Journal of Chitwan Medical College 2022;12(42):39-42
Available online at: www.jcmc.com.np

ORIGINAL RESEARCH ARTICLE

# VARIATIONS OF SCIATIC NERVE BIFURCATION: A CADAVERIC STUDY

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**Received**: 23 Aug, 2022
**Accepted**: 22 Dec, 2022
**Published**: 31 Dec, 2022

**Key words**: Bifurcation; Common peroneal nerve; Sciatic nerve; Tibial nerve.

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DOI:https://doi.org/10.54530/jcmc.1160

**Citation**

Pandit TK, Hada S, Kadel M. Variations of sciatic nerve bifurcation: a cadaveric study. Journal of Chitwan Medical College.2022;12(42):39-42.

## ABSTRACT

**Background**: The sciatic nerve is formed in the pelvic cavity and leaves the cavity through the greater sciatic foramen below the piriformis muscle. It terminates by giving tibial and common peroneal (fibular) nerve near the superior angle of the popliteal fossa. Awareness of variations in bifurcation of sciatic nerve is significant during deep intramuscular gluteal injections, clinical conditions such as piriformis syndrome, sciatica, coccygodynia and muscle atrophy. The main objective of this study was to highlight the site of bifurcation of sciatic nerve.

**Methods:** An observational cross–sectional study was performed in the Department of Anatomy of KIST medical college & Teaching Hospital, Lalitpur, Nepal. The data was collected after ethical approval from Institutional Review Committee. 50 specimens were taken in the study by convenient sampling method. Sciatic nerve was observed in respect to its site of bifurcation.

**Results:** Out of 50 lower limbs, in 30 specimens (60%) the sciatic nerve showed bifurcation near the superior angle of popliteal fossa. 20 lower limbs (40%) showed variations,of which eight limbs (16%) showed division of nerve prior to its exit in the gluteal region, eight limb (16%) showed division in upper 2/3rd of back of thigh and four limbs (8%) showed division of the nerve in the popliteal fossa.

**Conclusions:** This study concludes that the majority of sciatic nerve divides at the superior angle of the popliteal fossa while some divided into other regions such as pelvis, thigh & popliteal fossa.



## INTRODUCTION

The sciatic nerve is formed in the pelvic cavity from the ventral rami of the fourth lumbar to third sacral spinal nerves. It leaves the cavity through the greater sciatic foramen below the piriformis muscle. It runs along the back of the thigh and terminates generally near the superior angle of the popliteal fossa i.e., lower 1/3rd of back of thigh by giving tibial and common peroneal (fibular) nerve. The point of division is very variable. It may divide above or below the common site.[1]
The knowledge about the variations is significant during deep intramuscular gluteal injections.[2] Awareness of variations in bifurcation of sciatic nerve carries clinical significance in different clinical conditions such as piriformis syndrome, sciatica, coccygodynia and muscle atrophy.[3] It may contribute to avoid iatrogenic injury as well as useful in imaging techniques for identifying anomalies.[4]
The main objective of this study was to highlight the site of bifurcation of sciatic nerve.

## METHODS

An observational cross–sectional study was performed in the Department of Anatomy of KIST medical college & Teaching Hospital, Lalitpur, Nepal. After getting ethical approval from Institutional Review Committee NO: 2075/76/80, data was collected from 2076/01/02 to 2077/08/02. Twenty-five formalin fixed adult human cadavers of both sexes were properly dissected and intact nerves were included in the present study. Cadavers with damaged nerve were excluded. The 50 fixed lower limbs were partially dissected by the first year MBBS students during their routine dissection classes following the steps of Cunningham's Dissection Manual vol.1 [5] and further required dissection was done during the data collection.[5]
The sample size was calculated by using following formula.

$n = (z)2\ p\ (\ 1 - p\ )\ /\ d2$

$=47.18$

$\sim 50$

n = required sample size

z = level of confidence according to the standard normal

distribution (for a level of confidence of 95%, z = 1.96

p = estimated proportion of the population that presents the characteristic (p = 91.4%) [12]

d = tolerated margin of error (for example we want to know the real proportion within 8%)

So, 50 specimens were taken in the study by convenient sampling method. Specimens were numbered from 01 to 50. Sciatic nerve was observed in respect to its site of bifurcation. Variations of sciatic nerve bifurcation were tagged and photographs were taken. All the observations were recorded and tabulated with the help of SPSS version 20 software and the data was analyzed.

**RESULTS**

In 30 specimens (60%) of 50 lower limbs, the division of sciatic nerve was observed near the superior angle of the popliteal fossa (Table 1). The sciatic nerve divided into tibial and common peroneal nerves prior to its exit in the gluteal region in eight limbs (16%) (figure1). In one limb (2%), it divided in the upper part of back of the thigh (figure 2) whereas in seven limbs (14%), the nerve divided at the middle part of the posterior compartment of the thigh (figure 3). In four out of 50 (8%) extremities showed division of the sciatic nerve into tibial and common peroneal nerves in the popliteal fossa behind the knee joint (figure 4).

