

Introduction

The cingulum bundle is thought to be related with high-order cognitive function and emotional regulation. Tumors involving the cingulate gyrus are uncommon and surgically challenging. They may infiltrate the cingulum as their site of origin, or they may displace it when they arise from paracingulate areas, in which case the cingulum may be preserved. The objective of this report is to apply dMRI to evaluate the integrity of the cingulum to differentiate cingulate from para-cingulate tumors.

Methods

Retrospective evaluation of our dMRI fiber tracking database was conducted to identify patients with tumors involving the cingulum. Lesions infiltrating and/or disrupting the cingulum bundle were subclassified as primary cingulate tumors and those lesions purely displacing the cingulum were subclassified as para-cingulate tumors. Surgical technique and results were retrospectively evaluated for each subgroup.

Results

Eleven patients with cingulate / para-cingulate tumors were identified. Pre-operative dMRI fiber tracking showed 4 (36.4%) tumors purely displacing the cingulum and 7 (63.6%) infiltrating and/or disrupting it. Ten patients underwent surgical resection and 1 underwent biopsy only. Surgical approaches included anterior and posterior interhemispheric, and transcortical. For primary cingulate tumors, we performed complete resection of the involved segment of the cingulum in five out of 6 cases (83.33%) while 1 had a subtotal resection. All four patients classified as paracingulate tumors underwent preservation of the cingulum, but achieving gross total resection in 3 and sub-total resection in 1, due to motor positive stimulation during resection. One (10%) patient had postoperative transient aphasia and right-sided

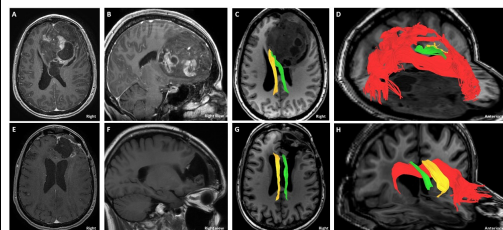
Learning Objectives

1. Describe the different types of tumor involvement in the cingulate gyrus.
2. Describe the applications of an advanced dMRI fiber tracking method in the pre-operative evaluation of tumor affecting the cingulum.
3. Define possible benefits in patient outcome when using dMRI fiber tracking in preoperative planning comparing results from the previous series using regular imaging methods.
4. Describe further directions on the surgery of tumor involving the cingulate gyrus.

Conclusions

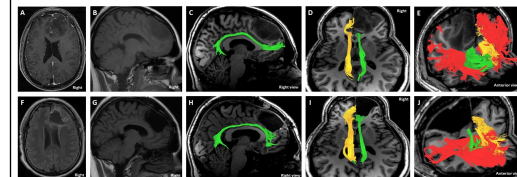
Advanced dMRI fiber tracking for surgical planning of cingulate tumors may allow cingulum bundle preservation in selected cases with maximal tumor resection and minimal rate of new post-operative deficits.

Brain MRI and HDFT study in a 43-year-old female with a glioblastoma multiform.



A, B. Contrast-MRI axial and sagittal cuts respectively showing a large partially enhanced lesion with cystic components on the right frontal lobe. C. Superior view of fiber tractography showing severe displacement and disruption of the right cingulum (green) and displacement of the left cingulum (yellow). D. Anterior view of fiber tractography showing severe displacement and disruption of the corpus callosum (red). E. Contrast-MRI showing the extent of resection also seen in a sagittal cut on F where it is clear that the cingulate gyrus and genu of the corpus callosum have been resected. G. Superior view demonstrated in fiber tractography the reestablishment of the cingulum bundle trajectory. H. Anterior view in fiber tracking showing the resection of the disrupted portion of the right cingulum (green) which corresponds with the rostral and lower segment of the genu. Also it is worthy to notice here that the left cingulum (left) has been preserved and its trajectory has returned to normal. The fibers belonging to the corpus callosum (red) have been resected along the tumor since they were infiltrated and already disrupted by the lesion.

Brain MRI and HDFT in a 28-year-old man with an astrocytoma (WHO grade 2).



Contrast-MRI shows a non-contrast mass on the right frontal lobe on an axial cut. B. Sagittal slide shows displacement of the cingulate gyrus and corpus callosum. C. Right view, sagittal cut on fiber tracking shows displacement of the right cingulum fibers (green) on the anterior segment also affecting the arborization of this tract on the frontal lobe, which can be also confirmed on D (posterior view, left cingulum in yellow) and E (anterior view) where it is also evident the mass effect of the lesion over the corpus callosum (red) displacing it downward and laterally to the right. F, G axial and sagittal cuts respectively showing gross total resection of the tumor. H, sagittal cut showing preservation of the right cingulum which can be also appreciated on a posterior and anterior view (I and J respectively).

References

Available Upon Request