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Rare Morphological Patterns of the Common Peroneal Nerve: A Cadaveric Perspective.

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ABSTRACT

During routine cadaveric dissection of lower limbs, a communication was found between the superficial and deep peroneal nerves. Common peroneal nerve provides cutaneous innervation to the feet in a peculiar, intricate pattern. In the current day scenario, with a surge in incidence of diseases like diabetic foot ulcer, knowledge of variations in the cutaneous nerve supply of foot is significant for foot reconstruction. Apart from the surgical view, knowledge of variations may help in sourcing the underlying cause of altered sensations in the foot. 32 lower limb specimens (16 of each side) taken from the Department of Anatomy, PIMS were examined to look at the superficial and deep peroneal nerves. Out of 32 lower limbs, 16 of left and 16 of right which were dissected and analysed, 2 limbs, 1 of each left and right were found to have a communication between SPN and DPN. Probability of communication is 2/32. Percentage of Communication is 6.25%. Variations in the common peroneal nerve are not uncommon. Knowledge of such variations could help the orthopedists, plastic surgeons in their respective fields during surgical management.

Keywords: Peroneal nerve, communication, cutaneous nerve, variations, sensations.

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INTRODUCTION

The nerve supply to the skin of the dorsal aspect of the foot is of great surgical significance. The innervation follows a very peculiar pattern and is provided by a combination of nerves, the common peroneal nerve being the major. The common peroneal nerve, also known as the common fibular nerve is the lateral terminal branch of the Sciatic Nerve which terminates at the upper angle of the popliteal fossa. The nerve, taking roots from the L4, L5, S1 and S2 spinal segments traverses in the popliteal fossa, winds around the neck of fibula and divides into superficial and deep peroneal branches. These two nerves enter the dorsum superficial and deep to the superior extensor retinaculum respectively and provide cutaneous innervation.

Objectives

To study the anatomical variations of the common peroneal nerve in cadaveric lower limb specimens

MATERIALS and METHODS

Type of study: Observational Study

Study materials: 32 lower limb specimens, 16 of each side.

During a routine cadaveric dissection of the right lower limb, a variant communication between the superficial and deep peroneal nerves was identified. To further investigate the prevalence of similar variations, 30 additional lower limb specimens were examined.

Statistical Analysis

The incidence of communication between superficial and deep peroneal nerves was analysed in percentage.

RESULTS

The superficial peroneal nerve divides into medial and lateral branches. Medial branch further supply to the medial part of the hallux and the lateral branch gives multiple branches to supply the 2nd, 3rd and 4th web spaces. The deep peroneal nerve supplies the 1st web space by emerging deep to the medial muscular slip of Extensor digitorum brevis.

The morphology of the common peroneal nerve and its branches were carefully dissected, observed and examined for variations among 32 lower limb specimens [Fig.1].

Figure 1: Lower limb specimens used for the study

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On the right dorsum of the foot, the deep peroneal nerve emerged from the deep proximal part of the first intermetatarsal space and immediately gave off a medial communicating branch. This branch communicated with the lateral communicating branch of the medial division of the medial branch of the superficial peroneal nerve, which innervates the ball of the hallux. From this communication, a small slender nerve extended distally to rejoin the deep peroneal nerve in the distal part of the first intermetatarsal space [Fig. 2, 3].

On the left dorsum of the foot, the superficial peroneal nerve crossed superficial to the extensor retinaculum and divided into two main divisions: medial and lateral. At the proximal end of the first intermetatarsal space, the medial branch of the medial division (innervating the medial side of the hallux) was communicating laterally with the deep peroneal nerve, forming a communication plexus. This plexus provided innervation to the medial side of the hallux, the lateral side of the hallux, and the first web space. Meanwhile, the lateral branch of the medial division continued distally to supply the second web space [Fig. 4, 5].

These variations were observed bilaterally [Table and Fig. 2-5]. No such communications were observed in the remaining 30 specimens.

