Spectrum analysis in targeting the epileptogenic lobe in temporal epilepsy

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Aim: Source modeling of MEG has been used to identify epileptogenic zones, because it can target the lobes of spike origination, especially for multi-foci epilepsy. From our tests, thus far, we found the spectrum analysis of MEG recording is also favorable for confirming the temporal lobe that generates seizure.

Methods: The MEG recordings of 19 temporal epilepsy patients identified with source modeling software were reanalyzed with spectrum analysis in bilateral temporal lobes. 11 left temporal epilepsy and 9 right temporal epilepsy patients. The wave from 1 to 90 Hz was segregated into 6 frequency bands, 1–4 Hz (delta band), 4–8 Hz (theta band), 8–13 Hz (alpha band), 13–30 Hz (beta band), 30–48 Hz (low gamma band) and 52–90 Hz (high gamma band). The power amplitude of the 6 frequency bands was evaluated in the bilateral temporal lobes.

Results: When the epileptogenic focus is located in the left temporal, the power amplitude of the temporal lobe with focus is significantly higher in alpha band ($P = 0.008$) and high gamma band ($P = 0.004$) relative to the other temporal lobe. When the epileptogenic focus is located in the right temporal, the power amplitude of the temporal lobe with focus is remarkably higher in high gamma band ($P = 0.01$) relative to the other temporal lobe.

Conclusions: The spectrum analysis is helpful in confirming the epileptogenic zone of temporal epilepsy, besides the identification with source modeling in MEG, especially by the increment in the power amplitude of high gamma band comparing to the other side.

http://dx.doi.org/10.1016/j.ijep.2015.12.015

Are focal cortical dysplasias being overlooked as a source of drug resistant epilepsy?

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Focal cortical dysplasia first described by Taylor et al in 1971, is a subtype of malformations of cortical development in which developmental abnormality is strictly or mostly intracranial and thus should be referred more or less focalized malformations primarily involving the gray matter of the cortex.

Focal cortical dysplasia is the most common cause of medically refractory epilepsy in the pediatric population particularly in children under the age of two years of life and the second/third most common etiology of medically intractable seizures in adults. The diagnosis is usually considered in disabled patients particularly those with refractory epilepsy. However, in some patients the diagnosis is overlooked as in at least 1/3 of the patients, the cognitive function is within normal range with no seizures and about 1/5 have normal EEG and/or negative MRI in about 30–40%, particularly for type-I focal cortical dysplasia where in the majority of cases MRI is normal.

The correct and accurate localization of the lesion is mandatory. A percentage of up to 80% of post-surgically seizures free following a complete resection, drops down to 20% after an incomplete resection. For this additional diagnostic imaging techniques such as FDG PET, MEG, DTI, 3T-MRI and intra-cranial EEG are widely used to improve diagnostic accuracy and decide on management.

Surgery in focal cortical dysplasia is a curative option except for those cases where abnormalities involve vital for life brain areas. A better understanding is needed of drug resistant epilepsies and advances in genetic and neuroimaging to help provide more successful pharmacological and/or surgical options.

http://dx.doi.org/10.1016/j.ijep.2015.12.016

Gene expression analysis of drug transporters and biotransformation enzyme in patients with MTLE and FCD: A comparative study

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Introduction: One of the many hypotheses proposed to explain pharmacoresistance in epilepsy is Drug Transporter Hypothesis which suggests that antiepileptic drugs fail to reach targets in sufficient concentration due to upregulation of ABC drug transporters and biotransformation enzymes at blood brain barrier. To validate this hypothesis, we analyse the alteration in expression levels of few of the drug transporters MRP1, MVP, BCRP, and drug metabolising enzyme UGT1A4, in resected brain tissues of the mesial temporal lobe epilepsy (MTLE) and focal cortical dysplasia (FCD) patients compared with non-epileptic controls.

Methodology: RNA extracted from resected brain specimens of MTLE, FCD patients and non-epileptic controls were analysed by semi quantitative One-step RT-PCR to look for differential gene expression. HPRT gene was used as a constitutive expression control for normalisation. Expression results were quantified by densitometric analysis and scattered plots were generated.

