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PATIENT GUIDE

Surgical options for essential tremor: my guide for patients

Who should consider surgery, and how deep brain stimulation, focused ultrasound, radiofrequency thalamotomy, and Gamma Knife compare.

AT A GLANCE

Consider surgery	When tremor interferes with daily life after at least two medications, one of them propranolol or primidone
Target	The VIM nucleus of the thalamus, treated by damaging it (thalamotomy) or by stimulating it (DBS)
Options	DBS and thalamotomy (focused ultrasound, radiofrequency, and Gamma Knife)
Average tremor reduction	About 90% after DBS and 75% after focused ultrasound
Both sides at once	Possible with DBS only
Testing	A neuropsychological evaluation before DBS, and a skull density CT before focused ultrasound
Insurance coverage	DBS, radiofrequency, and Gamma Knife are almost always covered; focused ultrasound is covered by most insurers

This information is intended as a general guide for my patients, and if you are seeing a different neurosurgeon, it should not substitute for advice, guidance, or instructions from that surgeon.

Introduction

Essential tremor (ET) is a neurologic disorder in which there is rhythmic shaking of one or more parts of the body. The hands are most commonly affected. ET can start at any age, and it tends to get worse over time. The tremor tends to be most visible when holding a posture or performing an action, and it tends to diminish or disappear at rest. About half of

ET cases run in the family. Although ET is not dangerous, the symptoms can be quite bothersome and interfere with activities of daily life. Fortunately, there are several effective surgical therapies for ET, described in more detail below.

Who should consider surgery for essential tremor?

You should consider surgery for ET when both of the following are true:

1. You have a tremor that interferes with activities in your daily life (e.g. eating, drinking, writing, typing, other hobbies or activities that require fine motor control/dexterity).
2. You have tried at least two different medications for tremor without satisfactory relief, and at least one of the two medicines is propranolol or primidone.

What are the surgical options for essential tremor?

All of the procedures for ET target the same part of the brain: a pea-sized region known as the VIM nucleus of the thalamus. There are two possible ways to treat this area: (1) by damaging it (known as a thalamotomy), or (2) by stimulating it with pulses of electricity (known as deep brain stimulation).

Thalamotomy

Thalamotomy has a long history, but the way the procedure is performed has changed over time. The newest way of performing thalamotomy is with an ultrasound machine, a procedure known as MRI-guided focused ultrasound. I also perform radiofrequency thalamotomy and Gamma Knife thalamotomy.

Deep brain stimulation (DBS)

Deep brain stimulation (DBS) is an alternative to thalamotomy that has been used in the United States for about 25 years. The technique and technology of DBS continue to improve over time. Unlike thalamotomy, DBS does not damage the thalamus. Instead, one or two thin wires, each just over 1 millimeter wide, are inserted and deliver painless pulses of electricity to interrupt tremor rhythms. The wires are connected to a small pacemaker that is implanted under the collarbone.

Are these procedures effective?

Tremor is usually very responsive to these procedures. Hand/arm tremor, for example, improves by an average of 90% after DBS and by 75% after focused ultrasound. Tremor involving the head, voice, or trunk is more variable.

What are the advantages and disadvantages of these procedures?

All of these procedures are effective, but there are differences between them. Below is a comparison of key features:

	Deep brain stimulation	Focused ultrasound	Radiofrequency	Gamma Knife
Tremor reduction	Most effective (average 90% tremor reduction)	Effective (average 75% tremor reduction)	Effective (average 75-80% tremor reduction)	Less effective (average 50-70% tremor reduction)
Timing of tremor relief	Immediate	Immediate	Immediate	Delayed (4-6 months)
Implant required?	Yes	No	No	No
Side effects (more explanation below)	Possible, but not bothersome to most patients	Prominent for the first few weeks; most fade over time	Prominent for the first few weeks; most fade over time	Variable
Can you treat both sides of the body/hands at once?	Yes	No (wait at least 9-12 months before second side)	No (wait at least 9-12 months before second side)	No (wait at least 12 months before second side)
Hospital stay required?	Yes, 1 night	No	Yes, 1 night	No
Awake or asleep	Asleep	Awake	Awake	Awake
Hair shave needed?	Minimal (size of a Band-Aid)	Yes, entire head must be shaved	Minimal (size of a Band-Aid)	No
Insurance coverage	All insurance carriers	Most insurance carriers (see below)	All insurance carriers	All insurance carriers

