

## Variation in Termination of Sciatic Nerve- A Case Series

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### Abstract

**Introduction:** The division of the sciatic nerve may occur anywhere from the sacral plexus to the popliteal fossa. During its course, the anatomy of the sciatic nerve and its branches have several anatomical variations. The separate (autonomous) development of the sciatic nervetibial and peroneal divisions could explain the source of Sciatic nerve variants during embryonic development.

**Material and Methods:** This study was conducted at the Department of Anatomy of Shija Academy of Health Sciences, Imphal, Manipur. During routine dissection of popliteal fossa, a variable division of Sciatic nerve was observed in 10 cases following which, the higher/ lower division of the nerve was traced up to its point of its division. **Results:** Ten cases of variable division of Sciatic Nerve were observed. Amongst these ten cases, 4 cases (40%) showed a lower level of division of Sciatic nerve i.e below the superior angle of popliteal fossa. A higher level of division of Sciatic nerve was seen in 6 cases (60%) where two cases showed division at the level of middle of back of thigh and four cases, division occurred at the lower border of Piriformis muscle. **Conclusion:** Sciatic nerve compression may be variable. In patients with chronic lower back pain and hip pain, such variations must be kept in mind. Also, a thorough knowledge of variations of Sciaticnerve may be helpful in diagnosing and treating associated disease without causing iatrogenic injuries.

**Keywords:** Sciatic nerve, case series, sacral plexus, anatomical, popliteal fossa

### Introduction

The sciatic nerve is 2 cm wide at its origin and is the thickest nerve in the body. It leaves the pelvis via the greater sciatic foramen below piriformis and descends between the greater trochanter and ischial tuberosity, along the back of the thigh, dividing into the tibial and common fibular nerves. The point of division of the sciatic nerve into its tibial and common fibular components is very variable, however, the common site is at the junction of the middle and lower thirds of the thigh, near the apex of the popliteal fossa, but the division may occur at any level above this point and, rarely, may occur below it.<sup>1</sup>

During its course, the anatomy of the sciatic nerve and its branches have several anatomical variations. The variations of piriformis muscle, sciatic nerve and its branches have clinical importance during surgical interventions and some other clinical approaches. 2-4 The division of the sciatic nerve may occur anywhere from the sacral plexus to the popliteal fossa. Some anatomical variations concerning its topography and division such as the division of the sciatic nerve in the popliteal fossa may be also responsible for failure of sciatic nerve popliteal blocks. 5,6

High division of SN is usually unilateral or bilateral, that leads to compression of nerve resulting in piriformis syndrome, incomplete block of SN during popliteal block anaesthesia and have a clinical importance in the etiology and pathogenesis of sciatica etc. 7 In the pediatric lower limb, the sciatic nerve is one of the most commonly blocked peripheral nerve for the management of pain after major orthopedic and surgical procedures to the leg, ankle, and foot. 8

Knowledge of the unusual variety of sciatic nerve enable the surgeon to find and preserve the nerve during fasciotomy, neurolysis, neuroma resection, or bony and soft tissue reconstruction. Surgical, diagnosis through biopsy and nerve conduction velocity studies and therapeutic interventions such as nerve grafting can be problematic due to the confusion in the origin of the nerves and associated structures. 9

## Material and Methods

This study was conducted at the Department of Anatomy of Shija Academy of Health Sciences, Imphal, Manipur. During routine dissection of popliteal fossa, a variable division of Sciatic nerve was observed following which, the higher/ lower division of the nerve was traced up to its point of its division. In cases where Sciatic nerve was seen to divide above the superior angle of popliteal fossa, the nerve was traced along its course in the back of thigh and gluteal region. This study did not require any ethics committee clearance as it is a case series.

## Study design

This was a descriptive case study.

## Inclusion criteria

The sciatic nerve passing above the superior angle of popliteal fossa were included.

## Exclusion criteria

The damaged and pathologically abnormal bones and nerves were excluded from the study.

