

CASE REPORT

Complex regional pain syndrome of the knee after conventional radiofrequency ablation of the genicular nerves treated successfully with dorsal root ganglion stimulation: A case report

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Abstract

Background: Radiofrequency (RF) treatment of the genicular nerves offers pain relief in patients suffering from chronic knee pain including persistent post-surgical knee pain (PPSP). We present the first case report of the development of complex regional pain syndrome (CRPS) in a chronic knee pain patient after an RF ablation of the genicular nerves that was successfully treated with dorsal root ganglion (DRG) stimulation.

Case Presentation: The patient developed increased pain, sympathetic and dysmorphic changes of the index knee 10 weeks after RF treatment for PPSP. Diagnosis of CRPS type II was made using positive clinical findings and the Budapest diagnostic tool. Laboratory workup and PET-CT were negative. The patient was refractory to usual care and she was treated successfully with dorsal ganglion root stimulation.

Conclusions: Complex regional pain syndrome is a possible complication of RF ablation of the genicular nerves in patients with chronic knee pain, and DRG stimulation may be a treatment option. Physicians should be aware of this complication, especially when patients have a medical history of CRPS.

KEYWORDS

complex regional pain, DRG stimulation, genicular nerves, radiofrequency ablation, chronic knee pain

INTRODUCTION

Radiofrequency (RF) ablation of the genicular nerves is a minimally invasive technique used to treat chronic knee pain including persistent post-surgical knee pain (PPSP) that has been unresponsive to usual care.^{1,2} Until now, only temporary and infrequent complications were reported with this treatment.³

Complex regional pain syndrome (CRPS) type II is a rare neuropathic pain condition associated with autonomic features caused by nerve tissue trauma of the extremities.⁴ We report the first case of a patient developing CRPS after an RF ablation of the genicular nerves. This case study will describe this rare adverse event of RF ablation and its treatment using dorsal root ganglion (DRG) stimulation.

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CASE REPORT

Patient information

A Caucasian woman in the mid-thirties presented at the pain clinic with a history of more than 20 years of chronic right knee pain. The knee pain originated post-traumatically at the age of 14 years. The patient underwent multiple right knee arthroscopies, one chondrocyte transplantation, and eventually a patellofemoral knee prosthesis. After temporary resolution of the symptoms, the patient experienced recurrent patellar subluxations treated with medial patellofemoral ligament reconstruction with an allogeneic Achilles tendon. After this last operation, the patient developed PPSP and developed pain over a 150 cm² area anterior to the patella accompanied by paresthesia. Conservative care had resulted in insufficient pain relief, and an orthopedic workup revealed no correctable causes.

The patient was treated with a conventional RF ablation of the right knee's superomedial, superolateral, and inferomedial genicular nerves at a temperature of 70°C for 90 s per nerve after a positive diagnostic block (lidocaine 2% 1 ml per genicular nerve). Both procedures were tolerated well and were uneventful. She reported transient neuritis during the first month after RF ablation. The patient informed the physician of anterior knee pain, fluctuating episodes of knee edema, local increase in temperature, and hair growth on the knee 2.5 months after the RF treatment. Symptoms were more present during knee mobilization. The patient used the

following painkillers when she first presented with the CRPS-like symptoms: Paracetamol 1 g 2–3 times daily PO, Tramadol extended-release 100 mg twice daily PO, and transdermal Lidocaine 5% applied to the knee once daily for 12 hours. The patient's medical history was limited to the mentioned orthopedic surgeries and a temporary episode of CRPS after knee arthroscopy more than 15 years ago. At that time, the patient experienced edema, increased pain, and color changes. The diagnosis of CRPS was made by the orthopedic surgeon, and the patient was successfully treated with the standard therapy of that moment. Recovery lasted a couple of months.

Clinical findings

The physical examination at diagnosis of CRPS type II was non-remarkable of knee edema or temperature changes of the knee. Modest color changes and hair growth were present on the superolateral right knee. Motor function was preserved; however, the patient's gait was antalgic. The patient presented photographs showing significant knee edema and color changes (Figure 1). The sensory, vasomotor, and trophic changes were limited to the innervation pattern of the genicular nerves.

