



American  
Association of  
Neurological  
Surgeons

# SPINAL CORD STIMULATION

## PATIENT INFORMATION

This resource, developed by neurosurgeons, provides patients and their families trustworthy information on neurosurgical conditions and treatments.

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Chronic pain is long standing pain that persists beyond the usual recovery period or that accompanies a chronic health condition. Because this pain is not protective and is not a result of an ongoing injury, it is referred to as "pathological" and is therefore treated as a condition, not as a symptom. Chronic pain may prevent people from working, eating properly, participating in physical activity or enjoying life.

Spinal cord stimulation (SCS) is a pain-relief technique that delivers a low-voltage electrical current continuously to the spinal cord to block the sensation of pain. SCS is the most commonly used implantable neurostimulation technology for management of pain syndromes. As many as 50,000 neurostimulators are implanted worldwide every year. SCS is a widely accepted, FDA-approved medical treatment for chronic pain of the trunk and limbs (back, legs and arms). There are three SCS device types:

- **Conventional systems** require little effort on the patient's part for maintenance. However, a minor surgical procedure is required to replace the power source when it runs out.
- **Radiofrequency systems** are designed to sustain therapy over long periods at the highest output level. Because of its high power capabilities, the RF system is suitable for the most challenging cases in which there is complex, multi-extremity pain. With this type of system, the patient must wear an external power source to activate stimulation.
- **Rechargeable systems** are the newest type of SCS device. The patient is responsible for recharging the power source when it runs low. A rechargeable system typically lasts longer than a conventional system. Eventually a minor surgical procedure may be required to replace the power source if the time between recharges becomes impractical.

## Patient Selection Criteria

Patients being considered for SCS should ideally meet the following criteria:

- Pain is not associated with malignancy
- Poor response to conservative treatment for a minimum of six months
- Revision surgery not an option or would have a low chance of success
- No pacemaker or other medical contraindications
- No major psychiatric disorders, including somatization
- Willingness to stop inappropriate drug use prior to implantation
- No related litigation
- Ability to give informed consent for the procedure

## SCS Trial Procedure

If it is determined that the patient is a suitable candidate for SCS, often the first step is to implant a device on a trial basis. During the SCS trial phase, a lead or leads are implanted temporarily and are connected to a trial spinal cord stimulator. The trial stimulator is programmed with one or more stimulation programs customized to the specific areas of the patient's pain. The trial phase can be beneficial for the following reasons:

- It can help the patient/physician analyze whether SCS effectively relieves pain
- It provides the patient/physician with an assessment period to determine which type of SCS technology works best
- It enables the patient/physician to evaluate different stimulation settings and programs

## SCS Implantation

If the SCS trial provides adequate pain relief, then a permanent system may be implanted. SCS is a reversible therapy, so even though it is called permanent, treatment can be discontinued at any time and the implanted parts turned off and/or removed.

Prior to the procedure, the patient is lightly sedated. Trial leads, if present, are removed. If leads are to be placed under the skin, a local anesthetic will be administered while the leads are placed, then the patient will be given a general anesthesia prior to the rest of the system being implanted. If surgical leads are used, the patient will likely be under general anesthesia the entire time. The leads are inserted in the epidural space above the spinal cord using a small needle or through a small incision. The exact location of the lead or leads depends on the specificity of the patient's pain. The generator is usually implanted in the abdominal or buttock region, but the physician/patient may determine other comfortable areas in which to place it.

Once the leads and generator are in place, connected and working, the incision will be closed, a dressing applied, and the patient will be taken to recovery, where he or she will be slowly withdrawn from the anesthesia. Most patients go home the same day, but some physicians will request an overnight stay in the hospital. Before being released from the hospital, the patient will receive instructions on caring for the incision area and how to program and regulate the SCS device.

Following implantation, lifting, bending, stretching and twisting should be avoided. However, light exercise, such as walking, can be helpful to build strength and relieve pain.

Although there may be some discomfort while the surgical incision heals, most patients say that they cannot feel the presence of the device under the skin after healing takes place.

