Case Report

Pulsed Radiofrequency of Dorsal Root Ganglia for the Treatment of Complex Regional Pain Syndrome in an Adolescent with Poliomyelitis Sequel: A Case Report

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Abstract

Objective. Complex regional pain syndrome (CRPS) is a painful and disabling syndrome in which the patient presents with neuropathic pain, edema, or vasomotor or pseudomotor abnormalities that are often refractory to treatment. Polio paralysis is caused by the damage or destruction of motor neurons in the spine, which lead to corresponding muscle paralysis. This report is a case report on the application of a pulsed radiofrequency (PRF) current to dorsal root ganglia (DRG) for the treatment of CRPS type 1 in an adolescent patient.

Design. Single case report.

Setting. Selcuk University Hospital.

Patient. A 16-year-old girl who suffered from CRPS type 1 secondary to surgeries for the sequelae of poliomyelitis.

Interventions. PRF current application to the lumbar 4 and lumbar 5 DRG.

Outcome Measures. Pain reduction.

Results. The patient had complete resolution of her symptoms, which was maintained at a 6-month follow-up.

Conclusions. This case illustrates that PRF applied to lumbar 4 and lumbar 5 DRG may play a significant role in CRPS type 1 management after the surgical treatment of poliomyelitis sequelae in adolescent patients. Further randomized, controlled studies are needed to support this argument.

Key Words. Neuropathic Pain; Complex Regional Pain Syndrome; Radiofrequency; Adolescent

Poliomyelitis is a strictly human pathogen that is transmitted via a fecal-oral route, and it typically infects children under the age of 5 years. Patients with poliomyelitis may develop paralytic polio, which results in an asymmetric flaccid paralysis without sensory loss [1]. Orthopedic surgeons commonly address the sequelae of paralytic polio. The goals of treatment include the correction of any significant muscle imbalances or soft tissue or bony deformities. Bony deformities are usually corrected after skeletal maturity.

Complex regional pain syndrome (CRPS) is a painful and debilitating syndrome in which the patient presents with disabling pain, edema, vasomotor, or pseudomotor abnormalities [2]. Here, we describe an adolescent patient with poliomyelitis who exhibited type I CRPS that developed after a series of orthopedic surgeries. The patient was successfully treated with an application of
pulsed radiofrequency (PRF) current to the lumbar 4 (L4) and lumbar 5 (L5) dorsal root ganglia (DRGs).

**Case Report**

A 16-year-old girl was admitted to the Orthopedics and Traumatology Department for limping. Past medical history revealed that she had poliomyelitis during her childhood, and the limb length discrepancy became more severe over time. Limb length inequality on the right side secondary to femoral shortness and right tibial torsion were diagnosed during her examination. A 4.5-centimeter femoral length inequality and 45 degrees of tibial torsion were measured. Limb lengthening over an intramedullary nail surgery was performed in July 2013 for her right femur. She had a derotational osteotomy over the intramedullary nail surgery 2 months later to correct her tibial torsion. Femoral external fixator removal and Achilles tendon lengthening surgeries were also performed during her second surgery at the same time.

She complained of a constant, intense pain 4 weeks after discharge from the hospital that was disproportionate to the inciting event and edema in her lateral and medial sides of the leg and an irradiating pain in the plantar face of the foot. The patient described the pain as a burning feeling that was enhanced by touch and mobilization. The patient felt a cold sensation in the entire foot. She was not suffering from other diagnosable entities, such as radiculopathy, discreet musculoskeletal entities, conversion reaction associated with immobility, or paralysis. The diagnosis of CRPS-1 was made as proposed by the Budapest International Association for the Study of Pain (IASP) consensus group [3]. She did not respond to non-steroidal antiinflammatory drugs and pregabalin (75 mg/day) because this medical treatment was not tolerated. Invasive approaches, including sympathetic blocks, Bier block, continuous epidural analgesia using a catheter [2], and radiofrequency application, were explained to her. She preferred the single shot PRF application over sympathetic blocks or epidural catheter-mediated analgesia.

The PRF technique was explained to the patient and her parent, and informed consent was obtained before she underwent the procedure. Treatment was initiated at the L5 DRG to reduce her lateral side and planter foot pain. An experienced anesthetist performed the PRF therapy using aseptic techniques. The patient was premedicated and laid in a prone position under fluoroscopy, and a 22-gauge cannula (54-mm cannula with a 4-mm active tip, Diros Technology Inc., Canada) was placed around the L5 DRG. The cannula was inserted in the direction of the radiation beam.

