

Case Report :

Multiple Neurovascular Variations in the inferior extremities of a Single Cadaver

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Abstract:

While doing the routine dissection for the MBBS Students, in the Department of Anatomy, NRS Medical College, Kolkata, India, multiple neurovascular variations were found in the inferior extremities of a 65 years old male cadaver in February, 2013. Variations were present in the Sciatic Nerve, sural nerve and sural communicating nerve, anterior tibial artery and deep fibular (peroneal) nerve. This case report will contribute in the field of Gross Anatomy and Clinical Anatomy. This case may also help the surgeons for a surgical approach and anaesthetists for regional anaesthesia in lower limbs.

Key Words: Sciatic Nerve, deep fibular (peroneal) nerve, sural nerve

Introduction:

The sciatic nerve is 2cm. wide at its origin from the sacral plexus. It is the thickest nerve of the body with the root value - L₄₋₅, S₁₋₃. It leaves the pelvis via the greater sciatic foramen below the piriformis and above the gemellus superior, descends between the greater trochanter and ischial tuberosity along the back of the thigh dividing into tibial and common peroneal (common fibular) nerves at a varying level proximal to the knee¹. The sciatic nerve usually bifurcates at the lower level of thigh. These two nerves often arise separately from the sacral plexus, may be separated in the greater sciatic foramen by the piriformis muscle and pass into the thigh as contiguous but separate structures².

The Common Fibular (Peroneal) Nerve is approximately half the size of the Tibial Nerve, derived from the dorsal branches of the L₄₋₅, S₁₋₂

ventral rami. It curves lateral to the fibular neck and divides into superficial and deep fibular nerves. Sural communicating nerve (a cutaneous branch) arises from the common fibular nerve, near the head of the fibula and crosses the lateral head of gastrocnemius to join the sural nerve at a varying level. It may descend separately as far as the heel¹.

The Deep Fibular Nerve (Deep Peroneal Nerve) begins at the bifurcation of the common fibular nerve between the fibula and the fibularis longus muscle. It passes obliquely forwards deep to the extensor digitorum longus muscle, pierces the muscle to reach the front of the interosseous membrane in the proximal third of the leg¹. The nerve descends with the anterior tibial artery to the ankle, dividing there into lateral and medial terminal branches³. As it descends, the nerve is first lateral to the artery (in the proximal third of the leg), then anterior (in the middle

third), and finally lateral again (in the distal third)^{1,2}. This nerve runs lateral to the dorsalis pedis artery at the ankle and so also its medial terminal branch on the dorsum of the foot³.

Sural Nerve is a cutaneous branch of the tibial nerve, passes between the two heads of the gastrocnemius and pierces the deep fascia of leg in the proximal part. Then it passes downward lying close to the small saphenous vein, to reach the interval between the lateral malleolus and the calcaneus¹.

The anterior tibial artery is smaller branch of popliteal artery at the distal border of the popliteus muscle. It passes above the proximal part of the interosseous membrane, enters anterior compartment of leg, runs distally as far as the ankle joint¹. Distal to this point the artery is renamed as the dorsalis pedis artery. The artery is accompanied by venae comitantes and deep fibular (peroneal) nerve^{1,4}. The present work was planned to know about the variations in the bifurcation of Sciatic Nerve, to know about the vascular and cutaneous nerve supply of leg and foot and to signify the implication of these findings in gross anatomy and clinical anatomy.

Materials and Methods:

Multiple neurovascular variations were found in the inferior extremities of a male cadaver in the Department of Anatomy, NRS Medical College, Kolkata, India, while doing the routine dissection for the MBBS students in February, 2013. The subject was about 65 years old. Proper dissection was done in both the lower limbs of that cadaver. Relevant structures were observed carefully, coloured and photographs were taken.

