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Original Research Article

Study of Divisions of Sciatic Nerve and Its Relationship with the Piriformis Muscle

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Abstract

The sciatic nerve is the largest peripheral nerve in the human body, and variations in its division and relationship with the piriformis muscle have important clinical implications for diagnosis, surgery, and regional anesthesia. This cadaveric study was conducted in the Department of Anatomy, MGM Medical College, and Jamshedpur, to observe the course, division, and anatomical variations of the sciatic nerve in relation to the piriformis muscle in formalin-fixed adult cadavers. A total of 12 cadavers (24 lower limbs) were examined using standard dissection techniques, and the findings were classified according to the Beaton and Anson system. The study found that the normal Type I pattern was predominant, while Type III variation was observed in only one limb, and no other types were identified. The sciatic nerve divided predominantly in the popliteal fossa, with only a small proportion showing gluteal division. These findings reinforce that the classic sciatic nerve-piriformis relationship is most common, but clinically significant variations do occur. Knowledge of these variants is essential for surgeons, anesthetists, orthopaedicians, and radiologists to reduce the risk of nerve injury and failed nerve blocks.

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Introduction

The sciatic nerve is derived from the Greek term "Ischiadichus," referring to the hip or ischial region, and it is the largest and thickest peripheral nerve in the human body. It is formed within the pelvis by the union of ventral rami from L4, L5, S1, S2, and S3, contributing to the sacral plexus. After formation, it leaves the pelvis through the greater sciatic foramen, usually below the piriformis muscle, and then descends deep to the gluteus maximus into the posterior compartment of the thigh. Because of its extensive motor and sensory distribution, any variation in its formation, course, or division can have major functional and clinical consequences. [2,3]

The piriformis muscle is a pear-shaped muscle in the deep gluteal region that extends from the sacrum to the greater trochanter. The close relationship between the piriformis muscle and the sciatic nerve is clinically important because deviations from the usual arrangement may predispose to nerve compression, piriformis syndrome, or iatrogenic injury during surgery and injections. In the most common anatomical pattern, the sciatic nerve exits below the piriformis as a single trunk and divides near the popliteal fossa into the tibial and common fibular nerves. However, a range of variations has been documented, including high division in the pelvis or gluteal region, passage of one component through or above the piriformis, and rare configurations involving separate pathways for the tibial and fibular divisions. [2,10] Beaton and Anson's classification remains the most widely used system for describing the anatomical relationship between the sciatic nerve and the piriformis muscle. This classification has six types, ranging from the normal undivided nerve passing below the undivided piriformis to rare variants involving division above, below, or through the muscle. Understanding these patterns is crucial for anesthesiologists performing sciatic nerve blocks, surgeons operating in the gluteal region, and clinicians evaluating sciatic pain that is not explained by spinal pathology. [2]

Variations of the sciatic nerve are of particular interest in cadaveric studies because they provide direct anatomical evidence that can be correlated with clinical and imaging findings. MRI and CT

studies have increasingly shown that many of these variants can also be identified in living subjects, but cadaveric dissection remains the gold standard for detailed anatomical observation. In India, especially in region-specific contexts, data on sciatic nerve variation are still limited, and there is a need for local anatomical evidence to support clinical decision-making. The present study was therefore undertaken to document the division patterns of the sciatic nerve and its relationship with the piriformis muscle in adult cadavers from East Singhbhum, Jharkhand. [5, 8]

Methodology

This was an observational cadaveric study conducted in the Department of Anatomy, MGM Medical College, Jamshedpur, Jharkhand, from November 2023 to April 2026. Formalin-fixed adult cadavers used for routine teaching and dissection were included in the study. A total of 12 cadavers providing 24 lower limbs were examined. All cadavers were assigned sequential numbers for identification and documentation. Standard dissection was performed according to Cunningham's Manual of Practical Anatomy. The gluteal region was exposed by appropriate skin and fascial incisions, followed by reflection 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 course in relation to the piriformis muscle. Particular attention was paid to the level of division of the sciatic nerve, the course of its tibial and common fibular components, and any variation in the piriformis relationship. Observations were recorded in a predesigned case record form and later transferred to Microsoft Excel for compilation and analysis.

Inclusion Criteria

Adult cadavers with no lower limb morphological abnormalities, no fractures, and no major deformities were included.

Exclusion Criteria

Cadavers with unequal lower limb length, fractures, or morphological abnormalities were excluded.

Data Collection Tools

The study used the following data collection tools:

- Standard cadaveric dissection instruments.
- Predesigned observation and case record forms.
- Microsoft Excel for tabulation and data compilation.
- Beaton and Anson classification for anatomical categorization.
- Ethical approval

The study received Institutional Ethics Committee approval from MGM Medical College, East Singhbhum, and Jamshedpur. Since the research involved formalin-fixed cadavers, informed consent was not applicable.

