



CAVERNOUS MALFORMATION

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CLINICAL PRESENTATION

The patient is a 24-year-old male diagnosed with a cavernous malformation in the left posterior frontal lobe, with no prior history of cranial surgery. He presented at an outside institution with numbness on the right side of his body and difficulty with speech after experiencing an acute stroke. The institution recommended a watchful waiting approach of monitoring the lesion for six months. The patient's family sought a second opinion at Houston Methodist Hospital as an attempt to minimize the risk of another harmful episode.

Preoperative MRI displayed a left inferior frontal perirolandic lesion (1.0cc) with significant hemorrhage (Figure I). Based on the imaging results, surgical treatment was chosen to prevent the possibility of a future seizure, stroke, or bleed.

BrightMatter™ Plan (pre-operative planning software) and BrightMatter™ Servo (BrightMatter™ Guide, Vision, and Drive) were used to both plan and execute the cranial surgery.



Figure I: Standard MR imaging visualizing the lesion: axial T1 with contrast (left) and sagittal T1 with contrast (right).

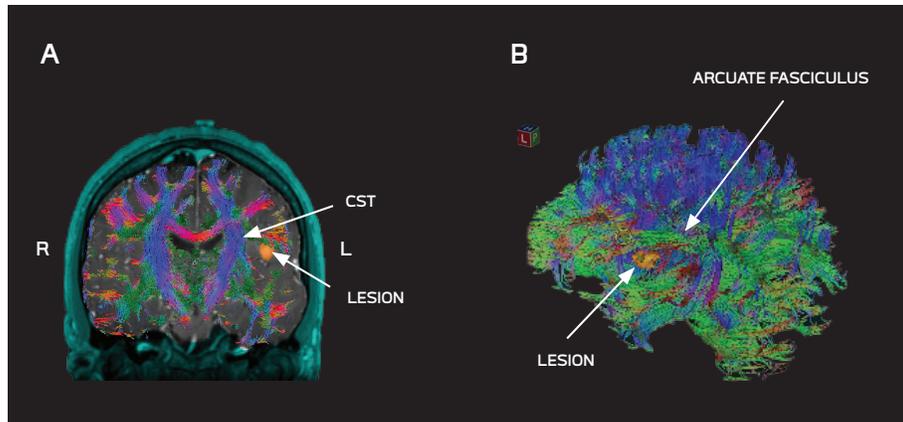


Figure II: Preoperative DTI visualized using BrightMatter™ Plan demonstrates that the lesion was in close proximity to (A) the left corticobulbar tract, the left cortical spinal tract (CST), (B) the horizontal segment of the left superior Arcuate Fasciculus (AF) and the left superior longitudinal fasciculus.

SURGICAL PLAN

Preoperative visualization of whole brain tractography using BrightMatter™ Plan revealed that the lesion was in close proximity to key fascicular anatomy, particularly the left CST and AF (Figure II). Studies have shown that this pathway is crucially involved with human language, specifically relating to repetition, language processing and speech comprehension.¹ The surgeon planned the surgical approach to avoid the AF, minimizing the risk of damage to white matter anatomy. Visualization of tractography was critical to creating this surgical plan.

CASE HIGHLIGHTS

- BrightMatter™ Plan enabled visualization of key fascicular anatomy including the left CST and AF to define the surgical approach.
- BrightMatter™ Guide enabled the surgeon to relocate the initial engagement point on the fly to avoid the AF and provide a greater margin of safety.

¹Fridriksson, J., et al. Damage to the anterior AF predicts non-fluent speech production in aphasia. (2013).



SURGICAL MANAGEMENT

Prior to resection, the surgical plan was exported to BrightMatter™ Guide. BrightMatter™ Guide was used to detect entry and locate the target based on the preoperative plan, which was initially created to avoid the AF (Figure III). The surgeon used BrightMatter™ Guide to relocate the engagement point intraoperatively 1.01 cm inferior to the original location to further increase the margin of safety (Figure IV).

