

## ***An Anomalous Variation in the Innervation Pattern of the Peroneus Longus Muscle by Deep Peroneal Nerve: A Case Report***

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### **SUMMARY**

*The muscles of the leg are partitioned into three compartments (anterior, lateral and posterior) which have separate innervations. The peroneus longus muscle is included in the lateral compartment and is innervated by the superficial peroneal nerve. We report an unusual finding in the innervation pattern of the peroneus longus muscle on the right side of a 65 year old female cadaver, in which the branches from the deep peroneal nerve were found to innervate the peroneus longus muscle. This finding is of academic interest and clinical significance to surgeons operating on the proximal fibula for nerve decompression, high tibial osteotomy and nerve transfer operations.*

**Key words:** *Deep peroneal, common peroneal, nerve, peroneus longus, variations.*

### **INTRODUCTION**

Standard text books of anatomy and past research reports have described the deep peroneal nerve as innervating the muscles of the anterior compartment of the leg i.e. tibialis anterior, extensor digitorum longus, extensor hallucis longus and peroneus tertius [1, 2, 3]. We are unaware of any previous report of the deep peroneal nerve supplying the peroneus longus muscle. The deep peroneal nerve

which usually innervates the anterior group of muscles of the leg was found to innervate the peroneus longus which is a muscle of the lateral compartment.

Such anomalies may confound clinical diagnosis or endanger the nerve during surgery, unsuspected in procedures such as surgical decompression of common peroneal nerve at the fibular head, percutaneous placement of wires in proximal tibia, high tibial osteotomy and biopsy of proximal fibula [4, 5]. The described anomaly is rare and it may be important to clinical practice.

### **CASE REPORT**

During routine cadaveric dissection of the lower limb in the Department of Anatomy, Maulana Azad Medical College, University of Delhi (India), we observed an anomalous branching pattern of the deep peroneal nerve in the right leg of a 65 year old female cadaver. The age of the cadaver was determined from records obtained from the voluntary body donation form. The portion of the leg below the knee was dissected carefully to expose the anterior, lateral and posterior compartments of the leg. The surrounding structures were carefully delineated and the specimen was studied in detail. See Fig. 1.

### **The Right Leg**

The common peroneal nerve ('c' in Fig.1) was observed to descend obliquely along the lateral side of the popliteal fossa towards the fibular head, medial to the biceps femoris muscle. It divided into the superficial peroneal nerve and the deep peroneal nerve at the level of the styloid process of the head of fibula. The deep peroneal nerve passed obliquely through the peroneus longus muscle and 1.5 cm distal to its origin, it divided into two branches (Fig.1)

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which supplied the peroneus longus muscle. The superficial peroneal nerve was found to innervate only the peroneus brevis muscle. The deep peroneal nerve pierced the anterior intermuscular septum to enter the anterior compartment, deep to the extensor digitorum longus muscle and anterior to the interosseous membrane.(Table 1)

**OBSERVATION**(Fig.1)



**Fig. 1. :** Photograph of dissected specimen (Right lower limb) showing:

*sn: sciatic nerves t: tibial nerve c: common peroneal nerve f: fibula p: detached peroneus longus 1: deep peroneal nerve 2: branches of deep peroneal nerve innervating peroneus longus 3: superficial peroneal nerve*

### The Left Leg

On the left leg, the superficial peroneal nerve and the deep peroneal nerve innervated the muscles of the lateral compartment (i.e. peroneus longus and brevis) and the muscles of the anterior compartment (i.e. tibialis anterior, extensor digitorum longus, extensor hallucis longus, peroneus tertius) respectively. No abnormalities were detected.(Table 1)

### DISCUSSION

Surgical procedures are commonly performed at the proximal end of fibula. An adequate knowledge of both normal and abnormal anatomy of the region is needed for successful surgery in the region. Decompression of the common peroneal nerve at the fibular head is usually performed to release the fascia of the peroneus longus muscle [4]. Percutaneous placement of wires in the proximal fibula is gaining increased usage with the application of the techniques of Ilizarov, Monticelli, and Spinelli [5]. Restoration of motor function of deep peroneal nerve by direct transfer of branches from tibial nerve is done in cases of traction injuries of common peroneal nerve leading to loss of dorsiflexion of the foot [6]. Biopsy of proximal fibula and division of fibula during high tibial osteotomy are also commonly performed procedures in which the topographical anatomy of common peroneal nerve is important [7, 8]. Awareness of the anomalous innervation pattern here described may be important to surgeons operating in this region.

The sciatic nerve divides into tibial and common peroneal components at the apex of the popliteal fossa [1]. The deep peroneal nerve arises within the peroneus longus, over the neck of fibula, at the bifurcation of common peroneal nerve. It spirals around the neck of the fibula deep to the fibers of extensor digitorum longus and so reaches the interosseous membrane, on the lateral side of the anterior tibial vessels [2].

Not much variation regarding the common peroneal nerve and the deep common peroneal nerve are documented in the standard anatomical textbooks. In the case we report, the common peroneal nerve divided into superficial peroneal nerve and deep peroneal nerve at the level of the styloid process of the head of fibula. The deep peroneal nerve passed through the peroneus longus muscle and 1.5 cm. distal to its origin gave rise to two branches (Fig. 1) which supplied the peroneus longus muscle in the lateral compartment of leg.

Abnormal innervation of the peroneus longus muscle as observed in the present case defies is unusual because the peroneus longus muscle is normally innervated by the superficial peroneal nerve in contrast to the present case where it was

**Summary of findings**

proximal to its terminal division. This collateral sent

**Table.1:** Table showing observational pattern of findings in right and left leg

Right leg	Left leg
1. Common peroneal nerve divided into superficial and deep	1. Common peroneal nerve divided into superficial and deep
2. Deep peroneal nerve innervated anterior compartment muscles as well as peroneus longus muscle	2. Deep peroneal nerve innervated anterior compartment muscles only.
3. Peroneus longus innervated by deep peroneal nerve	3. Peroneus longus innervated by superficial peroneal nerve.

innervated by the deep peroneal nerve. Thus, any injury to the deep peroneal nerve under such circumstances, would mean involvement of not only the anterior compartment muscles, but also peroneus longus.

Mammalian muscles are known to be partitioned with respect to their architecture, innervation and function. Each of these specific muscle groups is innervated by single nerve branch, contains motor unit territories with a unique array of physiological attributes and this has been known as neuromuscular compartment. A study on the specific innervation pattern of peronei group of muscles showed that peronei muscles were consistently found to have connective tissue partition and the innervation was consistent with segments defined by the connective tissue partition [9]. Another study reported that the most proximal branch of the deep peroneal nerve directly pierced the anterior intermuscular septum of the leg and this may be regarded as an important landmark for surgeons when dissecting the muscular branches of deep peroneal nerve [10].

The common peroneal nerve lies on the neck of fibula which forms the floor of the so called “fibular tunnel” which is a musculo-aponeurotic arch derived from the soleus and peroneus longus muscles.<sup>11</sup> In a study on 10 lower limbs, only one collateral branch was observed on the common peroneal nerve

a branch to the proximal tibiofibular joint before penetrating the tibialis anterior muscle therefore violating the rule of compartmental nerve supply [12].

In conclusion, we have described an unusual case of the branches from deep peroneal nerve innervating the peroneus longus muscle. Anatomical knowledge of such variations may be important for academic and clinical purpose. Knowledge of such variations is clinically relevant to surgeons operating on the proximal fibula in routine clinical practice.

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