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White matter tract recovery following medial temporal lobectomy and selective amygdalohippocampectomy for tumor resection via a ROVOT-m port-guided technique: A case report and review of literature

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ABSTRACT

Background: Surgical approaches to the temporal region for resection of tumors is challenging due to the anatomic complexity and, in particular, understanding of the critical subcortical white matter. Knowledge of the location of white matter fiber tracts and delicate vessels is essential in preventing complications. As a result, accurate navigation, planning and trajectory are necessary in designing a safe corridor for resection.

Case description: We describe here a 49-year-old male with a history of right mesial temporal lobe mass since 2012, with concomitant intractable seizures. MRI showed heterogeneous internal enhancement and multiple internal calcifications, resulting in local mass effect with uncal herniation. DTI showed lateral deviation of the Inferior Longitudinal Fasciculus (ILF) and focally diminished anisotropy of the uncinate. The findings were consistent with a WHO grade I pilocytic astrocytoma. BrightMatter Plan software (Synaptive Medical, Toronto, Canada) was then used to plan a trajectory for insertion of a port system (NICO BrainPath, Indianapolis, IN). Complete resection of the tumor, along with partial temporal lobectomy and amygdalohippocampectomy was performed to treat the seizure focus.

Conclusions: To our knowledge, this is the first reported case of a temporal lobectomy and amygdalohippocampectomy using a port technique, in particular, one that demonstrates recovery of the critical (ILF and uncinate fasciculus) subcortical white matter tracts. The combination of real-time, rapid, geometrically accurate 3D-planning of white matter tracts is imperative, especially in conjunction with minimally invasive approaches, thereby offering a new, safer perspective into the approach of temporal lobe lesions.

1. Introduction

Surgical treatment of temporal lobe epilepsy has been a well-established method for relief of intractable seizures, especially as a result of tumors. The epileptogenic focus includes the amygdala, hippocampus, and parahippocampal gyrus. Anterior temporal lobectomy (ATL) has been shown to be superior to medical management, and selective amygdalohippocampectomy (SA), including removal of the uncal portion, was developed to preserve the lateral temporal neocortex [1]. A narrow operative corridor, especially through the transsylvian approach, is required to access the medial temporal lobe structures. This approach, however, is technically complex and requires extensive knowledge in microsurgical anatomy as well as white matter fiber tract locations and can put these bystander tracts at risk. To increase the efficacy and safety of this approach, we have incorporated intraoperative real-time use of DTI rendering with navigation and DTI; specifically, planning and trajectory software, have been recently utilized as an adjuvant to the standard surgical approach. To our knowledge, the application of a port Brain Path (BP) (NICO corporation, Indianapolis, Indiana) in entering the medial temporal lobe has not yet been reported. Here we present a case of the resection of a medial temporal lobe tumor with the use of a combination of technologies: 3D white matter rendering and planning software combined with portal access (BP) and guided by a Robotically Operated Video Optical Telescopic-microscopy system (ROVOT-m) (Synaptive Medical Corporation, Toronto, Canada).

Abbreviations: DTI, Diffusion Tensor Imaging; FLAIR, Fluid-attenuated inversion recovery; MRI, Magnetic Resonance Imaging; T1WI, T1-weighted image; WHO, World Health Organization; ILF, Inferior Longitudinal Fasciculus; BP, Brain Path.

