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Case Report

Sacral Nerve Stimulation for Treatment of Intractable Pain Associated with Cauda Equina Syndrome

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Sacral nerve stimulation (SNS) is an effective treatment for bladder and bowel dysfunction, and also has a role in the treatment of chronic pelvic pain. We report two cases of intractable pain associated with cauda equina syndrome (CES) that were treated successfully by SNS. The first patient suffered from intractable pelvic pain with urinary incontinence and fecal incontinence after surgery for a herniated lumbar disc. The second patient underwent surgery for treatment of a burst fracture and developed intractable pelvic area pain, right leg pain, excessive urinary frequency, urinary incontinence, voiding difficulty and constipation one year after surgery. A SNS trial was performed on both patients. Both patients' pain was significantly improved and urinary symptoms were much relieved. Neuromodulation of the sacral nerves is an effective treatment for idiopathic urinary frequency, urgency, and urge incontinence. Sacral neuromodulation has also been used to control various forms of pelvic pain. Although the mechanism of action of neuromodulation remains unexplained, numerous clinical success reports suggest that it is a therapy with efficacy and durability. From the results of our research, we believe that SNS can be a safe and effective option for the treatment of intractable pelvic pain with incomplete CES.

KEY WORDS : Sacral Plexus · Neuromodulator · Pain · Cauda Equina.

INTRODUCTION

Sacral nerve stimulation (SNS) is an effective treatment for bladder and bowel dysfunction, and also has a role in the treatment of chronic pelvic pain. Its mechanism is uncertain, but this approach can substantially improve the quality of life for patients with pain refractory to traditional pharmacological therapy[19]. Cauda equina syndrome (CES) has been defined as low back pain, unilateral or usually bilateral sciatica, saddle sensory disturbances, bladder and bowel dysfunction, and variable lower extremity motor and sensory loss. It is quite difficult to improve intractable pain with medical treatment. If the patient has only pain, spinal cord stimulation (SCS) can be useful. In the case of intractable pain with combined urinary or fecal dysfunction, SNS has been a good option for treatment[9,12,16]. In this paper, we report the application of SNS for intractable pain with combined urinary or fecal dysfunction associated with CES.

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CASE REPORT

Case 1

A 60-year-old female patient had undergone discectomy surgery one year prior to presentation. After the operation, she suffered intractable pelvic pain with urinary incontinence and fecal incontinence. The pain was minimally relieved with oral medications (codeine, acetaminophen, ibuprofen, muscle relaxants, amitriptyline, diazepam). She underwent a bladder neck sling procedure in the urology department for urinary incontinence. Her symptoms were not improved and her visual analogue scale (VAS) of pelvic pain was still 9/10. She had a saddle anesthesia and her anal tone was decreased. Nerve conduction study (NCS), electromyography (EMG) and somatosensory evoked potential (SSEP) finding was multiple lumbosacral radiculopathy with sacral arc lesion, clinically, cauda equina syndrome. We performed a SNS trial of one week duration. InterStim (Model 3093 Quadripolar lead, Medtronic, Minneapolis,

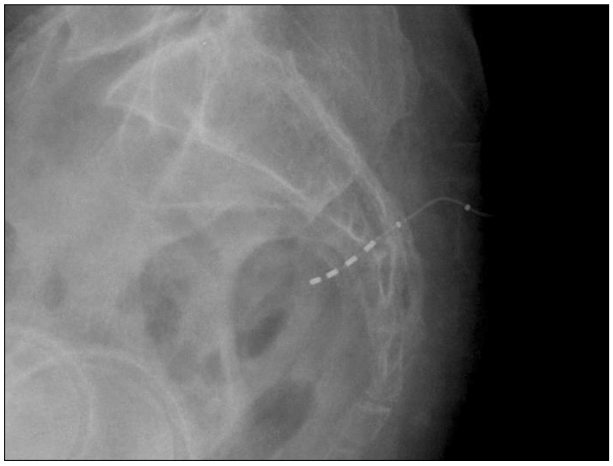

Fig. 1. Post operative plane X-ray image shows that Interstim (Model 3093 Quadripolar lead, Medtronic, Minneapolis, MN, USA) is placed percutaneously by way of a dorsal approach through the right S3 foramen.