Observations:

On both sides the sciatic nerve divided into Common Fibular and Tibial Nerves in the gluteal region. Both these branches emerged below the piriformis muscle

bilaterally and passed into the back of thigh as contiguous but separate structures. On the left side the sural communicating nerve (a branch of the common fibular nerve) was thicker than the sural nerve. The sural nerve arose from the tibial nerve and joined with the sural communicating nerve at the heel. On the right side these two nerves joined in the middle of the back of leg. On the right side the deep fibular nerve passed medial to the anterior tibial artery in the proximal part of the leg. At the distal one-third of leg, the nerve crossed the artery (also the beginning of the dorsalis pedis artery) from medial to the lateral side. On the left side this relation was according to normal anatomy.

Discussion:

It has been observed that Sciatic nerve (SN) usually shows a lot of variations in its division,⁵. In 2011, Khan et al stated about a rare case of bilateral high division of sciatic nerve with unilateral divided piriformis. On right side, both divisions of SN entered gluteal region by passing below the undivided piriformis, but on left side, the common fibular nerve passed between the two divisions of piriformis and the tibial nerve emerged below the inferior piriformis⁵.

Smoll compiled the results of 18 previous studies and 6,062 cadavers and found that prevalence of this variant (high division of Sciatic nerve) in cadavers was 16.9% and in surgical case series was 16.2%^{5,6}. This high division results in sciatica, nerve injury during deep intramuscular injections in gluteal region, piriformis syndrome, failed SN block in anesthesia and injury to the nerve during posterior hip operations^{5,7}. Low back pain, caused by a compression or irritation of the sciatic nerve is called sciatica⁸. Piriformis syndrome is caused by an entrapment of the sciatic nerve in the gluteal region

due to myospasm or contracture of piriformis or gemellus superior, leading to pain along the back of lower limb along with tingling and numbness in the sole of foot^{8,9}. Paval et al found another case of bilateral high division of sciatic nerve in 2006⁹.

The sural nerve has a purely sensory function, and therefore, its removal results in only a relatively trivial deficit. For this reason, it is often used for nerve biopsy, as well as the donor nerve when a nerve graft is performed¹⁰. The sural nerve continues on the lateral aspect of the foot supplying innervation to the skin, subcutaneous tissue, fourth interosseous space, and sensory innervation of the fifth toe. An ankle block is essentially a block of four nerves derived from the sciatic nerve (deep and superficial peroneal, tibial and sural nerves) and one cutaneous branch of the femoral nerve (saphenous nerve)¹¹. So the sural nerve and its communications have importance in regional anaesthesia.

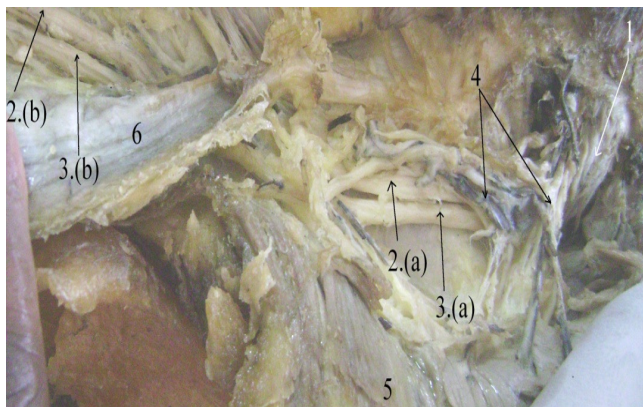
The arteria dorsalis pedis passed lateral to the medial terminal branch of the deep fibular nerve, distal to the fibro-osseous tunnel (deep to the tendons

of the extensor hallucis longus and extensor digitorum longus), in 30% of the lower limbs in a study conducted by Chitra R³. The deep fibular nerve and the dorsalis pedis artery (continuation of the anterior tibial artery) crossed over each other at multiple levels in 26.7% of the limbs, as was observed in the same study³. When the artery crosses over the nerve, there is a risk of entrapment of the deep fibular nerve by the dorsalis pedis artery aneurysms and anatomical knowledge will be helpful during the surgical release of the nerve¹². In Plastic Surgery, the design of a neurovascular free dorsalis pedis flap requires detailed knowledge of the nerve and vascular supply of foot and ankle³.