Results

A total of 12 cadavers were examined, comprising 24 lower limbs. The age distribution showed that the majority of cadavers were in the 36–40-year age group, followed by 46–50 years. Males predominated in the sample, accounting for 80%, while females constituted 20%.

Table 1: Age distribution of cadavers

Age Group (Years)	Number	Percentage
31-35	2	16.7
36-40	5	41.7
41-45	2	16.7
46-50	3	25.0
Total	12	100.00

Table 2: Sex distribution of cadavers

Sex	Number	Percentage
Male	10	80
Female	2	20
Total	12	100.00

Table 3: Sciatic nerve variation by Beaton and Anson classification

Type	Description
Type-I	Undivided nerve below undivided piriformis
Type-III	Common fibular nerve abotibial below
Type-II, IV, V, VI	Nor Observed

Table 4: Division level of sciatic nerve

Division Level	Number of Limbs
Poplitealfoss	23
Gluteal region	1

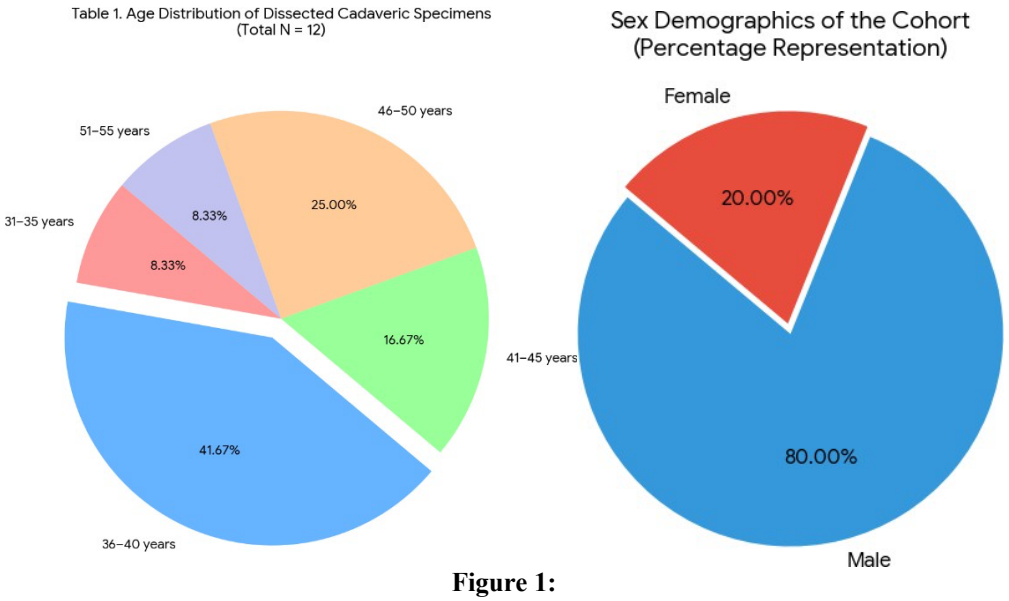


Figure 1:

Discussion

The present study demonstrated that the Type I pattern was by far the most common relationship between the sciatic nerve and piriformis muscle, accounting for 95.8% of limbs. This is consistent with the general anatomical literature, which reports Type I as the dominant pattern in most populations. The absence of most rare variants in this series may reflect the small sample size, regional differences, or true population-specific anatomical consistency. The single Type III variant underscores the fact that clinically important deviations do occur even when most specimens follow the normal course. [2, 8, 10]

The predominance of popliteal fossa division is also in line with prior studies, although earlier reports have described a somewhat higher frequency of gluteal division than was seen here. High division of the sciatic nerve is clinically relevant because it can influence the success of nerve blocks and increase the risk of incomplete anesthesia. It also matters in hip surgery, gluteal injections, and procedures near the piriformis muscle where unexpected branching may increase nerve injury risk. Thus, even rare variants should be recognized and documented. [6, 9]

Region-specific anatomical studies are especially valuable because anatomical variation may differ across populations. The East Singhbhum data presented here contribute to the limited Indian anatomical literature on sciatic nerve-piriformis relationships. Although the sample was limited, the findings support the standard teaching that the sciatic nerve usually passes below the piriformis and divides distally in the thigh. Future studies with larger sample sizes and balanced sex representation would help strengthen these conclusions. [5, 8]

Conclusion

The normal anatomical relationship of the sciatic nerve passing below the piriformis muscle was the predominant pattern in this cadaveric study.

A small number of variations were observed, highlighting their clinical importance for surgeons, anesthetists, and radiologists. Knowledge of these anatomical variants is essential to reduce complications during intramuscular injections, sciatic nerve blocks, and gluteal or hip surgeries.

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