

# Epidural unilateral stimulation with “Adaptive Stim” option in treatment of type II CRPS

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## Abstract

CRPS is a type of severe pain syndrome and can be triggered by previous surgery or trauma. CRPS type II is associated with a confirmed nerve injury. We want to present to your attention a case report of successful treatment of CRPS type II using unilateral epidural stimulation.

## Epidural unilateral stimulation with “Adaptive Stim” option in treatment of type II CRPS

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## Author contribution statement

Armen Samvelovich Simonyan - idea author; development of clinical aspects; article writing and editing

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## Key message

Intractable CRPS that fail more conservative treatments may undergo neuromodulation. Unilateral stimulation with “Adaptive Stim” option is an effective type of SCS in the treatment of various pain syndromes including CRPS.

## Abstract

*Background:* CRPS is a type of severe pain syndrome and can be triggered by previous surgery or trauma. CRPS involves vasomotor changes such as changes in color and temperature of the skin, edema, increased sensitivity to touch, and a limited range of movement. Depending on the presence of nerve damage, CRPS is divided into two types. CRPS type II is associated with a confirmed peripheral nerve injury, while CRPS type I is not associated with an apparent peripheral nerve injury. Despite the ongoing therapy, sometimes patients still have persistent, burning pain. Intractable CRPS that fail more conservative treatments may undergo neuromodulation.

*Case Description:* We want to present to your attention a case report of the successful treatment of a patient with CRPS type II using epidural unilateral stimulation. The patient came to us with complaints of burning pain and numbness of 1-3 fingers of the right hand, the lateral surface of the right wrist and lower quarter of the forearm; shooting pain in the projection of the right median nerve from the shoulder to the wrist. A clinical diagnosis was made - CRPS type II. During the stimulation trial, the most effective pain relief was obtained when the electrode was located in the right side of epidural space at the C4 – Th1 level. The implantation of an impulse generator was performed, the final selection of the stimulation parameters was carried out. Observation of the patient showed that a stable analgesic effect of neurostimulation was achieved using standard neuromodulation regimens and Adaptive Stim option.

*Conclusion:* Unilateral stimulation is an effective type of SCS in the treatment of pain syndromes. It may make sense for some patients to have neuromodulation instead of DREZ ablation.

## Keywords

Epidural stimulation, CRPS, Type 2 CRPS, SCS, Neuromodulation

## Introduction

CRPS is a type of severe pain syndrome and can be triggered by previous surgery or trauma. CRPS involves vasomotor changes such as changes in color and temperature of the skin, edema, increased sensitivity to touch, and a limited range of movement.<sup>1</sup> Depending on the presence of nerve damage, CRPS is divided into two types. CRPS type II is associated with a confirmed peripheral nerve injury, while CRPS type I is not associated with an apparent peripheral nerve injury.<sup>1,2</sup> There are four diagnostic tools for CRPS in adult populations. These include the Veldman criteria, IASP criteria, Budapest Criteria, and Budapest Research Criteria.<sup>3,4</sup>

The complex treatment of CRPS includes pharmacotherapy, nerve blocks, physical and psychological measures, and rTMS.<sup>1,5</sup> Despite the ongoing therapy, sometimes patients still have persistent, burning pain. It leads to the disability of patients and a decrease in the quality of life. Also, the long-lasting, severe pain can result in psychological disorders such as depression and anxiety. Therefore, controlling CRPS-induced pain is a challenge in clinical practice.<sup>1</sup> Intractable CRPS that fail more conservative treatments may undergo neuromodulation in the form of spinal cord stimulation (SCS), dorsal root ganglion stimulation (DRG), or peripheral nerve stimulation (PNS). Such factors will generally determine the choice of which modality is more suitable as pain localized to a specific nerve territory or pain that is felt mainly distal in an extremity.<sup>2</sup>

Destructive interventions in the DREZ zone for pain management have been used for many years, and the effectiveness of such interventions remains at a high level.<sup>6</sup> Unilateral epidural stimulation, and stimulation of the DREZ zone were described much less often in the literature. However, in our opinion, the effectiveness of unilateral stimulation and DREZ - stimulation is not inferior, and in some cases, even exceeds destructive interventions.