## Statistical analysis

Considering this is a case series no statistical analysis was required for obtaining the results.

## Results

Ten cases of variable division of Sciatic Nerve were observed. Amongst these ten cases, 4 cases (40%) showed a lower level of division of Sciatic nerve i.e below the superior angle of popliteal fossa as shown in figure 1.

A higher level of division of Sciatic nerve was seen in 6 cases (60%) where two cases showed division at the level of middle of back of thigh and four cases, division occurred at the lower border of Piriformis muscle as shown in figure 2.

No intra-pelvic bifurcation of Sciatic nerve was observed.

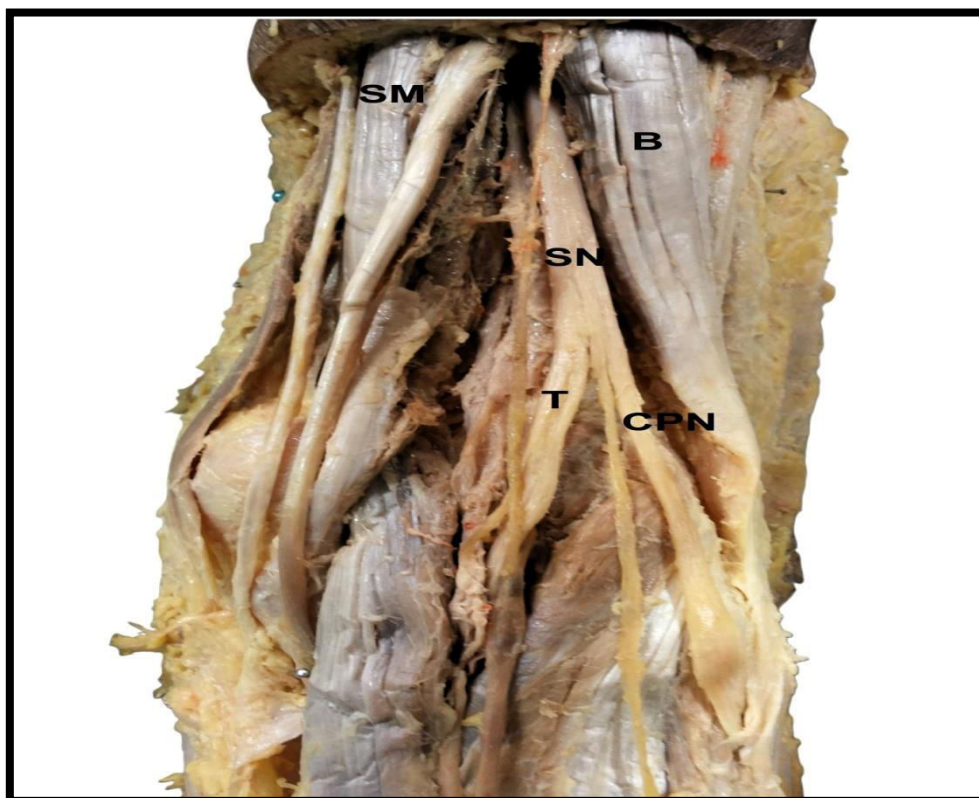


Fig 1 showing lower level of division of Sciatic nerve (in the popliteal fossa). SM- Semimembranosus, B- Biceps Femoris, SN Sciatic Nerve, T- Tibial Nerve. CPN- Common Peroneal Nerve