Conclusion:

This case will enhance our knowledge in gross anatomy and clinical anatomy. At the same time this case will provide information to the clinicians regarding any surgery or intramuscular injection in the gluteal region, sciatica or piriformis syndrome, regional nerve block and surgical approach to leg, foot and ankle.

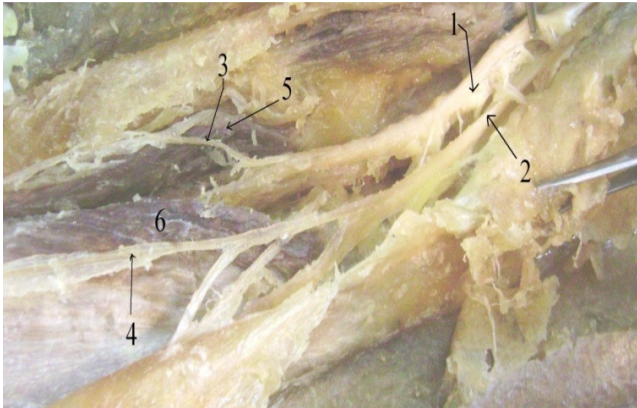
Figure A : Two divisions of the Sciatic Nerve (Tibial and Common Fibular) emerged below the piriformis muscle in the gluteal region, passed to the back of the thigh deep to the origin of the Hamstring Muscles on the right side.



Index:

1. Piriformis Muscle.
2. (a) Tibial Nerve in the gluteal region
2. (b) Tibial Nerve in the back of the thigh
3. (a) Common Fibular Nerve in the gluteal region
3. (b) Common Fibular Nerve in the back of the thigh
4. Inferior Gluteal Vessels and Nerve
5. Gluteus maximus muscle
6. Hamstring group of muscles.

Figure B : Tibial Nerve and Common Fibular Nerve in the popliteal fossa on the right Side along with the Sural Nerve (a branch of Tibial Nerve), Sural Communicating and other branches of Common Fibular Nerve.



Index:

1. Tibial Nerve
2. Common Fibular Nerve with its branches
3. Sural Nerve
4. Sural Communicating Nerve
5. Medial Head of Gastrocnemius
6. Lateral Head of Gastrocnemius

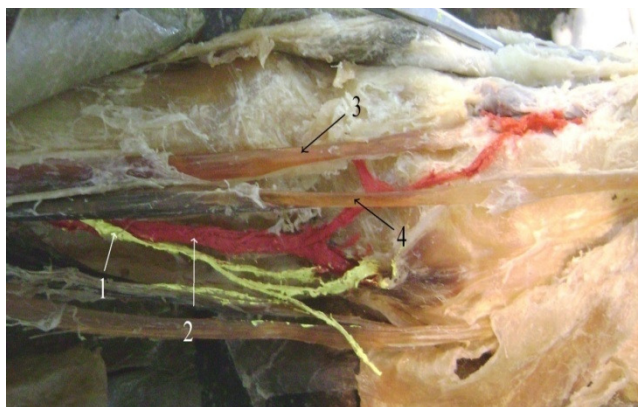
Figure C : Sural Nerve (thinner one) joined with the Sural Communicating Nerve at the heel on the right side (the point of joining of the two nerves is held by forceps).



Index:

1. Tibial Nerve
2. Common Fibular Nerve
3. Sural Nerve
4. Sural Communicating Nerve

Figure – D : Deep Fibular Nerve crossed the Anterior Tibial Artery from medial to lateral side in the distal third of left leg. The nerve is visible with its branches.



Index:

1. Deep Fibular Nerve
2. Anterior Tibial Artery
3. Tendon of Tibialis Anterior
4. Tendon of Extensor Hallucis Longus.

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