What You Need To Know About Neurostimulation?

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As a kid, I was always fascinated with remote-controlled cars. The ability to control something on the other side of the room and have it chase my brother around really made my day. Fastforward about 30 years and remote-controlled devices still appeal to me, only now, I use them to chase neurons and pain signals instead of my brother, much to his delight. When we talk about neurostimulation, we are quite simply talking about this very phenomenon—using a specialized remote control to modify impulses in the spinal cord or peripheral nerves to relieve neuropathic pain.

Spinal cord stimulators have been implanted in increasing numbers to treat neuropathic pain since they received FDA approval in 1989. However, the great majority of patients, and many physicians, have not had much exposure to them. There are several companies that make the devices, each of which have certain distinguishing features, but the vast majority of them consist of a battery pack or pulse generator, which is best described as a cousin of the pacemaker, and leads or a paddle to deliver the signal to the target site.

Because neurostimulators are most useful for neuropathic

conditions, the target sites usually are in the thoracic spine for many neuropathic conditions in the lower back and legs, in the neck for most problems in the upper back and arms, and near specific peripheral nerves for various other conditions, such as headaches.

Who Benefits From Neurostimulation?

Ideal candidates for neurostimulation are patients with some form of neuropathy or condition that affects or chronically irritates nerves which may not be amenable to surgical correction. The most common use in the United States is for patients who have exhausted conservative measures—including physical therapy, neuropathic pain medications, nerve blocks, and adjuvant medications—and may have undergone surgery to decompress the nerves in the back or neck but are still plagued by nerve pain. In these cases, which are referred to as post-laminectomy syndrome or failed back surgery syndrome, neurostimulation is very effective. Other commonly treated disorders include complex regional pain syndrome affecting the limbs, nerve injury, and arachnoiditis.

The simplest explanation for how traditional neurostimulators work is that they replace the sensation of pain with paresthesia. In that respect, it works well for patients whose primary symptom is pain, but won't offer much to a patient who has primarily numbness or weakness.

Recent efforts in the field of neurostimulation have been aimed at minimizing the paresthesias associated with traditional stimulators. The FDA recently approved Senza SCS System (Nevro). In a press release, the agency noted that "this system is unique because it delivers a high frequency output of 10 kHz that does not cause paresthesia, or tingling sensation, in patients."

Patient-Centered: Try It Before You Buy It

One of the reasons neurostimulation has become one of my favored treatment modalities is because it is patient centered. It is one of the few instances in the world of interventional medicine that a patient gets to "try it before they buy it." This is because neurostimulation often is broken up into steps: a trial and, if successful, a permanent implant.

The trial is a relatively minor procedure that can be performed in an office setting or at a surgery center. It involves little more than placing an epidural/Tuohy needle, inserting the trial leads through the needle and guiding them to the proper location. Each lead is approximately the diameter of a string of cooked spaghetti.

Fluoroscopy is used to confirm that the lead is placed in the appropriate location; however, due to normal anatomic variance, the lead sometimes needs to be further adjusted before it is secured in place. Once secured, the lead is connected to an external pulse generator and the patient goes home with the device for several days during which they assess its efficacy.

Many providers administer antibiotics during the trial period because there is a small risk of infection due to the presence of a device sticking out of the body. I often tunnel the lead to further reduce the risk. When the patient returns to the office, the temporary trial leads are removed and a bandage is applied. If the patient liked the device and reports that it reduced their pain appropriately, they often will go on to permanent implantation.

Most estimates show a 50% to 70% reduction in pain, with varying success rates based on the provider. The more conservative a provider is with the therapy, and the better they are at patient selection, the higher the trial to implant ratio will be.

Many of the manufacturers have a database of patients who serve as resources for those who may be considering the device. They can answer questions from a patient's perspective, often providing additional useful information to a patient considering the therapy to help them gain a better understanding of whether it will meet their expectations.

Stimulator Implantation

Stimulator implantation involves placing permanent leads or a paddle near the target site and creating a small pocket for the pulse generator. Again, the pulse generator is about the size of a pacemaker and is typically implanted in the buttocks, just below where the top of the patient's pants would normally sit, or near the shoulder blade. This is most often an outpatient procedure, and the patient usually goes home the same day, with a permanent, fully internalized wireless system, complete with a remote control.

The permanent devices rarely are removed unless they become infected or there is some unwanted side effect in which the device causes stimulation in places where it is not wanted. When this occurs, it is most often the result of lead migration, ie, the lead moves up, down or laterally from where it was placed. The other scenario in which the device may need to be explanted is when the pulse generator results in pain or discomfort. Explantation is a rare occurrence and is less likely to occur with appropriate patient education about expectations and meticulous preimplant planning and trialing.

Case Study: Intercostal Neuralgia

A middle aged male was admitted to the hospital with intractable epigastric and anterior rib pain secondary to esophageal cancer with secondary peritoneal carcinomatosis. His pain was deemed unbearable despite initiation of

a relatively high dose patient-controlled analgesia device, containing fentanyl or hydromorphone at various points in his care.