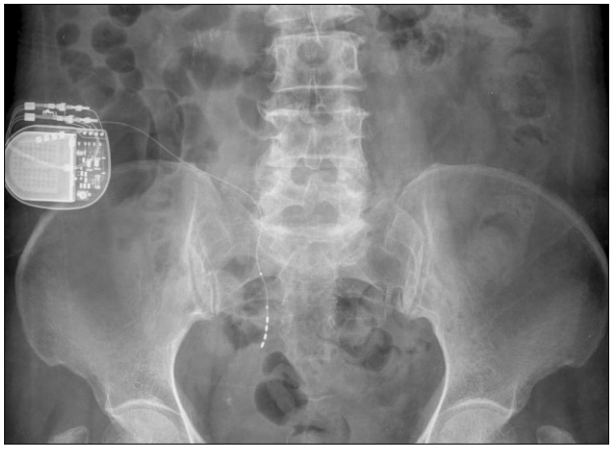

Fig. 2. The pulse generator is placed in right lower quadrant of abdominal subcutaneous layer.

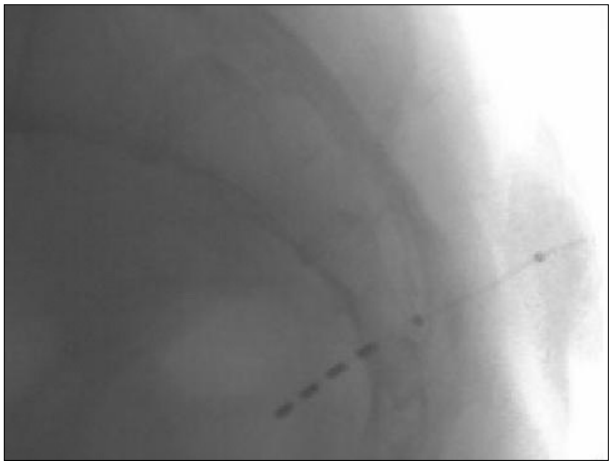

Fig. 3. Intraoperative C-arm image, the electrode is well placed through the right S3 foramen.

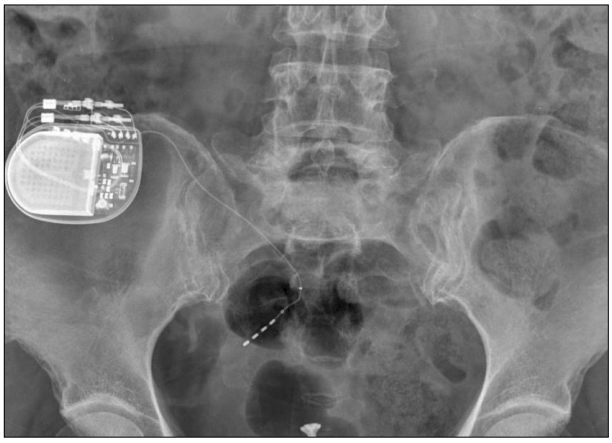

Fig. 4. She decided to implant the pulse generator. Post-operative simple X-ray shows the pulse generator is well placed in right lower quadrant of abdominal subcutaneous layer.

MN, USA) was placed percutaneously using a dorsal approach through the right S3 foramen (Fig. 1). The predicted S3 foramen location was a line connection the inferior border of the bilateral sacral iliac joint. The point of lead insertion was approximately 1.5 cm above the marked location of S3. During the procedure, stimulation produced a contraction of the pelvic floor as well as plantar flexion of the great toe, and adjacent toes, so confirming the location of S3 root. Her pain was significantly relieved from 9 to 3 on VAS and her urinary incontinence was reduced during the trial period. And, the sensory at saddle area was recovered moderately. After that, she underwent surgical implantation of a permanent pulse generator which was placed in right lower quadrant of abdominal subcutaneous layer (Fig. 2). Last stimulation parameters programmed in this patient were as followed : electrode, 2(-), 1(+); pulse width, 300 μsec; rate, 54 Hz; amplitude, 3.8 V. In last follow-up 18 months after the operation, her pain maintained a score of 4 on VAS without medications. Activities of daily life were restricted by her pain, but she is performing a daily life without an inconvenience at present

Case 2

A 58-year-old female patient suffered an L1 burst fracture and underwent surgery (transpedicular screw fixation on T11, T12, L1, L2) one year prior to presentation. She developed intractable pelvic area pain, right leg pain, urinary frequency, urinary incontinence, voiding difficulty and constipation. She was taking oral codeine, acetaminophen, ibuprofen, and gabapentin (1,800 mg/day). Her pelvic and right leg pains were 10/10 on VAS prior to undertaking a SNS trial (Fig. 3). NCS, EMG and SSEP finding was bilateral polyradiculopathy with sacral arc lesion, clinically, cauda equina syndrome. The procedure was same as Case 1. After a week, her pain was relieved, down to 5 on VAS, and her urinary frequency was much improved. She decided to have a

permanent pulse generator implanted. After that, she underwent surgical implantation of a permanent pulse generator which was placed in right lower quadrant of abdominal subcutaneous layer (Fig. 4). Last stimulation parameters programmed in this patient were as followed: electrode, 1(+), 2 (-); pulse width, 330 μsec; rate, 50 Hz; amplitude, 3.6 V. In last follow-up 20 months after the operation, her pain maintained at 5 on VAS with intermittent medication. The result of psychiatric test was depressed mood, but it was much improved postoperatively.

