The application of signal processing in advanced epilepsy surgery

**Abstract**

Epilepsy is one of the most common chronic neurologic disorders. Most individuals who will respond favorably to antiseizure drugs are successfully managed within the first two years of treatment. Patients who do not respond favorably to two antiseizure drugs used appropriately are likely to have drug-resistant epilepsy and should be investigated for surgery and other alternative forms of treatment. Surgical therapy is an important and underutilized treatment in patients with drug-resistant focal epilepsy. Surgical procedures for epilepsy range from focal resection of the epileptogenic cortex to interventions that remove or isolate the cortex of a grossly diseased hemisphere. However, how to limit the region of epileptogenic cortex is still an unsolved problem.

Because there is no single tool which can define the epileptogenic zone, conventional epilepsy evaluation establish a multimodality evaluation system which include NE, Semiology, Scalp EEG, Long-term Vedio-EEG, MRI, SPECT , FDP PET , MEG and psychobehavior assessment with SISCOM (Subtraction Ictal SPECT Co-registered to MRI). Based on EEG difficulty for epileptogenic zone localization, Therefore, there are 4 resolution which are not mutually exclusive in practice: Electrical Source Imaging、MEG、Stimutaneous Recording and the invasive EEG.

We now understand, that epilepsy is a network disease. However, epilepsy network determination by invasive EEG visual inspection is not as easy as what we think. The work of signal processing made several signal biomarker possible to differentiate epilepsy discharge origin by primary generator of propagation from elsewhere. New engineering technique and computer science may give us a new tool or another windows to find out the exact answer for current difficulties with defining epileptogenic zone, finding out the lesion, recognizing the network and mapping the functional area.