Focal extratemporal epilepsy

Extra-temporal seizure surgery constitutes about a quarter of the surgical procedures for epilepsy and includes resection of the frontal lobes, parietal lobes or occipital lobes. These resections are guided by localization from invasive subdural electrodes and, if necessary, detailed cortical functional mapping. Extra-temporal resections are individualized to the seizure onset focus, the type of seizure or syndrome, and the functional mapping which defines a safe resection boundary. Motor and sensory cortex and language cortex localization is performed and greatly minimizes neurological deficits from surgery.

Insular lobe epilepsy (ILE) is an under-recognized cause of extratemporal epilepsy

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A 'Virtual resection' consists of computationally simulating the effect of an actual resection on the brain. Demuru et al. validated two functional connectivity based virtual resection methods with the actual connectivity measured using post-resection intraoperative recordings.

A nonlinear relationship association index was applied to pre-resection recordings from 11 Focal extratemporal epilepsy patients. They computed two virtual resection strategies: first, a 'naive' one obtained by simply removing from the connectivity matrix the electrodes that were resected; second, a virtual resection with partialization accounting for the influence of resected electrodes on not-resected electrodes. They validated the virtual resections with two analysis:

1) They tested with a Kolmogorov-Smirnov test if the distributions of connectivity values after the virtual resections differed from the actual post-resection connectivity distribution; 2) they tested if the overall effect of the resection measured by contrasting pre-resection and post-resection connectivity values is detectable with the virtual resection approach using a Kolmogorv-Smirnov test.

The estimation of post-resection connectivity values did not succeed for both methods. In the second analysis, the naive method failed completely to detect the effect found between pre-resection and post-resection connectivity distributions, while the partialization method agreed with post-resection measurements in detecting a drop connectivity compared to pre-resection recordings.

The findings suggest that the partialization technique is superior to the naive method in detecting the overall effect after the resection.

They pointed out how a realistic validation based on actual post-resection recordings reveals that virtual resection methods are not yet mature to inform the clinical decision-making [1].

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Demuru M, Zweiphenning W, van Blooijs D, Van Eijsden P, Leijten F, Zijlmans M, Kalitzin S. Validation of virtual resection on intraoperative interictal data acquired during epilepsy surgery. J Neural Eng. 2020 Oct 21. doi: 10.1088/1741-2552/abc3a8. Epub ahead of print. PMID: 33086212.