

## Case Report

# VARIATIONS OF SCIATIC NERVE BIFURCATION IN DISSECTED CADAVERES FROM ETHIOPIA AND THEIR CLINICAL IMPLICATION: A CASE REPORT

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## ABSTRACT

**Background:** The tibial and common peroneal nerves are dorsal and ventral divisions of the ventral rami of L4 to S3 of the lumbosacral plexus that join to form the sciatic nerve. The two nerves are structurally separate and supply the posterior compartment of the thigh, the leg and the foot. The point of bifurcation or separation of the sciatic nerve into tibial and common peroneal nerve varies. The common site is at the junction of the middle and lower third of the back of the thigh, near the apex of the popliteal fossa, but division may occur at any point above this. It may also rarely occur below it. The variations in the bifurcation of the sciatic nerve have clinical implications. They may result in nerve injury during deep intramuscular injections in the gluteal region, sciatica, piriformis syndrome etc. This study is to report the variations of the bifurcation in the sciatic nerve found in the cadaveres from Ethiopia, and discuss the clinical implications of such variations.

**Conclusion:** We conclude from this study that the bifurcation of the sciatic nerve could occur high up in the gluteal region in relation to the piriformis muscle and may present clinical challenges in patient management

**KEY WORDS:** Sciatic Nerve, Piriformis, Bifurcation, Tibial nerve, Common Peroneal nerves.

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## INTRODUCTION

The sciatic nerve (SN) is the thickest nerve in the body and innervates the posterior compartment of the thigh and most compartments of the lower leg and foot. It is formed in the pelvis from the ventral rami of the L4–S3 spinal nerve roots, and enters the lower limb via the greater sciatic foramen below the piriformis, together with the posterior cutaneous nerve, pudendal and inferior gluteal nerves, the inferior gluteal artery with veins as well as the internal pudendal artery and veins. It descends between the greater trochanter and ischial

tuberosity [1]. Commonly at the apex of popliteal fossa (PF) the sciatic nerve bifurcates (85-89%) into Tibial nerve (TN) and Common Peroneal nerve (CPN) [2], which are encompassed by a single epineural sheath [3]. Variations are seen in the point of bifurcation, unilaterally or bilaterally [4]. It may divide at various levels above the knee which may account for frequent failures reported in the popliteal block [5]. In higher bifurcation (i.e. tibial nerve and common peroneal nerve), it may be prone to injury [4]. Different studies have reported a variety of different anatomic relations between the sciatic

nerve or its terminal branches and the piriformis [5-8]. The sciatic nerve may be undivided and may emerge above or through the piriformis muscle; or divided [6]. In this case, the thicker branch may pass below the piriformis muscle and the thinner part goes through or above the muscle. The evidence of each variation may cause different clinical presentations [6].

The sciatic nerve, with its components, is the most frequently injured nerve of the lower extremity. It is one of the nerves commonly injured during intramuscular injection [9]. Anatomical variations may also contribute to piriformis syndrome; sciatic coccygodynia and muscle atrophy [4]. The high division of SN have been implicated in intramuscular injections, anaesthesia or surgery in the gluteal region [2,10]. It is also vulnerable to injury in posterior dislocation of hip joint [11] and during total replacement hip surgery. Though complete palsy of sciatic nerve is rare, it results in flail foot and severe difficulty in walking [4].

The report of the variations in the bifurcation of this nerve observed in the cadavers of a particular region could provide medical practitioners and surgeons with useful tool for the treatment of patients and surgical procedures.

The purpose of this report is to create awareness of bifurcation variations observed in the sciatic nerve on the dissected cadavers of Anatomy Unit of the College of Health sciences, Mekelle University, Mekelle, Ethiopia.

### CASE REPORT

During a routine medical dissection of formalin-fixed cadavers by preclinical medical students of the College of health Sciences, Mekelle University, Ethiopia, a male cadaver presented with a different case of bilateral bifurcation of the sciatic nerve in relation to piriformis muscle. This observation prompted further close observations of another four male cadavers which were also dissected during the study of the lower extremity.

A total of eight gluteal regions were examined in 4 formalin- fixed male cadavers.