Diagnostic assessment

The diagnosis of CRPS type II, presenting a “primarily warm” phenotype, was made clinically using the

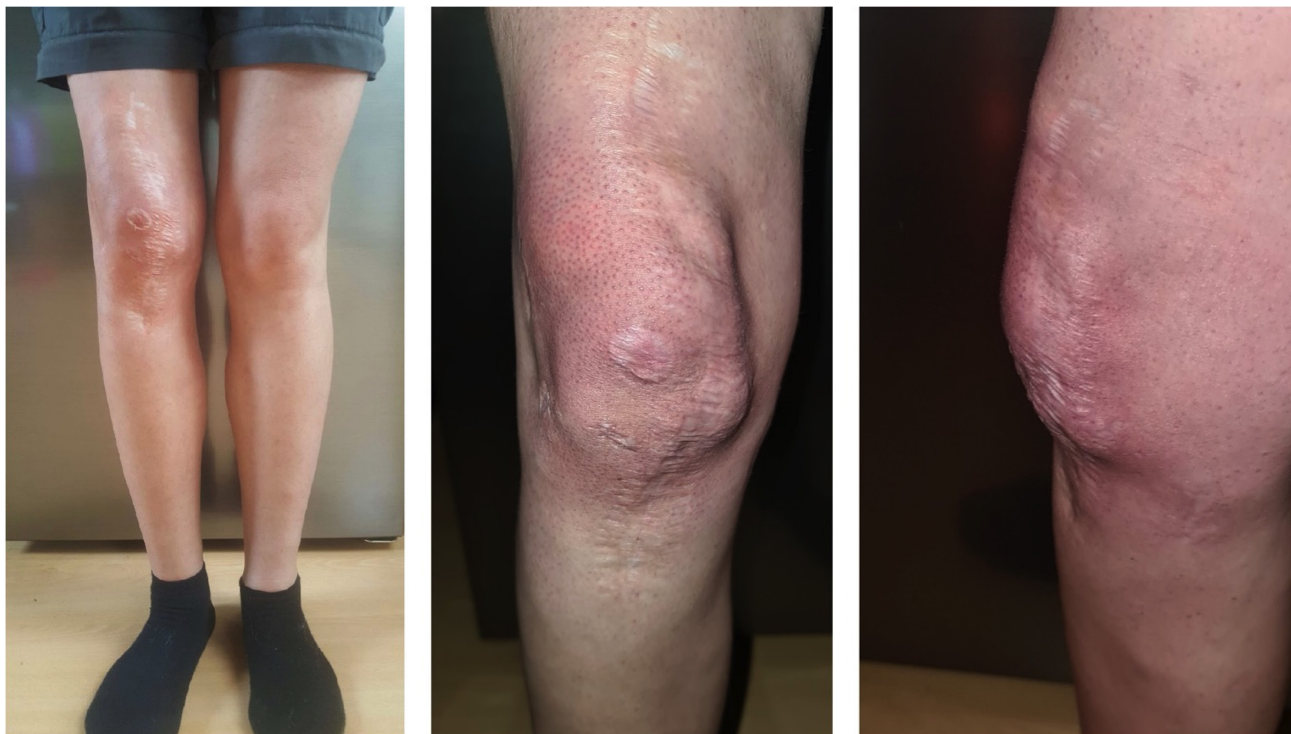


FIGURE 1 View of index knee at diagnosis of CRPS

diagnostic criteria of the International Association for the Study of Pain (IASP) more commonly known as the “Budapest criteria.”⁵ SPECT-CT and laboratory tests did not point toward an infection. There was a moderately increased uptake of the proximal knee in SPECT-CT, probably corresponding with CRPS. The orthopedic surgeon excluded other differential diagnoses.

Diagnosis

CRPS type II.

Therapeutic interventions

The patient was approached multimodally. Pharmacological therapy was initiated with the following medications: Vitamin C 500mg once daily PO, and Acetylcysteine 600mg once daily PO for 6 weeks. The previously mentioned painkillers were continued. Physical therapy and rehabilitation together with mirror therapy were conducted by a physiotherapist specialized in CRPS. Because of the failure of conservative therapy in achieving tolerable pain, the patient was treated with a pulsed radiofrequency of the fourth lumbar nerve after a positive diagnostic block with local anesthetics.

The treatment resulted only in the temporary improvement of knee pain. A trial with Amitriptyline 10 mg once daily PO was made without effect. After 7 months of therapy-resistant CRPS, the patient was referred for DRG stimulation.

Follow-up and outcomes

Following a positive test stimulation during 3 weeks with right DRG L3 and L4 leads, she received a definitive pulse generator implant (Proclaim DRG non-rechargeable IPG) in the lower abdomen with two SlimTip DRG leads approximately 8 months after the first diagnosis of CRPS (Figure 2). The patient described full recovery at 2 months and resumption of work at 5 months after DRG implantation. Symptom relief was present at 8 months of follow-up. Figure 3 demonstrates the diseased knee after DRG treatment while Figure 4 represents the timeline of the patient's medical care.

