=11, 64.7%), followed by oligodendroglioma (n=5, 29.4%) and ganglioglioma (n=1, 5.9%). Tumor locations were frontal (n=8), temporal (n=4), parietal (n=3), and left insular (n=2). Post-operative deficits occurred in 6 (35.3%) patients, which were all resolved or improving on last follow-up (median 8 months, range 1- 43). Deficits included visual neglect (n=1, left parietal), mental fog/fatigue (n=1, right frontal), leg paresthesia (n=1, left frontoparietal), expressive aphasia (n=1, left insular), disinhibition (n=1, left temporal), and left facial weakness (n=1, left mesial temporal). Of these deficits 4 (66.7%) were expected and corresponded with tractography, and 2 (33.3%) including disinhibition (left temporal) and left facial weakness (left mesial temporal) were not explained by tractography. Gross total resection was achieved in 12 (70.6%) patients, 5 of which experienced transient deficits. Among 5 (29.4%) patients in which intentional residual remained to preserve eloquent tracts, a single patient experienced expressive aphasia that resolved on follow-up.

Conclusion: Advanced structural white matter tractography aids in presurgical planning including guiding extent of resection, and corresponds well with expected transient neurological deficits in most cases. This enables patient specific counseling, tailored presurgical planning, and maximized resection with consistent preservation of major eloquent networks.