Clinical Case Report

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# Complex regional pain syndrome type II after cervical transforaminal epidural injection

## A case report

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**Abstract**

**Rationale:** We report a case of a 61-year-old patient who developed complex regional pain syndrome (CRPS) type II after a cervical transforaminal epidural steroid injection (CTESI).

**Patient concerns:** The patient developed sudden-onset severe pain and swelling of his upper right limb after a cervical transforaminal epidural injection.

**Diagnoses:** On physical examination, the patient's symptoms and signs corresponded to the Budapest criteria for CRPS. Cervical magnetic resonance imaging and laboratory tests were performed to rule out other causes. An electrodiagnostic study revealed right C6/7 radiculopathies. A three-phase bone scan showed increased uptake in the right wrist in all phases. Thus, he was diagnosed with CRPS type II due to a cervical nerve root injury caused by the transforaminal epidural injection.

**Interventions:** He received oral methylprednisolone and gabapentin, and underwent physical therapy for 9 days.

**Outcomes:** The pain and swelling of his right upper limb disappeared and he returned to his previous functional activities.

**Lessons:** CRPS type II due to cervical root injury is rare but can develop during CTESI. Early comprehensive physical therapy and oral medications might result in good outcomes.

**Abbreviations:** CRPS = complex regional pain syndrome, CTESI = cervical transforaminal epidural steroid injection.

**Keywords:** complex regional pain syndrome, corticosteroid, epidural injection, rehabilitation

## 1. Introduction

Complex regional pain syndrome (CRPS) is characterized by a wide range of painful conditions and continuing limb pain that is seemingly disproportionate in time or intensity to the typical course of any known trauma or other lesion. The pain usually involves a single limb with distal predominance but is not related to an individual nerve territory or dermatome.[1] However, it is usually associated with abnormal sensory, motor, vasomotor, or trophic findings. CRPS can be divided into 2 subtypes: type I does not involve nerve injury, whereas type II involves significant proven nerve injury.[2–4] Although most patients with CRPS usually recover within a year after symptom onset, severe pain may persist for a long time and patients may suffer from a very low quality of life.

Cervical transforaminal epidural steroid injection (CTESI) is usually performed as conservative treatment for neck pain and/or upper limb radiating pain because of cervical herniated disc and stenosis. The incidence of complications after CTESI is reportedly relatively low, but a variety of side effects such as traumatic injury of the spinal nerve, dural puncture, and infection have been reported.[5] To the best of our knowledge, there have been no previous reports of CRPS type II after CTESI that was confirmed in an electrodiagnostic study. Therefore, here we present our experience with a case of acute CRPS type II after CTESI that was successfully treated conservatively.

## 2. Case presentation

A 61-year-old man presented at our outpatient clinic with a 7-day history of throbbing pain and heat in his right wrist. His symptoms developed gradually after CTESI was performed at a local clinic. He visited the local clinic because of a 1-month history of posterior neck pain radiating to the upper right arm. The physician in the local clinic delivered the right C7 transforaminal epidural steroid injection with C-arm guidance. The patient felt a painful tingling sensation in his right thumb during the procedure, and the swelling and heat in the right hand gradually developed thereafter. One day after CTESI, the patient felt the throbbing pain in his right hand that spread throughout the entire upper right limb. His medical history revealed that he had been diagnosed with hypertension and gout 3 years ago. He did not take antihypertensive medications because his blood pressure had been well controlled recently.

A physical examination revealed erythematous swelling and heat of his right hand, wrist, and forearm. Allodynia and

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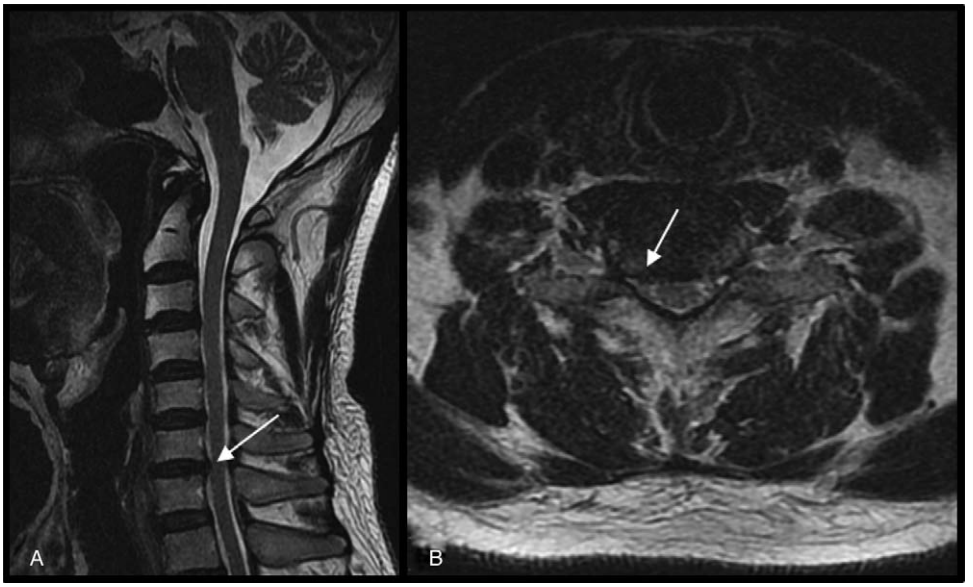


