

Neurostimulation and Chronic Pain Management

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Neurostimulation has been used for several decades and become increasingly popular for treatment of chronic intractable pain. Following is introducing the principles of spinal cord stimulation (SCS) and peripheral nerve stimulation (PNS).

What is Neurostimulation?

A neurostimulator is a therapy with an implanted device consisting of leads and an implantable pulse generator (IPG). The leads are percutaneously inserted into epidural space or near to the peripheral nerve, where leads deliver electrical impulses. The IPG can be implanted in several different anatomic regions based on the patient or surgeon preference. The mechanism of pain relieved by neurostimulation is unknown. The common consent is that electrical impulse modifies the pain signal before reaching brain. The pain reduction from SCS may be associated with inhibition of neurotransmitters [1].

What are Indications?

Spinal cord stimulation and peripheral nerve stimulation have been widely used for various pain syndromes. Here we summarize the following indications.

Indications of SCS

Neuropathic pain: radiculitis (cervical, thoracic, lumbar and sacral), postherpetic neuropathy, complex regional pain syndrome (CRPS I and II), brachial and lumbar plexus neuropathy, axial pain secondary to degenerative disc disease, lower back caused by lumbar stenosis, arachnoiditis, peripheral neuropathy (including diabetic peripheral neuropathy), phantom pain, idiopathic neuropathic foot pain, post-thoracotomy syndrome, post-laminectomy, coccydynia, and trigeminal neuralgia.

Ischemic vascular diseases are peripheral vascular disease, Refractory angina, Raynaud's syndrome and Visceral pains are chronic abdominal pain, chronic pancreatitis, renal pain; chronic pelvic pain.

Indication of PNS

Axial pain (cervical, thoracic, lumbar, sacral); headaches (cervicogenic, occipital neuralgia, migraine, tension-type, cluster, hemicrania continua); complex regional pain syndrome, abdominal pain, inguinal neuralgia, facial pain.

How do we Select Patients?

The patient selection for spinal cord stimulation is one of the keys to achieving successful treatment outcomes. The likelihood of risks, complications, and adverse events and the realistic expectations and functional goals should be discussed. All candidates should pass psychological evaluation. The patients should have no contraindication to therapy and surgery.

What is the Neurostimulation Trial?

Neurostimulation trial is a procedure in which SCS lead(s) are percutaneously inserted into the appropriate anatomic spinal space or PNS lead(s) to the anatomic region near to the affected nerve(s). It is an outpatient procedure with mild sedation or local anesthesia. The patients will wear an external pulse generator and receive stimulation

therapy for 5-7 days to experience the effectiveness of neurostimulation therapy. The patient is encouraged to participate in routine functional activities in order to assess the degree of pain reduction and functional improvement. Over-activity or significantly reduced activity during the trial will not help to determine the efficacy of therapeutic outcome. The goal for pain reduction is at least a 50% reduction in pain without intolerable side effects. Functional goals should be patient-specific and may include less pain reduction, but should also consider an improved quality of life.

How and when does Implantation Take Place?

After the successful trial, the permanent SCS or PNS leads are inserted with a similar technique as during the trial. However, the leads are anchored to the deep fascia to prevent lead migration. An IPG (Implantable Pulse Generator) is also implanted. The IPG can be either rechargeable or non-rechargeable and the need for either is patient specific. This procedure can also be done in the outpatient setting with mild sedation.

What is the Outcome of Neurostimulation?

The outcomes of pain relief and functional improvement are dependent on three major factors. Patient factors include underlying pathology, patient's participation/motivation and expectations. Physician's factors include clinical experience such as acute diagnostic accuracy, precise lead implantation and surgical skill. The outcome is also dependent in some degree on the Neuromodulation Clinical Specialist from the SCS manufacturer. Well trained Neuromodulation Clinical Specialists can program the electrical current to cover desired painful area without causing over stimulation. In general, the success rate of PNS is 60% and SCS is 47% to 67% on average (2).

What are the Post-implantation Considerations for Care?

After the procedure, the patient should avoid bending, lifting or twisting for 6 weeks after surgery depending on the location of the neurostimulation in order to prevent the lead migration. The patient should also avoid very aggressive activities such as diving, free weight lifting and wrestling. The patient should also be trained to use the device in terms of amplitude adjustments and recharging. The patient should be followed up closely after the procedure. After the immediate post-surgical care, patients should be seen every three to six months in order to maximize the efficacy of pain relief and functional improvement.

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What are the Common Complications?

The common device-related complications are depletion of pulse generator and lead migration. Other complications include pain at the IPG site, pain at the anchoring site and infection [2]. Some of these complications are preventable in the well-trained surgeons.

In summary, neurostimulation provides a cost-effective treatment for very selective patients who failed conservative therapies [3]. This modality is a minimally invasive and reversible. This therapy can avoid the side-effects of chronic pain medication and is typically less costly than spine surgical intervention.

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