Neuropathic Pain:

Treatment with Spinal Cord Stimulation (SCS)

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Spinal cord stimulation may be offered to patients who do not find adequate relief from expert treatment with pain medications

Neuropathic pain is pain that is generated by nervous tissue itself. It is a disordered response to nerve injury of either the central nervous system (spine and brain) or peripheral nervous system (in areas of the body beyond the spine and brain).

A European survey found chronic pain was rated as moderate to severe in 19% of people surveyed.[9] It is estimated that neuropathic pain affects up to 10% of the population. Neuropathic pain is responsible for 30 to 65% of activity seen at hospital pain clinics.

Although its course is poorly understood, it is a long-term condition – usually lifelong. In severe cases the health-related quality of life is rated worse than other pain conditions, heart failure and even cancer diagnoses.[4] It is only in recent times that mainstream medicine and the healthcare systems around the world are taking note of the societal burden of neuropathic pain.

Typical cases include pain after nerve root injury in spinal disorders (commonly known as failed back surgery syndrome [FBSS]), post-amputation pain, other traumatic neuropathies, complex regional pain syndrome and metabolic and viral neuropathies. With the help of expert treatment using pain medications, some of these patients can receive adequate relief. For others, the burden of therapy is too great or ineffective, and these patients can be offered spinal cord stimulation (SCS). [10]

In SCS, mild electric currents applied to the spine through small medical devices interrupt pain signals and replace the sensation with a mild tingling known as paraesthesia. In therapeutic use for over 40 years, SCS successfully treats neuropathic pain of the peripheral nervous system.[8]

In recent years, there have been important advances in knowledge of how best to use SCS, increasing sophistication of the technology, and more studies demonstrating its effectiveness in treating patients with refractory neuropathic pain.[1-6] Among its other medical applications, SCS is also used in chronic critical limb ischaemia, angina pectoris, chronic pancreatitis, chronic painful bladder syndrome, and chronic abdominal pain.[7]

New developments

The commonest indication for SCS is FBSS. Neuropathic buttock and leg pain can often be successfully treated, but the associated back pain can be difficult to treat since its basis may go beyond neuropathic pain, involving another pain system called nociceptive.

A number of strategies, described below, have evolved in order to meet the need to relieve pain of mixed origin.

Spinal cord stimulation involves placing a series of electrical contacts in the epidural space near the spine in the region that

supplies nerves to the area to be treated.[11] The trend is evermore towards minimally invasive outpatient techniques for this procedure. Generally, a patient will try a temporary SCS treatment and if it is found to reduce pain by at least 50 %, the patient returns to receive an implanted pulse generator.

Rechargeable implantable pulse generator

Stimulation is supplied by the pulse generator, which is about the size of a thin matchbox. Improvements in battery technology have allowed the development of fully rechargeable implantable pulse generators (RIPGs). A patient may spend approximately two hours per week charging their device with an induction coil device without interrupting treatment. Some IPGs have no life limit such that one IPG may last 10 to 25 years depending upon usage. Being rechargeable offers the ability to run multiple programmes simultaneously to cover all the area needed. The other benefit is that the patient can use the SCS as much as wanted.

The IPGs are placed under the skin either in the abdominal or chest wall or upper outer buttock, slightly above the location of a hip pocket on a pair of jeans. The patient has a remote control unit to allow adjustments to their programmes, switching between them in order to achieve desired coverage in different postures.

One manufacturer has even incorporated accelerometers (iPhone technology) that allow the IPG to sense whether the patient is sitting or lying on his or her back or side and to automatically adjust programmes that have been preselected in each position or activity.

Other targets and strategies for achieving better coverage

To better cover areas of the back, nerve root stimulation can be used in isolation or in combination with SCS. Low back pain can also be treated by placing electrodes across the low back, with the goal of stimulating shallow nerve branches there. This can even be combined with SCS to optimise back coverage in those difficult to achieve with SCS alone.

Peripheral field nerve stimulation is an emerging therapy. Stimulation is applied to nerve junctions or branches just under the skin. This approach is being used to treat severe, persistent head pain, as well as in post-surgical traumatic neuropathies after groin or gynaecological surgery. Many localised but difficult-to-treat chronic pains may be helped by peripheral field nerve stimulation techniques.