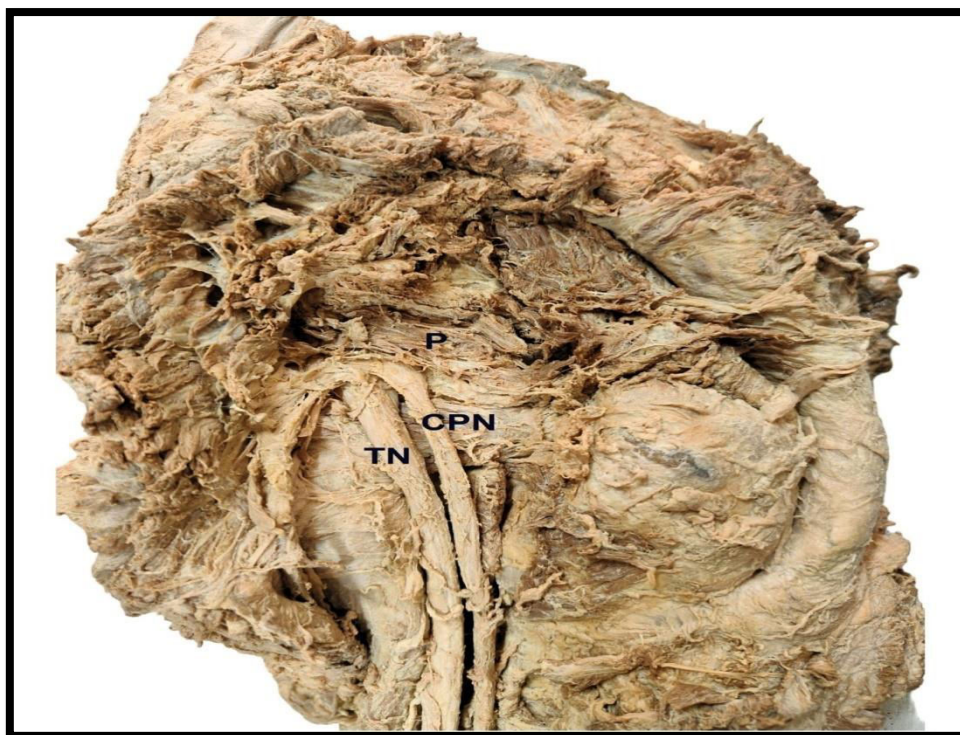


Fig 2 showing a higher division of Sciatic nerve at the level of lower border of Piriformis muscle.

P- Piriformis muscle, TN- Tibial nerve, CPN- Common peroneal nerve

### Discussion

Sciatica is a Greek word derived from “Ischiadichus” and hence it is called as ischiadic nerve.<sup>10</sup> The sciatic nerve supplies the knee flexors and all the muscles below the knee, which means that a complete palsy of the sciatic nerve results in a flail foot and severe difficulty in walking. Fortunately, complete sciatic nerve palsy is very rare. The nerve is vulnerable in posterior dislocation of the hip. As it leaves the pelvis, it passes either behind piriformis or sometimes through the muscle where it may very rarely become entrapped or tethered leading to piriformis syndrome. External compression over the buttock, e.g. in patients who lie immobile on a hard surface for a considerable length of time, can injure the nerve. However, the most common cause of serious sciatic nerve injury is iatrogenic. The nerve may be damaged in misplaced therapeutic injections into gluteus maximus.<sup>1</sup>

Sciatic nerve palsy occurs after total hip replacement or similar surgery in 1% of cases, and may be caused by sharp injury, burning from bone cement, traction from instruments, manipulation of the hip, inadvertent lengthening of the femur, or haematoma surrounding the nerve. For some reason, possibly anatomical, the common fibular component of the sciatic nerve is more usually affected; the patient has a foot drop and a high-stepping gait. <sup>1</sup>

Variations of the division of sciatic nerve at the different levels has been reported by various authors. The separate development of the Sciatic nerve tibial and peroneal

divisions could explain the source of Sciatic nerve variants during embryonic development. 11Guvencer et al. studied on the variations of sciatic nerve and its high division in 25 formalin fixed male cadavers. The study showed that whole sciatic without division in pelvis in 52% of cases while in 48% of cases there was high division of sciatic nerve. The divided branches of sciatic nerves left pelvis through infra piriform fossa men in 24%. In another 24% of cases, only one branch left the pelvis through infra piriform foramen, whereas other branch came out of pelvis through different route. 12 Sharma et al observed in male cadaver aged 60 years the two division of sciatic were separate bilaterally in the gluteal region where tibial nerve was passing below piriformis and common peroneal nerve piecing the piriformis muscle. High division of sciatic nerve may be the cause for failure of popliteal block. 13Saritha et al studied on twenty-five cadavers that is Variations of sciatic nerve were in 12% fifty lower limbs. However, it may rarely been separated within the pelvis. In such cases they may cause nerve compression under anatomic structures. Sciatic endometriosis is a rare condition as detected by MRI, cyclic pain vary with menstrual cycle.14