### METHODS AND OBSERVATIONS

The Gluteus maximus was dissected by making incision around the iliac crest then down along

the midline posteriorly to the anal cleft. The gluteus maximus muscles, along with the gluteus medius were reflected to explore the piriformis and the sciatic nerve. The piriformis, gamelli, quadratus femoris, obturator intermus muscles as well as sciatic nerve were identified, and the point of sciatic nerve bifurcation noted. Normally, the sciatic nerve bifurcates at the superior angle of popliteal fossa in 80-90% of individuals. This was used as a standard point of bifurcation. Any other point of bifurcation besides this point was considered as a variation. Pictures were taken and note made of the observed variations.

**Fig. 1a:** Right gluteal region showing the division of SN in relation to the piriformis muscle (P), with the common peroneal nerve (CP) above the muscle and the tibial nerve (T) below the muscle.



**Fig. 1b:** Left gluteal region showing the bifurcation of SN below the piriformis muscle (P); the common peroneal nerve (CP), the tibial nerve (T) and their relation to inferior gluteal nerve (I).



**Fig. 1c:** left gluteal region showing the bifurcation of the SN(a little lower than fig.1b) below the piriformis (P) muscle, into the common peroneal nerve (CP), the tibial nerve (T), in relation to the inferior gluteal nerve (I).



## DISCUSSION

In figure 1a, the right gluteal region showed the division of SN in relation to the piriformis muscle (P), with the common peroneal nerve (CPN) above the muscle and the tibial nerve (TN) below the muscle. This confirms the work of Ugrenovic et al. (2005) [12] who showed that 1.5% of the specimen they studied presented CPN above the piriformis and TN below the piriformis. In another study reported by Ronald et al. (2015) [13], CPN was found to exit the pelvis into the gluteal region above the piriformis in 0.5% of the total number of specimen observed. Both studies of the authors quoted above showed that the percentage occurrence of this type of variation was lowest compared with other types of variations.

In figure 1b&c, the sciatic nerve bifurcated in the gluteal region below the piriformis into its tibial and common peroneal components. In figure 1C, the point of bifurcation was a little lower than in 1b. This shows that even in the gluteal region the point of its bifurcation varies. This is in consonant with the observation of Muthu et al. (2011) [9], in which they reported 4% division of SN in the gluteal region.

Sharma et al. (2010) [14] observed in their routine dissection of a 60 year old male cadaver that two divisions of SN were separate in the gluteal region on both sides with TN passing below the piriformis and CPN piercing the piriformis muscle.

Variations on the high division of the SN and the relationship between the SN and the piriformis were studied by Güvençer et al. (2009) [15]. In their results, 52% of the cases showed that SN exited as whole nerve without any division, in 48% a high division was observed, in 24% of cases CPN left the pelvis above and TN below the piriformis whereas 24% of cases followed different route.

The differences in the exit routes of these two nerves are important clinically in the etiology of sciatica and the piriformis syndrome.

Popliteal block uses the normal point of anatomical division of SN to TN and CPN to be between 4 and 10 cm proximal to the popliteal fossa crease [16]. This point is used for administration of anaesthetic, to anaesthetize

the entire distal two thirds of the lower leg. With a high division of the SN, this becomes difficult and consequently foot surgery becomes a challenge.

The piriformis syndrome is a nerve entrapment syndrome, characterized by sciatic nerve compression that comes from piriformis muscle hypertrophy, inflammation, or irritation. The clinical symptoms are similar to intervertebral disc herniations in which patients suffer from low back, buttock, and posterior thigh pain, showing occasional neurological symptoms such as foot drop, and dysesthesia [17].

The common peroneal nerve is most frequently affected in intramuscular injection injuries, and recovery is minimal [18]. This may be implicated with its entry into the gluteal region above the piriformis muscle as observed in this study.

## CONCLUSION

The main essence of this study is to report on the variations of the bifurcation of the sciatic nerve, and discuss the clinical implications of such variations. Here, we conclude that the bifurcation of the sciatic nerve could occur high up in the gluteal region. Surgeons and medical practitioners should take this into consideration in performing sciatic nerve block. Besides, the manner in which the components of the sciatic nerve relate with piriformis muscle is also very important in assessing the etiology of piriformis syndrome, and cases of sciatica.

