

Spinal Cord Stimulation for Treatment of Failed Back Surgery Syndrome - Two Case Reports

R Vijayan, FRCA*, T S Ahmad, FRCS**, *Department of Anaesthesiology, **Department of Orthopaedic Surgery, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur

Summary

Severe, persistent back pain following back surgery is often referred to as Failed Back Surgery Syndrome (FBSS). Conservative measures such as physiotherapy, back strengthening exercises, transcutaneous electrical nerve stimulation and epidural steroids may be inadequate to alleviate pain. Spinal Cord Stimulators were implanted into two patients suffering from FBSS. Both patients responded successfully to spinal cord stimulation with reduction of pain and disability.

Key Words: Failed back surgery syndrome, Chronic pain, Spinal cord stimulator, Electrical stimulation

Introduction

Severe persistent pain following back surgery is often referred to as "Failed Back Surgery Syndrome" (FBSS)¹. The cause of the pain is multi-factorial. Inadequate surgery with failure to recognize or treat lateral stenosis of the lumbar spine with resultant nerve irritation is a common cause. Other causes are recurrent or persistent disc herniation, epidural scarring, lumbosacral adhesive arachnoiditis and vertebral instability^{1,2}. Multiple surgery is usually attempted in an effort to alleviate pain and suffering. Pain is often described as severe pain in the back with radiation down the back of one or both legs. It is usually neuropathic in origin due to nerve entrapment in scar tissue. Inadequate pain relief hinders exercise and reduces mobility. As a result, patients get into a vicious cycle where chronic pain becomes a central focus in their lives. They become depressed and their social and family life suffers.

Conservative multimodal management includes patient education, physiotherapy with back strengthening exercises, transcutaneous electrical nerve stimulation (TENS), and the judicious use of analgesic drugs in an effort to break the vicious cycle of pain and muscle spasm. These maneuvers can improve mobility and may allow patients to have a better quality of life³. Epidural steroids can be administered in an effort to reduce epidural scarring, which is often the main cause for nerve entrapment and pain⁴. Spinal cord stimulation, a technique which is increasingly being used for FBSS, can be offered when the above measures fail^{4,5}. We present two patients who have benefited from implantation of spinal cord stimulators.

Case 1

A 44-year old, single Malay woman (RH) was referred to the Pain Control Clinic in October 1996 with a four year history of severe low back pain with radiation down

the legs. She gave a history of an episode of acute back pain in 1992, which was initially treated conservatively, but had had two back surgeries since then. A laminectomy for a herniated intervertebral disc at L 3-4 level and spinal fusion for persistent pain following the laminectomy. At the time of presentation she was in a great deal of discomfort despite controlled release morphine sulfate 30mg twice a day and carbamazepine 200mg three times a day. She had been off work for more than a year and could barely manage everyday activities. A MRI showed extensive epidural scarring from previous surgeries. Conservative management with physiotherapy, transcutaneous electrical nerve stimulation, addition of gabapentin to the opioid medication and a trial of epidural steroid injections over the ensuing two months failed to provide any significant relief. She was then offered a trial of a spinal cord stimulator.

With the patient in a prone position, under local anaesthesia and X-ray control, a single Pisces-Quad lead- Model 3487A (Medtronic Inc. Minneapolis, MN, USA) was inserted percutaneously into the epidural space via the lumbar 1 - 2 interspace and threaded up to the lower border of the body of T8 vertebra. (Fig. 1) A