A recent new development has been the discovery that high-frequency SCS achieves pain relief of the back and leg of patients who have not responded to conventional SCS. Further work will be needed to understand how it works and more about its clinical effectiveness.

Another new technique with CE mark approval going through clinical trials in Europe and Australia may allow more precise and even stimulation. In it, fine electrodes with 4 contacts are threaded through the epidural space and allowed to lie up against tissue known as the sensory dorsal root ganglia. The technique can selectively stimulate different areas, which allows focussing of stimulation onto specific nerve roots or parts of nerve roots. Due to the local anatomy, the stimulation remains relatively even when the patient moves. Such low power is required that a non-RIPG will suffice with excellent device longevity.

The evidence base for SCS is different than for pharmaceuticals, which are usually proven through large clinical trials. Similar trials are not fully possible with SCS, since sham stimulation will not produce the telltale tingling of paraesthesia, and unnecessary surgical procedures to place a device in volunteer subjects would not be advised. Since the treatment effect of SCS is so large, however, many relatively smaller SCS studies have still demonstrated clinical significance.[12, 13]

In 2008, the UK Health policymaking advisory group, the National Institute of Clinical Excellence, issued guidance that SCS should be used for refractory neuropathic pain, finding it both effective and cost-effective, with lower lifetime healthcare cost and better long-term outcomes.[14, 15]

Still, across Europe, its use is being adopted slowly. In Belgium the estimated number of patients getting SCS compared to those who need it is still only at about 10%. In the UK, only about 1,000 patients receive it per year, placing a similar estimate at only 3%.

However, it is likely that in the future, medical implants that provide neurostimulation, such as SCS, will be as commonplace as heart pacemakers are today.

Please note: *This information should not be used as a substitute for medical treatment and advice. Always consult a medical professional about any health-related questions or concerns.*

References

1. North RB et al. Spinal cord stimulation versus repeated lumbosacral spine surgery for chronic pain: a randomised, controlled trial. Neurosurgery 2005;56:98–106.
2. Kemler MA et al. Spinal cord stimulation in patients with chronic reflex sympathetic dystrophy. N Eng J Med 2000;343:618–624.
3. Kemler MA et al. Spinal cord stimulation for chronic reflex sympathetic dystrophy--five-year follow-up. N Eng J Med 2006;354:2394–2396.
4. North RB et al. Spinal cord stimulation versus re-operation in patients with failed back surgery syndrome: an international multicenter randomised controlled trial (EVIDENCE Study). Neuromodulation 2011;14:330–6.
5. Kumar K et al. Spinal cord stimulation versus conventional medical management for neuropathic pain: a multicentre randomised controlled trial in patients with failed back surgery syndrome. Pain 2007;132:179–188.
6. Kumar K et al. The effects of spinal cord stimulation in neuropathic pain are sustained: a 24-month follow-up of the prospective randomised controlled multicenter trial of the effectiveness of spinal cord stimulation. Neurosurgery 2008;63(4):762–770.
7. Ekre O et al. Long-term effects of spinal cord stimulation and coronary artery bypass grafting on quality of life and survival in the ESBY study. Eur Heart J 2002;23:1938–1945.
8. Cruccu G et al. EFNS guidelines on neurostimulation therapy for neuropathic pain. Eur J Neurol 2007;14:952–970.
9. Breivik H et al. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. Eur J Pain 2006;287–33.
10. Thomson S, Jacques L. Demographic characteristics of patients with severe neuropathic pain secondary to failed back surgery syndrome. Pain Pract 2009;9:206–214.
11. Holsheimmer J, Struijk. How do geometric factors influence epidural spinal cord stimulation? A quantitative analysis by computer modelling. Stereotact Funct Neurosug 1991;234–249.
12. NICE. (2010) Neuropathic pain: the pharmacological management of neuropathic pain in adults in non-specialist settings. Available at: www.nice.org.uk/CG96 (Accessed: 13 March, 2012)
13. Attal N et al. EFNS guidelines on pharmacological treatment of neuropathic pain. Eur J Neurol 2006;13:1153–1169.
14. NICE. (2008) Spinal cord stimulation for chronic pain of neuropathic or ischaemic origin. Available at:www.nice.org.uk/TA159 (Accessed: 13 March, 2012)
15. Krames E et al. Using the SAFE principles when evaluating electrical stimulation therapies for the pain of failed back surgery syndrome. Neuromodulation 2011;14:299–311.