

## **PATIENT SELECTION FOR SPINAL CORD STIMULATION**

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### **Abstract**

Spinal cord stimulation (SCS) is now only rarely used in motor disorders and its efficacy for the neurogenic bladder is often forgotten. It is now recognised that neuropathic pain and ischaemic pain are the main indications. The first criterion is the diagnosis but this includes both specific and heterogeneous disorders. For some disorders the results are variable or unclear. No diagnosis is associated with 100% success; other selection criteria are therefore required. The quality of the pain and a psychiatric opinion are useful predictors of outcome. The reliability of psychological tests and of nerve stimulation including TENS has not been established. Trial cord stimulation is a surprisingly poor predictor of outcome where it is needed most (in the heterogeneous conditions). Too little is known about those screened out by trial stimulation and those in whom SCS fails. Finally, should ongoing litigation disqualify the patient from having SCS?

### **Introduction**

Therapeutic spinal cord stimulation (SCS) was introduced more than 30 years ago (1) but case selection remains problematic. SCS is undoubtedly of benefit in some motor disorders (2) but this general indication has been largely discarded. In multiple sclerosis (MS) particularly, a significant effect on the neurogenic bladder was often noted (3,4) but this application has not continued. Warming of the extremities during SCS in MS was regarded as a side effect but has gone on to form the basis of one of the two main broad indications for SCS, namely ischaemic pain. The other major contemporary indication is neuropathic pain. It is not yet known whether the effect in ischaemic pain is antinociceptive, anti-ischaemic or both. In general, SCS is not effective against nociceptive pain such as cancer pain, arthritis, wound pain, etc. Some neuropathic conditions respond better than others; diagnosis is the first selection criterion. All cases with the same diagnosis do not respond equally and some do not respond at all, indicating the need for further selection criteria.

### **The diagnosis**

The commonest indication is the failed back surgery syndrome (FBSS). This heterogeneous condition comprising persistent back and leg pain following lumbar spine surgery, often several operations, is not, however, one of the best indications. The leg pain responds much better than the back pain and mechanical back pain will not respond. Published success rates with SCS rarely exceed 60% overall (5) but SCS is probably superior to lumbar re-operation (6).

Chronic pain following surgical or traumatic damage to peripheral nerves or plexuses, including phantom pain, constitutes a favourable but variable group of indications (see ref.2 for review). Complete root avulsion from the cord precludes a

response. Post herpetic neuralgia (PHN) responds unpredictably, possibly reflecting the variable course of the condition. In contrast, painful diabetic neuropathy responds well in nearly all cases where posterior column function is preserved (7). Some cases of trauma to the limbs develop severe chronic pain and hypersensitivity associated with immobility, wasting and autonomic features including vasomotor instability, sweating and swelling. This may follow nerve damage (complex regional pain syndrome type II; formerly causalgia) or other trauma including crushing, burns, fractures (CRPS type I; formerly reflex sympathetic dystrophy). CRPS types I and II generally respond very well to SCS in the majority of cases, both the pain and the autonomic changes (8,9). It is not understood why some patients do not respond.

The pain that may follow spinal cord damage responds well in some patients but not others, the heterogeneity of the outcome reflecting the neurological heterogeneity of the cases. If the cord lesion is anatomically complete SCS will not work because of complete degeneration of the ascending A $\beta$  collaterals in the posterior columns which subserve the action of SCS in neuropathic pain (10). Perianal, genital and intercostal neuropathic pains other than PHN do not respond well, probably in part because of difficulty in stimulating topographically - appropriate fibres. The same applies to facial deafferentation pain ("anaesthesia dolorosa"); the spinal tract of the trigeminal system has been successfully stimulated in a few cases. Central post-stroke pain ("thalamic syndrome") cannot be regarded as an indication for SCS.

Ischaemic limb pain in patients unsuitable for (further) reconstructive arterial surgery is effectively relieved by SCS in at least two thirds of cases (11) and often far more (12,13). Mobility improves considerably. Small cutaneous ischaemic ulcers heal better than with prostaglandin treatment alone (14). Beneficial changes in the microcirculation are known to occur (13,15). Vasospastic conditions including Raynaud's disease can respond equally dramatically (16,17) but the numbers reported are small. In Europe, SCS is performed equally for ischaemic pain and neuropathic pain in contrast with the USA where it is rarely used in ischaemia.

The best indication for SCS, in terms of success rates, is intractable inoperable angina pectoris. This has become well established in some European countries. Nearly all patients experience fewer and less severe attacks, use less glyceryl trinitrate and have better exercise tolerance (18,19). There is a marked anti-ischaemic effect (20,21,22) which appears to be the primary effect although anti-nociception may also contribute. One of the few prospective randomised trials concerning SCS has shown it to be as effective as coronary bypass surgery in relieving angina but with a much lower morbidity and mortality (23).

### **Trial Stimulation**

Trial SCS is not usually employed in angina and peripheral vascular disease as the diagnosis is usually clear and unitary and because the success rate is very high. It is potentially most useful in heterogeneous conditions where the mechanism of the pain and/or the extent of the neurological damage are not clear, such as FBSS and spinal cord injury. Although frequently advocated, trial stimulation in such conditions yields a published long term success rate which barely exceeds 50%

overall. The success rate after trial stimulation is higher in more specific conditions, including ischaemic pains, but only to a similar level to that achieved without a trial (2). The fate of those rejected by trial stimulation is very rarely reported, which detracts from assessments of its efficacy. The false negative rate is not known. The causes of failure with a definitive implant, after a successful trial, are also not fully known. Peripheral nerve stimulation, direct, transcutaneously (TENS), chemically and thermally, has been employed sporadically in case selection for SCS but with no consensus. TENS does not appear to be a useful screening test.

### **Psychiatric and psychological assessment**

While nobody would deny that the seriously mentally disturbed should probably be excluded, few patients whose lives have been dominated by severe pain for years, with concomitant loss of independence, employment, social interaction, well-being and hope, will gain normal scores on psychological tests. Despite a large literature, the application of psychological testing has not materially influenced the success rate of SCS. In contrast, there is evidence that a *psychiatric* opinion is effective in identifying poor risk candidates (24). In Belgium, where reimbursement for SCS is conditional upon a psychiatric assessment, the success rate was three times higher in those approved by a psychiatrist in a series of 100 patients (25).

### **The quality of the pain**

It has long been recognised that a continuous burning feeling, which is typical of neuropathic pain, is a positive indicator (26). "Sharp" also correlates with success but descriptors with "added value" such as "wretched" and "terrifying" do not (27), nor do those from the McGill Pain Questionnaire depression set (28).

### **Litigation**

Some regard ongoing litigation, with its potential "disincentive for a positive treatment outcome", to be a contraindication for SCS (25,27,28). This would exclude many personal injury litigants who are totally genuine, who through no fault of their own have developed a pain syndrome which might well respond to SCS, and whose case may not be settled for several years.

### **Summary**

As with medicine in general, diagnosis precedes treatment. Pain is not a diagnosis. The diagnosis is the primary indicator for SCS. Where the diagnosis is unclear or non-specific, the mechanism of the pain should be elucidated if possible. Ischaemic pain responds the most predictably. Many neuropathic pain states respond well but not in every case. Psychological screening and trial stimulation are less good predictors of outcome than is commonly proposed but a psychiatric opinion does aid case selection. More needs to be known about the failures, both with definitive implants and from trial stimulation, before selection of patients can improve significantly. Even the lowest success rates are often remarkable, however, in very painful chronic conditions where all else has failed.

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