**Figure 1.** Magnetic resonance image of cervical spine revealing a mild right central herniated disc at the C6/7 level in the sagittal (A) or axial (B) view.

hyperesthesia were provoked by light touch, whereas hyperalgesia was induced by pinprick. The right wrist and hand muscle strength could not be measured because of the severe pain. The features of the neuropathic pain were throbbing and continuous, and a visual analog scale (VAS) rating of the pain on the left wrist and hand was 10. These symptoms and signs were compatible with Budapest clinical diagnostic criteria for CRPS.[6]

His white blood cell count was 11,200 cells/μL with 74.1% neutrophils, erythrocyte sedimentation rate was 37 mm/hr, and C-reactive protein level was 18 mg/dL. Other blood parameters were in normal range. Needle electromyography showed abnormal spontaneous activities including a positive sharp wave and fibrillation potential in the left cervical paraspinal, triceps, extensor digitorum communis, extensor carpi radialis longus, and flexor carpi radialis muscles. The latency of the H-reflex from the right flexor carpi radialis (25.78 ms) was abnormally prolonged compared to the normal H-reflex (23.59 ms) in the left muscle. Nerve conduction study findings were normal in the right median, ulnar, and radial nerves. Our electrophysiological interpretation was right C6/7 radiculopathies. Magnetic resonance imaging (MRI) showed a mild right central herniated disc at the C6/7 level (Fig. 1). A 3-phase bone scan using Tc 99m-labeled bisphosphonates showed increased periarticular uptake of the right wrist throughout the three phases (flow, blood pool, and delayed) that was compatible with the classic findings of CRPS (Fig. 2). Our final diagnosis was CRPS type II because of a cervical nerve root injury caused by CTESI in the upper right limb. The treatment consisted of oral methylprednisolone 36 mg daily for 4 days, followed by a 6-day tapering period (decreased by 12 mg every 3 days), gabapentin 900 mg daily, and physical therapy including cryotherapy, transcutaneous electrical stimulation, a contrast bath, gentle flexibility, and isometric strengthening exercises. Clinical symptoms and signs were subsided rapidly after comprehensive rehabilitation treatment. At discharge after inpatient treatment for 9 days, erythematous swelling and heat of his upper right limb had disappeared, the VAS was 2, and he could return to his previous functional activities. At 3 months after discharge, he complained of no pain or abnormal sensation except hypoalgesia induced by a pinprick in the right thumb and middle finger.

## 3. Discussion

CRPS is an acute or chronic pain condition characterized by spontaneous or evoked regional pain that usually begins in a distal portion of an extremity that is disproportionate in intensity or duration to the common course of pain after similar tissue trauma. The international Association for the Study of Pain proposed dividing CRPS into types I and II according to nerve damage on the Budapest clinical diagnostic criteria.[7] The incidence rates of CRPS types I and II were reportedly 5.46 and 0.82 per 100,000 person-years in the United States, respectively.[8] However, the distinction of CRPS types I and II based on the presence of a nerve injury has been disputed.[9] It is generally agreed that although the 2 types may be pathophysiologically different, the clinical symptoms remain the same. In a study of CRPS types I and II that were differentiated by a nerve conduction study, the frequency of clinical parameters was not different between the 2 types.[3] Although the nerve conduction study only detected the dysfunction of a large-diameter peripheral nerve, the clinical distinction between the 2 types could not be proven.