In a study conducted by Jesudas, 10 percent cases showed higher division of the nerves.i.e below the piriformis.15 Pitta VC et alconducted a study in 80 specimenswhereit was observed thatin 7 (8.75%) out of 80 specimens nerve is seen dividing within the pelvis the common peroneal nerve piercing the piriformis muscle and the tibial nerve passing inferior to the muscle to exit the gluteal region. The sciatic nerve is seen dividing in the pelvis, with the common peroneal nerve passing above the piriformis muscle and the tibial nerve passing below the muscle in 4 (5.0%) out of 80 specimens. In 2 (2.5%) out of 80 specimens, the undivided sciatic nerve is seen passing by, piercing the piriformis muscle to enter the posterior compartment of the thigh. In the remaining 1 (1.25%) specimen, the sciatic nerve is seen dividing within the pelvis. Both the tibial and common peroneal nerves pass below the piriformis muscle to exit the gluteal region. This is the rare variation described in very few studies.16

The possible relationships between the Sciatic nerve (SN) and Piriformis muscle (PM) were firstcategorized by Beaton and Anson into the following six morphological types- Tibial Nerve (TN), Common Peroneal Nerve (CPN):

Type A: typical pattern with the SN passing below the PM, undivided

Type B: the CPN exits through the PM and TN exits below the PM

Type C: the CPN exits above the PM and TN and below the PM

Type D: the SN exits through the PM, as a single trunk

Type E: the CPN exits above the PM and TN through the PM, and

Type F: the SN passes undivided above the PM17

Various authors have reported variable division of Sciatic nerve into Tibial and Common Peroneal nerve in relation to Piriformis muscle.



Author	Year	Country	Sample size	Type A n (%)	Type B n (%)	Type C n (%)	Type D n (%)	Type E n (%)	Type F n (%)	Total Variation n (%)
Natsis et al. <sup>2</sup>	2014	Greece (Europe)	294	275 (93.5%)	12 (4.1%)	1 (0.3%)	1 (0.3%)	-	1 (0.3%)	14 (4.7%)
Sulak et al. <sup>18</sup>	2014	Turkey	400	392 (98%)	5 (1.3%)	5 (1.3%)	-	-	-	3 (0.8%)
Lewis et al. <sup>19</sup>	2016	USA	102	90 (88.2%)	9 (8.8%)	9 (8.8%)	-	-	-	3 (2.9%)

Son BC and Lee C reported two cases of Piriformis syndrome caused by a rare type C sciatic nerve variation which clinically presented with chronic hip pain and pain in the leg. Trans gluteal sciatic nerve decompression provided significant pain relief. It was stated that if severe sciatic nerve deformation due to a rare sciatic nerve variation can be confirmed with typical findings of piriformis syndrome, the possibility that sciatic nerve entrapment may have occurred in this variation should be considered.<sup>20</sup>

The findings of the present cases are in accordance with the literature in case of higher division of Sciatic nerve. However, lower division of Sciatic nerve is seldom reported.

### Conclusion

As seen in the literature and the present cases, it can be concluded that Sciatic nerve has variable level of division into its terminal branches, Tibial nerve and Common peroneal nerve. Due to its long course and variations in its level of termination, clinical presentation of Sciatic nerve compression may be variable. In patients with chronic lower back pain and hip pain, such variations must be kept in mind. Also, a thorough knowledge of variations of Sciatic nerve may render helpful in diagnosing and treating associated diseases without causing iatrogenic injuries.

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