The sensory stimulation test was performed using an RF generator (Neuroterm 1100, MA, USA). Tissue impedance and sensory tests were checked before PRF was applied, and the impedance was <600 Ohm. A sensory response of 0.7 V was obtained in the L5 DRG. Needle locations were confirmed via the administration of contrast material. PRF treatment consisted of the passage of

**Figure 1** The exact location of the DRG was confirmed using the administration of contrast material. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

PRF currents of 2 Hz at 45 V with 20 m/second active and 480 m/second silent periods. PRF currents were then applied for 120 seconds, with the endpoint being an electrode tip temperature that did not exceed 42°C.

The patient’s visual analog scale (VAS 0–100 mm) pain scores decreased from 100 to 50 the day after intervention. She complained of pain only on the medial side of her leg 2 weeks later. We then performed PRF on the L4 DRG using the same technique. The locations of the cannulae are presented in Figure 1. The patient’s VAS pain scores decreased from 50 to 10 immediately after the intervention. The patient tolerated the procedures well, and no significant complications occurred. The patient had symptom relief for over 6 months.

**Discussion**

To the best of our knowledge, this is the first case report in the literature of the application of a PRF current to the DRG to treat CRPS type I in an adolescent patient. This case suggests that the application of PRF to the DRGs may play a significant role in CRPS type I management in the lower extremities.

CRPS is a type of neuropathic pain, and it is a well-established entity in children and adolescents [4]. DRGs [5] and sympathetic ganglia [6] are active participants in the development of neuropathic pain. However, the interactions between the multiple pathophysiological mechanisms of CRPS remain poorly understood. Several pathophysiological concepts, including direct coupling between sympathetic and sensory neurons in the dorsal root ganglion, chemical coupling between sympathetic and nociceptive neuron terminals in skin, pathological sympathosensory coupling, neuroplastic changes and genetic factors, have been proposed to explain the complex symptoms of CRPS [6,7]. Simple analgesics
(paracetamol or nonsteroidal antiinflammatory drugs) are frequently prescribed or supplemented by adjuvant analgesics (tricyclic antidepressants or anticonvulsants) to enable the children to participate in physiotherapy [8]. Invasive approaches, including repeated sympathetic blocks and Bier block, continuing peripheral nerve blocks and epidural analgesia using a catheter [2], and radiofrequency application are sometimes necessary in pediatric cases who exhibit no response to medical therapy [9]. Among these procedures, sympathetic blocks are the first choice for the management of CRPS-I patients [10]. Apiliogullari et al. successfully treated CRPS-I in an adolescent patient with Becker Muscular Dystrophy using an epidural catheter [2]. However, this patient required hospitalization during the treatment. The patient in the present case did not want to stay in the hospital and undergo repeated local anesthetic application using an epidural catheter. Van Buyten et al. [11] reported a case series of eleven adult patients with CPRS who were successfully treated using DRG stimulation by a neurostimulation system, which was placed at the lumbar DRG. However, their technique was more invasive and expensive than the application of PRF to the DRG.

PRF has gained popularity in recent years for the treatment of neuropathic pain because of its inexpensive, minimally invasive, and minimally destructive nature [12,13]. Our knowledge of the cellular analgesic mechanisms of action of PRF is not clear [12,13], but the application of PRF currents to DRGs produces relief in certain peripheral neuropathic pain entities [9,12–14]. Published neurobiological trials indicate that PRF and sham treatments have different biological effects and that the mode of action is independent of temperature. Neural destruction using conventional RF and PRF is dependent on the distance between the electrode and the tissue, but it is less pronounced and transient with PRF [13–16]. Furthermore, the biological effect of PRF appears selective to small diameter C- and A-delta-fibers, and it is unlikely to be related to thermal damage [17].

The application of PRF currents to DRGs produces relief in certain peripheral neuropathic pain entities, mostly in adults [12–14]. Hofmeester et al. [9] described a 13-year-old boy who was successfully treated for chronic scrotal and inguinal pain with PRF following orchidopexy. To our knowledge, the present case is the second case of PRF on DRG for neuropathic pain in the pediatric population.

Sensory stimulations are used to place the PRF probe sufficiently close to the DRG. Polio paralysis is caused by the damage or destruction of motor neurons in the spinal cord, which leads to corresponding muscle paralysis [1]. The dorsal roots are intact in patients with poliomyelitis, and sensory stimulation tests were applied successfully in our case. The locations of the DRG can only be confirmed via the administration of contrast material in pediatric patients [18]. The exact location of the DRGs was confirmed using the sensory stimulations test and the administration of contrast material in the present case (Figure 1).

This case suggests that 1) PRF application to the DRG is an option for the treatment of CRPS type 1 in adolescent patients, even with poliomyelitis sequelae and 2) DRG may be an active organ in CRPS. Further randomized, controlled studies are needed to obtain conclusive evidence for the treatment of lower extremity CRPS in general pediatric populations.

References
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