Corpus Callosotomy for Non-localizable Medically Refractory Generalized Seizures

BACKGROUND
Uncontrolled seizures are a source of disability, and an adjusted risk of sudden, accidental, or unexplained death with generalized epilepsies.

SIGNS and SYMPTOMS of DISEASE
Seizures can manifest in many ways, but a common type involves alteration of consciousness with or without bodily manifestations or convulsions. These ‘generalized’ or ‘complex’ seizures can often be treated with medication, but if they are not responsive to one of the first three agents tried, there is a 90% likelihood they will not be controllable with any number of medications.

DIAGNOSTIC TESTS
Imaging such as brain CT and MRI, if not already performed, should be undertaken to search for an abnormality that could be the source of seizures. If this is not found, further testing with inpatient video-electroencephalography (EEG) is used to watch for and record seizures. If standard scalp electrodes used for EEG are not sensitive enough to determine the source of seizures, then surgery to implant electrodes can be used to more sensitively look for a seizure source or focus.

TREATMENT OPTIONS
If no specific lesion can be found, then curative resection procedures, such as temporal lobectomy or a seizure focus resection, are not options. However, palliative procedures, designed to reduce seizure frequency and/or severity, can still play an important role. Such procedures include:

- Corpus callosotomy
- Vagal nerve stimulator - for partial epilepsies
**RELEVANT ANATOMY & SURGICAL TECHNIQUE**

The corpus callosum is the main bridge of connections between the two halves or hemispheres of the brain. This bridge often serves as the conduit for seizures to travel from one hemisphere to the other, which is what then makes a seizure ‘generalized,’ or one that results in a loss of consciousness or loss of tone.

Surgery can be performed to cut this bridge, and over time it has become clear what portions of this bridge can be cut with little permanent side effect while generating the maximum seizure reduction benefit. Typically the first stage is to perform an ‘anterior’ corpus callosotomy, which has a lower likelihood of permanent neurologic deficits. If seizures are not improved after anterior callosotomy, then completion of the callosotomy can be considered. Below, the corpus callosum is outlined in yellow on this MRI of the brain. The goal of anterior corpus callosotomy is to section the front 2/3 to 3/4 of the callosum (green).

![MRI of the brain with corpus callosum outlined](image)

**SURGICAL RISKS**

Types of complications seen range from infection of the skin or skull, new onset weakness, difficulties with gait, difficulties with speech, stroke, pneumonia, deep venous thrombosis or blood clots in the deep veins of the leg, uncontrolled seizure, coma, or even death. Less than 4% of patients that undergo this procedure have an adverse event that leads to a permanent disability. While this risk is not insubstantial, it is considered to be lower than that of the natural history of medically intractable epilepsy, which is why corpus callosotomy is advisable for the appropriate patient.

**EXPECTED OUTCOME**

After two years of follow-up after corpus callosotomy, ~15% of patients do actually become seizure-free. Nearly 60% of patients have an 80% decrease in the number of seizures (i.e. a patient with 10 seizures a month would afterward have only 2 per month), and almost 80% will have at least a 50% decrease in the number of their seizures. Seizure reduction will vary on a case-by-case basis, which to some degree can be anticipated; expected outcome should be discussed in detail with your neurosurgeon and will take into account the subtype of generalized seizures experienced and their severity.

Overall, the mean number of seizures experienced per month after corpus callosotomy for all types of seizure patients drops by 75%. This is significantly better than the reduction afforded by a Vagal nerve stimulator, the other palliative procedure available for non-localizable medically intractable seizures. However, this must be weighed again the greater risks involved with callosotomy versus Vagal nerve stimulator.

**AUTHORS**

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