

# Common Peroneal Neuroma-in-Continuity with Complete Foot Drop Secondary to a Bullet Fragment Injury: A Case Report Demonstrating End-to-End Nerve Repair

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## ABSTRACT

**Background:** CPN injuries are generally common but they are uncommon due to gunshot injuries and are associated with poor motor outcomes. Managing neuroma-in-continuity is still challenging because there are currently no accepted standards for deciding on the most effective course of treatment or estimating the time needed for repair. Treatment options for a neuroma-in-continuity include neurolysis, neuroma resection with interposition, end-to-side nerve grafting, and bypass grafting.

**Case Presentation:** A 40-year-old man presented with findings of complete right foot drop due to an 8-month-old firearm injury to his right distal thigh. Following baseline investigations, imaging, and anesthesia fitness, he underwent surgical exploration under general anesthesia. A neuroma-in-continuity was found in the CPN, resected, and an end-to-end nerve repair was performed. Along with the neuroma-in-continuity, a bullet fragment was also removed. The neurological status remained unchanged postoperatively.

**Conclusion:** Regardless of the cause of the lesion, patients should be urged to seek surgical therapy if there is no spontaneous recovery within four months after the CPN injury. Sharp injuries and knee dislocations have a better chance of recovery than crush injuries and gunshot wounds.

**Keywords:** Peripheral Nerves; Peripheral Nerve Injuries; Peroneal Neuropathies; Neuroma; Foot Drop; Firearms

## Introduction

Sciatic nerve splits into common peroneal nerve (CPN) and tibial nerve in the mid to distal third of the thigh. From the apex of the popliteal fossa to the lateral popliteal fossa, the CPN descends obliquely across the plantaris muscle and curves around the proximal peroneus longus muscle. It then makes its way to the anterior lower leg, where it splits into deep and superficial branches [1]. CPN injuries are generally common but they are

uncommon due to gunshot injuries and they are associated with poor motor outcomes. So far, it is believed that nerve reconstruction is a reasonable option and it is recommended up to 6 months after the primary injury [2]. Managing neuroma-in-continuity is still challenging because there are currently no accepted standards for deciding on the most effective course of treatment or estimating the time needed for repair. Neurolysis, neuroma resection with interposition, end-to-side nerve grafting, and bypass grafting are

all treatment options for a neuroma-in-continuity. The issue with complete neuroma resection is that it separates and sections not only the disorganized fibro-neural tissue mass that forms the neuroma, but also all potentially still viable nerve fibers passing through the damaged nerve part, removing the possibility of spontaneous recovery. Simultaneously, there is a limited time frame for axonal regrowth before motor endplates degenerate and muscles are irreversibly paralyzed. It is possible that with a neuroma-in-continuity, enough trophic factors have been transported to the motor endplates to preserve some mechanisms such as enhanced synchronization of motor unit actuating, muscle fiber hypertrophy, and distal motor fiber sprouting, resulting in doubly innervated muscle fibers and allowing functional recovery. This may allow recovery to extend beyond the traditional one year limit after injury [2]. The following case report demonstrates neuroma-in-continuity resection and end-to-end nerve repair in a patient with a CPN neuroma-in-continuity secondary to a bullet fragment injury.