**Table 1: Site of bifurcation of sciatic nerve**

| | | Site of bifurcation | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | Nerve dividing proximal to its exit in gluteal region | Divided at upper part of thigh | At the middle part of thigh | Near the superior angle of popliteal fossa | In the popliteal fossa | |
| Side | Right | 4 (8%) | 1 (2%) | 3 (6%) | 15 (30%) | 2(4%) | 25 (50%) |
| | Left | 4 (8%) | 0 (0%) | 4 (8%) | 15 (30%) | 2 (4%) | 25 (50%) |
| Total | | 8 (16%) | 1(2%) | 7 (14%) | 30 (60%) | 4 (8%) | 50 (100%) |

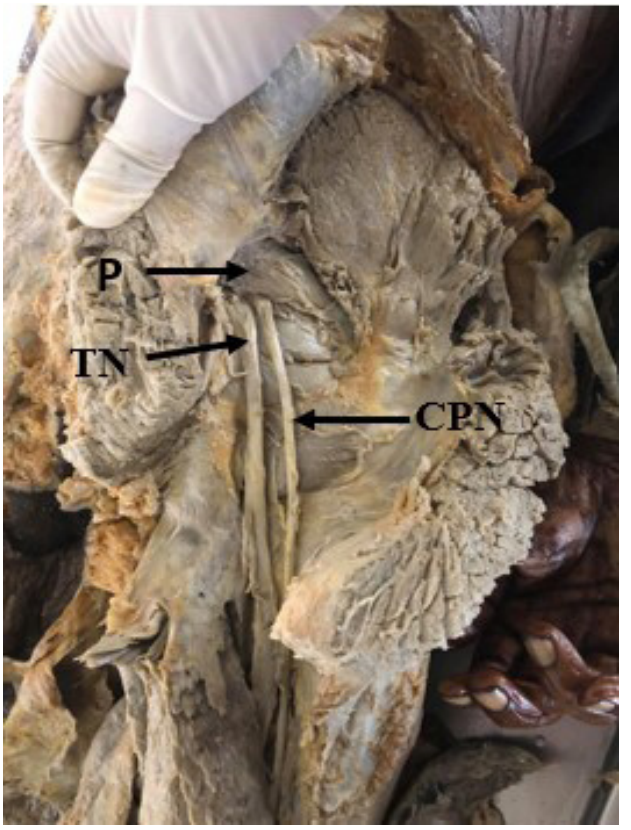


**Figure 1: Higher division of sciatic nerve, tibial & common peroneal nerve emerging separately below the piriformis muscle**

P- piriformis muscle, TN- tibial nerve, CPN- common peroneal nerve

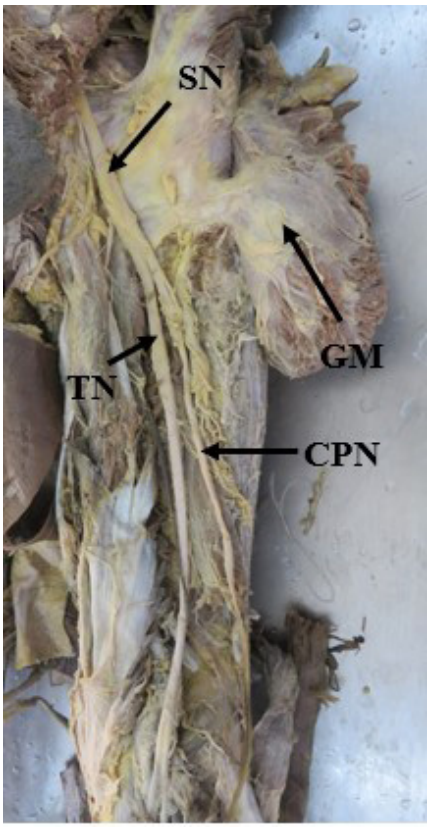


**Figure 2: Division of sciatic nerve in the upper part of back of the thigh**

S- sciatic nerve, GM- gluteus maximus , TN- tibial nerve, CPN- common peroneal nerve


ISSN 2091-2889 (Online) ISSN 2091-2412 (Print) JCMC/ Vol 12/ No. 4/ Issue 42/ Oct-Dec, 2022

