Temporal cortex

see also ventral temporal cortex.

In neurosurgery there are several situations that require transgression of the temporal cortex. For example, a subset of patients with temporal lobe epilepsy require surgical resection (most typically, en-bloc anterior temporal lobectomy). This procedure is the gold standard to alleviate seizures but is associated with chronic cognitive deficits. In recent years there have been multiple attempts to find the optimum balance between minimising the size of resection in order to preserve cognitive function, while still ensuring seizure freedom. Some attempts involve reducing the distance that the resection stretches back from the temporal pole, whilst others try to preserve one or more of the temporal gyri. More recent advanced surgical techniques (selective amygdalohippocampectomy) try to remove the least amount of tissue by going under (sub-temporal), over (trans-Sylvian) or through the temporal lobe (middle-temporal), which have been related to better cognitive outcomes. Previous comparisons of these surgical techniques focus on comparing seizure freedom or behaviour post-surgery, however there have been no systematic studies showing the effect of surgery on white matter connectivity. The main aim of this study, therefore, was to perform systematic 'pseudo-neurosurgery' based on existing resection methods on healthy neuroimaging data and measuring the effect on long-range connectivity. We use anatomical connectivity maps (ACM) to determine long-range disconnection, which is complementary to existing measures of local integrity such as fractional anisotropy or mean diffusivity. ACMs were generated for each diffusion scan in order to compare whole-brain connectivity with an 'ideal resection', nine anterior temporal lobectomy and three selective approaches. For en-bloc resections, as distance from the temporal pole increased, reduction in connectivity was evident within the arcuate fasciculus, inferior longitudinal fasciculus, inferior frontooccipital fascicle, and the uncinate fasciculus. Increasing the height of resections dorsally reduced connectivity within the uncinate fasciculus. Sub-temporal amygdalohippocampectomy resections were associated with connectivity patterns most similar to the 'ideal' baseline resection, compared to trans-Sylvian and middle-temporal approaches. In conclusion, we showed the utility of ACM in assessing long-range disconnections/disruptions during temporal lobe resections, where we identified the subtemporal resection as the least disruptive to long-range connectivity which may explain its better cognitive outcome. These results have a direct impact on understanding the amount and/or type of cognitive deficit post-surgery, which may not be obtainable using local measures of white matter integrity [1].

[1]
Busby N, Halai AD, Parker GJM, Coope DJ, Lambon Ralph MA. Mapping whole brain connectivity changes: The potential impact of different surgical resection approaches for temporal lobe epilepsy. Cortex. 2018 Nov 17;113:1-14. doi: 10.1016/j.cortex.2018.11.003. [Epub ahead of print] PubMed PMID: 30557759.