Did I read that correctly? The head needs to be shaved for focused ultrasound?

Yes, the entire head must be shaved for focused ultrasound. Ultrasound waves do not pass through hair.

DBS and radiofrequency thalamotomy require only a small area of hair to be shaved (about the size of a Band-Aid). No hair is shaved for Gamma Knife.

What are possible side effects of these procedures?

In general, side effects of a procedure on the thalamus can include balance or gait difficulties, tingling (usually in the hand), tongue numbness causing slurring of speech, change in arm coordination or strength, and a change in taste, among others.

In my experience, prominent side effects are uncommon after DBS. Most such side effects can be reduced or eliminated with changes in the settings of the stimulator.

Side effects are very common after focused ultrasound and radiofrequency thalamotomy, particularly trouble with gait or balance. Most patients see these side effects improve over the course of a few weeks, but a small percentage of patients may have persistent side effects.

Side effects are possible but hard to predict after Gamma Knife due to the differences from one person to the next in how the brain responds to radiation.

Is any testing needed to confirm that I am a candidate?

Before DBS, I require (and most insurance companies require) a neuropsychological evaluation. This is a meeting with a specialized psychologist who will perform a detailed cognitive assessment. If you have not had this exam, I will arrange for one.

Before focused ultrasound, a special CT scan of your brain is required. The CT scan evaluates the density of your skull to confirm that the ultrasound waves will penetrate and reach the thalamus. Most patients have suitable skull densities, but around 15% of patients have skull densities that are too low; these patients are not candidates for focused ultrasound.

No special testing is needed to clear a patient for Gamma Knife or radiofrequency thalamotomy.

For both DBS and all three forms of thalamotomy, once we have decided to proceed with surgery, I will order a special MRI to plan the procedure.

Will the procedure be covered by my insurance?

DBS, radiofrequency thalamotomy, and Gamma Knife are (almost) always covered by insurance. My team will obtain a pre-authorization from your insurance company. The cost to you depends on the particulars of your insurance plan (i.e. your plan's out-of-pocket/deductible policy).

Because focused ultrasound is a newer procedure, a few insurance companies do not yet cover it, even though it is FDA-approved and is covered by Medicare. The major culprit is United Healthcare commercial plans. United Healthcare Medicare plans cover the procedure, and, in general, "Medicare" appearing anywhere in the name of your insurance plan means it will be covered.

If you are in doubt, you can save yourself potential disappointment and contact your insurance company before meeting me to make sure that the procedure would be covered. To do this, please call the member services number/department; this is usually listed on the back of an insurance card. You should ask if focused ultrasound for essential tremor is a covered procedure under your plan. You can also provide them the CPT code that is used for the procedure: 61715. Again, this is necessary only for focused ultrasound, not for DBS, radiofrequency, or Gamma Knife.

If you are interested in focused ultrasound but it is not covered by your insurance, a self-pay option is available.

Where can I learn more?

My website is an excellent resource for patients wanting to learn more about ET and the procedures reviewed above. Here is a list of relevant pages from the site:

- Essential Tremor
- Deep Brain Stimulation
- Deep Brain Stimulation: my guide for patients
- Focused Ultrasound
- Focused Ultrasound: my guide for patients
- Radiofrequency Thalamotomy
- Thalamotomy
- Gamma Knife

If you live near Denver and have essential tremor, please consider meeting me in consultation to learn about your treatment options.