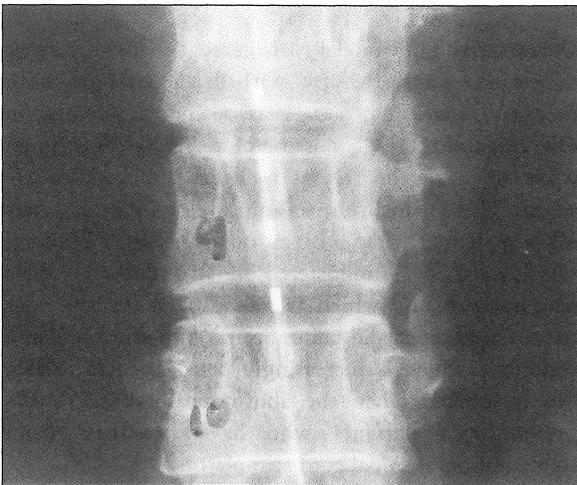


Fig. 1: X-ray (PA view) of the thoracic spine from T8 - T10 showing the midline position of the lead with its four electrodes

temporary screener kit was used to adjust the position of the lead in the epidural space so that the patient felt paresthesia (tingling sensation) over the painful areas of her back and legs. The lead was attached to a temporary extension, which was exteriorized and connected to a temporary screening stimulator. She was sent home the following day and advised to continue with stimulation for 10 - 20 minutes every three to four hours while maintaining a detailed record of activities in association with pain relief. She obtained excellent pain relief over the ensuing week with marked reduction in analgesic medications and we decided to implant a permanent SCS system. Under general anaesthesia, the temporary screener kit was replaced with a permanent Xtrel Receiver - Model 3470 (Medtronic) which was implanted in a subcutaneous pouch in the anterior abdominal wall and connected to the original epidural lead with a subcutaneously placed extension cable.

She continued to obtain excellent relief over the next four weeks, using an X-trel External Transmitter and antenna (Model 3425) over the implanted receiver for stimulation and for the first time in four years was able to move around without discomfort. Four weeks after the initial implantation, she suffered a setback when she came back to the hospital with severe postural headache. Neurological examination including CT scan of brain did not reveal any abnormality and she had no signs of any infection. A lumbar puncture done to rule out cryptococcal infection revealed low CSF pressure. A presumptive diagnosis of late post-dural puncture headache was made and she was treated with an epidural blood patch. She improved dramatically after the blood patch and was able to get back to light duties about ten weeks after the initial implantation. She remained well over the next eight months and had sufficient pain relief to be able to travel to Mecca for the Umrah. Pain recurred following a motor vehicle accident at the end of October 97. X-rays showed that the epidural lead had shifted up by 0.5cm. The stimulation parameters and electrode combinations were readjusted to cover the painful areas and pain relief was regained. Eighteen months after the initial implantation, the patient is well, is continuing to obtain sufficient pain relief with the stimulator to allow her to carry out her normal activities at home. Her medication intake is down to oral Tramadol 50mg, twice a day.

Case 2

A 32-year-old Chinese woman (YSC) was referred to the Pain Control Clinic in December 1995 with complaints of severe back pain radiating down both legs. She had had a lumbar laminectomy 18 months prior to her referral, for a herniated intervertebral disc. She was unable to undertake her duties as a lecturer and had been off work of a year. Clinical examination and MRI scan, which showed epidural scarring, was consistent with the diagnosis of 'failed back surgery syndrome'.

Conservative management included patient education, epidural steroid injections, physiotherapy and a trial of transcutaneous electrical nerve stimulation. She obtained about 20 - 30% pain relief with these measures and was sufficiently confident to go back to teaching part time at the University. Analgesic medication consisted of tramadol, as the patient was allergic to a variety of non-steroidal-anti-inflammatory drugs. A trial of gabapentin produced marked rash and was promptly discontinued. She was managed conservatively over the next eighteen months but continued to have episodes of severe leg pain. She was becoming depressed and hardly went out socially. In view of the success we had with the previous patient she was offered spinal cord stimulation.

A single Pisces Quad lead Model 3487A (Medtronic Inc., Minneapolis, MN, USA) was inserted, in the same manner as described in Case 1, at the Lumbar 1 - 2 interspace and threaded up to T8. Paresthesia was obtained over one side of the back and down both legs at 4.5V. She was sent home for a trial stimulation period of a week. She returned to the hospital prematurely with sharp pain in the interscapular region coinciding with the onset of stimulation. Extensive changes to stimulation parameters, such as rate, pulse width and electrode combinations as well as an attempt to readjust the lead under local anaesthesia failed to solve the problem and the lead was removed.

