



Ultrasound-guided Cryoneuroablation as a Treatment for Post-amputation Neuroma in a Pediatric Patient

Maria Vega Bayon^{3*}, Judith Hermano de la Concepcion¹, Serafin Rodriguez Palero¹, David Morcillo Corominas², Maria Teresa Vara Arias¹

Abstract

Introduction: Post-amputation pain is a frequent and limiting complication, especially in pediatric patients. Stump neuromas represent a common cause of refractory neuropathic pain, with few effective therapeutic options available.

Objective: To describe the use of ultrasound-guided cryoneuroablation as a minimally invasive alternative for the treatment of painful post-amputation neuroma in a pediatric patient.

Methods: A 10-year-old girl with left transtibial amputation due to meningococcal sepsis and severe neuropathic pain (VAS 8/10) secondary to a tibial nerve neuroma, refractory to conventional treatment. Ultrasound-guided cryoneuroablation of the tibial nerve was performed under general anesthesia.

Results: The procedure was completed without complications, achieving pain reduction to VAS 1/10 and full functional recovery within two weeks.

Conclusions: Ultrasound-guided cryoneuroablation is a safe, effective, and minimally invasive technique for the management of painful post-amputation neuroma in the pediatric population, providing novel evidence in this understudied group.

Keywords: Cryoneurolysis; Ultrasound-Guided; Neuropathic Pain; Nerve Block; Neuroma; Amputation.

Introduction

Lower limb amputation in pediatric patients represents a significant medical, functional, and psychological challenge.

Although the prevalence of amputations in children has shown a decreasing trend in recent years, in 2021 an age-standardized incidence rate (ASIR) of 141.5 per 100,000 inhabitants was reported, according to Thao Zang et al [1]. Furthermore, these interventions may lead to long-term complications that affect rehabilitation and quality of life. Among the most significant complications is chronic post-amputation pain, with a prevalence of up to 83% of pediatric patients with limb amputations. Its etiology is multifactorial, although it is estimated that around 20% of cases are due to stump neuromas, according to Ahneesh J. Mohanty et al [2,3]. Neuromas can cause severe pain—burning or stabbing in nature—that worsens with local pressure or prosthesis use, limiting functional adaptation and increasing the risk of prosthesis abandonment during critical stages of motor development in childhood [4]. In response to these challenges, minimally invasive alternatives aimed at modulating neuropathic pain have emerged in recent years, with the goal of achieving effective pain control with lower morbidity and shorter

Affiliation:

¹Hospital Infantil Universitario Nino Jesús, Madrid, Spain

²Hospital Universitario Albacete, Albacete, Spain

³Hospital Río Carrion, Palencia, Spain

*Corresponding author:

Maria Vega Bayon, Hospital Río Carrion, Palencia, Spain

Citation: Maria Vega Bayon, Judith Hermano de la Concepcion, Serafin Rodriguez Palero, David Morcillo Corominas, Maria Teresa Vara Arias. Ultrasound-guided cryoneuroablation as a treatment for post-amputation neuroma in a pediatric patient. *Archives of Physiotherapy and Rehabilitation*. 9 (2026): 60-62.

Received: April 04, 2026

Accepted: April 20, 2026

Published: May 06, 2026

recovery times. One such technique is cryoneuroablation, a procedure that involves the controlled application of extremely low temperatures, generally between -20°C and -100°C , to the affected nerve. This exposure induces a process of Wallerian degeneration, characterized by the selective destruction of axons and the reversible interruption of nociceptive impulse conduction from the periphery to the central nervous system. Although cryoneuroablation has shown promising results in various neuropathic pain conditions in adults, evidence regarding its safety and efficacy in pediatric patients—particularly in cases of post-amputation neuromas—remains limited. In this context, we present the case of a pediatric patient with a painful tibial nerve neuroma following infracondylar amputation, treated with ultrasound-guided cryoneuroablation, achieving significant pain relief and full functional recovery. The aim of this work is to provide additional evidence on an innovative and scarcely documented approach to the management of post-amputation neuromas in pediatric patients.

