Hemispherotomy for syndrome and hemispheric epilepsy experience in Surabaya, Indonesia

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Hemispherotomy is a procedure to disconnect the hemisphere of the brain. This procedure provides the highest rate of seizure control (average 77–80%, class I Engel) when performed in the right properly indicated patients. Hemispherotomy has two major techniques, a vertical parasagittal approach that has been described by Delalande and perinsular approach described by Villemure. There are various number of techniques that have been developed based on the two major techniques which have less invasive procedure. We present our experience in treating intractable epilepsy that has been operated using hemispherotomy procedure from 2010 until 2014 in Neurosurgery Department, Faculty of Medicine, Airlangga University, Surabaya, Indonesia. We have five cases: Rasmussen's syndrome, West syndrome, Hemimegalencephaly, Proteus syndrome and Status epilepticus. All patients underwent workup for epilepsy surgery before the procedure.

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Extra-temporal seizure semiology – Central

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The localization of seizures is evident in the transient functional changes that occur during seizures, as can be assessed through several diagnostic tests. Beyond the electrophysiologic and imaging modalities, the patient's subjective experience and objective behavior during seizures are critical tests, and each of the other diagnostic tests must be validated as plausible in the context of the seizure manifestation (semiology). A critical facet to semiology is that the seizure manifestation does not necessarily indicate the epileptogenic region. More accurately, it indicates the symptomatogenic zone, that is, the zone where the seizure first becomes behaviorally evident. This may be the epileptogenic zone or the first eloquent cortex to become involved in the seizure as it spreads. Semiology may be approached by parcellating each cerebral hemisphere into 16 regions that differ in their associated seizure manifestation. Of these regions, primary motor, supplementary motor, primary sensory, and parietal association are collectively the central region. Each of these four regions may produce motor and sensory abnormalities, but the motor regions are, of course, more likely to produce motor and more likely to have a larger motor component when both motor and sensory activity are present. The complexity of the activity is differentiating and helps localize the region to either primary or supplementary/association. Simple and spreading jerks or sensations are more likely to be primary cortex. Complex and asymmetric movements are more likely to be supplementary motor, and cognitively complex somatosensory perception are more likely to be parietal association cortex.

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Modern concepts in the evaluation for epilepsy surgery

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The benefits of surgical treatment for epilepsy have been clear for many years, and evidence-based guidelines have reinforced the importance of surgical treatment for some forms of epilepsy. Overall, the benefits of surgery relate to both the high prevalence of medication-resistant epilepsy and also the increasing effectiveness of surgical treatment. However, much of the increasing effectiveness has emerged from advances in the surgical evaluation. The rising seizure-free rates after surgery for some forms of epilepsy relate to the greater specificity of the evaluation for the epileptogenic zone. Furthermore, the increasing numbers of candidates for surgical treatment relates to the greater sensitivity of the evaluation across diverse pathologic causes for epilepsy. Historically, the epilepsy surgery evaluation has progressed from the use of seizure manifestation, to intracranial EEG, and then to extracranial EEG with functional and then structural imaging. The inclusion of complementary techniques and the advances in resolution and interpretation have improved the evaluation substantially in the modern era, and considerable progress continues to result from new understanding on how to integrate the collection of diagnostic information. All of these advances have been predicated on the concept that focal seizures are due to a focal abnormality. Looking forward, we now are at the cusp of a shift toward conceptualizing epilepsy as network abnormality. With incorporation of this more sophisticated understanding into the evaluation of epilepsy, surgical success will hopefully continue to grow.