The procedure was repeated four weeks later using two leads in an attempt to provide wider coverage. The first lead, a Pisces Quad 3487A (Medtronic) was inserted into the epidural space through the T12 - L1 interspace and another similar lead was inserted via a lower interspace, at L1 - L2. The leads were threaded up to the

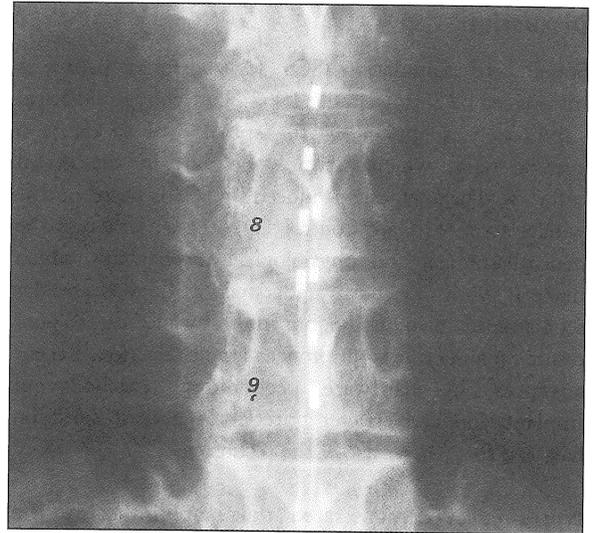


Fig. 2: X-ray (PA view) of the thoracic spine T7 - T10 shows the position of the two leads in the midline of the epidural space

bodies of T8 and T9 vertebrae (Fig. 2) and the positions adjusted to obtain paresthesia over the whole of the back and down the back of both legs including the feet. The two lead extensions were exteriorized and connected to the temporary screening kit. After a successful trial period of two weeks, a Matrix Implantable Receiver Model 3272 (Medtronic Inc) was implanted under general anaesthesia. It was placed in a subcutaneous pouch in the anterior abdominal wall and the dual extensions were connected to the two epidural leads using a subcutaneous tunnel. The Matrix External Transmitter Model 3210 with antenna was used over the implanted receiver to obtain spinal cord stimulation. At follow up, a month later, the patient continued to obtain excellent pain relief with stimulation and was able to stop all analgesic medications. Fifteen to twenty minutes of SCS provided three to four hours of total pain relief. In addition, she was ready to undertake a part time further education course as well as continue with her teaching at the University.

Discussion

Spinal cord stimulation (SCS) for control of pain was introduced by Shealy et al in 1967⁶. Low voltage electrical stimulation is applied to the spinal cord to create a current field, which activates neurons in the dorsal columns. The analgesia produced by SCS is based on the widely accepted Gate Control Hypothesis, although the neuroanatomical and physiological mechanisms which make it work are poorly understood⁷. SCS was popular soon after its introduction, but interest waned due to poor results, mainly due to improper patient selection. Recent advances in hardware technology, methods of implantation and stricter criteria for patient selection have led to a resurgence of the technique⁸.

North et al demonstrated that superimposing the paraesthesia, created by electrical stimulation of the spinal cord, over the patient's area of pain is a necessary condition for pain relief⁹. Intra-operative testing, with the patient's cooperation, is therefore an essential tool for optimum placement of the lead. Trial stimulation in the patient's own home is also important, as it allows the patient to decide whether stimulation is effective in reducing pain during ordinary activities of daily living. If the trial period does not result in at least 50% reduction of pain, it is deemed to be a failure and the lead is removed. The permanent receiver is therefore only implanted in those patients who have responded positively to the trial stimulation. This sequence can reduce the cost of a trial stimulation by half with considerable cost savings. We repeated the trial in our second case, as the patient did not have an opportunity to really test the device due to severe interscapular pain with stimulation. The pain could have been due to the close proximity of the electrode to a nerve root.