DISCUSSION

In 1997, sacral nerve modulation (InterStim, Medtronic, Minneapolis, MN, USA) was approved by the Food and Drug Administration for urinary urge incontinence, urinary urgency-frequency, and nonobstructive urinary retention. The major frontiers for sacral neuromodulation in adults are interstitial cystitis and chronic pain syndromes (pelvic pain, prostadynia, epididymo-orchalgia, and vulvodynia), neurogenic bladder from spinal cord injury, fecal incontinence and constipation, and erectile dysfunction[4]. The mechanism of action of sacral neuromodulation remains uncertain. The mechanism of action of direct spinal cord stimulation is generally assumed to be based on the gate control theory of Melzack and Wall[13]. Sacral nerve stimulation for the control of pain is thought to work by a similar mechanism.

Sacral neuromodulation has been used to control a variety of forms of pelvic pain. Siegel et al.[16] performed a feasibility study in patients with intractable pelvic pain. They showed that sacral nerve stimulation decreased the severity and duration of the pain with improvement in quality of life. Similarly, Everaert et al.[6] achieved improved pelvic pain levels using sacral neuromodulation.

Neuromodulation of the sacral nerves is an effective treatment for idiopathic urinary frequency, urgency, and urge incontinence[12]. The mechanism of action is not completely understood, but this approach can substantially improve the quality of life for patients with pain refractory to traditional pharmacologic therapy[19]. Especially, neuromodulation of the sacral nerves has been used for treatment of interstitial cystitis. Interstitial cystitis is a painful and frequently debilitating condition of the urinary bladder. In 2003, Comiter[5] performed a prospective study that evaluated sacral neuromodulation for the treatment of refractory interstitial cystitis. Ninety-four percent of subjects with implants demonstrated a sustained improvement in symptoms. SNS can also be helpful for neurogenic bladder caused by spinal cord injury. Vastenholt et al.[18] reported a series of 37 patients with spinal cord injury who underwent implantation of sacral anterior root stimulators. Overall improvement in incontinence was 73% and urinary tract infections decreased by 87% after implantation.

Bowel function is another area of research in the field of neuromodulation. Both fecal incontinence and chronic constipation are difficult clinical entities[4]. Matzel et al.[11] analyzed SNS outcomes for patients with fecal incontinence treated with a permanent neurostimulator with follow-up ranges up to 14 years. Ripetti et al.[15] reported that neuromodulation improves incontinence and obstructive defecation symptoms. Ganio et al.[8] showed sacral neuromodulation decreases the number of unsuccessful defecation attempts and reduces the difficulty of defecation. In addition, Gstaltner et al.[9] retrospectively studied 11 patients suffering from flaccid paresis of the anal sphincter muscle and fecal incontinence caused by CES. They reported that, in the case of flaccid paresis of the anal sphincter muscles caused by an incomplete CES, permanent SNS offers a promising option for the treatment of fecal incontinence.

In each of our cases, the patient suffered from intractable pelvic pain, urinary incontinence and fecal incontinence. Clinical signs accompanying CES may differ in each individual patient but the fully developed syndrome is characterized by low-back pain, bilateral sciatica, pelvic hypaesthesia or anaesthesia, motor weakness of the lower extremities, impairment of anal, bulbocavernous, medioplantar, and Achilles' tendon reflexes bilaterally, rectal and bladder sphincter dysfunction, and sexual impotence[2,7,14]. Although a precise definition of CES has not been well established, most authors believe that an element of bladder dysfunction is required for the diagnosis[1,10,17]. We believe that SNS can be effective in these patients. However, there are limitations and precautions for the use of SNS in CES patients. If the sacral parts of the spinal cord or all the responsible sacral nerves are completely transected, the stimulation will not be effective. It is quite difficult to distinguish between complete and incomplete CES. Also, it is uncertain what degree of injury is best treated by SNS. Therefore, indications for the appropriate use of SNS should be considered[15].

CONCLUSION

SNS is simple, non-destructive and reversible. We suggest that this procedure may be an effective treatment option with low morbidity for the management of patients with intractable pain with combined urinary or fecal dysfunction associated with CES. It remains difficult to predict which patients will most benefit from this treatment. Longer follow-up periods with more cases are needed to fully validate efficacy of this treatment.

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