

Anatomical Variation in Bifurcation of Sciatic Nerve: A Cadaveric Study

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Abstract

Background and Aims: The Sciatic nerve is the largest nerve in the body. It originates from the Sacral plexus. The nerve exits the pelvis by passing through the greater sciatic foramen, usually below the piriformis muscle. Its terminal division into Common Peroneal nerve and Tibial nerve may however occur at different levels. The purpose of this study is to identify variation of bifurcation of Sciatic nerve and its relation to piriformis muscle which may lead to various clinical manifestations.

Material and Methods: Ten formalin fixed cadavers, comprising of twenty lower limbs and ten specimens of lower limbs with intact gluteal and thigh regions were used for this study. Gluteal region and posterior compartment of the thigh were dissected. The sciatic nerve was exposed and bifurcation level of sciatic nerve and its relations were noted and photographed.

Results: In 53.33% cases sciatic nerve divided near upper angle of popliteal fossa. 26.66% showed sciatic nerve division in middle of posterior thigh, while division of the sciatic nerve at upper one third of posterior thigh was seen in 13.33%. Only in 6.66% the common peroneal nerve passed through piriformis muscle and the tibial nerve passed below the piriformis muscle.

Conclusion: The anatomical variations of sciatic nerve can lead to piriformis syndrome, coccydynia, sciatica and muscle atrophy. A good knowledge about these variations are necessary for surgeons and clinicians to avoid surgical complications, prevent failure of sciatic block and prevent sciatic nerve injury during deep intramuscular injections.

Keywords: Sciatic nerve; Common Peroneal nerve; Tibial nerve.



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INTRODUCTION

Sciatic nerve is also known as "Ischiadic nerve". Ischiadic is derived from the Greek word "Ischiadichus".¹ Sciatic nerve is a branch of sacral plexus. It is about 2cm wide at its origin and is the thickest nerve in the human body. It consists of two components namely: the Tibial and the Common Peroneal components. Initially both these components forms a common trunk. The Tibial component is derived from the ventral branch of ventral rami of L₄ to S₃. The common peroneal



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component is derived from the dorsal branches of ventral rami of L₄ to S₂.²

Sciatic nerve exits the pelvis through the greater sciatic foramen, mostly below the Piriformis muscles and enter into the gluteal region. The nerve descends between the greater trochanter and ischial tuberosity to the back of the thigh, where it divides into the Tibial and Common Peroneal nerve at different levels proximal to the knee. The usual site of division of the nerve is at the junction of middle and lower third of the posterior thigh, near apex of the popliteal fossa. According to Beaton and Anson's classification, there are six types of relation of the Sciatic nerve with Piriformis muscle in the pelvic cavity.³

The classification is as follows:

- Type 1:** Undivided nerve below undivided muscle.
- Type 2:** Divisions of nerve between and below undivided muscle.
- Type 3:** Divisions above and below undivided muscle.
- Type 4:** Undivided nerve between heads.
- Type 5:** Divisions between and above heads.
- Type 6:** Undivided nerve above undivided muscle.⁴

MATERIAL AND METHODS

The present study was done in routine dissection of 10 cadavers (i.e. 20 lower limbs) during academic teaching of 1st year MBBS students and on 10 dissected specimens of lower limbs with intact gluteal and thigh region in the Department of Anatomy, ESIC Medial College and Hospital, Faridabad. In all cases, the gluteal regions were dissected. Gluteus maximus was cut in the midline vertically and reflected to sides. Piriformis muscle, Sciatic nerve, Gluteus Medius muscle, Gemelli superior and inferior muscles and obturator internus muscle were identified. Course and site of division of Sciatic nerve into terminal branches was noted.

RESULT

Among the 15 cases that were studied, one female cadaver (6.66%) about 82 years old showed a high division of Sciatic nerve on the left side of the body while right side had the usual course. The Sciatic nerve, Common Peroneal nerve and the Tibial

nerve were properly traced and photograph was taken. The division of Sciatic nerve was seen just after its formation. Common Peroneal nerve passed through the substance of Piriformis muscle whereas Tibial nerve was seen passing below Piriformis muscles. While in the rest of the cases the Sciatic nerve emerged below the Piriformis muscle and descended downwards. In 53.33% cases the Sciatic nerve divided into Tibial and Common Peroneal nerves, near the upper angle of popliteal fossa while in 26.66% cases it divided in the middle of the posterior thigh and in the rest 13.33% it divided in the upper one third of the posterior thigh.