CRPS type II, which must demonstrate a specific nerve injury, is rarer than type I. In most cases of CRPS type II, the peripheral nerve injury is usually located distal to the dorsal root ganglion, but cases caused by a nerve root injury are extremely rare. In 1 case report about CRPS after a cervical epidural injection,[10] a 49-year-old woman experienced a cervical epidural injection delivered using a midline approach at the C5/6 interspace level. During the procedure, the woman felt throbbing pain in her upper right limb; after the procedure, allodynia and lancinating pain developed in her arm. She was clinically diagnosed with CRPS type II, but no electrodiagnostic study was performed to prove the nerve root injury. The other case was CRPS caused by herniated lumbar disc.[11] However, no abnormal findings were detected in an electrodiagnostic study including electromyography, sensory, and motor conduction studies. Here we present a

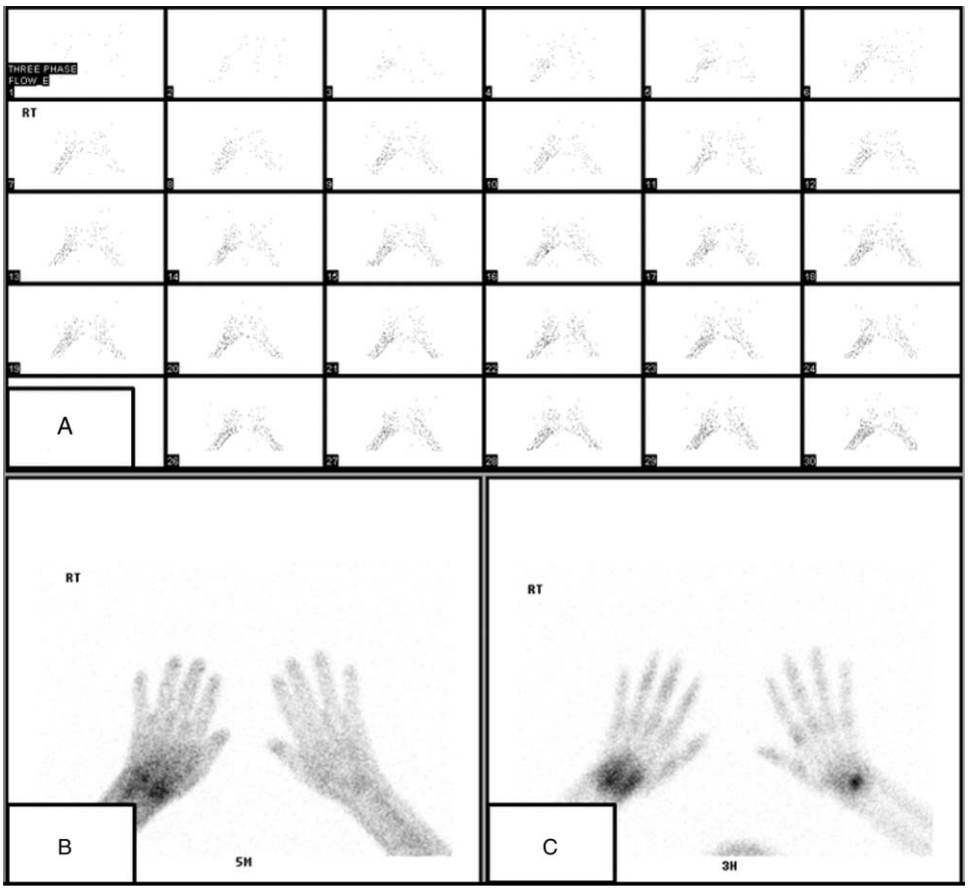


**Figure 2.** Three-phase bone scan images demonstrating increased uptake in the right wrist in the flow (A), blood pooling (B), and delayed (C) phases.

case of a patient whose CRPS symptoms developed after CTESI followed by electrodiagnostic confirmation of cervical root injury. The patient felt a painful tingling sensation in his right thumb during the CTESI procedure. Considering the dermatome of the cervical root, his symptoms were provoked by the needle contact with the C6 nerve root. Right C6/7 radiculopathy was confirmed in an electrodiagnostic study. Cervical MRI showed a mild right central herniated disc at the C6/7 level that did not agree with a right C6/7 radiculopathy. Therefore, this is the first case of CRPS type II caused by cervical root injury owing to CTESI that was confirmed in an electrodiagnostic study.

The pathophysiologic mechanisms of CRPS are multifactorial and include brain plasticity, central and peripheral sensitization, abnormal cutaneous innervation, impaired sympathetic nerve system function, inflammation, and genetic and psychological factors. Recent research has concentrated on the role of inflammatory and immune-related mechanisms in CRPS. The patients with CRPS showed significantly increased concentrations of proinflammatory neuropeptides and mediators (substance P, calcitonin gene-related peptide, bradykinin) and cytokines (interleukins 1β, 2, and 6; tumor necrosis factor-α) in the plasm and cerebrospinal fluid.[12] Therefore, inflammatory factors are responsible for clinical features in the acute phase of CRPS. In a human study, increased numbers of proinflammatory monocytes (CD14+, CD16+) and mast cells were reported in patients with CRPS compared with healthy controls.[13] Considering these mechanisms, corticosteroids and nonsteroidal anti-inflammatory drugs have been used as treatment.