Results and conclusion: We observed a broad upregulation of all 4 genes investigated in this study in both MTLE and FCD tissues compared to controls. Fold change for BCRP was 1.25 for MTLE and 1.4 for FCD; For MRP1 it was 1.5 for MTLE and 2 for FCD; In case of MVP it was 1.4 for MTLE and 1.5 for FCD. For UGT1A4, MTLE value was 1.42 and 1.46 for FCD. The upregulation was comparatively higher in FCD as compared

to MTLE group for all genes. Upregulation for BCRP, MRP1 and UGT1A4 were statistically significant for Control versus FCD groups ($p < 0.05$). Further studies on bigger cohort of patients are required to conclude these findings.

http://dx.doi.org/10.1016/j.ijep.2015.12.017

Endoscopic assisted inter hemispheric trans-callosal hemispherotomy: Preliminary description of a novel technique

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Background: Various hemispherotomy techniques have been developed to reduce complication rates and achieve the best possible seizure control.

Objective: We present a novel and minimally invasive endoscopic assisted approach to perform this procedure.

Method: Endoscopic assisted inter hemispheric trans-callosal hemispherotomy was performed in 20 children (April 2013–June 2014). The procedure consisted of the use of a small craniotomy (4×3 cm), just lateral to midline using a transverse skin incision. Following dural opening, the surgery was performed with the assistance of a rigid high-definition endoscope, bayonetted self-irrigating bipolar, and other standard endoscopic instruments. Steps included a complete corpus callosotomy followed by the disconnection of the hemisphere at the level of the basal nuclei and thalamus. The surgeries were performed in a dedicated operating room with intra-operative MRI and neuro navigation. Intra-operative MRI confirmed a total disconnection.

Results: The pathologies for which surgeries were performed included sequelae of middle cerebral artery infarct (8), Rasmussen's (4), and hemimegalencephaly (8). Four patients had a class I Engel and one patient had a class II outcome at a mean follow up of 10.2 months (range: 3–14 months). The mean blood loss was 80 cc and mean operating time was 220 min. There were no complications in this study.

Conclusion: The present study describes a pilot novel technique and the feasibility of performing a minimally invasive endoscopic assisted hemispherotomy.

http://dx.doi.org/10.1016/j.ijep.2015.12.018

Endoscopic assisted (through a mini craniotomy) corpus callostomy combined with anterior, hippocampal, and posterior commissurotomy in Lennox Gastaut syndrome: A pilot study to establish its safety and efficacy

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Background: Corpus callosotomy (CC) is a palliative procedure especially for Lennox Gastaut semiology without localization with drop attacks.

Objective: To describe endoscopic assisted complete CC combined with anterior, hippocampal and posterior commissurotomy.

Methods: Patients with drug refractory epilepsy (DRE) having drop attacks as predominant seizure type, bilateral abnormalities on imaging, moderate to severe mental retardation. All underwent a complete work up (including MRI).

Results: Patients ($n = 16$, mean age 11.4 ± 6.4 years, range 6–19 years) mean seizure frequency: 24.5 ± 19.8/days (range 1–60); mean intelligence quotient: 25.23 ± 10.71. All had syndromic diagnosis of Lennox Gastaut syndrome (LGS), with etiologies: hypoxic insult (10), lissencephaly (2), bilateral band heterotropia (2) microgyria and pachygyria (2). Surgery: complete callosotomy and section of anterior and posterior commissure by microscopic approach through a mini craniotomy (11) and endoscopic assisted approach (5). Complications: meningitis (1) hyperammonemic encephalopathy (2) and acute transient disconnection (5). No mortality or long-term morbidity. Mean follow-up: 18 ± 4.7 months (range 16–27 months). Drop attacks stopped in all. Seizure frequency/duration decreased >90% in 10 and >50% in 5, increased in one patient. All patients attained pre-surgical functional levels in 3–6 months. Child behavior checklist scores: no deterioration. Parental questionnaire reported 90% satisfaction, attributing to control of drop attacks. The series was compared retrospectively with age/sex matched cohort (where a callosotomy only was performed), showed better outcome for drop attacks ($p < 0.003$).

Conclusion: This preliminary study demonstrated efficacy, safety of complete callosotomy with anterior, hippocampal and posterior commissurotomy in LGS (drop attacks) with moderate-severe mental retardation.

http://dx.doi.org/10.1016/j.ijep.2015.12.019