Patient's perspective

“I feel an important change in my knee after the DRG implantation. I don't experience any acute flare-ups; my knee does not swell any more. I can do eight km

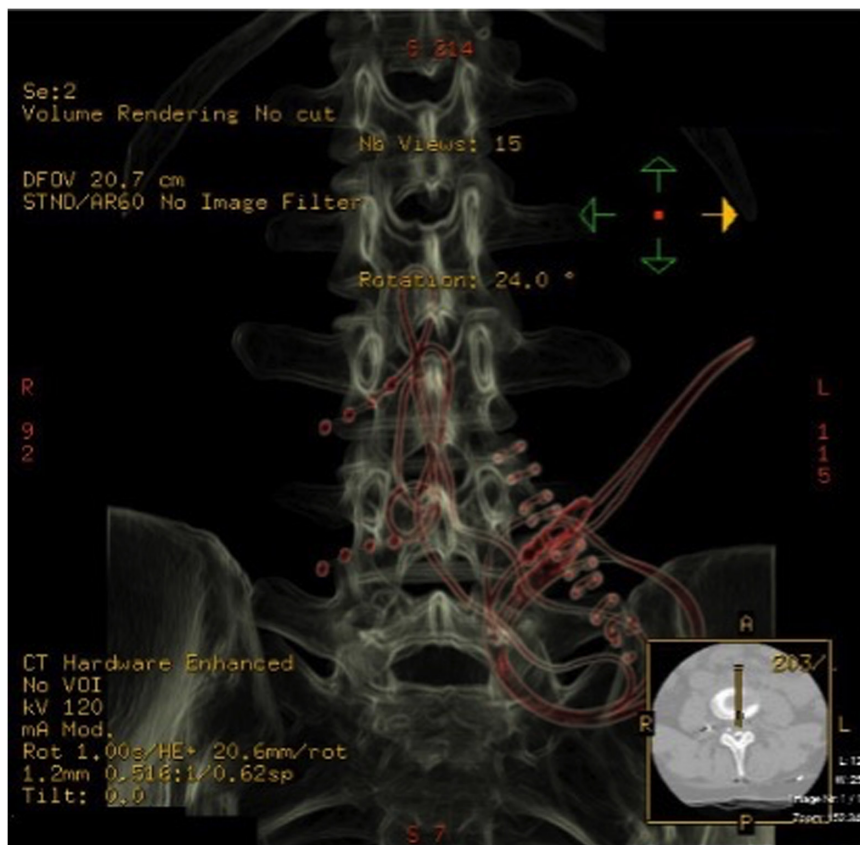


FIGURE 2 Computed tomography of the lumbar spine of the patient demonstrating the placed DRG L3 and L4 leads



FIGURE 3 View of index knee after DRG implantation

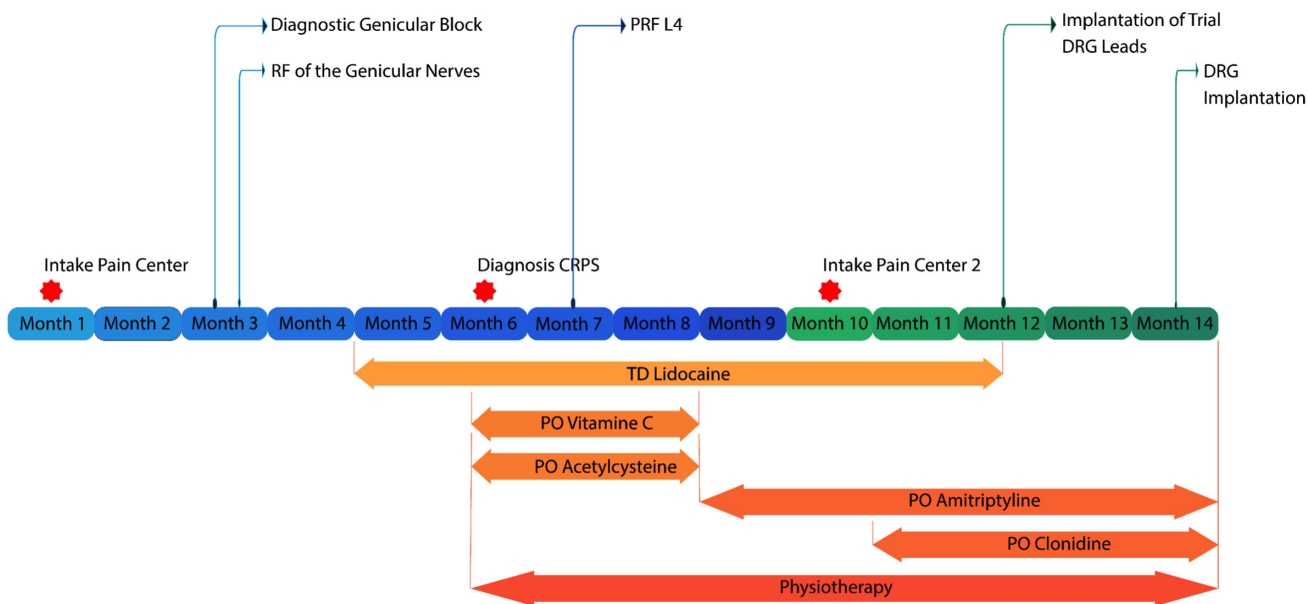


FIGURE 4 Timeline of the patient's medical care. CRPS, Complex regional pain syndrome; DRG, Dorsal root ganglion stimulation; PO, Per os; PRF L4, Pulsed radiofrequency ablation of lumbar nerve 4; RF, Radiofrequency ablation; TD, Transdermal