The surgeon proceeded with an awake minimally-invasive craniotomy with the patient positioned supine and the nose rotated at 2:00. Access to the surgical target was enabled using the NICO™ BrainPath. Synaptive's hands-free device positioning system, BrightMatter™ Drive, and video microscope, BrightMatter™ Vision, provided automated positioning and visualization. Overall, the full BrightMatter™ solution was used throughout the entire surgery to facilitate gross resection.

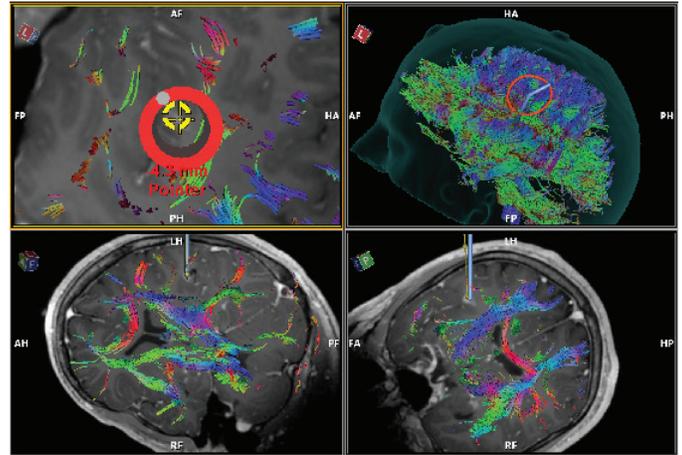


Figure III: BrightMatter™ Guide was used to detect entry and locate the target.

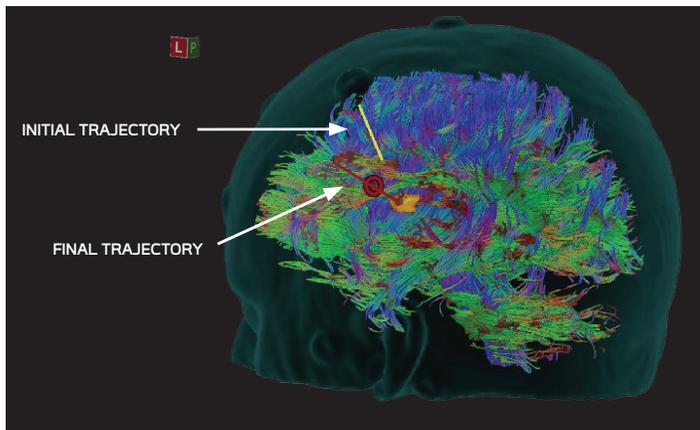


Figure IV: Initial trajectory (yellow) using BrightMatter™ Plan and final trajectory (red) using BrightMatter™ Guide. The surgeon used BrightMatter™ Guide to relocate the engagement point 1.01 cm inferior to the original location.

CLINICAL OUTCOMES

Postoperative MRI demonstrated gross total resection of the cavernous malformation (Figure V). The patient was discharged after an overnight stay in the ICU. The patient experienced mild weakness in his right arm, headaches, and trouble recalling some words in the first 24 hours. The patient's symptoms diminished afterwards, and they regained full function. Surgical intervention led to preservation of both speech and comprehension.

The patient experienced no postoperative complications or deficits.

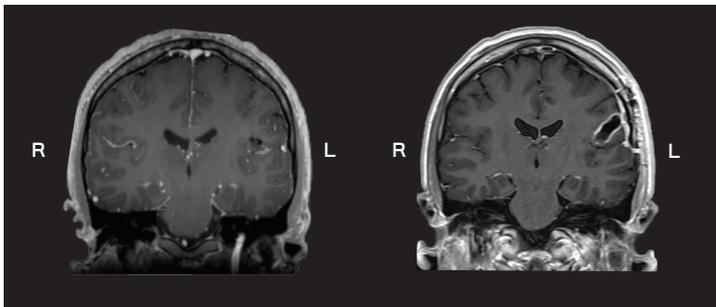


Figure V: Preoperative coronal T1 with contrast (left) and post-operative coronal T1 with contrast (right).

CASE HIGHLIGHTS

- Surgical care with the BrightMatter™ Solution led to preservation of both speech and comprehension, resulting in a short length of stay and no residual lesion or deficits.