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Anatomical Variations of High Division of Sciatic Nerve and its Relation to Piriformis – A Cadaveric Study

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ABSTRACT

Background: The sciatic nerve normally emerges as a single trunk below the piriformis muscle before dividing into tibial and common peroneal nerves. Variations in its division and relationship with the piriformis muscle are clinically important, as they may predispose to piriformis syndrome, complicate regional anesthesia, and increase the risk of iatrogenic injury during gluteal surgeries.
Objectives: To identify the pattern and level of sciatic nerve division, to analyze its anatomical relationship with the piriformis muscle, and to classify observed variations using the Beaton and Anson classification.
Materials and Methods : This retrospective observational cadaveric study was conducted in the Departments of Anatomy at Siddhartha Medical College and Government Medical College, Rajamahendravaram, over a period of three years. A total of 60 gluteal regions from 30 formalin-fixed adult cadavers were examined. Specimens with high division of the sciatic nerve were included, while those showing normal division below the piriformis were excluded from variant analysis. Data were analyzed using descriptive statistics and expressed as frequencies and percentages.
Results: Normal sciatic nerve anatomy was observed in 42 specimens (70.0%), while high division was identified in 18 specimens (30.0%). Among the variants, division above the piriformis muscle was most common (55.6%), followed by division at the level of the piriformis (27.8%) and separate emergence without a common trunk (16.6%). According to the Beaton and Anson classification, Type II pattern was the most frequent variant, followed by Type III and Type IV. Variations were predominantly unilateral, with right-sided involvement being slightly more common than left-sided.
Conclusion:A significant proportion of sciatic nerve variations exists in relation to the piriformis muscle. Awareness of these anatomical patterns is essential for clinicians to improve diagnostic accuracy and minimize complications during surgical and interventional procedures in the gluteal region.

Keywords*: Sciatic nerve; High division; Piriformis muscle; Anatomical variations; Beaton and Anson classification.*

INTRODUCTION

The sciatic nerve is the largest peripheral nerve in the human body and serves as the principal neural supply to the posterior compartment of the thigh, leg, and foot. It is formed by the ventral rami of the L4–S3 spinal nerves and typically exits the pelvis through the greater sciatic foramen, passing inferior to the piriformis muscle as a single trunk before dividing into the tibial and common peroneal nerves near the popliteal fossa [1,2]. Although this classical anatomical pattern is well described, numerous variations in the level of division and course of the sciatic nerve have been documented.

Variations in the relationship between the sciatic nerve and the piriformis muscle are of considerable clinical importance. Aberrant courses or high division of the nerve may predispose individuals to piriformis syndrome due to compression or irritation of one or more nerve components [3,5]. Such anatomical deviations also increase the risk of iatrogenic injury during intramuscular injections in the gluteal region, hip and pelvic surgeries, posterior surgical approaches, and regional anesthesia techniques [2,4].

Several cadaveric and radiological studies have systematically described these variations and classified them using established anatomical frameworks, notably the Beaton and Anson classification [1,5]. However, the reported prevalence of different patterns varies widely across populations, suggesting possible ethnic, genetic, or developmental influences [3,4]. Indian cadaveric studies have reported a variable incidence of high sciatic nerve division, yet region-specific data remain limited [6].

Therefore, the present cadaveric study was undertaken to document the pattern, level of division, and anatomical relationship of the sciatic nerve with the piriformis muscle. The findings aim to enhance anatomical knowledge and provide clinically relevant information for surgeons, anesthesiologists, and clinicians involved in the diagnosis and management of sciatic nerve–related conditions.

MATERIALS AND METHODS

Study Design, Setting, and Period

This study was conducted as a retrospective observational cadaveric study in the Departments of Anatomy at Siddhartha Medical College and Government Medical College, Rajamahendravaram. Formalin-fixed adult cadavers preserved for routine teaching and academic purposes were utilized. The study was carried out over a defined period from January 2023 to 14 November 2025.

Study Material and Sample Size

The study material comprised 30 formalin-fixed adult cadavers, providing a total of 60 gluteal regions and posterior compartments of the thigh for detailed anatomical examination.

Inclusion Criteria

Formalin-fixed adult cadavers with intact and well-preserved gluteal and posterior thigh regions
Specimens suitable for complete anatomical dissection

Exclusion Criteria

Cadavers showing evidence of trauma, previous surgical intervention, or pathological distortion in the gluteal region
Specimens demonstrating normal division of the sciatic nerve below the piriformis muscle, which were excluded from variant analysis

Dissection Procedure

Standard anatomical dissection techniques were employed. The skin and superficial fascia of the gluteal region were reflected, followed by careful dissection of the gluteus maximus muscle. The piriformis muscle was identified, and the sciatic nerve was traced from its exit through the greater sciatic foramen to its point of division. The level of division and the course of the tibial and common peroneal components in relation to the piriformis muscle were meticulously observed and documented.

Classification of Variations

Observed variations in the sciatic nerve and its relationship with the piriformis muscle were classified according to the Beaton and Anson classification. The laterality of variations (right, left, or bilateral) was also recorded.

Data Collection and Statistical Analysis

All observations were systematically recorded. Data were analyzed using descriptive statistics and expressed as frequencies and percentages. The findings were presented in tabular form.

Ethical Considerations

The study was approved by the Institutional Ethics Committee (IEC/GMC-RJM/2025/27, Dt.14/11/2025) of Government Medical College, Rajamahendravaram. Informed consent was not applicable, as the research was conducted exclusively on formalin-fixed cadaveric specimens used for educational and research purposes.