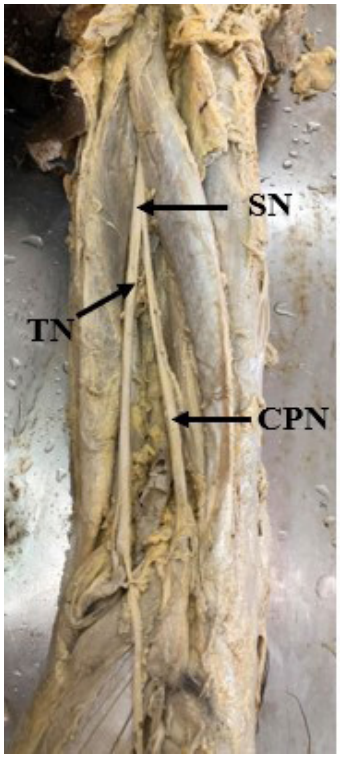


**Figure 3: Division of sciatic nerve in the middle part of back of the thigh**

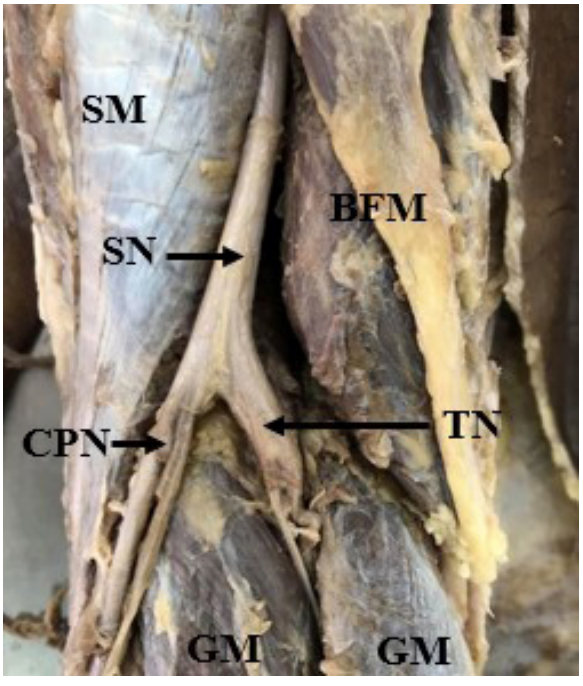


**Figure 4: Division of sciatic nerve in the popliteal fossa**

SM- semimembranosus muscle, BFM- biceps femoris muscle, SN- sciatic nerve, TN- tibial nerve, CPN- common peroneal nerve, GM- gastrocnemius muscle

## DISCUSSION

The level of bifurcation of sciatic nerve is important during clinical procedure. Normally the sciatic nerve exits in the gluteal region through greater sciatic foramen below the piriformis and divides at the superior angle of the popliteal fossa.[6,7] During the development of lower limb two plexuses (lumbar and sacral) are formed at the base of the lower limb bud. As the limb bud grows, the plexuses also grow and divide into dorsal and ventral components to supply the muscles of the limb. The sciatic nerve is formed when both components, the dorsal (common peroneal nerve) and the ventral (tibial nerve) run downward close together.[8-11] The sciatic nerve can divide at different levels; it may be in the pelvic region, gluteal region, posterior compartment of thigh or in the popliteal fossa.[11,12]

Various researches have been done regarding the bifurcation of sciatic nerve. In the present study the normal pattern of division of sciatic nerve was found in 60% of cases, whereas Berihu BA et al. found in 75%, Sangram S et al. in 82%, Sukre SB et al. in 83.33% Saritha S et al. in 88%, Shewale AD et al. in 70%, Anbumani TL et al. in 82%, Grewal H et al. in 63.33% and Prakash et al. in 40.7% of cases. Sciatic nerve terminated into tibial and common peroneal nerves prior to its exit in the gluteal region was observed in16% of cases in the present study. Berihu BA et al. showed in 11% cases, Sukre SB et al. in 16.67%, Kiros MD et al. in 8%, Saritha S et al. in 6%, Swargam N et al. in 3.33%, Grewal H et al. in 10% and Sangram S et al. showed in 14% of cases. The incidence of sciatic nerve division in the upper part of thigh in our study was 2%. This was similar to the results studied by Prakash et al., Kiros MD et al., Saritha S et al., Shewale AD et al., Swargam N et al., Grewal H et al., Muthu TK et al. and Sabnis AS in 3.5%, 12%, 2%, 6.67%, 3.33%, 20%, 14% and 31% of cases respectively.

Division of sciatic nerve at the middle part of the thigh was found in 14% of cases in this study. Anbumani TL et al. and Kiros MD et al. in 4%, Shewale AD et al. in 4.44%, Grewal H et al. in 6.6%, Muthu TK et al. in 38% and Prakash et al. in 2.3% of cases. In 8% of the present study the extremities showed division of sciatic nerve in the popliteal fossa. This type of variation was observed by Prakash et al., Saritha S et al., Shewale AD et al., Swargam N et al., Muthu TK et al. and Sabnis AS in 34.9%, 4%, 7.78%, 6.66%, 32% and 58% of cases respectively. The study also has limitations related to small sample size which was due to less availability of cadavers.

## CONCLUSION

It is concluded that bifurcation of sciatic nerve is common in the lower 1/3 of the thigh and few are just proximal to its exit through the greater sciatic foramen. Variation in the level of bifurcation of sciatic nerve is importance during various surgical interventions.

## ACKNOWLEDGEMENT

We would like to acknowledge the Department of Anatomy, KIST Medical College, Lalitpur for their support.

**CONFLICT OF INTEREST:** None

**FINANCIAL DISCLOSURE:** None

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