Spinal Cord Stimulation in the Treatment of Complex Regional Pain Syndrome (CRPS) of the Lower Extremity: A Case Report

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Complex regional pain syndrome (CRPS) is a condition that is often associated with the extremities. This chronic pain syndrome, when localized to the lower extremity, includes peripheral changes such as edema, temperature alterations, limited range of motion, loss of or excessive perspiration, pain out of proportion to any stimulus, and trophic alterations of the skin, hair, and nails. In this report, we describe the case of a patient who developed complex regional pain syndrome following an ankle injury and surgery. This case report highlights treatment options that are available to patients experiencing complex regional pain, including the use of a spinal cord stimulator. Level of Clinical Evidence: 4 (The Journal of Foot & Ankle Surgery 48(1):52–55, 2009)

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Complex regional pain syndrome (CRPS), formerly known as reflex sympathetic dystrophy, is often a devastating neuropathic condition that has, in recent years, been recognized with increasing frequency in the lower extremities. Patients with CRPS, who are not diagnosed and treated in a timely fashion, may worsen to such a degree that the individual may never return to a satisfactory and productive life. Spinal cord stimulation (SCS) has been used in the treatment of neuropathic pain since 1967 (1). Although it was infrequently used during the 1970s and 1980s, SCS has gained in popularity over the past 15 years because of technological progress that has directly impacted the use of implantable systems. Before the use of SCS, patients who failed to respond to conservative modalities such as physical therapy and pharmacological interventions were left to deal with continued and debilitating pain. Currently, the treatment of CRPS includes early intervention and implantation of a spinal cord stimulator, as soon as it becomes apparent that less invasive modalities fail to diminish and provide pain relief (2). Unfortunately, delaying the diagnosis and treatment of CRPS can adversely affect the response to treatment (2). Many clinicians feel that an early and accurate diagnosis of the condition provides the greatest chance of a full recovery and an improved quality of life.

Case Report

A 69-year-old female presented to her podiatric physician for a work-related crush injury to the left foot. The injury was initially treated by a different physician, who had been appointed by the patient’s workers’ compensation adjustor. The initial surgeon had already performed a primary repair of the patient’s ruptured lateral ankle ligaments. After the initial surgical intervention and subsequent recovery, the patient was discharged from the previous surgeon’s practice. Several months thereafter, she presented to our practice with a complaint of continued pain and instability involving her left ankle. Following historical interview and physical examination, a diagnosis of chronic left ankle lateral ligamentous instability was made and, after considering treatment options, the patient underwent revisional lateral ankle...
ligamentous reconstruction using a split peroneus brevis tendon graft. Initially, the patient appeared to respond favorably to the procedure and temporarily returned to work. Over time, however, she displayed increased anxiety and her left foot exhibited persistently worsening edema and discoloration. She subsequently reported progressive burning pain in the left foot. Despite extensive physical therapy, anxiolytic therapy, peripheral nerve blocks, and adjunctive pharmacological management, her condition failed to improve. The presence of hyperalgesia, edema, allodynia, and skin discoloration, raised concerns about the possibility of CRPS, and the patient was referred to an interventional pain medicine physician for further evaluation and treatment at approximately 4 weeks following the second left ankle operation.

At the time of her initial evaluation with the pain medicine specialist, a diagnosis of CRPS was confirmed. Her pre-procedural subjective visual analog scale (VAS) pain core was reported by the patient to be 8 out of 10 in intensity. Chronic pain therapy was initiated with the use of an anticonvulsant (gabapentin titrated over 3 weeks, up to 600 mg orally 3 times daily), a tricyclic antidepressant (nortriptylene, 50 mg orally at bedtime), topical compounded analgesic cream (ketamine, clonidine, capsaicin amitriptyline, and ketoprofen applied to the affected area 3 to 5 times daily), an opioid analgesic (methadone, 5 mg orally every 8 hours), and 4 separate lumbar sympathetic nerve blocks (LSB). These treatment interventions failed to provide satisfactory pain relief after 12 weeks, and she experienced a number of adverse side effects related to the medications. Moreover, she experienced only temporary pain relief following LSB. In an effort to improve her response to therapy, the decision was made to perform a 5-day SCS trial using the Precision Plus (Boston Scientific Corporation, Valencia, CA) SCS. The patient responded favorably to the SCS trial, reporting a 75% reduction of her pain. Based on her response to the SCS trial, a permanent SCS (Figures 1 and 2) was implanted 8 weeks following removal of the trial leads. Over the ensuing several weeks, the patient reported clinically significant pain reduction, improved sleep, and increased activity level after implantation of the permanent SCS system. At the time of her last follow-up evaluation, 6 months following implantation of the permanent SCS, she related that her subjective VAS pain scale score was 2 out of 10.

Discussion

CRPS can be debilitating, and is often difficult to treat. The controversial role of sympathetic nervous system involvement in reflex sympathetic dystrophy (RSD), lack of evidence for a reflex mechanism, and the small subgroup of patients who present with dystrophy, led to a revision of the terminology used to describe this condition (3) and, in 1994, the International Association for the Study of Pain (IASP) changed the terminology so that RSD would thereafter be referred to as complex regional pain syndrome type I (CRPS I), and causalgia would thereafter be referred to as CRPS type II (4).

