This pamphlet contains general information for the public. It is not medical advice. All decisions about surgery for epilepsy, or any therapy, should only be made after discussion with the treating physician.

EPILEPSY FOUNDATION®

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Surgery for Epilepsy

EPILEPSY FOUNDATION®

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- Brain surgery is a way of treating certain kinds of epilepsy that cannot be controlled with medication.
- Risks and benefits of surgery should be carefully discussed in advance with the doctors who are going to perform the operation.
- Certain testing is necessary before the operation. In some cases, surgery for epilepsy requires two operations.
- Not all patients are good candidates for surgery.
- Having surgery does not guarantee that a person will be free of seizures or won't have to take medicine anymore. However, chances are good that most people will have fewer seizures after surgery and many will become seizure-free.
- Brain surgery is an accepted treatment for relief of seizures and is covered by most health insurance plans.

Surgery as Treatment

Epileptic seizures are produced by abnormal electrical activity in the brain. Surgical removal of seizure-producing areas of the brain has been an accepted form of treatment for over 50 years.

However, because of new surgical techniques and new ways of identifying areas to be removed, more of these operations are being done now than ever before, and with greater success.

Surgery can be performed on both children and adults. However, it is not a suitable treatment for everyone who has epilepsy, or for everyone with poor seizure control.

In trying to decide whether an adult or child will benefit from surgery, doctors want to know:

- Is the problem really epilepsy?
- Is it the kind of seizure that can be helped by an operation?
- Have we tried hard enough to control the seizures with medicine, diet, or other treatment?
- Might the condition get better without surgery?
- Might it get worse without surgery?
- Do the benefits outweigh the risks?

These are very individual questions with different answers for each person based on the medical history of the patient or his family; physical examinations; medical records; and a whole battery of pre-surgical tests.

Types of Surgery

All epilepsy surgery involves the brain. However, different types of operations may be done. In general they fall into two main groups:

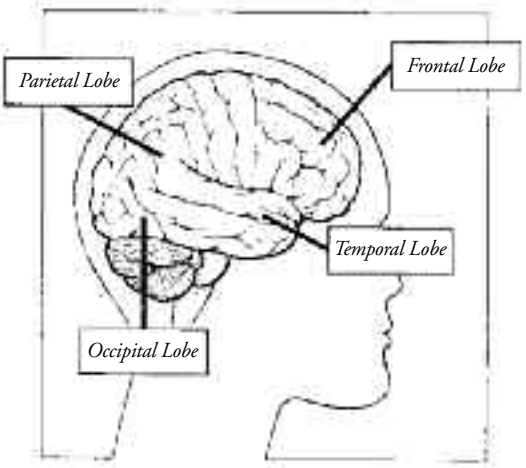
- Removal of the area of the brain that is producing the seizures.
- Interruption of nerve pathways along which seizure impulses spread.

Lobectomy

Seizures that begin in one or more areas of the brain are known as simple or complex partial seizures. The seizures can take on different forms, depending on where they originate in the brain.

The brain is divided into areas called lobes. There are temporal lobes, frontal lobes, parietal lobes and occipital lobes. There is one of each lobe on each side of the brain. An operation to remove all or part of these areas is called a lobectomy.

This type of surgery may be performed when a person has seizures that start in the same lobe every time. It is sometimes possible to stop the seizures by removing the seizure-producing area if it can be safely done without damaging vital functions.



Hemispherectomy

A lobectomy removes a fairly small area of the brain. However, in rare cases a child or an adult may have severe brain disease on just one side of the brain which produces uncontrollable seizures and paralysis on the opposite side of the body.

When this happens, a much more extensive operation may be considered.

It is called a hemispherectomy and it removes all or almost all of one side (hemisphere) of the brain.

It seems impossible that someone could function with only half a brain, but in children the half that is left takes over some of the functions of the part that was removed. However, there may be weakness and loss of some movement on the opposite side of the brain which is usually present prior to the operation. There will also be a loss of peripheral vision.

Corpus Callosotomy

Another kind of surgery for epilepsy is called a corpus callosotomy (split brain surgery).

The corpus callosotomy operation does not take out brain tissue; it interrupts the spread of seizures by cutting the nerve fibers connecting one side of the brain to the other. This nerve bridge is called the corpus callosum.

The seizures which may respond to this type of surgery include uncontrolled generalized tonic clonic (grand mal) seizures, drop attacks, or massive jerking movements.