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Resting-state fMRI abnormalities in temporal lobe epilepsy

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The differentiation of epilepsies into focal and generalized has been undergoing reconsideration, as is evident in the 2010 ILAE definitions. Focal is no longer defined as limited to one region of cerebral tissue and is now defined as network(s) limited to one hemisphere. Moreover, generalized is no longer defined as distributed across the whole head and is now defined as bilaterally distributed networks that do not encompass the whole cortex. The evidence for value in this

re-conceptualization of epilepsy as a distributed or network abnormality includes the potential to treat at sites other than the ictal onset zone, as the anterior nucleus of the thalamus stimulation trial demonstrated. Better understanding of the network abnormality is arising from resting-state imaging studies. Resting-state imaging is the identification of regions of brain activity are not elicited by functional tasks. These regions were first identified through analyses of the rest-state across a variety of task-related imaging studies, such as language and motor mapping. Although an actual rest-state actually does not exist for the brain, resting-state imaging provides insights into the background functional connectivity across regions, as can be identified with several analysis approaches, including region-of-interest (seed) based connectivity, independent component analyses, and graph theory metrics. Connectivity has now been identified as abnormal in several brain disorders. For temporal lobe epilepsy, resting-state imaging has identified differences between left and right temporal lobe epilepsy and abnormalities of increased connectivity to some regions and decreased connectivity to others. Each finding clarifies the underlying abnormality of epilepsy.

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How do network and neurotransmitters interact in epileptogenesis?

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It is difficult to understand when the process of epileptogenesis is complete and which mechanisms develop with time-course that produces clinically detectable epileptiform activity. Changes in network characteristics and functional connectivity are shown to be associated with epileptogenesis. Excessive neuronal synchronization is also the hallmark of epileptic discharges. Several mechanisms have been implicated in the initiation of epileptic synchronization. Hyper-synchronous synaptic transmission can spread epileptiform activity from a single neuron to different regions of the brain by recruiting local area neurons as well as distant neurons. These neurotransmitter-mediated activities will convert a normal neuronal network to an epileptogenic network. The widely accepted principle that is applied to the process of epileptogenesis is disruption of mechanisms that normally create a balance between excitation and inhibition. Any alteration in the glutamatergic and GABAergic synaptic transmission can create a micro-environment of epileptic activity which can propagate to other cortical regions. Measurement of excitatory and inhibitory postsynaptic currents, using patch-clamp technique, in slice preparations of resected brain specimens assist in investigating modulation of neurotransmission. The comparison of GABA and glutamate-mediated synaptic transmission in specimens obtained from two different regions will throw light on the magnitude of change in epileptic activity. Understanding the propagation and maintenance of the functional connectivity and network configurations through neurotransmitter mediated abnormal synaptic activity in complex brain regions in epilepsy may open avenues for novel surgical interventions as well as for the accurate localization of the epileptic focus, thus resulting in a better surgical outcome.

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Endogenous activity of NMDA receptors contributes to the enhanced glutamatergic tone and hyperexcitability in resected brain samples obtained for patients with mesial temporal lobe epilepsy

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Altered excitatory synaptic transmission is one of the primary causes of seizure generation in patients with mesial temporal lobe epilepsy (MTLE). The present study is designed to delineate the contribution of glutamatergic tone under resting conditions to the hyper excitability in patients with MTLE. Resected hippocampal tissues were obtained from patients with MTLE. In these samples spontaneous excitatory postsynaptic currents (EPSCs), sensitive to NMDA receptor antagonist APV (50 μM) and AMPA receptor antagonist CNQX (10 μM) were recorded from pyramidal neurons at −70 mV. We observed that frequency of EPSCs were 28.2% higher in slices obtained from patients with MTLE compared to that in case of non-epileptic controls. We also examined spontaneous fast current transients (CTs) recorded from these pyramidal neurons under cell-attached configuration. The frequency of CTs increased in the absence of extracellular Mg^{2+} in brain slice preparations and was completely blocked by APV. We found that the frequency of CTs in pyramidal neurons were higher in case of MTLE samples compared to nonepileptic controls. This study suggests that enhanced endogenous activity of NMDA receptor contributes to excitability in pyramidal neurons of slice preparations obtained from patients with MTLE.

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Ictal MEG yield in patients with drug refractory epilepsy undergoing magnetoencephalography

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Background: It is not uncommon for a person with epilepsy (PWE) who is referred for a magnetoencephalography to have a seizure during the procedure. The aim of this study was to