Resection for focal cortical dysplasia treatment

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- A Scoping Review of Responsive Neurostimulation in Focal Cortical Dysplasia-Related Epilepsy

Patients with Type II FCD, particularly with Type IIb malformations are the best candidates for curative surgery, including cases with lesions in brain eloquent areas. Kids with Type I FCD have much less chance of becoming free of seizures when attempting focal cortectomy. However, some of them with early onset catastrophic epilepsies may benefit from larger surgeries using lobectomy or various disconnections ¹⁾.

The most common surgical procedure for FCD is to remove the abnormal tissue, known as a resection. It aims to eliminate the source of seizures while minimizing damage to healthy brain tissue. The type and extent of resection depend on the location and size of the dysplastic area. Laser Ablation: In some cases, minimally invasive techniques like laser interstitial thermal therapy (LITT) can be used to target and destroy the dysplastic tissue without the need for open surgery. Responsive Neurostimulation (RNS): For FCD cases where surgery is not feasible, RNS devices may be implanted. These devices monitor brain activity and deliver electrical stimulation to interrupt seizures as they start.

Resection is one of the primary treatment options for Focal Cortical Dysplasia (FCD) when conservative approaches like medication fail to control seizures or when seizures severely affect a person's quality of life. Here's a more detailed look at resection as a treatment for FCD:

Pre-surgical Evaluation

Identification of FCD: Before considering resection, it's crucial to accurately identify the location and extent of the dysplastic tissue causing seizures. This is typically done through advanced imaging techniques like MRI and sometimes with additional functional mapping using techniques such as functional MRI (fMRI) and intracranial EEG monitoring.

A strong understanding of the main implicated tracts in epileptogenic spread in FCD patients remains cardinal for neurosurgeons dealing with epilepsy. To achieve meaningful seizure freedom, despite the focal lesion resection, the interconnections and tracts should be understood and somehow disconnected to stop the spreading ²⁾.

The presence of a focal lesion on MRI, correct localized hypometabolism on FDG-PET, or localized ictal rhythms on EEG were identified as predictors of a seizure-free outcome. These findings allow the selection of better candidates for neocortical epilepsy surgery ³⁾

Neuropsychological Assessment: A thorough neuropsychological evaluation is conducted to assess the patient's cognitive and neurological functions, which helps in understanding the potential risks and benefits of surgery.

2. Surgical Planning:

Epileptologist and Neurosurgeon Collaboration: A team of specialists, including epileptologists (neurologists with expertise in epilepsy) and neurosurgeons, work together to plan the surgery. The goal is to remove the dysplastic tissue while minimizing damage to healthy brain regions responsible for critical functions like motor skills and language.

Mapping and Localization: Detailed mapping of the brain, often using intraoperative electrocorticography (ECOG), helps pinpoint the exact location of the dysplastic tissue and identify the boundaries of healthy brain tissue.

3. Resection Procedure:

Open Resection: This involves a craniotomy, which is the surgical removal of a section of the skull. The neurosurgeon then carefully removes the identified dysplastic tissue while preserving as much healthy tissue as possible.

Incomplete resection of FCD has been consistently known to be a poor prognostic factor. However, the complete removal of FCD is often difficult because the demarcation of the lesion is frequently poor, and dysplastic tissues tend to be more extensive than is apparent on MRI. Evidence indicates that even patients with MRI abnormalities who have resective epilepsy surgery for FCD have worse surgical outcomes than those of patients who have surgery for other focal lesional epilepsy syndromes. Careful planning of evaluation using intracranial electrodes is necessary for successful epilepsy surgery ⁴⁾

Minimally Invasive Techniques: In some cases, minimally invasive techniques like laser interstitial thermal therapy (LITT) may be used. This involves inserting a laser fiber into the brain through a small

incision to heat and destroy the dysplastic tissue.

4. Post-surgical Recovery:

Hospital Stay: Patients typically stay in the hospital for a period after surgery for monitoring and recovery. The length of stay varies depending on the specific procedure and individual recovery progress.

Rehabilitation: Depending on the extent of the surgery and its impact on brain function, rehabilitation may be necessary to help the patient regain motor skills, speech, and other cognitive functions.

5. Postoperative Follow-up and Medication:

Regular Monitoring: Patients require ongoing follow-up appointments with their medical team to monitor their progress and assess seizure control.