These seizures affect both sides of the brain at once and there is usually no one area which can be removed to stop them from happening.

Seizures are usually not stopped entirely by the operation. Some type of seizure activity on one side of the brain or the other is likely to continue, but the effects are generally less severe than the repeated drop attacks or convulsions.

The corpus callosotomy operation is often done in two steps. The first operation partially separates the two halves of the brain but leaves some connections in place.

If the generalized seizures stop, no further surgery is done. If they continue, the doctors may recommend a second step that completes the separation.

Multiple Subpial Transection

Some seizures originate in or spread to parts of the brain that are responsible for functions such as movement or language. Removing these areas would lead to paralysis or loss of language function.

A surgical technique called multiple subpial transection (MST) may be performed in these situations. It involves making small incisions in the brain which interfere with the spread of seizure impulses.

This technique may be used alone or in addition to a lobectomy.

Pre-Surgical Testing

Before any operation for epilepsy can be performed, there has to be a period of careful testing and evaluation.

These tests are done to make sure the surgery has a good chance of being successful and won't affect any of the important functions of the brain.

Most of the tests are used to pinpoint the area of the brain where seizures begin or to locate other areas, like speech and memory, that have to be avoided.

How many tests have to be done depends on the kind of operation that is being planned and how much information each test produces.

The following tests are most often used before a decision to operate is made:

- Electroencephalography (EEG) tests record electrical activity in the brain and identify areas of the brain where seizures occur.
- Magnetic resonance imaging (MRI) scans take pictures of the inside of the brain. MRI scans may show tumors, abnormal blood vessels, cysts, and areas of brain cell loss or other brain damage.
- Simultaneous video (TV) monitoring and EEG recording help identify the type of seizure that is taking place.
- Neuropsychological tests, including IQ, memory, and speech tests, tell doctors more about where the

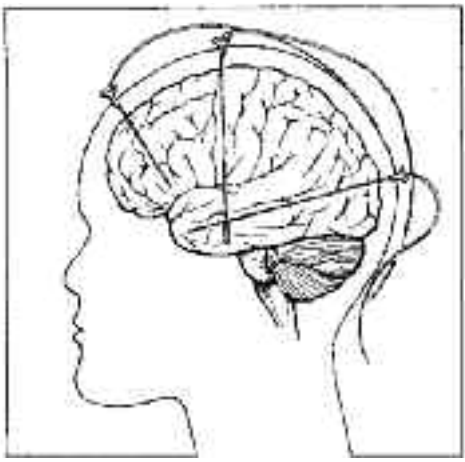
seizures (or the brain damage which is causing the seizures) are located.

- An intracarotid sodium amobarbital test locates speech and memory centers. A drug is injected into an artery leading to the brain. It puts half of the brain to sleep for a short period of time. The doctors then check speech and memory on the side of the brain not put to sleep.
- Positron emission tomography (PET) scans may be used in certain cases to help identify where seizures are taking place. PET measures how intensely different parts of the brain use up glucose, oxygen, or other substances.
- Single photon emission computed tomography (SPECT) scans also help identify where seizures are taking place by measuring blood flow.

Even after all the previously described tests are done, additional information may be needed to identify the epileptic area in the brain. This is because the area of seizure activity sometimes can't be found by electrodes attached to the surface of the head.

To obtain that additional information, two separate operations may be required.

The first operation places electrodes in or on the brain itself. These special electrodes are called depth or subdural electrodes.



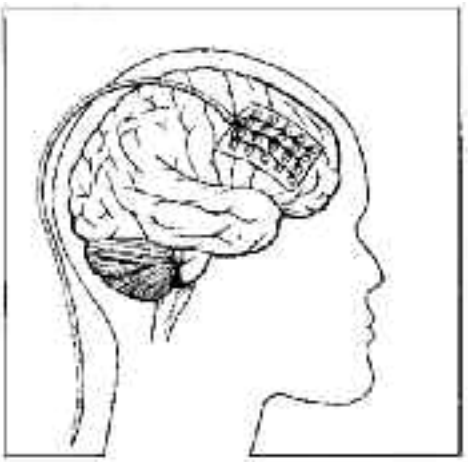
Depth electrodes may be placed in various parts of the brain to record seizures.

After they are placed, the patient remains in the hospital with the head wrapped in a large dressing, with wires attached to the electrodes coming out of the dressing. Seizures are then recorded directly from the brain, often on simultaneous video and EEG. This process is called electrocorticography.