The pathophysiology of CRPS type II remains unclear. A previous study suggested the hypothesis that a peripheral nerve injury induced complex responses involving Wallerian degeneration and modifications in the phenotype of surviving neurons in CRPS type II.[14] This phenotypic switch enhanced the synthesis of nociceptive neurotransmitters such as substance P and calcitonin gene-related peptide, which cause symptom and sign of CRPS.[15] In our case, the injury site was preganglion of cervical root, and Wallerian degeneration was not happened. CRPS type II is distinguished from type I by evidence of peripheral nerve injury, but the nature of the injuries (fractures, crush injuries, and surgery) may be associated with some degree of nerve injury.[4] Therefore, it is difficult to distinguish between the 2 types from the pathophysiological point of view.

CRPS is differentiated from other chronic pain disease by the prominent autonomic and inflammatory changes in the affected area. Patients with CRPS usually experience extreme hyperalgesia and allodynia; skin color and temperature change; sweating; edema; altered hair patterns of hair, skin, or nail growth; reduced muscle strength; and tremors and dystonia of the affected limb.[3] The diagnosis of CRPS is clinically dependent on the Budapest criteria that consist of clinical symptoms and signs.[6] In this case, our patient was clinically diagnosed as CRPS according to Budapest criteria[6] because he complained of continuous right wrist and hand pain, which is disproportionate to injury during CTESI, had sensory (hyperesthesia, hyperalgesia, and allodynia), vasomotor (heating and erythematous skin color change), edema (swelling), and motor (weakness and decreased

range of motion of the wrist) symptoms and signs at the time of evaluation. Additionally, no other diagnosis better illustrates the above symptoms and signs.

Although no specific diagnostic method is available for CRPS, several imaging studies including radiography, thermography, computed tomography, 3-phase bone scan, and MRI may be used to support a clinical diagnosis and help with the differential diagnosis. Three-phasic bone scan using technetium Tc 99m-labeled bisphosphonates is highly sensitive but nonspecific and may help confirm CRPS.[16] The characteristic finding of 3-phasic bone scans in CRPS increased periarticular radiotracer uptake at the affected area through the 3 phases (flow, blood pool, and delayed), but a negative finding does not exclude CRPS. In our case, the 3-phasic bone scan showed increased periarticular uptake of the right wrist throughout the three phases that was helpful for confirming the clinical diagnosis.

Active and multidisciplinary treatment is needed for CRPS. The selection of ≥1 treatment modalities is guided by the severity of clinical symptoms and the degree of disability. Physical therapy and oral medications are the first line of treatment for CRPS. Physical therapy was shown to be helpful for reducing pain and improving active mobility of the affected extremity in patients with CRPS.[17] The goal of physical therapy is to decrease the pain and improve the function of the affected extremity. A phase-stage approach to physical therapy should start at the beginning of CRPS, while the physical therapy program should be individualized for each patient based on specific symptoms and impairments. Physical therapies include desensitization using cold, heat, contrast baths, massage, stress loading, transcutaneous nerve stimulation, active and passive range of motion exercises, strengthening exercises (initial isometric and final isotonic), and general aerobic conditioning.

Corticosteroids are reportedly useful for reducing pain and edema and improving mobility patients with CRPS.[18,19] The actual mechanism of action of corticosteroids in CRPS is not fully understood, but in addition to its anti-inflammatory effect, it can be involved in the suppression of ectopic neural discharges. A short-term course of corticosteroids is beneficial for reducing the strong inflammatory process in the early phase of CRPS. However, the long-term use of corticosteroids is not recommended in CRPS because of their many side effects. Gabapentin is an effective anti-epileptic drug that is used to treat neuropathic pain. It has been shown to have a mild analgesic effect and reduce the sensory deficit in CRPS.[20] In our case, an early stepwise program of comprehensive physical therapy combined with short-term corticosteroid therapy for 9 days rapidly reduced the clinical symptoms and impairments in the early stage of CRPS type II and prevented the disability.