RESULTS

The present cadaveric study evaluated 60 gluteal regions to document variations in the division of the sciatic nerve and its relationship with the piriformis muscle. Of these, 42 specimens (70.0%) demonstrated the normal anatomical pattern,

with the sciatic nerve emerging undivided below the piriformis muscle. High division of the sciatic nerve was identified in 18 specimens (30.0%), indicating a substantial prevalence of variant anatomy in the study population (**Table 1**).

Table 1. Distribution of Sciatic Nerve Division Pattern (n = 60 gluteal regions)

Sciatic Nerve Pattern	Number of Specimens	Percentage (%)
Normal division below piriformis	42	70.0
High division (variant patterns)	18	30.0
Total	**60**	**100**

Among the 18 specimens showing high division, the most frequent level of division was above the piriformis muscle, observed in 10 specimens (55.6%). Division occurring at the level of the piriformis was noted in 5 specimens (27.8%), while separate emergence of the tibial and common peroneal components without a common sciatic trunk was documented in 3 specimens (16.6%) (**Table 2**).

Table 2. Level of High Division of Sciatic Nerve (n = 18 variants)

Level of Division	Number of Specimens	Percentage (%)
Above piriformis muscle	10	55.6
At the level of piriformis	5	27.8
Separate emergence without common trunk	3	16.6
Total	**18**	**100**

When classified according to the Beaton and Anson classification, Type I pattern (undivided sciatic nerve passing below the piriformis) constituted the majority, accounting for 42 specimens (70.0%). Among the variant patterns, Type II configuration—where the common peroneal nerve pierces the piriformis and the tibial nerve passes below—was the most common (16.7%), followed by Type III (8.3%) and Type IV (5.0%) arrangements (**Table 3**).

Table 3. Relationship of Sciatic Nerve Components to Piriformis Muscle (Beaton and Anson Classification)

Beaton & Anson Type	Description	Number (n)	Percentage (%)
Type I	Undivided nerve below piriformis	42	70.0
Type II	Common peroneal through piriformis, tibial below	10	16.7
Type III	Common peroneal above piriformis, tibial below	5	8.3
Type IV	Separate emergence of both divisions	3	5.0
Total	—	**60**	**100**

Analysis of laterality revealed that sciatic nerve variations were more commonly unilateral. Right-sided variations were observed in 8 specimens (44.4%), while 7 specimens (38.9%) showed left-sided involvement. Bilateral variations were comparatively less frequent, identified in 3 specimens (16.7%) (**Table 4**).

Table 4. Laterality of Sciatic Nerve Variations (n = 18 variants)

Laterality	Number of Specimens	Percentage (%)
Right side	8	44.4
Left side	7	38.9
Bilateral	3	16.7
Total	**18**	**100**

Figure 1: Cadaveric dissection showing high division of the sciatic nerve in the right gluteal region, with separation of the tibial and common peroneal components in relation to the piriformis muscle.

Figure 2. Posterior view of the thigh demonstrating high division of the sciatic nerve with distinct tibial and common peroneal nerve trunks, extending along the posterior compartment.

Figure 3. Comparative view of bilateral gluteal regions illustrating asymmetry in the sciatic nerve–piriformis relationship, with variation noted on one side.

Figure 4. Close-up view of the sciatic nerve and its divisions in the gluteal region, emphasizing the proximity of nerve components to surrounding musculature.

DISCUSSION

The present cadaveric study highlights the anatomical variations in the division of the sciatic nerve and its relationship with the piriformis muscle, underscoring their frequency and clinical significance. In the current series, normal division of the sciatic nerve below the piriformis muscle was observed in 70% of specimens, while variations were identified in 30%. This prevalence is comparable to rates reported in imaging-based and cadaveric studies, which have consistently demonstrated that variant sciatic nerve anatomy is not uncommon and should be anticipated during clinical evaluation and surgical planning [7,8].

High division of the sciatic nerve above the piriformis muscle emerged as the most frequent variant pattern in the present study. Magnetic resonance neurography and cadaveric analyses have similarly reported this configuration as the predominant variant, emphasizing its role as a potential anatomical substrate for extraspinal sciatica and piriformis syndrome [7,9]. The close spatial relationship between the nerve components and the piriformis muscle in such cases increases the likelihood of nerve compression or irritation, particularly during hip movements or muscle hypertrophy [11,13].

Application of the Beaton and Anson classification revealed Type II pattern as the most common variant, followed by Types III and IV. Systematic reviews and meta-analyses have shown wide variability in the distribution of these patterns across different populations, supporting the influence of ethnic and developmental factors on lumbosacral plexus morphology [8,13]. Although less frequent, the presence of separate emergence of the tibial and common peroneal nerves without a common sciatic trunk is surgically important, as highlighted in several case reports describing increased susceptibility to inadvertent nerve injury during posterior hip procedures or intramuscular injections [10,12].

Laterality analysis in the present study demonstrated a predominance of unilateral variations, with right-sided involvement being slightly more common. Similar findings have been reported in cadaveric and clinical studies, whereas bilateral variations remain relatively rare [11,14]. Clinically, unilateral variations may account for asymmetric symptoms and diagnostic uncertainty in patients presenting with sciatic pain.

CONCLUSION

The present cadaveric study demonstrates that anatomical variations in the division of the sciatic nerve and its relationship with the piriformis muscle are relatively common. Nearly one-third of the examined specimens showed high division of the sciatic nerve, with division above or at the level of the piriformis being the most frequent patterns. These variations have important clinical implications, particularly in the context of piriformis syndrome, sciatic nerve entrapment, and posterior approaches to the hip and gluteal region. Recognition of such anatomical patterns is essential for surgeons, anesthesiologists, and clinicians to minimize iatrogenic nerve injury and to improve diagnostic accuracy during the evaluation and management of sciatic nerve–related conditions.

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