Incidence of peroneal sensory deficit following ankle trauma, a long-term outcome analysis on patients who underwent subsequent surgical peroneal nerve decompression.

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STATEMENT OF PURPOSE

Peroneal neuropathy is the most frequent mononeuropathy encountered in the lower limb and the third most common focal neuropathy encountered overall, after median and ulnar neuropathies. The exact incidence of peroneal nerve injury after ankle trauma is unknown. Many studies suggest a direct correlation between ankle trauma and traction of the nerve due to forced plantarflexion and inversion of the foot. The purpose of our study was to further investigate the incidence of peroneal sensory deficits after ankle trauma requiring surgical intervention as well as to assess the outcome following surgical nerve decompression.

METHODOLOGY

A retrospective review from 5/16/2017 to 7/18/2019 was performed on 102 patients who suffered ankle trauma (defined as fracture or sprain) which required surgical intervention. The patients were each examined clinically for alteration/loss of sensation with positive Tinel's sign along the distribution of the peroneal nerve. The mean follow-up time was 9.6 months.

PROCEDURE

General anesthesia was performed by anesthesia services. The lower extremity was prepped in the usual aseptic technique and a thigh tourniquet was applied.

→ **CPN**

- A 3- to 4-cm incision is made obliquely across the fibular neck and deepened into the subcutaneous tissue. Care is taken not to injure the lateral cutaneous nerve of the calf. The deep fascia is palpated to identify the common peroneal nerve. This fascia is lifted and then incised to identify the CPN which often has a yellowish color and appears like a lipoma. Only the epineurium is grasped in the atraumatic forceps. The fascia is released into the popliteal fossa. The fascia of the peroneus longus is divided transversely and longitudinally, the muscle retracted anteriorly. Beneath the muscle, a fascial band is released, and the nerve is noted to be indented and flattened beneath this band. The CPN is then elevated and any fascial bands on the lateral head of the gastrocnemius muscle beneath the CPN are cauterized and divided.

→ **SPN**

- An incision is made 10- 12 cm proximal to the lateral malleolus parallel to the fibula, but anterior to the fibula to permit access to both anterior and lateral compartments. The incision is made into the subcutaneous plane with care taken not to injure it. The spot of the entrapment as the SPN travels from deep to the fascia to enter the subcutaneous plane is identified and the fascia is incised for about 15 cm so that the SPN is totally free from constriction and a new small muscle herniation is not created through a small fascial window.

→ **DPN**

- An incision is made obliquely across the juncture of the 1st and 2nd metatarsals and the cuneiform. In the subcutaneous tissue, blunt dissection is used to identify the superficial peroneal branches so they can be retracted and not injured. The extensor hallucis brevis tendon is identified unambiguously, and then a 2-cm section of it is resected.

→ **TTR**

- A 6cm curvilinear incision is made from proximal to distal, 1cm posterior to the medial malleolus to the porta pedis, lateral plantar nerve portal. The incision is then deepened to subcutaneous tissue and curved Metzenbaum scissors are used to bluntly dissect down to the laciniate ligament and the superficial septum is then released under careful dissection. At this time, the area of the tarsal tunnel, the posterior tibial nerve is identified and freed both proximally and distally. The posterior tibial nerve proximally and was then followed down to the level of medial plantar nerve, medial calcaneal nerve, and the lateral plantar nerve tunnel, which are decompressed utilizing hemostats and tenotomy scissors with care.

All sites are copiously irrigated with NSS and subcutaneous tissue closed utilizing 4-0 vicryl and skin edges reapproximated with 3-0 prolene.

LITERATURE REVIEW

→ Review of the present literature revealed an association between ankle injuries and common fibular nerve palsies. More than 150 cases of fibular nerve palsy associated with ankle injury (fracture more frequently than sprain) have been documented [10].

→ The CPN courses from behind the knee laterally through a fibro-osseous tunnel at the level of the fibular neck deep to the peroneus longus muscle origin where it divides into the deep and SPN and lateral sural cutaneous nerve [3]. The close and variable relationship of the SPN and its branches to the distal fibula and the ankle joint mean that it is vulnerable to damage from ankle sprain injuries and ankle fractures [1].

→ Signs and symptoms suggestive of nerve entrapment include anesthesia, dysesthesias, paresthesia or weakness in the distribution of a peripheral nerve [3]. Diagnosis may be made using the results of the history and physical examination. The presence of a positive Hoffmann-Tinel sign over the tibial nerve in the tarsal tunnel gives a 92 % positive predictive value for good to excellent results after nerve decompression in the diabetic with neuropathy and 88% in the patient with idiopathic neuropathy [9].