I was consulted to review interventional options to reduce his pain. After meeting with and examining the patient, I surmised that he might achieve improvement with bilateral intercostal nerve blocks. We scheduled these and after the first set of blocks, he noted about an 80% reduction in pain for several days before the pain gradually returned to its original level. We scheduled a second set of fluoroscopy-guided intercostal nerve blocks. This time he achieved complete relief for several days before the pain returned to its original level.

At this point, given that his cancer was terminal and MRIs will not be a major long-term concern, we decided to proceed with a trial of spinal cord stimulation. Two 8-contact leads were placed into the upper thoracic spinal canal and stimulation was initiated to confirm adequate coverage of his painful areas. He reported complete resolution of his pain during the trial and wished to proceed with the permanent placement. Upon permanent implantation (Figure), he reported complete relief of his pain and was very happy with the result after his incisions healed. He has since passed away but was able to live out his final days without significant pain. The power of neurostimulation never ceases to amaze me.

Contraindications

While many patients benefit from neurostimulation, there are certain patients for whom additional concerns or contraindications may make them less than ideal candidates. Many of these contraindications overlap with other spinal interventions, such as epidurals, and include use of anticoagulants, systemic infections, psychological conditions that aren't compatible with an implanted device, and a perceived future need for certain types of MRIs. Several of the manufacturers have developed MRI-compatible devices in certain situations, with the caveat that the lead is placed below T7. This rules out many patients with upper limb symptoms and patients with cancer or neurological conditions, who may require serial MRI studies.

Summary

Neuromodulation is a very effective tool that may enable a severely debilitated patient to return to a functional life and regain fulfillment. The best part about it is that the power to control pain is placed into the hands of the patient who is experiencing it—they can control the level of stimulation. Many patients are able to wean off or significantly reduce their use of opioid medications through the use of neurostimulators. Most providers who perform these interventions will provide consultations to patients wishing to further explore this amazing technology. ■

Author's Bio: *Christopher M. Gay, MD, is pain specialist at the Alaska Center for Pain Relief, in Anchorage, Alaska. Having completed his undergraduate studies at Duke University and his medical studies at The University of North Carolina at Chapel Hill, Dr. Gay continued on to complete his residency and fellowship training at Columbia University/New York Presbyterian Hospital, in New York City. Board certified in Pain Management and Anesthesiology, Dr. Gay aim is to deliver high-quality care in a compassionate manner. He uses appropriate interventions and incorporates integrative modalities to ensure the best possible results. Dr. Gay also uses conservative medication management in select patients in conjunction with appropriate screening and risk stratification.*

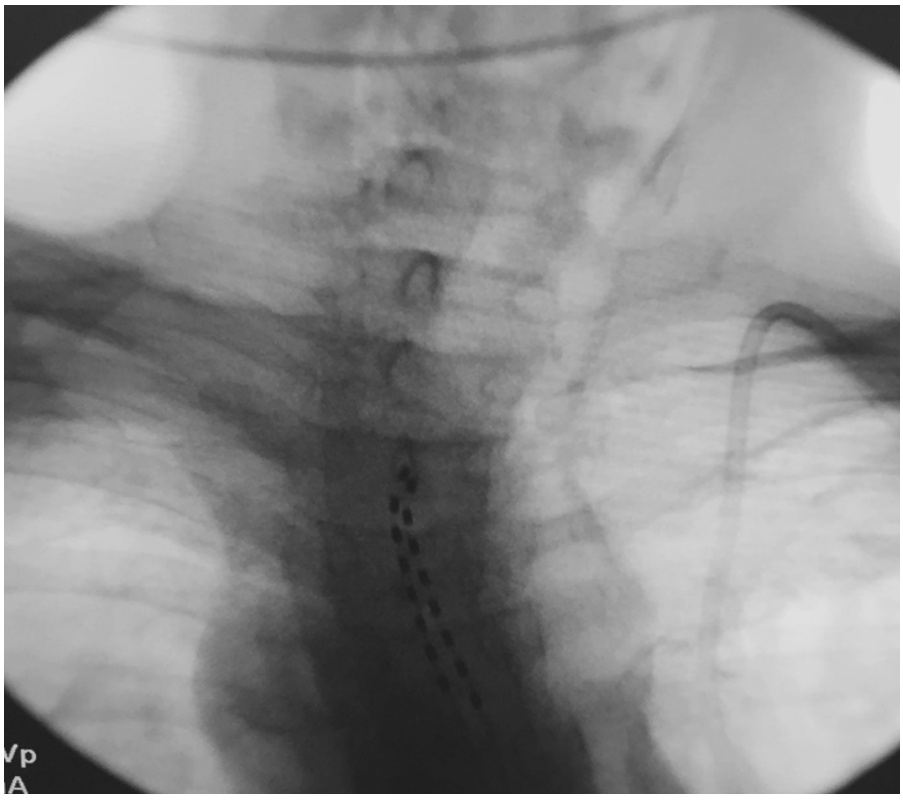

Figure. Neurostimulator leads in the upper thoracic spine for intercostally mediated nerve pain.