In conclusion, here we reported the first case of CRPS type II caused by an iatrogenic cervical nerve root injury owing to CTESI based on clinical, electrodiagnostic, and 3-phase bone scan findings, which rapidly improved under early comprehensive physical therapy and oral medications. When physicians perform CTESI, they must be careful to avoid inducing a cervical nerve root injury. If CRPS owing to a nerve root injury occurs, early diagnosis and treatment may result in good outcomes.

## 4. Method

This was a case report. Ethics committee or institutional review board approval was not obtained. It was not necessary for the case report. The patient signed informed consent for the publication of this case report.

## Author contributions

**Conceptualization:** Gi-Young Park, Dae Gil Kwon.
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**Supervision:** Gi-Young Park, Dong Rak Kwon.
**Writing – original draft:** Gi-Young Park.
**Writing – review & editing:** Gi-Young Park, Dong Rak Kwon, Dae Gil Kwon.

## References


[1] Casale R, Atzeni F, Masala IF, et al. The words of pain in complex regional pain syndrome. Best Pract Res Clin Rheumatol 2015;29:71–6.
[2] Żyluk A, Puchalski P. Complex regional pain syndrome of the upper limb: a review. Neurol Neurochir Pol 2014;48:200–5.
[3] Harden RN, Bruehl S, Galer BS, et al. Complex regional pain syndrome: are the IASP diagnostic criteria valid and sufficiently comprehensive? Pain 1999;83:211–9.
[4] Stephen Bruhel . Complex regional pain syndrome. BMJ 2015;351: h2730.
[5] Muro K, O'Shaughnessy B, Ganju A. Infarction of the cervical spinal cord following multilevel transforaminal epidural steroid injection: case report and review of the literature. J Spinal Cord Med 2007;30:385–8.
[6] Harden RN, Bruehl S, Perez RS, et al. Validation of proposed diagnostic criteria (the "Budapest Criteria") for complex regional pain syndrome. Pain 2010;150:268–74.
[7] Merskey H, Bogduk N. Classification of Chronic Pain: Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms. 2nd edIASP press, Seattle:1994.
[8] Sandroni P, Benrud-Larson LM, McClelland RL, et al. Complex regional pain syndrome type I: incidence and prevalence in Olmsted county, a population-based study. Pain 2003;103:199–207.
[9] Katherine D, Geoffrey J. Terminology, criteria, and definitions in complex regional pain syndrome: challenges and solutions. Journal of pain research 2015;8:871–7.
[10] Richard N. Development of complex regional pain syndrome after a cervical epidural steroid injection. Anesthesiology 1997;86:1394–6.
[11] Kim SH, Choi SS, Lee MK, et al. Complex regional pain syndrome caused by lumbar herniated intervertebral disc disease. Pain Physician 2016;19: E901–4.
[12] Schinkel C, Gaertner A, Zaspel J, et al. Inflammatory mediators are altered in the acute phase of posttraumatic complex regional pain syndrome. Clin J Pain 2006;22:235–9.
[13] Birklein F, Drummond PD, Li W, et al. Activation of cutaneous immune responses in complex regional pain syndrome. J Pain 2014;15:485–95.
[14] Drummond PD, Drummond ES, Dawson LF, et al. Upregulation of α1-adrenoceptors on cutaneous nerve fibres after partial sciatic nerve ligation and in complex regional pain syndrome type II. Pain 2014;155: 606–16.
[15] Ueda H. Molecular mechanisms of neuropathic pain-phenotypic switch and initiation mechanisms. Pharmacol Ther 2006;109:57–77.
[16] Wuppenhorst N, Maier C, Frettloh J, et al. Sensitivity and specificity of 3-phase bone scintigraphy in the diagnosis of complex regional pain syndrome of the upper extremity. Clin J Pain 2010;26:182–9.
[17] Oerlemans HM, Oostendorp RA, de Boo T, et al. Pain and reduced mobility in complex regional pain syndrome I: outcome of a prospective randomised controlled clinical trial of adjuvant physical therapy versus occupational therapy. Pain 1999;83:77–83.
[18] Christensen K, Jensen EM, Noer I. The reflex dystrophy syndrome response to treatment with systemic corticosteroids. Acta Chir Scand 1982;148:653–5.
[19] Bianchi C, Rossi S, Turi S, et al. Long-term functional outcome measures in corticosteroid-treated complex regional pain syndrome. Eura Medicophys 2006;42:103–11.
[20] Van de Vusse AC, Stomp-van den Berg SG, Kessels AH, et al. Randomised controlled trial of gabapentin in complex regional pain syndrome type 1 [ISRCTN84121379]. BMC Neurol 2004;4:13.