## Case Description

We want to present to your attention a case report of the successful treatment of a patient with CRPS type II using unilateral epidural stimulation. The patient came to us with complaints of burning pain and numbness of 1-3 fingers of the right hand, the lateral surface of the right wrist and lower quarter of the forearm; shooting pain in the projection of the right median nerve from the shoulder to the wrist. The

patient had previously suffered an injury to the right hand with damage to the tendons and median nerve and underwent several reconstructive surgeries. After the injury, the appearance of a pronounced pain syndrome was noted. Conservative therapy, physiotherapy, multiple surgical interventions, including Radiofrequency ablation (RFA), Sympathectomy, with a short-term positive effect, were carried out. Taking into account the clinical picture, anamnesis, and using the Budapest criteria, a clinical diagnosis was made - CRPS type II. A decision was made to implant an epidural electrode to perform a stimulation trial. During the stimulation, the most effective pain relief was obtained when the electrode was located in the right side of epidural space at the C4 – Th1 level (Figure 1 A).

Against the background of the therapy, a significant decrease in the severity of the pain syndrome was noted, and the effective parameters of stimulation were determined. The implantation of an impulse generator was performed. After the implantation of an impulse generator (Figure 1 B), the final selection of the stimulation parameters was carried out. Later, the Adaptive-Stim option was installed, which, according to the patient, greatly facilitates everyday life and reduces the time spent on programming the device. Observation of the patient showed that a stable analgesic effect of neurostimulation was achieved. The severity of pain syndrome was assessed using the scales VAS, NTSS-9, DN-4, Pain Detect (Table 1).

Some decrease in efficiency compared with the early postoperative period (when complete regression of pain syndrome was noted) is most likely due to addiction to stimulation.

## Conclusion

Most patients with CRPS I reported minor trauma prior to the development of symptoms, such as a sprain, fracture, fall, crush injury, burn, or soft tissue injury.<sup>2</sup> The pathogenesis of CRPS is not understood. However, evidence now emerging from many different fields suggests a multifactorial disorder triggered by an initial, sometimes relatively minor injury. There is then an aberrant response by the body with exaggerated immune response, maladaptive neuroplasticity, and abnormal vasomotor function within the tissues of the affected limb.<sup>5</sup> The International Association for the Study of Pain (IASP) has endorsed the Budapest criteria for the diagnosis of CRPS. CRPS I is not associated with an identifiable nerve injury, whereas CRPS II is associated with a nerve injury.<sup>5</sup> Physical and occupational therapy is a critical component of the rehabilitation process in patients with CRPS and is recommended as the first-line treatment.<sup>3</sup> Historically, Sympathectomy has been used to treat CRPS. This can now be performed using radiofrequency, chemicals, and surgery.<sup>7,8</sup> Sympathectomy has a significant complication rate, including local anhydrosis and Horner's syndrome.<sup>5</sup> Ackerman showed that stellate ganglion blockade is effective for pain management in CRPS.<sup>9</sup>

A randomized study involving 24 patients with CRPS, SCS plus physical therapy (PT) reduced pain and improved health-related quality of life more than PT alone for up to two years.<sup>10</sup> The potential that combination therapy with t-SCS and DRG-S may be beneficial in patients with severe and refractory CRPS.<sup>11,12</sup> Data from the ACCURATE study suggests that DRGS could be used in patients suffering from chronic intractable pain conditions that are refractory to t-SCS.<sup>13</sup>

Unilateral epidural stimulation is an effective type of SCS in the treatment of pain syndromes. It may make sense for some patients to have neuromodulation instead of DREZ ablation. In our opinion, ablation is preferable for patients with a relatively poor prognosis of survival for palliative purposes. In other cases, we consider neuromodulation primarily. The possibility of conducting a minimally invasive stimulation trial, the reversibility of the technique, and the ability to control the stimulation process, in our opinion, is an advantage over destructive interventions. Our clinical case confirms the possibility of using unilateral epidural stimulation with "adaptive stim" regimen to treat complex pain syndromes such as CRPS. Cases of migration of epidural leads have been reported in the literature, but improvements in implantation techniques have minimized this risk.<sup>14</sup> The preoperative selection plays a crucial role in good results. If SCS effects do slowly diminish over time, DRG stimulation seems to be a treatment alternative.<sup>15</sup> For patients who seem resistant to all other forms of therapy, some doctors argue that there is a case for amputation of the affected limb.<sup>5</sup> In our opinion, limb amputation does not apply to patients with CRPS since the rapidly developing technique of neuromodulation opens up new possibilities in the treatment of pain syndromes.

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