long walks, which was previously not possible. Before the treatment, I had to rest all day and take painkillers for the pain. Now I am working full-time and usually a

light painkiller or changes in the neurostimulator settings are sufficient to perform my daily activities. I am very thankful to the pain team for the help. I was in the

beginning reluctant to the treatment but now I can say that the implant has decreased my pain and brought a lot of comfort to my life.”

The patient provided permission for the presentation of this report.

DISCUSSION

Radiofrequency of the genicular nerves has gained popularity for treating invalidating chronic knee pain in osteoarthritis and PPSP patients. Pain relief is the result of blocking the propagation of nociceptive input from the knee to the central nervous system by thermocoagulation of the genicular nerves. RF treatment is reported to have self-limiting and potentially transient adverse events in RCTs and cohort studies.^{5,6} Only a few case reports describe serious complications of the RF procedure, including knee joint infection, pes anserine damage, bleeding, hemarthrosis and third-degree burns.⁷ Lack of knowledge on the exact incidence of serious and non-serious complications of RF ablation, mainly long-term ones, creates an obstacle for the large-scale implementation of the RF treatment in chronic knee pain.⁸

In the presented case study, RF ablation of the genicular nerves performed for PPSP was complicated with an episode of CRPS type II. CRPS type II is a disease that develops after documented nerve injury in the patient's extremities. The pathophysiology of CRPS is, despite being convoluted and multifactorial, dominated in the acute phase by a posttraumatic inflammatory reaction.⁴ Timely recognition and treatment of the disease are crucial and could prevent dramatic motor dysfunction, fixed dystonia, and limb neglect.⁴ We suspect that the genicular nerve lesion caused by RF is the trigger of the mentioned inflammatory reaction and the further development of autonomic changes and peripheral and central sensitization. A factor that potentially could delay the diagnosis of CRPS is the frequent transient neuritis that patients experience after RF of the genicular nerves. Pain is often the most essential symptom of transient neuritis and CRPS.⁴ Dysesthesia and impairment of thermal perception due to transient neuritis unfortunately additionally overlap with CRPS symptomatology. Nevertheless, other accompanying symptoms such as temperature, skin color, and trophic changes should prompt further testing for CRPS. The patient's medical history, such as previous episodes of CRPS, should prompt a faster diagnosis.

Treatment of CRPS is multimodal.⁴ Despite adequate pharmacological and physiotherapy treatments, the patient was therapy-resistant. Sympathetic nerve blocks and neurostimulation are considered alternative treatments for CRPS. Chemical or radiofrequency sympathetic neurolysis at the lumbar level has been reported to successfully reduce CRPS symptoms.⁹ While pulsed

RF of the fourth lumbar nerve performed in this case study did not cause reduction of the sympathetic tonus in the lower limb, the rationale behind this treatment is that neuromodulation of the lumbar nerve could diminish neuropathic pain transmission from the knee.

DRG and spinal cord stimulation (SCS) are two forms of neurostimulation that should be considered after failure of non-invasive treatment in CRPS.^{10,11} Most research focuses primarily on CRPS type I (no evident nerve damage); nevertheless, SCS and DRG stimulation have been described as successful in CRPS type II.^{4,12} DRG stimulation provides better pain and quality of life outcomes than SCS in CRPS patients as presented in one RCT of Deer et al.¹² SCS is reported to be successful for up to 5 years in low extremity CRPS type I^{4,13} while DRG stimulation data for CRPS are limited to 12 months.¹² DRG stimulation resulted in complete symptom regression up to 8 months after treatment in the present case report.

CONCLUSIONS

CRPS type II is a rare but possible complication of RF ablation of the genicular nerves. The lesion caused by the RF ablation can precipitate episodes of CRPS especially in patients with a previous history of CRPS. Awareness of this occurrence is crucial as anticipation, timely recognition and treatment of acute CRPS can prevent its development into a chronic therapy-resistant pain condition. DRG stimulation resulted in full recovery of the patient at 2 months after treatment and it may be thus an alternative treatment option for therapy-resistant CRPS.

ACKNOWLEDGMENTS

The authors have no conflict of interest to declare. This case report was prepared according to the CARE guidelines.

CONFLICT OF INTEREST

The authors declare no conflicts of interests.

DATA AVAILABILITY STATEMENT

The information for this case report was retrieved from the patient's electronic record in both hospitals she was treated. Justified request for the patient data can be addressed to the corresponding author.

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