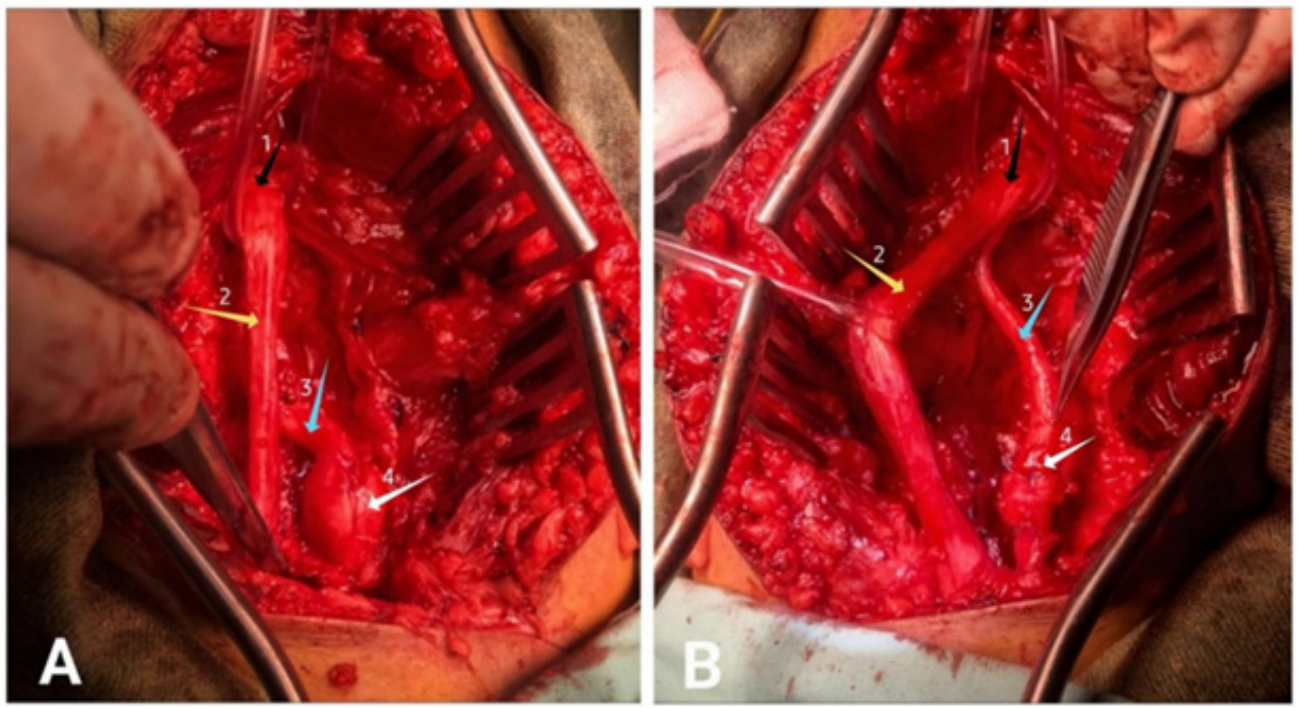
### Case Presentation

A 40-year-old man presented to us as an outpatient with findings of complete right foot drop due to an 8-month-old firearm injury to

his right distal thigh. On examination, he had plegia of the ankle dorsiflexors and extensors of the great toe, as well as hypesthesia in the right peroneal nerve supply area. He underwent surgical exploration under general anesthesia after baseline investigations, imaging, and anesthesia fitness. Nerve conduction study was not performed because the patient was very poor and non-affording. Anteroposterior (AP) and lateral X-rays of his right distal thigh and knee revealed a bullet fragment (Figure 1). The patient was positioned prone, with padding beneath the knee and ankle. A vertical S-shaped incision was made in the lower thigh, medial to the short head of the biceps femoris muscle, after cleaning and draping. Dissection was carried out. The sciatic nerve bifurcation, the tibial nerve, and the common peroneal nerve were discovered (Figure 2A). A neuroma-in-continuity of the CPN was identified, resected, and an end-to-end nerve repair was performed using Ethicon Prolene 10.0 suture (Figure 2B). Exploration also turned up the bullet fragment, which was also removed along with the neuroma-in-continuity (Figures 3A & 3B). The surgical wound was thoroughly washed with saline before being closed. The postoperative neurological status remained unchanged. Hematoxylin and Eosin (HE) stains revealed a random and convoluted arrangement of nerve bundles within a fibrous connective tissue stroma (Figure 4).