## Neurological Treatment Uses for SCS

- Arachnoiditis
- Complex regional pain syndrome (CRPS)
- Failed-back surgery syndrome (FBSS) or post-laminectomy syndrome (lumbar or cervical)

- Nerve damage, neuropathy or neuritis

## Neurological Conditions Overview

**Arachnoiditis** is a painful condition caused by the inflammation of the arachnoid, one of three linings that surround and protect the brain and spinal cord. The arachnoid can become inflamed due to a variety of reasons. These include irritation from chemicals present in myelograms and epidural steroid injections; bacterial or viral infections; spinal cord injury; or complications from spinal surgery or other invasive spinal procedures. When arachnoiditis begins to impact the nerves, it can cause a number of symptoms, including numbness, tingling and a distinctive stinging and burning pain in the lower back or legs. Other symptoms may include debilitating muscle cramps, twitches, spasms and bladder/bowel/sexual dysfunction. There is no cure for this condition, so the goal of treatment is to control pain and symptoms.

**Complex regional pain syndrome (CRPS)** is an uncommon nerve disorder that causes intense burning pain, usually in the arms, hands, legs or feet. It can occur after an injury, either to a nerve or to tissue in the affected area. Along with pain, the patient may experience extreme skin sensitivity and changes in the color, temperature or moistness of the skin. The cause of CRPS is unknown, and there is no cure.

**Failed back syndrome (FBSS) or post-laminectomy syndrome (lumbar or cervical)** is persistent or recurrent pain, mainly involving the lower back and/or legs, even after prior anatomically successful spinal surgery. FBSS is considered a diagnosis of exclusion, so CT scans or MRIs must demonstrate that there are no surgically correctable lesions present. Patients with FBSS often have epidural/intraneural/perineural fibrosis or scar tissue, which generally will not respond to surgery but may respond to SCS.

**Nerve damage, neuropathy or neuritis** normally occurs when the outer sheathing or the myelin (protective covering) of nerve cells degenerate. There are many conditions and diseases that cause nerve damage. More than 100 types of peripheral neuropathy pain have been identified, each with its own characteristic symptoms. These symptoms depend on the type of nerves involved. Some people may experience temporary numbness, tingling and pricking sensations, sensitivity to touch, or muscle weakness. Others may experience more extreme symptoms, such as burning pain (especially at night), muscle wasting, paralysis or organ or gland dysfunction.

## Surgery Risks

As with any surgical procedure, there are risks, including:

- Allergic reaction
- Bleeding
- Headache
- Infection
- Paralysis or weakness
- Spinal fluid leakage
- Worsened pain

### SCS-specific Risks

- Stimulation stops or only works intermittently
- Stimulation affects the wrong location
- Overstimulation
- Poor system connection
- Device malfunctions requiring revision surgery
- The lead may move or become damaged, requiring surgical repositioning or removal
- Device interactions with other tests/devices

### Precautions

- The patient should not drive or use heavy equipment while the stimulator is activated.
- SCS systems may set off metal detectors at airports and elsewhere. The physician will provide special identification that certifies the a SCS system. Patients should carry this with them to avoid any security problems.
- Anti-theft devices in retail stores may temporarily increase stimulation if the system is on when the patient walks through. It is best to turn off the stimulator before walking through any of these devices.
- The magnet on the stimulator-control device may damage certain items or erase information on items with magnetic strips including credit cards, video or audiocassettes and computer disks. The magnet can impair watches and clocks, so store the magnet at least two inches away.
- MRIs, ultrasound, defibrillators, electrocautery, diathermy and cardiac pacemakers can damage or cause adverse effects to the SCS device.

## Outcome

Although the exact mechanisms of its action are not fully understood, there is evidence that SCS is beneficial in the treatment of several pain syndromes, with fairly consistent results. One study reported that an estimated 60 percent of people who received SCS experienced pain reduction or relief when surveyed one to two years post procedure.

In patients with FBSS, clinical studies have shown good outcome when the following criteria is present:

1. Treatment is initiated early (within 0–3 years) after first failed back surgery;
2. Predominance of neuropathic leg pain; and
3. Absence of psychological conditions such as depression.

*The AANS does not endorse any treatments, procedures, products or physicians referenced in these patient fact sheets. This information is provided as an educational service and is not intended to serve as medical advice. Anyone seeking specific neurosurgical advice or assistance should consult his or her neurosurgeon, or locate one in your area through the AANS' Find a Board-certified Neurosurgeon online tool.*