Material and Methods

A 10-year-old girl is presented, with a history of left lower limb transtibial amputation at the proximal third level (T1) at the age of four, secondary to an episode of meningococcal sepsis. The initial postoperative course was favorable, allowing early prosthetic fitting and achieving a functional level K3 according to the Medicare scale. Two years later, the patient began to experience progressive intolerance to prosthesis use, characterized by pain of intensity VAS 8/10 localized in the amputation stump, especially in contact with the socket. Clinically, she reported focal pain on palpation over the distal tibial region, accompanied by neuropathic symptoms of a burning and dysesthetic nature radiating diffusely throughout the stump. Despite pharmacological treatment with gabapentin, percutaneous drainage procedures of a seroma, and a surgical stump revision procedure, the clinical symptoms persisted. Imaging studies were performed using ultrasound and knee MRI. The latter revealed findings consistent with the presence of a post-traumatic neuroma (figure:1). Given the persistence of symptoms and the new diagnosis of this complication, in October 2025 a cryoneuroablation procedure targeting the amputation neuroma was indicated. The procedure was performed under general anesthesia and ultrasound guidance. The cryoablation probes were positioned in the region of the tibial nerve at two levels, applying two alternating freeze–thaw cycles, with a freezing time of two minutes at -80°C in each cycle, separated by a thawing interval of two minutes (figure:2).

Results

The procedure was completed without incidents or intraoperative complications. In the immediate postoperative evaluation and during follow-up, the patient reported a

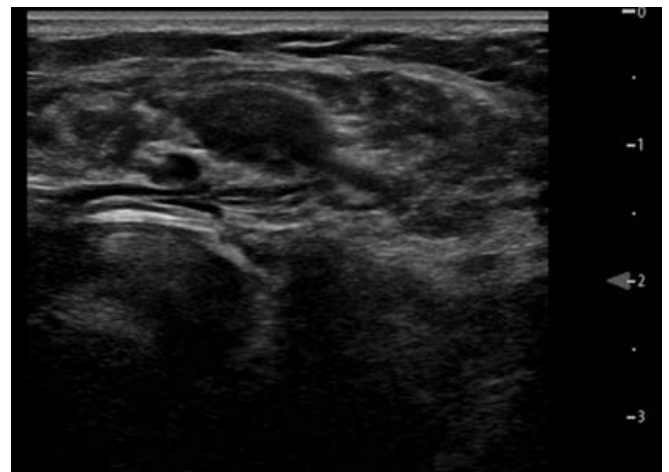


Figure 1: Amputation neuroma.

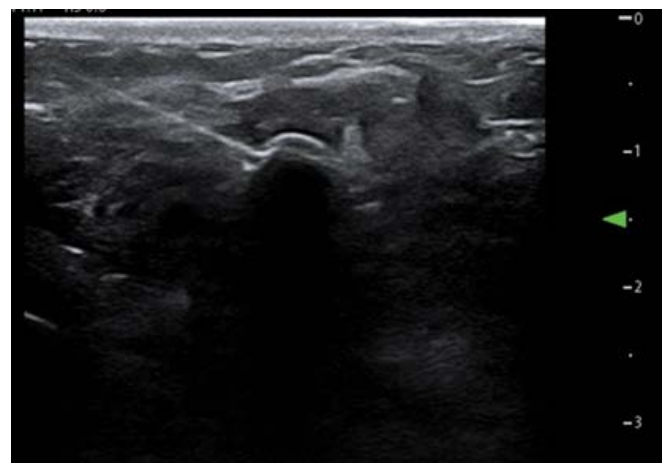


Figure 2: Cryoneuroablation procedure performed on the amputation neuroma.

significant reduction in pain, evidenced by a decrease in the visual analog scale (VAS) score from 8 to 1 one week after the procedure, along with a subjective pain improvement of 80%. At two weeks, she resumed functional use of the prosthesis without recurrence of symptoms or signs of local complications, with results maintained at the three-month follow-up. This corresponded to an improvement in the Barthel Index of dependence from a score of 45 to 90 (indicating near-complete independence).