Medication Adjustment: In some cases, anti-seizure medications may still be needed after surgery, but the goal is often to reduce the medication dosage over time while maintaining seizure control.

6. Outcome:

Seizure Control: The success of resection for FCD varies depending on factors such as the location, extent, and type of FCD, as well as the individual patient's characteristics. Some patients experience significant seizure reduction or even complete seizure freedom, while others may still have some seizures but with improved quality of life.

Cognitive Function: Preservation of cognitive and neurological functions is a primary concern, and the surgical approach is designed to minimize any functional deficits.

The decision to undergo resection surgery for FCD is made on a case-by-case basis after a comprehensive evaluation by a team of experts. It's essential for patients to have a thorough understanding of the potential risks and benefits of the procedure and to be actively involved in the decision-making process. Additionally, seeking care at a specialized epilepsy center with experience in FCD treatment can lead to better outcomes.

The most important factor in seizure freedom following surgery for focal cortical dysplasia (FCD) is completeness of resection. However, intraoperative detection of epileptogenic dysplastic cortical tissue remains a challenge, potentially leading to a partial resection and the need for reoperation.

Focal cortical dysplasia can cause focal epilepsy (FE) and epileptic encephalopathy (EE), in pediatric age, and resective surgery should be considered as a treatment option for both types of epilepsy ⁵⁾.

iMRI-guided resection of FCD in pediatric patients precluded the need for repeat surgery. Furthermore, it resulted in the achievement of complete resection in all the patients, leading to a high rate of postoperative seizure freedom ⁶⁾.

Test

What type of FCD is considered the best candidate for curative surgery, even if it involves lesions in brain eloquent areas? a) Type I FCD b) Type IIa FCD c) Type IIb FCD d) Type III FCD

What is the most common surgical procedure for FCD that aims to eliminate the source of seizures while minimizing damage to healthy brain tissue? a) Lobectomy b) Vagus Nerve Stimulation (VNS) c) Resection d) Responsive Neurostimulation (RNS)

In cases where open surgery might not be suitable, what minimally invasive technique can be used to target and destroy dysplastic tissue? a) Intracranial EEG monitoring b) Laser interstitial thermal therapy (LITT) c) Functional MRI (fMRI) d) PET scan

What is the primary goal of resection surgery for FCD? a) Complete removal of healthy brain tissue b) Elimination of all cognitive functions c) Removal of the dysplastic tissue while preserving healthy tissue d) Reducing the size of the dysplastic area

Which factor is crucial for achieving seizure freedom following surgery for FCD? a) The type of medications used b) Completeness of resection c) The patient's age at the time of surgery d) The number of electrodes used during surgery

What is the purpose of intraoperative electrocorticography (ECOG) during FCD surgery? a) To monitor the patient's blood pressure b) To assess cognitive function c) To pinpoint the exact location of the dysplastic tissue d) To perform laser interstitial thermal therapy

In cases where surgery is not feasible, what alternative treatment option involves monitoring brain activity and delivering electrical stimulation to interrupt seizures? a) Intracranial EEG monitoring b) Lobectomy c) Vagus Nerve Stimulation (VNS) d) Responsive Neurostimulation (RNS)

What type of preoperative assessment helps in understanding the potential risks and benefits of FCD surgery, particularly regarding cognitive and neurological functions? a) Neuropsychological Assessment b) Physical fitness evaluation c) Blood pressure monitoring d) Dental examination

What type of FCD surgery involves inserting a laser fiber into the brain through a small incision to heat and destroy the dysplastic tissue? a) Intracranial EEG monitoring b) Vagus Nerve Stimulation (VNS) c) Lobectomy d) Laser interstitial thermal therapy (LITT)

What is the ultimate goal of FCD surgery with respect to cognitive function? a) Preservation of cognitive and neurological functions b) Complete elimination of cognitive function c) Inducing temporary amnesia d) Enhancing cognitive abilities

Answers:

c) Type IIb FCD c) Resection b) Laser interstitial thermal therapy (LITT) c) Removal of the dysplastic tissue while preserving healthy tissue b) Completeness of resection c) To pinpoint the exact location of the dysplastic tissue d) Responsive Neurostimulation (RNS) a) Neuropsychological Assessment d) Laser interstitial thermal therapy (LITT) a) Preservation of cognitive and neurological functio

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