**Conflicts of Interests: None**

## REFERENCES

- [1]. Standring S, Gray's Anatomy 39th Edition: The Anatomical Basis of Clinical Practice. AJNR 2005;26:2703-2704.
- [2]. Paval J, Nayak S. A Case of bilateral high division of sciatic nerve with a variant inferior gluteal nerve. Neuroanatomy. 2006;5:33-34.
- [3]. Saritha S, Praveen KM, Supriya G. Anatomical Variations in the Bifurcation of the Sciatic Nerve, A Cadaveric Study and its Clinical Implications. Anatomy & Physiology 2014; 2(5):2-4.
- [4]. Sabnis AS. Anatomical Variations of Sciatic Nerve Bifurcation in Human Cadaveres. Journal of Clinical Research Letters 2012;3(2):46-48.
- [5]. Vlora JD, Hadzic A, April EW, Thys DM. The division of the sciatic nerve in the popliteal fossa: anatomical implications for popliteal nerve blockade. Anesth Analg 2001;92:215-217.

- [6]. Babinski M. A., Machado FA, Costa WS. A rare variation in the high division of the sciatic nerve surrounding the superior gemellus muscle. *Eur J Morphol* 2003;41:41–42.
- [7]. Machado FA, Babinski MA, Brasil FB, Favorito LA, Abidu- Figureiedo M, Costa MG. Anatomical variations between sciatic nerve and piriformis muscle during fetal period in human. *Int J Morphol* 2003;21:29-35.
- [8]. Smoll NR. Variations of the piriformis muscle and sciatic nerve with clinical consequence: a review. *Clin Anat* 2010;23:8-17.
- [9]. Muthu Kumar .T, Shrimathi, Ananda Rani, Sumathi Latha. A Cadaveric Study of Sciatic Nerve and It's Level of Bifurcation. *Journal of Clinical and Diagnostic Research* 2011;5(8):1502-04.
- [10]. Khan YS, Khan TK. A rare case of bilateral high division of sciatic nerve (of different types) with unilateral divided piriformis and unusual high origin of genicular branch of common fibular nerve. *International Journal of Anatomical Variations (IJAV)* 2011;4:63-66.
- [11]. Standring S, Mahadevan V, Collins P, Healy JC, Lee J, Niranjana NS. From Gray's Anatomy, The Anatomical Basis of Clinical Practice. Pelvic Girdle and Lower Limb: Overview and Surface Anatomy; Pelvic girdle, gluteal region and thigh. 40th Edition. Spain, Philadelphia; Churchill Livingstone Elsevier. 1337-1338, 1371, 1384.
- [12]. Ugrenovic S, Jovanovic I, Krstic V, Stojanovic V, Vasovic L, et al. The level of the sciatic nerve division and its relations to the piriform muscle. *Vojnosanit Pregl* 2005; 62:45-49.
- [13]. Ronald AB, Adel KA, Ryosuke M. Sciatic Nerve, Illustrated Encyclopedia of Human Anatomic Variation: Opus III: Nervous System: Plexuses, Anatomy Atlases; 2015 [www.anatomyatlases.org/AnatomicVariants/NervousSystem/Text/SciaticNerve.shtml](http://www.anatomyatlases.org/AnatomicVariants/NervousSystem/Text/SciaticNerve.shtml)
- [14]. Sharma T, Singla RK, Lalit M. Bilateral eventration of sciatic nerve. *JNMA J Nepal Med Assoc* 2010;50:309-312.
- [15]. Güvençer M, İyem C, Akyer P, Tetik S, Naderi S. Variations in the high division of the sciatic nerve and relationship between the sciatic nerve and the piriformis. *Turkish Neurosurg* 2009; 19:139–144.
- [16]. Borgeat, A, Blumenthal S, Lambert M, Theodorou P, Vienne P. The feasibility and complications of the continuous popliteal nerve block: a 1001-case survey. *Anesth Analg.* 2006;103(1):229-33.
- [17]. Parziale JR, Hudgins TH, Fishman LM. The piriformis syndrome. *Am. J. Orthop.* 1996;25:819-823.
- [18]. Selda B, Mehmet A, Ümmühan BL, Metin K, Adile ZGN, Ayşe RÇ. Sciatic nerve injury due to intramuscular injection: electrophysiological findings and one-year follow-up. *Turk J Med Sci* 2012;42 (5):913-917.

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