Microanatomic Investigation of the Catheter Trajectory for Targeting Insular Lesions with Laser Interstitial Thermal Therapy

Abuzer Gungor MD; Serhat Sevki Baydin; Vanessa Milanese Holanda MD PhD; Erik H. Middlebrooks; Shabbar F. Danish MD

1. Bakirkoy Research and Training Hospital for Neurology, Neurosurgery, and Psychiatry, Istanbul, Turkey. 2. Kanuni Sultan Suleyman Research and Training Hospital, Istanbul, Turkey. 3. Beneficência Portuguesa of São Paulo Hospital,

Introduction

MRI-Guided Laser Interstitial Thermal Therapy (MRgLITT) is an emerging minimally invasive procedure for the treatment of deep intracranial lesions. Insular tumors are challenging to treatment without damaging important surrounding structures. The option of a minimally invasive procedure is appealing, but the precise knowledge of the neural structures that are at risk along the trajectory and during the ablation is essential to reduce associated complications. We aimed to describe the relevant anatomy of the LITT trajectory to the insular region by using sectional anatomy and fiber dissection technique.

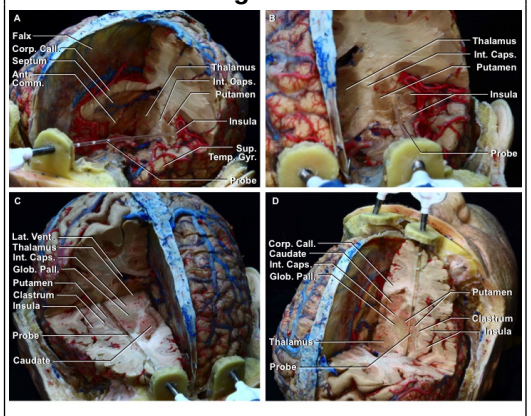
Methods

Three silicone injected cadaveric heads were used to implant laser catheters bilaterally to the insular region by using a frameless stereotactic technique. Sections were cut in both in oblique axial plane parallel to the trajectory and in the coronal plane. White matter fiber dissections were used to establish the tracts related to the laser trajectory. MR tractography was used to demonstrate the fibers surrounding the catheter path.

Results

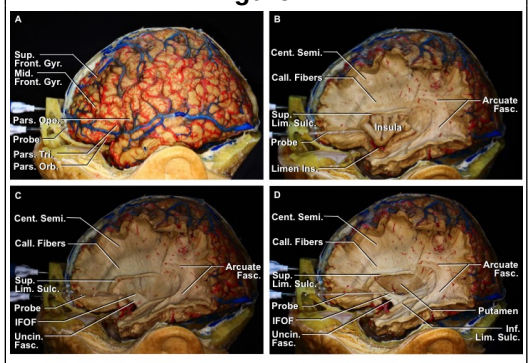
Supraorbital regions were selected as entry points for each procedure. After crossing the frontal bone, the track intersected the inferior frontal lobe (figure 1). The catheter was illustrated reaching the insular region medial to the inferior fronto-occipital fasciculus and insular cortex, and superior to the uncinate fasciculus. Uncinate fasciculus, extreme capsule, claustrum, external capsule and the putamen were traversed, preserving the major vascular structures (figure 2).

Figure 1.



A and B. Cuts in the coronal plane. C and D. Cuts in the oblique axial plane.

Figure 2.



A-D. Lateral to medial white matter fiber dissections following the laser trajectory from the supraorbitary region until reach the insula.

Conclusions

Independent of the insular area treated, an understanding of the neuroanatomy related to the laser trajectory is essential to improve the ability to perform LITT of this challenging region. The current study is the first to examine the anatomy of the laser trajectory into the insular region and will serve as the basis for future studies.