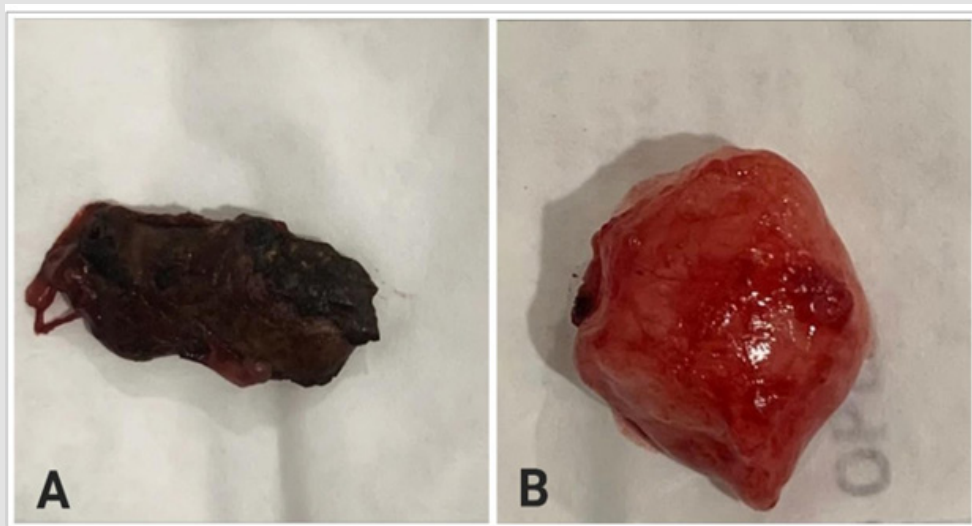
**Figure 1:** X-rays right distal thigh and knee AP and lateral views showing a bullet fragment (marked by white arrows).



Note: Common peroneal nerve, 4 (white arrow) End-to-end nerve repair after neuroma in-continuity resection.

**Figure 2:**

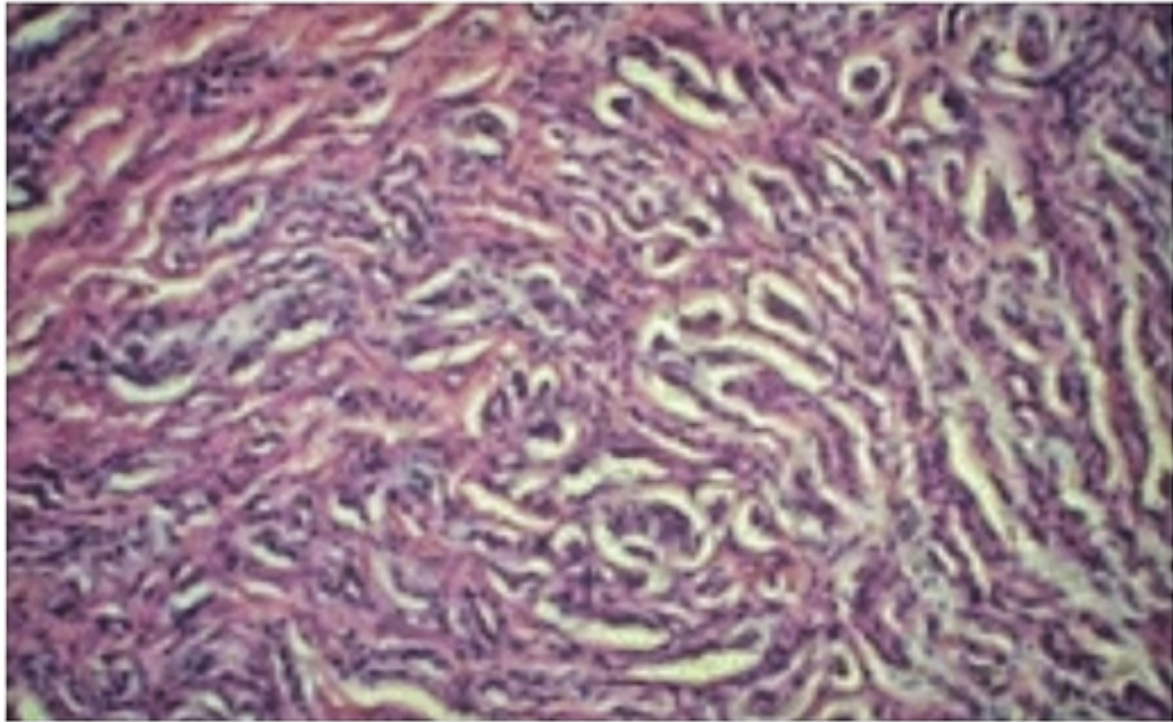
- A. 1 (black arrow) Sciatic nerve bifurcation, 2 (yellow arrow) Tibial nerve, 3 (blue arrow) Common peroneal nerve, 4 (white arrow) Neuroma-in-continuity.
- B. 1 (black arrow) Sciatic nerve bifurcation, 2 (yellow arrow) Tibial nerve, 3 (blue arrow).