→ A high index of suspicion for nerve entrapment enables the clinician to identify these conditions in a timely manner and institute an appropriate management program, thus improving patient outcomes [2,3].

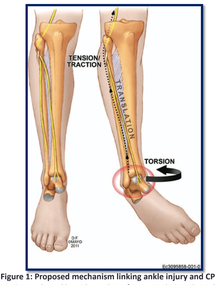


Figure 1: Proposed mechanism linking ankle injury and CPN. Torsion at the ankle with resultant force translation along the IOM produces tension/traction to the CPN. (Mayo Foundation, 2011.)

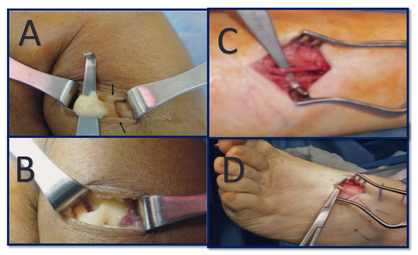


Figure 2: Peroneal nerve entrapment sites. A. CPN compressed below the peroneus longus muscle by a white fibrous band (arrows). The peroneus muscle is retracted. B. The overlying fascia has been excised, note the indentation in the CPN. C. SPN located in BOTH the anterior and the lateral compartment. D. DPN, the extensor hallucis brevis tendon has been excised, and there is an indentation with proximal swelling of the deep peroneal nerve. [7]

RESULTS

Of the 102 patients (39 LAS and 63 ORIF), 52 (50.9%) were found to have symptoms of peroneal nerve entrapment upon physical exam, reporting percussion of the nerve reproduced painful symptoms. In total, 31 (59.2%) of those patients required surgical peroneal nerve decompression after failing conservative measures > 6 months.

Only 7 patients out of the 31 who underwent surgical decompression still experienced occasional nerve pain. 24 (77.4%) of patients who underwent the decompression surgery reported broad reprieve of their symptoms following the procedure.

Table 1: Clinical diagnosis for Peroneal nerve injury (All 3 criteria fulfilled)

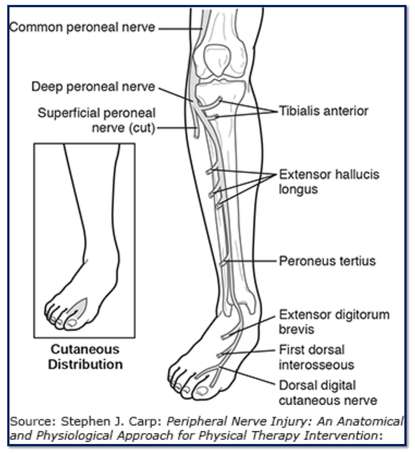
1.	Positive Tinel along the CPN, SPN, DPN, or Tarsal Tunnel
2.	Altered sensation within the distribution of the CPN and its branches
3	Pain along the distribution of the CPN with passive stretch

DISCUSSION & CONCLUSION

→ This study indicates that over half of ankle trauma patients experience symptomatic ipsilateral peroneal nerve entrapment. Over the years, various mechanisms have been postulated to explain the interrelationship between CPN palsy and ankle injury including nerve traction, nerve entrapment, and vascular compromise (Oppenheimer, 1911; Platt, 1940; Hyslop, 1941; Maciver and Letts, 1966; Nobel, 1966; Meals, 1977; Naylor and Walsh, 1987; Connolly et al., 1990; Barbour and Levitt, 1993; O'Neal et al., 2007; Brief et al., 2009). Traction to the CPN resulting in axonal damage was first postulated by Oppenheimer in 1911 and has since been supported by other authors. According to Hyslop (1941), inversion injuries cause muscles that are innervated by the CPN to contract strongly to counteract the force, thus entrapping the nerve against the fibula as it passes deep to the Peroneus longus muscle. The entrapment of the nerve results in a traction injury with resultant nerve injury (Hyslop, 1941; Hayes et al., 2000). Meals (1977) believed that there was a mixture of entrapment and compression of the nerve at the arcade of fibrous tissue at the fibular neck as this structure is tightened during ankle inversion.

→ Peroneal nerve injury should be evaluated in patients after ankle trauma of any kind. If there is a positive Tinel sign, alteration in sensation along the distribution of the nerve and pain with passive stretch, further assessment for nerve entrapment may be warranted.

→ A high index of suspicion for peroneal nerve entrapment following ankle trauma will enable physicians to identify this condition in a timely manner and implement appropriate management; thus improving overall patient outcome, quality of life and satisfaction.



Source: Stephen J. Carp: *Peripheral Nerve Injury: An Anatomical and Physiological Approach for Physical Therapy Intervention:*

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