Both kinds of recording instruments may be kept in place for some time while doctors monitor signals from within the brain during seizures.

The brain may be stimulated with mild electrical impulses via the electrodes to identify special areas controlling speech, movement and sensation. In addition, further electrical recording to map out the seizure focus (the exact area to be removed) may be done.

If the tests show that there is a single epileptic area and it can be removed safely, a second operation is performed to remove the affected area. If not, surgery is done only to remove the electrodes.



Subdural grids record seizure signals from the surface of the brain.

Sometimes all the tests and procedures rule out surgery as a suitable treatment. Other times the tests may fail to give enough information and the doctors may decide not to recommend surgery.

The Operation

Successful epilepsy surgery depends on careful selection of patients and a skilled medical and surgical team.

The operation may take several hours to perform, as surgeons first locate and then remove the area of the brain identified in pre-testing as the source of the seizure activity, or carefully sever the nerve fibers between the two halves of the brain if a split brain operation is being performed, or make the incisions required by the MST procedure.

EEG recordings during the surgery help the physicians map out the exact area of brain to be removed.

The brain may be stimulated with mild electrical impulses during the operation itself to identify special areas controlling speech, movement and sensation.

Sometimes the whole operation is done with the patient awake but under local anesthetic. This is possible because brain tissue is not sensitive to pain.

After the operation, the patient stays up to a week in the hospital and then goes home and continues to recuperate. After about three to eight weeks he or she can usually go back to normal activities.

Doctors usually recommend that surgery patients stay on antiepileptic medicines for up to two years after the operation. Some people may have to continue with medication indefinitely to retain seizure control.

Benefits and Risks

Lobectomies

While there are risks in all surgical procedures, including the placement of depth electrodes and grids, most brain surgery for epilepsy appears to be relatively safe. The success rate for epilepsy surgeries depends on the type of operation performed and can usually be predicted after all the test results are available.

For temporal lobectomies, 65 to 85% of patients will be seizure-free.

Complications occur in about 4 out of every 100 of these operations. Depending on the kind of surgery that's performed, possible complications include: partial losses of vision, motor ability, memory or speech. Infection or temporary swelling of the brain may also sometimes happen.

Corpus Callosotomies

A variety of possible neuropsychological complications of corpus callostomy can occur in addition to the major ones that are present for all epilepsy surgeries. Generalized seizures may stop or happen less often than before the operation. Partial seizures (that is, changes in movement, feeling or emotion without loss of consciousness) will probably continue and may even get worse. Still, the uncontrolled drop attacks and generalized tonic-clonic seizures that the operation is designed to treat have risks of their own. Decisions to operate take all these possibilities into account.

Hemispherectomies

Excellent results for this operation, which involve removal of one half or almost one half of the brain, are being reported by the small number of very specialized centers doing these operations. However, there are more risks with hemispherectomies than with other types of epilepsy surgery.

Children who have hemispherectomy operations will continue to have loss of function on the side of the body opposite the side where the brain was removed.

Costs

Surgery for epilepsy is complex and must be carefully planned for good results. It is therefore best undertaken in a center that specializes in these operations and has a successful track record.

In addition, some surgical cases offer a greater challenge than others and may require more testing and evaluation before an operation takes place.

Because of this variation, the cost of surgery also varies, depending on the kind of procedures that have to be done.

Planning Ahead

Good communication between the doctor and the patient is important with all epilepsy treatment, but especially when surgery is being considered.

Although surgery for epilepsy is more common, more successful and safer than ever before, it is still a major operation.

The patient and the family should therefore have a realistic picture of the benefits, the risks, and the chances of complete or partial control of seizures afterwards.

For example, there may be some physical after-effects of epilepsy surgery. Sometimes there are emotional changes as well. People may feel disappointed if their seizures do not stop completely, or if they have to go on taking medicine, at least for a while, after the surgery.

When seizures stop altogether or happen very seldom, there is an understandable feeling of relief and celebration. But sometimes people also feel depressed. It may be stressful and difficult to meet the new expectations that others may have, or to adjust to being a person without seizures after having them for so long.

In most cases, these reactions are temporary. Like other issues that may arise in connection with epilepsy surgery, they can be handled better if both the patient and the family know what to expect and have talked about them with the multidisciplinary medical team (which may include neurologists, surgeons, nurses, and psychologists) before any operation takes place.

For more information on epilepsy and epilepsy surgery, contact:

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