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Brain and Spine Surgery

PATIENT GUIDE

Responsive neurostimulation (RNS): my guide for patients

What to expect before, during, and after RNS surgery, and from long-term therapy.

AT A GLANCE

Anesthesia	Asleep (general anesthesia)
Hospital stay	1-2 nights
Surgery time	Less than 2 hours, plus about an hour of setup
Treatment mode	Turned on in your neurologist's office, usually 3-4 weeks after surgery
Wound check	In my office about 2 weeks after surgery
Battery	Lasts over 10 years on average, and replacement is outpatient surgery

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

Responsive neurostimulation (RNS or “NeuroPace”) is a procedure used to treat epilepsy in which one or more millimeter-thin wires is inserted into the brain and connected to an implant within the skull, similar to a pacemaker. The system delivers targeted and painless electrical pulses to the brain to reduce and prevent seizures. RNS is a safe, effective therapy that has been used to treat epilepsy patients in the US for over 10 years. This is a guide for my patients on what to expect from RNS surgery. For more background on RNS, please visit the dedicated page on my website: https://mian-neurosurgery.com/responsive-neurostimulation.

Benefits of RNS

Clinical trials have established several benefits of RNS:

- Fewer seizures (82% average reduction in long-term studies).
- Improvements in cognition and memory.
- Lower risk of sudden death from epilepsy.
- Improved quality of life.
- Fewer side effects versus other epilepsy surgeries.
- Reductions in anti-seizure medications.
- Insight into your seizure patterns that helps you make decisions about lifestyle.

What to expect from surgery

- RNS is performed under general anesthesia (i.e. asleep).
- An overnight hospital stay is required. Patients generally stay in the hospital 1-2 nights, depending on how they feel (see below).
- The surgery itself is less than 2 hours, but there is an hour or so of setup in the operating room before the surgery begins.
- I shave only a strip of hair along your incision. I do not shave the whole head.
- At the time of surgery, the device is turned on in “listening” mode, meaning that it is recording brain activity but not yet treating your seizures. We try to collect a few weeks of brain activity (ideally including at least one seizure) before the device's “treatment mode” is turned on. “Treatment mode” is turned on in your neurologist's office, usually a few weeks after surgery. It is a good idea to reach out to your neurologist when you have a date scheduled for your surgery so that you can set up this appointment.
- Headache is common after the procedure and may take a week or two to resolve. Some patients may have temporary discomfort while chewing or neck stiffness during this time. Very few patients have any long-term symptoms or side effects related to RNS.
- The RNS battery/computer is embedded in the skull during surgery. It is not visible from the outside. It sits within the skull - not on top of it.
- Before discharge from the hospital, you need to be eating and drinking, managing your surgical pain with pills only, and cleared by physical therapy - meaning you are safe and steady on your feet.
- Please continue taking your regular seizure medications through and after surgery.

Summary of instructions before surgery

- If you take a blood thinner such as aspirin, Plavix, warfarin (Coumadin), Eliquis, Xarelto, Lovenox, or fish oil supplements, make sure you have confirmed with me when I would like you to stop the medication before surgery.
- When you have scheduled a date for your surgery, please notify your neurologist to arrange for an initial programming visit 3-4 weeks later.
- Do not have anything to eat or drink after midnight on the night before your surgery. Do not have breakfast on the day of surgery.
- Be prepared to stay in the hospital for 1-2 nights.
- Please call my office with any questions.

Post-op care

Wound care

- I use absorbable sutures, so your stitches do not need to be removed.
- You may shower on the day after your surgery. Normal shampoo is fine to use. Do not scrub or rub the incision too hard. Instead, let the soapy water run over it, and then pat it dry. You can wash the rest of your hair normally. While showers are OK, please do not take baths or go swimming until after your wound check appointment.
- Please do not apply any ointments or creams to your incision. The best way for the incision to heal is to leave it clean, dry, and open to the air.
- You will have a wound check in my office roughly 2 weeks after surgery.

Medications

- Continue taking your seizure medications on your normal schedule. Many patients are able to reduce their seizure medications after RNS, but we typically wait at least a few months to make sure the seizures are responding well. Your neurologist will guide you regarding if and when medication reductions are recommended.
- If you take blood thinners such as aspirin, Plavix, warfarin (Coumadin), Eliquis, and so on, please remember to discuss with me how soon you should restart them after surgery. In nearly all cases, these drugs are safe to start one week after surgery.
- You will be discharged with a short course of prescription medication for pain control. You do not have to take this medication unless you need it. Over-the-counter alternatives like Tylenol and Motrin are fine to use, too (though please avoid aspirin, initially). Most patients do not need prescription medication for more than a few days.

Activity

You can resume most of your normal day-to-day activities almost immediately after surgery. The exception is activities that involve straining - things like lifting heavy objects (anything much heavier than a gallon of milk) and vigorous exercise. You should wait 2-4 weeks before these activities, and begin them gradually.

Programming

RNS will be turned on in your neurologist's office in most cases 3-4 weeks after surgery.

Please be patient with the effects of stimulation. We usually start at low settings and then ramp them up gradually. Patients tend to see continued improvement over time (months). Do not be discouraged if you do not see a dramatic improvement after your first programming session.

When to call my office

Be vigilant in the first few weeks after surgery. Please call my office if you develop any of the following:

- Fever higher than 101.5°F.
- New redness, swelling, or drainage from your incision. A little redness and swelling is normal immediately after surgery, but it should get better each day, not worse.
- Eye or facial swelling. Many patients notice a swollen eye a few days after surgery, usually after waking up. This is common and not dangerous, and it relates to fluid working its way down beneath the scalp from the surgery site. Elevating the head for a night while sleeping can help. You only need to call if this does not improve in a day or two or if there are other concerning symptoms.
- New neurologic problems not associated with your regular seizures: weakness, numbness, visual changes, difficulty speaking, and so on.
- Confusion that gets gradually worse rather than better.

If you are experiencing a medical emergency, please call 911.

For questions or concerns that are not a medical emergency, you can reach my medical assistant directly at (720) 599-3075 or MDMian@carepointhc.com. You can also call the CarePoint Neurosurgery main line at (303) 515-2320.

What to expect from long-term therapy with RNS

- Seizure control improves gradually over time with RNS. Your seizure control at 6 months is likely to be better than at 3 months and so on.

- You will not be able to feel the stimulation when the device treats you. You may get hundreds or even thousands of treatments daily - each very brief (a fraction of a second) and timed precisely to your seizures.
- There are no restrictions on lifestyle or daily activities with an RNS implant. It is safe to travel through airport security, and the device does not trigger metal detectors.
- You can still have an MRI scan, but please alert the radiologists, MRI technologists, and your NeuroPace company representative that you have an RNS implant so that they can help put the device safely into “magnet mode” for your scan.
- Your neurologist will be able to see how many seizures you are having, and he or she will be able to use that data to make decisions about your medications.
- To keep your neurologist updated on your progress, it is important to regularly upload data from your implant. This is done with a wireless transmitter, at home, and takes just a few minutes. I recommend that patients upload a couple of times per week.
- The RNS implant has a battery that, on average, lasts over 10 years. Your neurologist will alert you when you are approaching the time for replacement. Replacement involves an outpatient surgery.

If you or a family member is considering RNS and has not yet met with me, please consider meeting me in consultation to learn more about your treatment options.