



The use of permanent peripheral nerve stimulation to manage chronic pain after a grenade injury to the hand

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Introduction

The use of electrical stimulation of the peripheral nerves to improve pain has been reported in the medical literature since the 1860s¹. Peripheral nerve stimulation devices were first approved by the US Food and Drug Administration to treat acute and chronic pain in 2018..

The majority of PNS done today consists of temporary pulse generators that are used for up to 60 days but at least four devices are currently available in the US for permanent implantation².

Presentation

The patient is a 33-year-old male service member who had a flash bang grenade in the right hand that accidentally discharged during a training exercise in June 2021. He was initially treated at a civilian hospital and underwent surgery for a right ring finger traumatic amputation & multiple palmar lacerations. The palmar wounds were able to be closed primarily & the ring finger amputation was revised to the level of the DIP.

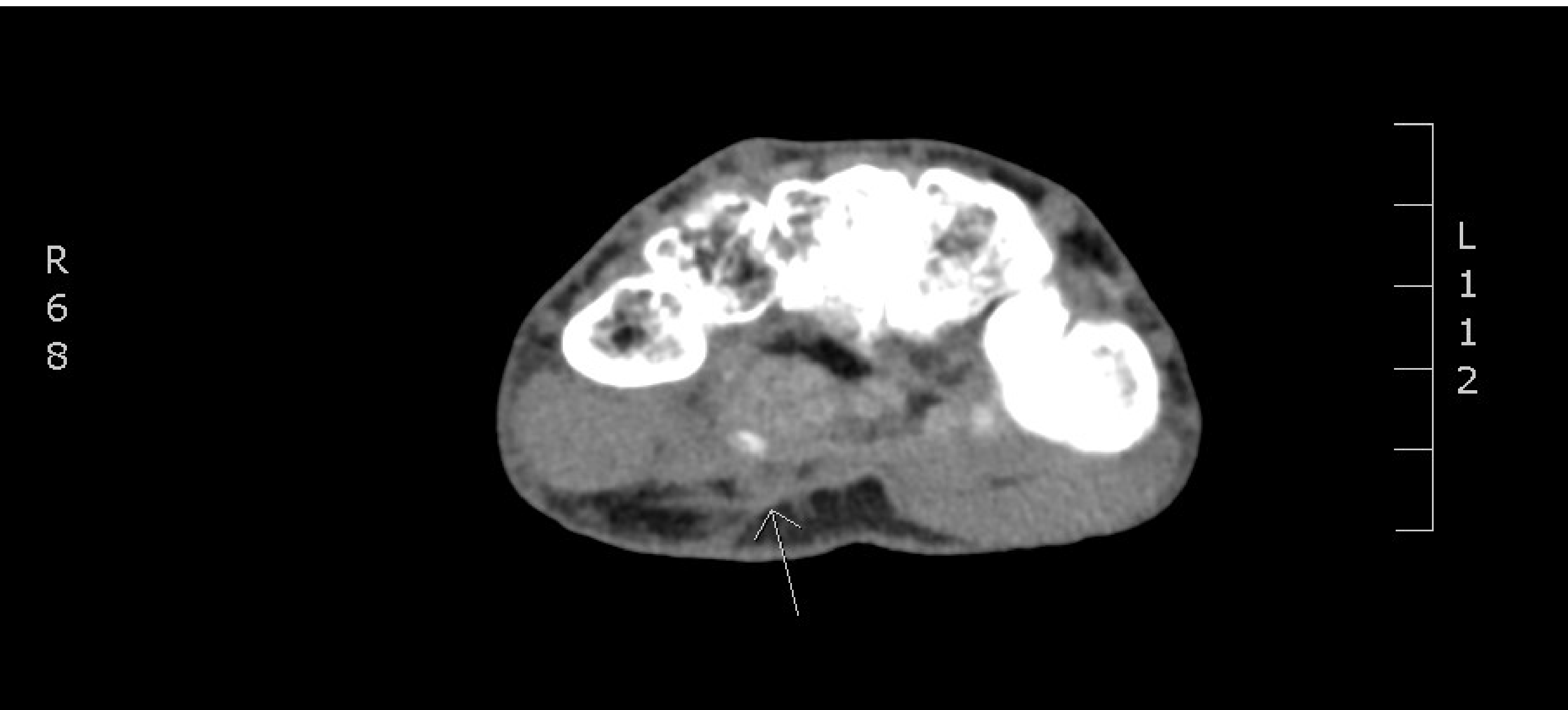
The patient followed up at Walter Reed National Military Medical Center in the Orthopedic Hand Surgery & Physical Medicine and Rehabilitation clinics for after care.



Hand status post initial exploratory surgery and phalanx amputation



Triple phase bone scan concerning for CRPS in the right wrist



Hook of hamate fracture abutting the ulnar nerve with perineural fibrosis present

Clinical Course

From his initial presentation the patient struggled with neuropathic pain in the right palm & 4th and 5th digits. Pharmacotherapy with neuropathic agents was started and titrated up for better efficacy. The patient was also evaluated & treated by Occupational Therapy & Pain Psychology.

The patient followed up with Orthopedic Hand Surgery who obtained a **triple phase bone scan** in October 2021 for persistent pain that **showed increased radiotracer uptake in the right carpal bones, IP, and MCP joints suggestive of CRPS**. **Nerve conduction studies** were done in January 2022 and **significant for a demyelinating and axonal sensorimotor neuropathy of the ulnar nerve and signs of a chronic ulnar denervation injury on EMG**.

A **CT of the hand in January** showed a **chronic hook of hamate fracture with a fragment abutting the ulnar nerve** near the terminal bifurcation and some mild perineural fibrosis.

A **MRI** of the hand that was initially done in Oct 2021 around the time of his bone scan was reread by the Radiology Department and found to have **scar or granulation tissue partially encasing the ulnar branches to the ring and small fingers**. With this information the patient was referred to the Walter Reed Peripheral Nerve Injury Clinic. A multidisciplinary team evaluated him & recommended excision of the hamate. In March 2022 he **underwent excision of the hook of hamate, ulnar artery reconstruction with reverse volar vein graft, & neurolysis of the common digital nerve to the middle and ring fingers**.

Unfortunately, after surgery the patient continued to have neuropathic hand pain, so **he underwent a temporary peripheral nerve stimulation trial (PNS) of the ulnar nerve** by the PM&R clinic in June 2022 & was able to tolerate it for the full 60-day trial with significant improvement in his pain. **Once the lead was removed his symptoms returned to their baseline**. In September 2022, another PNS trial was performed with a different pulse generator for 1 week. Again, his pain was significantly improved making him a good candidate for permanent PNS.

The patient **underwent implantation of the permanent pulse generator in June of 2023**. **Two leads were placed superiorly and inferiorly to the ulnar nerve in the brachium of the right arm**. The patient tolerated the surgery well and was discharged home the same day. **One month after the procedure our patient reported a greater than 90% sustained improvement in his neuropathic pain** with the IPG & is very satisfied with the results. He is primarily taking Duloxetine for pain control & will continue to follow up in clinic periodically to have his pain monitored.

Discussion

Many patients with nerve injuries/CRPS like our patient face decades of having to live with chronic pain, and effective treatment options are often limited. Permanent PNS is an emerging tool in the pain management physician's armamentarium that should be considered.

References

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