**Figure 3:**

- A. Removed bullet fragment.
- B. Resected neuroma.





**Figure 4:** Hematoxylin and Eosin (H&E) stains reveal a random and convoluted arrangement of nerve bundles inside a fibrous connective tissue stroma.

## Discussion

The CPN has been shown to be the most vulnerable and frequently injured nerve of the lower extremity [3] due to its superficial anatomical location [1,4] and fixation at the sciatic notch and the peroneus longus muscle, as opposed to the less vulnerable location of the tibial nerve [1-5]. At the same time, CPN injuries have a poorer recovery rate when compared to other lower extremity nerve injuries. The reasons for this are a poorer neural blood supply, a «lower force-absorbing fascicle or connective tissue count,» and a greater demand for innervation of peroneal nerve supplied muscles [2,4]. Aside from the injured nerve, factors influencing the outcome after nerve reconstruction include the trauma mechanism such as laceration, compression, traction, and focal ischemia, the graft length, and the time between grafting and intervention. Sharp trauma, shorter grafts, and early reconstruction or neurolysis have all been linked to a better prognosis [6,7]. The main limiting factor in the optimal treatment of peroneal nerve lesions associated with foot drop is time. It is well known that nerve regeneration occurs at a rate of 1 mm per day [7,8] that motor endplates die 12-16 months after denervation, [7] and that innervated muscles remain viable 18-24 months after the injury [9]. When the rate of regeneration and the distance to cover are disproportionate, it leads to irreversible degeneration and fibrosis, as well as permanent paralysis of the

denervated muscles [10]. The CPN nerve transfer or reconstruction has been said to be reasonable for motor recovery up to 6 months.

By no means later than 12 months after denervation, and denervation longer than 12 months has been said to be an absolute contraindication [8,11,12]. On the other hand, in patients grafted 13 and 18 months after the injury, simultaneous CPN reconstruction and tibialis posterior tendon transfer results in satisfactory functional recovery, indicating the importance of rebalancing ankle movement forces to enhance neural regeneration [13]. Neurolysis has been shown to be an effective method for improving nerve function in the context of neuroma-in-continuity, [4,14,15] for up to 8 months after the injury [6]. However, this method has been linked to microvascular damage and the formation of intraneural scars [16]. A few months after the injury, intraoperative nerve action potentials have been proposed as a crucial tool for reevaluating the reason for resection and nerve grafting against neurolysis in the CPN lesions. 1 CPN injuries in open wounds should undergo exploration in an emergency room. Patients should be urged to seek surgical treatment if a close injury fails to recover on its own within four months of the damage, regardless of the cause of the lesion. Sharp injuries and knee dislocations have got a good recovery compared to crush injuries and gunshot wounds which have a poor recovery.

## Conclusion

CPN is the most vulnerable and frequently injured nerve in the lower extremity but gunshot injuries are a less common cause. Time is the most important limiting factor in the optimal treatment of peroneal nerve lesions associated with foot drop. CPN injuries in open wounds should be explored in the emergency room. Patients should be advised to seek surgical treatment if there is no spontaneous recovery within four months of the injury, regardless of the causative mechanism of the lesion. Sharp injuries and knee dislocations have a better chance of recovery than crush injuries and gunshot wounds.

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## Conflict of Interest

Authors declare no conflict of interest.

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