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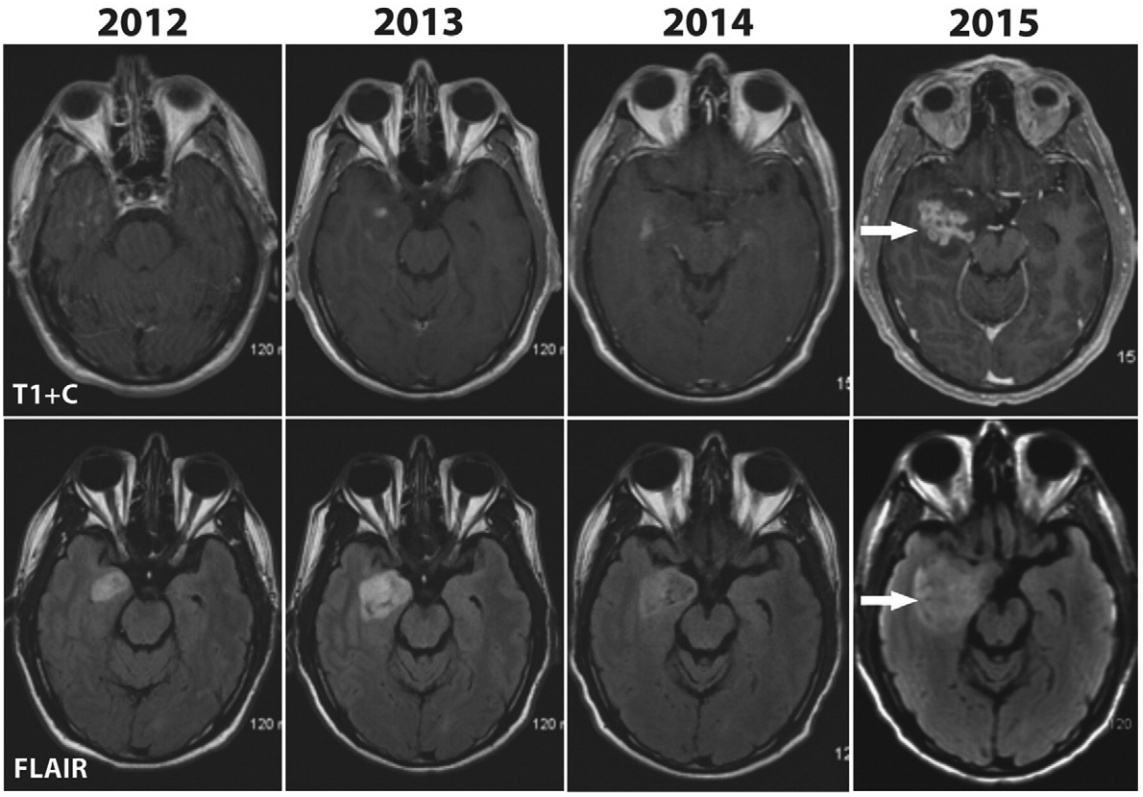

Fig. 1. Axial contrast-enhanced T1WI (**A**) and FLAIR (**B**) magnetic resonance images spanning 2012 through 2015 demonstrate progressive mass-like abnormal enhancement and FLAIR signal abnormality in the medial right temporal lobe (white arrow). Sequential images demonstrate slow interval progression from 2012 to 2014, with subsequent significantly increased enhancement and FLAIR signal abnormality on the 2015 exam.

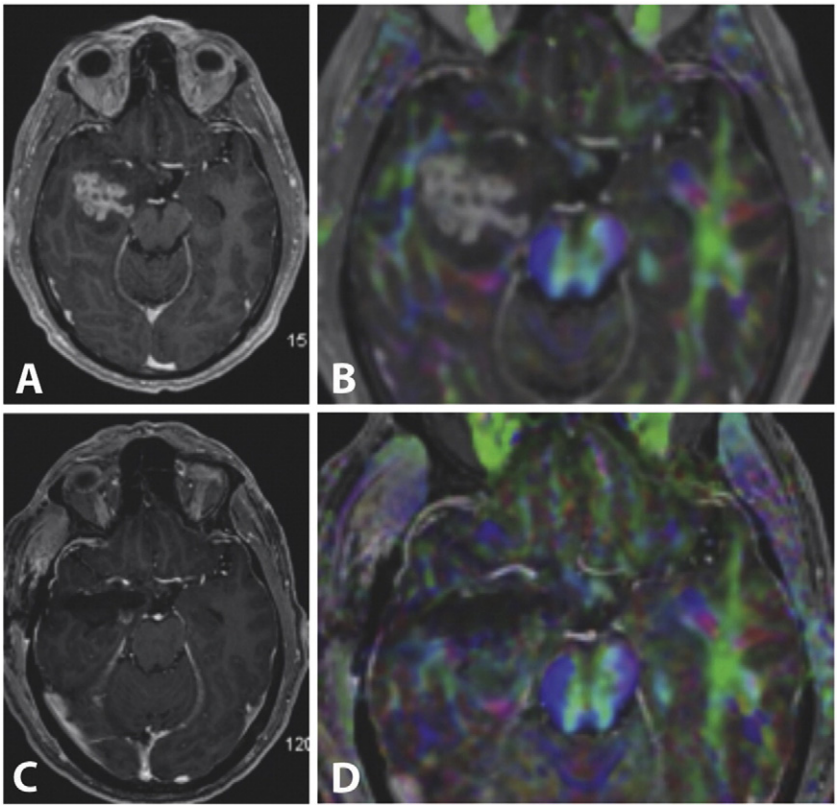

Fig. 2. Pre- and postoperative axial T1 3D BRAVO with contrast (**A**, **C**), and DTI color directional maps superimposed on contrast enhanced images (**B**, **D**). Note port-based anterior temporal lobe resection tract extending lateral to medial with complete resection of contrast-enhanced portion of tumor.