

Presurgical evaluation: the alpha & omega



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Epilepsy surgery has benefited from major advances during the last two decade, thanks to the development of neuroimaging and long-term video-electroencephalographic (EEG) monitoring. The primary aim of the presurgical evaluation is to identify the epileptogenic zone (EZ, ie the minimum amount of brain tissue that should be resected to render the patient seizure-free). At the present time, none of the available investigations allows direct delineation of the EZ. Thus, the identification of the EZ results from the integration of the following information: the sequence of ictal signs and symptoms that defines the symptomatogenic zone, the brain regions that generate interictal epileptiform discharges (so-called irritative zone), the ictal onset zone corresponding to the region of EEG seizure onset, and the epileptogenic lesion disclosed by magnetic resonance imaging (MRI). Eloquent cortex and the functional deficit zone also need to be identified to ensure a safe and optimal surgical treatment. Finally, several indicators of postoperative outcome need to be gathered to anticipate the chance of successful epilepsy surgery. Three types of investigations should be distinguished: (i) those considered mandatory for every patient, which include a detailed past history and description of seizures by the patient and his or her relatives, interictal scalp EEG data, and an optimal brain MRI unless contraindicated; (ii) long-term video-EEG monitoring that allows capture of the patient's seizure is also considered a mandatory investigation in the majority of epilepsy surgery centers, but it might be skipped in a minority of patients; and (iii) all other investigations that are either used in selected patients in most epilepsy surgery centers. Invasive EEG recordings and the Wada test illustrate the former situation, whereas positron emission tomography (PET), ictal single photon-emission computed tomography (SPECT), and magnetoencephalography (MEG) are examples of the latter. However, the decision as to whether or not to perform a presurgical evaluation must be individualized, and take into account the likelihood of meeting the patient's expectations in terms of outcome. These expectations need to be balanced with the apparent severity of the epileptic condition, the chance of achieving a successful surgical treatment, and the risk of a post-operative neurological, cognitive, or psychiatric deterioration. At the present talk, the roles and specific features of the main types of presurgical investigations will be reviewed and discussed.

Evaluation for epilepsy surgery (presurgical evaluation)

Info

In order to decide if epilepsy surgery can help you to control your seizures, we need to do a number of tests. These tests help us locate where in the brain seizures may be starting. They also tell us if any part of the brain is abnormal in other ways. Each person is evaluated individually before we decide which tests you will need.

Diagnostic EMU Evaluation - We need to determine first

whether or not your typical spells/events are truly epileptic seizures and if they are the right types of seizures for the epilepsy surgery.

Phase I Evaluation - If we think you should be evaluated for possible surgery to help control your seizures, we bring you into the hospital for another EMU evaluation with additional tests. Ultimately, we need to capture 3-5 seizures to ensure all of your seizures are coming from one focus. Also, an ictal SPECT study is done during this admission.

SPECT Study - SPECT is a special type of brain scan,

SPECT stands for Single Photon Emission Computed Tomography. A small amount of a radioactive isotope is given intravenously when the seizure occurs. This isotope goes to the part of the brain where the seizure is occurring. Inter-ictal SPECT is often obtained for the baseline. This is a very safe test. This type of radioactivity only lasts a couple of hours in the body before it is eliminated. There are no special precautions after the injection.

MRI of Brain - High resolution MRI is performed to evaluate any structural abnormalities or lesions which may be responsible for seizure foci.

Inter-ictal PET Scan - This is also a special brain scan. PET stands for Positron Emission Tomography. It is similar to SPECT scan. It is also very safe and usually can be done as an outpatient study. It will show if there is any functional abnormality in the brain where there may be the seizure focus.

Neuropsychological Testing - It will be performed by our neuropsychologist in the office. These tests show us how the different areas of the brain work. The tests include thinking, problem solving, reading, visual identification, naming, other language function, memory, and movement. These tests help identify areas where the patients may have problems. Usually the problem areas are the areas where your seizures are happening. These tests take several hours. Please get a good night's sleep and have a meal before coming.

Psychiatric Evaluation - Epilepsy is hard to live with. Having epilepsy can cause many emotional problems for you and your family. Depression is more common in patients with epilepsy. Also, many of anti-epileptic medications can cause emotional problems, such as depression and suicidal thought. Epilepsy surgery can produce many changes in your life. Patients who undergo the surgical evaluation see our psychiatrist for an evaluation so that we can be sure they will get all the emotional support.

WADA Test and Angiogram - The WADA test is named after Dr. Juhn Wada. The test is conducted while the patient is awake. A barbiturate or other anesthetic medication is introduced into one of the internal carotid arteries

via angiogram. The drug is injected into one hemisphere at a time in order to shut down temporarily any language and/or memory function in that hemisphere. The patient is engaged in a series of language and memory related tests to understand which hemisphere support these functions.

Functional MRI - It is a specialized MRI to understand how the different areas of your brain work. It measures the hemodynamic response (change in blood flow) related to neural activity in the brain with various activities.

MEG- Magnetoencephalogram (MEG) is a record of magnetic fields, measured outside the head, produced by electrical activity within the brain. The magnetic fields are produced by the same underlying electrical changes that give rise to the electroencephalogram (EEG). This technique is also used for mapping brain activity.

Surgery Conference - When all the tests are done, our team meets. Team members include neurologists, neurosurgeons, nurses, neuro-psychologists, psychiatrists, neuro-radiologists, social workers or case managers, and EEG technologists. All decisions are made by the team. Together we review all the information gathered so far. We then decide what will be the best treatment options for our patients. This information is later discussed with the patients and their family.

Phase II - It is an evaluation of continuous video-EEG monitoring with intracranial electrodes instead of scalp electrodes. Some patients who are evaluated for epilepsy surgery with Phase I scalp video-EEG monitoring need to have more intensive video-EEG monitoring. This time we do an operation and put special electrodes into or onto the brain. Then we record seizures just as we did during the previous diagnostic and Phase I evaluation. This helps us to pinpoint more precisely the area where your seizures are starting within only a few millimeter radiuses. It also helps us learn if the seizures are coming from more than one area of the brain. During this invasive evaluation, we may perform the brain mapping with electrocorticography and stimulation which can tell us if the seizure focus has any important function such as controlling language, movement, or vision.