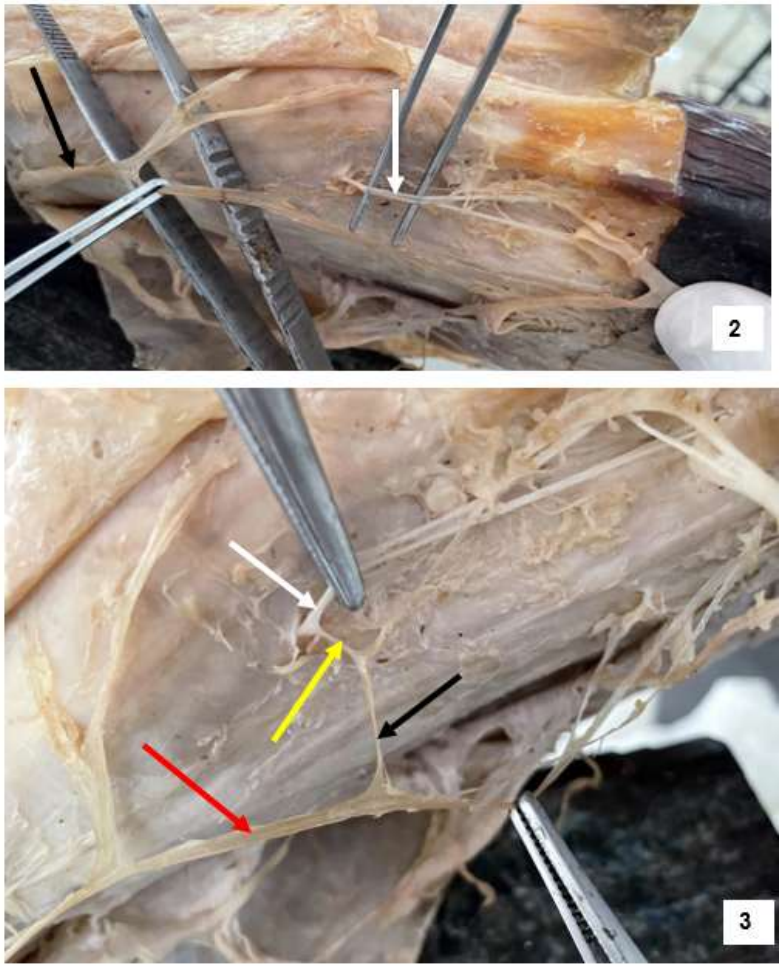

Figure 2: Black arrow indicates Superficial Peroneal Nerve and white arrow indicating Deep Peroneal Nerve of Right foot.

3: Red arrow indicates Superficial Peroneal Nerve, White arrow show Deep Peroneal Nerve, communication between Superficial Peroneal (Black arrow) and Deep Peroneal Nerves (Yellow arrow) of Right foot.

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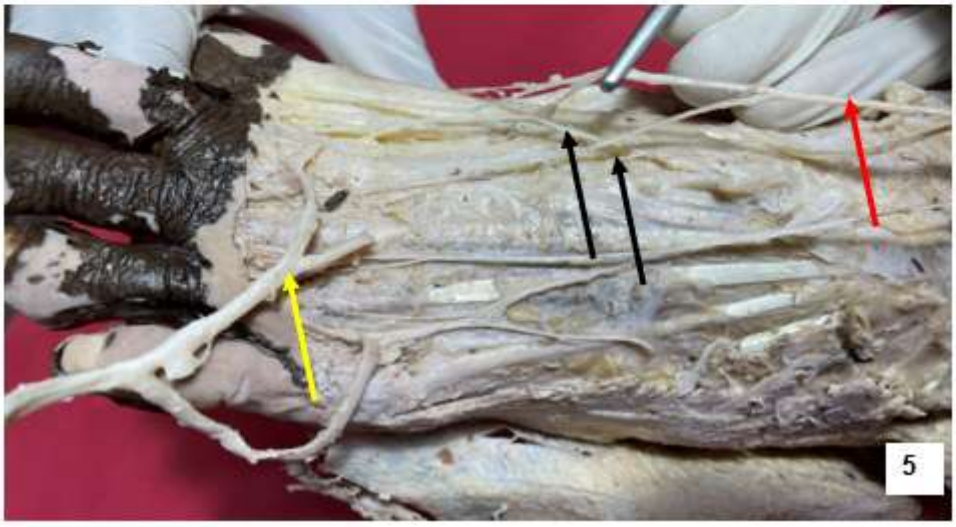

Figure 4: Yellow arrows indicating communication between superficial peroneal Nerve and deep peroneal nerve, Red arrow show the plexus of left foot.

Figure 5: Black arrows indicating deep peroneal nerve, Red arrow show superficial peroneal nerve, Red arrow show the dorsal venous arch.

Table: Communication Between Superficial and Deep Peroneal nerves

Total number of lower limbs examined	32
Number of limbs with communication between superficial and deep peroneal nerves	2
Probability of communication	2/32
Percentage of communication	6.25%

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DISCUSSION

Wahee P et al. reported interesting observations on the cutaneous innervation patterns of the dorsum of the feet in fetuses but did not identify any communication between the superficial and deep peroneal nerves [1].

Drizenko A et al. reported an incidence of communication between superficial peroneal and sural nerves [2].

The study by Nagabooshana S et al also elaborated on the variations in the cutaneous innervation of foot focusing particularly on variations of the superficial peroneal nerve in leg. Coexistence of such variations in the leg and foot requires further studies [3].

The study by Prakash et al. in 2010 examined the course and branching pattern variations of the superficial peroneal nerve; however, it did not address the communication patterns between the superficial peroneal nerve and the deep peroneal nerve [4].

A similar study conducted by Nayak VS et al. in 2019 investigated the incidence of communication between the superficial and deep peroneal nerves in the South Indian population. The study, which examined 20 adult cadaveric lower limbs, reported that 10% of the cases exhibited such communication [5].

Manning C et al. (2021) studied the communication between the superficial and deep peroneal nerves in 19 cadaveric specimens. They observed that 11 of these specimens exhibited such communications [6].

Cook S et al. conducted a study on the electrophysiology of deep and superficial peroneal nerve conduction to the first dorsal web space of the foot. They observed asymmetrical electrophysiologic responses, indicating significant anatomical and functional variability in the sensory supply to this region. In one limb, the sensory response was attributed to contributions from both the deep peroneal nerve and the interdigital cutaneous nerve branch of the superficial peroneal nerve [7,8,9,10].

present study observed bilateral communication between the superficial and deep peroneal nerves in one cadaver (6.25%) [Table and Fig.2-5] however, no such communication was identified in the remaining 30 specimens.

CONCLUSION

Variations in the common peroneal nerve are relatively common and can have significant implications for medical professionals, particularly orthopedists, plastic surgeons, and physiotherapists. Understanding these variations is crucial during surgical procedures, as they can influence surgical planning and outcomes as in reconstruction of diabetic foot ulcers or soft tissue defects, recognizing altered nerve anatomy helps prevent inadvertent nerve damage. Furthermore, variations in the nerve's cutaneous innervation can affect sensory function, leading to changes in skin sensation and potentially impacting rehabilitation strategies. In non-surgical cosmetic procedures, awareness of these variations is essential to avoid unintended nerve damage and optimize results, especially in procedures involving the lower limbs.

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