Discussion

The management of residual post-amputation pain secondary to refractory painful neuromas in the pediatric population represents a significant clinical challenge. In this context, ultrasound-guided cryoneuroablation has been proposed as an effective therapeutic alternative for pain control and functional rehabilitation [5,6]. In a study evaluating the application of cryoneurolysis in a sample of 31 neuromas corresponding to 20 patients, Caporusso et al. concluded that 40% of patients achieved complete pain resolution, while

45.2% experienced a significant reduction in pain intensity [7]. Among its advantages over other pain modulation methods, cryoneurolysis is minimally invasive, preserves motor nerve structures, and limits damage to surrounding tissues. Unlike thermal or surgical ablation techniques, it does not compromise the integrity of the epineurium or perineurium, thereby reducing the risk of neuroma formation and promoting nerve regeneration. Additionally, it provides prolonged and reversible analgesia without cumulative tissue damage or the risks associated with the systemic toxicity of chemical ablation [8,9]. In a 2023 study involving a large sample of 113 patients treated with cryoneurolysis, Winston et al. reported that 96.75% of patients experienced no pain or dysesthesia after treatment, and the complications observed were mild and all resolved within one month [10]. In the present case, the intervention achieved a significant reduction in pain and full restoration of prosthetic function in a short period, without associated complications, demonstrating its potential as a therapeutic option for post-amputation neuromas in pediatric patients. This report provides preliminary clinical evidence on the safety and efficacy of cryoneuroablation in children, as no published studies specifically evaluating the use of this technique for neuromas in the pediatric population were identified. It highlights the need for prospective studies and larger case series to establish its role in this group.

References

1. Zhang T, Chen Q, Li H, et al. Global burden of amputation among children and adolescents from 1990 to 2021: systematic analysis of the Global Burden of Disease study 2021. *13* (2025).
2. Mohanty AJ, Cederna PS, Kemp SWP, et al. Prophylactic Regenerative Peripheral Nerve Interface Surgery in Pediatric Lower Limb Amputation Patients. *Ann Surg* 282 (2025): 346-351.
3. Wilkins KL, McGrath PJ, Finley AG, et al. Phantom limb sensations and phantom limb pain in child and adolescent amputees. *Pain* 78 (1998): 7-12.
4. Buch NS, Qerama E, Brix Finnerup N, et al. Neuromas and postamputation pain. *Pain* 161 (2020): 147-155.
5. Ilfeld BM, Preciado J, Trescot AM. Novel cryoneurolysis device for the treatment of sensory and motor peripheral nerves. *Expert Rev Med Devices* 13 (2016): 713-25.
6. Von Falck C, Orgel M, Wacker F, et al. Icing the Pain-Ultrasound-Guided Cryoablation of Symptomatic Post-Amputation Stump Neuroma. *Cardiovasc Intervent Radiol* 45 (2022): 223-227.
7. Caporusso EF, Fallat LM, Savoy Moore R. Cryogenic neuroablation for the treatment of lower extremity neuromas. *J Foot Ankle Surg* 41 (2002): 286-90.
8. Finneran Iv JJ, Ilfeld BM. Percutaneous cryoneurolysis for acute pain management: status and prospects. *Expert Rev Med Devices* 18 (2021): 533-543.
9. Biel E, Aroke EN, Maye J, et al. The applications of cryoneurolysis for acute and chronic pain management. *Pain Pract* 23 (2023): 204-215.
10. Winston P, MacRae F, Rajapakshe S, et al. Analysis of adverse effects of cryoneurolysis for the treatment of spasticity. *J Phys Med Rehabil* 102 (2023): 1008-1013.



This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC-BY\) license 4.0](https://creativecommons.org/licenses/by/4.0/)