Failed Back Surgery Syndrome (FBSS) is one of the commonest indications for SCS. In a 5-year follow up study of 50 patients with FBSS who had SCS implanted, North et al recorded a successful outcome (at least 50% sustained pain relief) in 53% of patients at 2.2 years and

47% of patients at 5.0 years⁵. Ten of 40 patients who were disabled preoperatively returned to work with marked improvement in activity. Most patients had also reduced or eliminated analgesic intake. Both our patients had marked improvement in their functional status and the second patient was able to stop all analgesics. SCS has also been shown to have a significantly higher success rate in females than males, and in radicular rather than axial pain⁵. Turner et al reviewed all literature concerning the use of SCS for back pain and found that 50 - 60% of patients had a successful outcome with the procedure. Forty two percent of them had complications, but most of these were minor⁹. Complications that have been reported are CSF leak¹⁰, infection at the site of implantation, breakage of leads and lead migration which may necessitate removal or readjustment of leads.

Better outcomes seen in recent studies could be due to more stringent criteria being applied for SCS implantation. Pain is a complex mix of physical and psychosocial factors and therefore psychological assessments are usually recommended prior to any interventional therapy. Psychological tests cannot predict treatment outcome but have been found to assist in patient selection i.e. to exclude patients with risk factors such as a drug addiction problem, a serious mood disorder or borderline personality disorder¹¹. SCS has also been used in the successful management of other types of neuropathic pain syndromes such as complex regional pain syndrome - Type I (reflex sympathetic dystrophy) and in patients with peripheral vascular insufficiency⁷.

Conclusion

Chronic pain of FBSS is difficult to treat. When conservative modalities fail, SCS may be an option in selected cases, particularly when pain is largely neuropathic in origin.

References

1. Burton CV, Kirkaldy-Willis WH, Yong-Hing K, Heithoff KB. Causes of failure of surgery on the lumbar spine. *Clin Orthop* 1981; Jun 157: 191-99.
2. Yaksich I. Failed back surgery syndrome: problems, pitfalls and prevention. *Ann Acad Med Singapore* 1993; 22: 3 Suppl 414-17.
3. Raj PP. Management of low back pain. *Pain Digest* 1994; 4: 55-64.
4. Benzon HT. Epidural Steroid Injections for low back pain and lumbosacral radiculopathy. *Pain* 1986; 24: 277-95.
5. North RB, Ewend MG, Lawton MT, Kidd DH, Piantadosi S. Failed Back Surgery Syndrome: 5-year follow up after spinal cord stimulation. *Neurosurgery* 1991; 28: 5; 692-99.
6. Shealy CN, Mortimer J, Reswick J. Electrical inhibition of pain by stimulation of the dorsal columns: A preliminary report. *Anesth Analg* 1967; 46; 489-91.
7. Stanton-Hicks M, Salamon J. Stimulation of the central and peripheral nervous system for the control of pain. *J Clin Neurophysiol* 1997; 14: 46-62.
8. North RB, Ewend MG, Lawton MT, Piantadosi S. Spinal cord stimulation for chronic, intractable pain: superiority of "multi-channel" devices. *Pain* 1991; 44: 119-30.
9. Turner JA, Loeser JD, Bell KG. Spinal cord stimulation for chronic low back pain: a systematic literature synthesis. *Neurosurg* 1995; 37: 1088-96.
10. Vijayan R, Ahmed TS. Late postdural puncture headache following implantation of a lumbar spinal cord stimulator - Case report. *Pain Digest* 1997; 7: 349-50.
11. Burchiel KJ, Anderson VC, Wilson BJ, Denison DB, Olson KA, Shatin D. Prognostic factors of spinal cord stimulation for chronic back and leg pain. *Neurosurg* 1995; 36: 1101-11.