It is interesting, moreover, to note that although CRPS I has been a recognized clinical entity for more than a century, even today early diagnosis is often missed. One of the key clinical features of CRPS I is the presence of pain out of proportion to the stimulus, with a nondermatomal distribution. It was once thought that these patients had a psychogenic disorder, but to date no empirical evidence has substantiated this claim (5). A retrospective study found that patients with CRPS had, on average, seen 4.8 different...
physicians and had received an average of 5 different types of treatments before being referred to a pain center, and the mean duration of symptoms before evaluation by a pain specialist was approximately 30 months (6).

Currently, there is limited epidemiological data pertaining to the incidence of CRPS. A population-based study at the Mayo Clinic found that the median age of onset of CRPS was 46 years, and that it occurred 4 times more frequently in females than males (7). Furthermore, the development of CRPS is usually associated with trauma or surgery, although the condition can arise without any precipitating traumatic event. According to the IASP, the clinical features to be taken into account for diagnosing CRPS type I include the presence of regional and continued pain disproportionate to any inciting event, sensory changes such as allodynia and hyperalgesia, sudomotor alterations, edema, vasomotor instability (temperature changes and skin discoloration), and exclusion of any other condition that would account for the above-mentioned signs and symptoms. CRPS II (causalgia) includes the aforementioned features accompanied by a specific peripheral nerve lesion (3), and the sensory changes that usually accompany this diagnosis include burning, aching, pain to light touch, and an exaggerated response to noxious stimuli. As CRPS persists, trophic nail and hair alterations, as well as skeletal muscle weakness, tremor, and dystonia may develop, and radiographs often display patchy demineralization of long bones. In severe cases involving the lower extremity, contractures often may be observed, and dystonia may present with resultant equinovarus position of the foot. Still further, sudomotor dysfunction, manifested as hyper- or hypohidrosis (3), as well as peripheral edema, which conveys a glossy, swollen appearance.

The signs and symptoms of CRPS result from dysfunction of the peripheral and central components of the nervous system. Nociceptors are peripheral nerve fibers that transmit pain signals to the spinal cord. These fibers are capable of releasing inflammatory mediators, such as substance P and calcitonin gene-related peptides, into the peripheral tissues. The release of these mediators is believed to trigger neurogenic inflammation through capillary leakage and activation of inflammatory cells in peripheral tissues (8). Abnormal interactions subsequently develop between the sensory and mechanical nociceptors that are responsible for normal sensations such as touch and vibration. Allodynia results when abnormal connections are established between the axons of nociceptors and mechanosensory fibers, resulting in nociceptor excitation from tactile fiber stimulation (8). These abnormal interactions result in the interpretation of nonpainful stimuli as painful, with amplified pain perception following an injury; such interactions can evolve following even relatively minor trauma.

Various opioids and adjuvant medications have been successfully used to treat CRPS. Adjuvant medications include anticonvulsants, tricyclic antidepressants, nonsteroidal anti-inflammatory drugs (NSAIDS), corticosteroids, and topical compounded creams. Intrathecal therapy may also be effective in certain cases where intolerable side effects occur with high doses of opioids. Sympathetic nerve blocks have also been used to reduce the pain associated with CRPS, to facilitate physical therapy, and to aid in the determination of whether or not the sympathetic nervous system is involved in the maintenance of pain. Sympathetic blocks are performed under fluoroscopic guidance by injecting a local anesthetic agent on the stellate ganglion for treatment of the upper extremity, or on the lumbar sympathetic chain for treatment of the lower extremities. In some cases, surgical sympathectomy has been shown to be beneficial in the treatment of sympathetically maintained pain (9); however, this procedure is generally reserved for cases in which extensive conservative treatment has failed. Physical therapy, as well as cognitive and behavioral therapies are important adjunct modalities that should also be considered in the multidisciplinary approach to the treatment of CRPS.

Since its first use in 1967 by Shealy et al (1), SCS has been widely used for the treatment of chronic pain. A spinal cord stimulator is an implantable medical device that generates electrical pulses that stimulate the dorsal column fibers of the spinal cord. The electrical current produced by an implantable pulse generator (IPG) is carried through either a single- or dual-lead cathode to the spinal cord. The location of the lead(s) in the epidural space affects stimulation of the desired dermatome. Following the SCS trial, the percutaneous leads are removed from the patient and, as such, are not considered a permanent implant. SCS technology has been used effectively in the management of chronic pain related to diabetic peripheral neuropathy (DPN), failed back surgery syndrome (FBSS), CRPS, phantom limb pain, postamputation stump pain, and arachnoiditis; and, after more than 30 years of experience, SCS has come to be a first line intervention for cases of CRPS that have not satisfactorily responded after 12 to 16 weeks of conservative therapy (2).

Foot and ankle surgeons faced with patients who fail to progress as anticipated after surgical intervention, and who display persistent pain, pain out of proportion to a stimulus, burning sensation, edema, and limited range of motion, should be alerted to the possibility that the patient may be developing CRPS. If CRPS is suspected, then consideration should be given to the potential benefits of a timely referral to an interventional pain medicine physician for further evaluation and potential management. The treatment of CRPS is considered by many clinicians to be most effective when it is multifaceted and undertaken as early as possible. As demonstrated in the patient described in this case report, SCS can provide a safe and minimally invasive modality for the treatment of CRPS.
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References