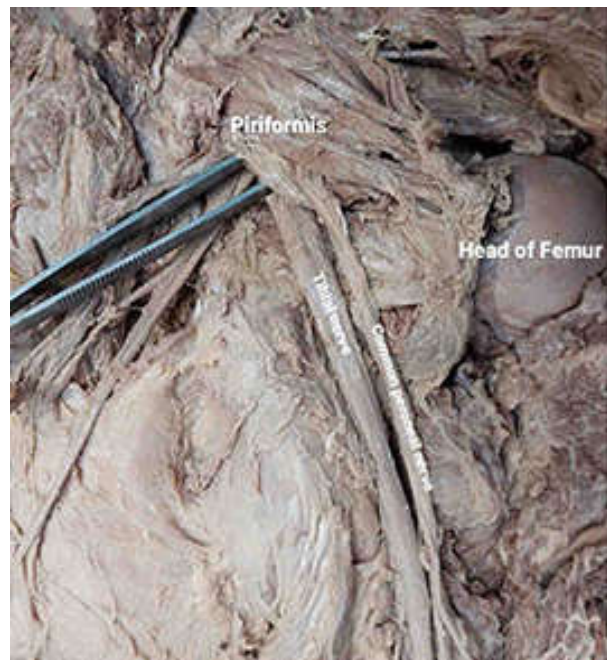


Fig. 1: Common Peroneal nerve passing through the Piriformis muscle on left side.

DISCUSSION

Variation in the level of division of sciatic nerve are commonly seen and has important clinical significance. A proper knowledge about the course, division and branching pattern will help clinicians in appropriate diagnosis and therefore manage the conditions related to Sciatic nerve with more accuracy.

Saritha S *et al*¹ conducted a study on 25 cadavers, in which they observed variation in Sciatic nerve bifurcation in four (16%) cadavers. In 4% cadaver the Sciatic nerve on the left lower limb divided in the pelvis and Common Peroneal nerve exited through the bifid Piriformis while Tibial nerve exited below the Piriformis. Other 4% cadaver had

variation in both lower limbs. On right the Sciatic nerve divided at the ischial tuberosity while on the left it divided in the pelvis. After division on both sides the Tibial nerve and Common Peroneal nerve emerged below the Piriformis. In next 4% cadaver bilateral variation was observed. On the left side the division of Sciatic nerve was seen at the level of the popliteal crease and on the right-side division took place about 50mm above the popliteal crease but below the apex of popliteal fossa. In the remaining 4% cadaver, on the right side the Sciatic nerve division took place in pelvis and Common Peroneal nerve emerged above Piriformis and Tibial nerve below Piriformis.

In 2015, Birhane Alem Berihu *et al*⁴ studied 56 lower limbs (28 cadavers) of which 14 lower limbs (25%) showed variation in Sciatic nerve. In five lower limbs (9%) they observed that the Common Peroneal nerve and Tibial nerve emerged separately below the Piriformis but again joined posterior to Quadriceps Femoris and further divided again at the superior angle of popliteal fossa. In another 2% lower limb the Common Peroneal nerve emerged above the Piriformis and Tibial nerve below the Piriformis. In the remaining 8 lower limbs (14%) with variation, they observed trifurcation of Sciatic nerve in the middle of popliteal fossa into tibial, superficial and deep peroneal nerve.

In another study done by Shivaji B Sukra *et al*⁵ on 30 cadavers, 5 cadavers (16%) with unilateral Sciatic nerve variation were seen. Among the five cadavers with variation, in one (3.33%) cadaver the Common Peroneal nerve emerged above the Piriformis and Tibial nerve below the Piriformis on the right side. While in rest 4 cadavers (13.33%) Sciatic nerve emerged below the Piriformis with the two nerve together but in separate sheaths on the left side.

Atoni D.A *et al*⁶ studied 56 lower limbs of human cadavers. 4 lower limbs (7%) showed Sciatic nerve variation. In two lower limbs (3.5%) they observed that the Common Peroneal nerve emerged through the Piriformis and the Tibial nerve below the Piriformis bilaterally. In another two lower limbs (3.5%), the Sciatic nerve divided in the thigh. On left lower limb Sciatic nerve divided at mid-thigh while on right lower limb it divided at upper one-third of the thigh.

In a case studied by M.A Babinski *et al*⁷ the Common Peroneal nerve emerged beneath Piriformis and the Tibial nerve was seen under the inferior margin of superior Gemellus muscle and over Obturator internus muscle on the left side.

According to Anbumani T.L *et al*⁸ in their study of 25 cadavers, five cadavers (20%) showed variations in Sciatic nerve, of which in 4% cadaver the Common Peroneal nerve pierced the Piriformis muscle and the Tibial nerve emerged below the Piriformis bilaterally. In other 4% cadaver, Common Peroneal nerve pierced the Piriformis and Tibial nerve passed under the Piriformis and inferior gluteal artery ran between Common Peroneal nerve and Tibial nerve bilaterally. While in other 4% cadaver they observed high division of Sciatic nerve into Tibial nerve and Common Peroneal nerve under Piriformis on the left side. In the rest 4% cadaver, trifurcation of Sciatic nerve into Tibial nerve, Common Peroneal nerve and Sural nerve was seen in the right popliteal fossa.

CONCLUSION

Anatomical variations of Sciatic nerve are of great clinical significance. Since variations of Sciatic nerve are commonly encountered, a clear knowledge about the types of variations and clinical indications are useful for understanding of the complexities that involve Sciatic nerve. Awareness of these variations would be helpful for accurate diagnosis, proper surgical planning, adequate pain management and prevention of iatrogenic injuries and thus improving patient care and outcomes.

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