

Variations in Sciatic Nerve Emergence in Relation to Piriformis Muscle in Central India Population among Males and Females

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Abstract:

Background: The sciatic nerve, a critical component of the human nervous system, plays a pivotal role in the motor and sensory functions of the lower limb. Its anatomical relationship with the piriformis muscle is of particular interest due to its implications for both clinical practice and surgical interventions.[5] Variations in the emergence of the sciatic nerve in relation to the piriformis muscle can influence the presentation of sciatica, a common condition characterized by pain radiating along the nerve's distribution, and can complicate surgical procedures in the pelvic region[3].**Materials & Methods:** In this study total number of 64 cadavers have been examined for different types of variations a total of three types of variations are found in this population formalin-fixed cadavers, provided by the Department of Anatomy at our institution. **Results:** Out of 64 cadavers male cadavers are 32 and female cadavers 32. The total number of variations recorded are 15(23%) remaining 49 (77%) shows normal, where variations in males are 5(8%) and females are 10(16%) were recorded and the different types of variations and their prevalence in central India population were recorded and tabulated. **Conclusion:** This study underscores the significant anatomical variations in the emergence of the sciatic nerve in relation to the piriformis muscle in a Central Indian population, with notable differences between males and females. These findings highlight the importance of considering such variations in clinical practice

Key words: Sciatic nerve , Piriformis muscle, Common peroneal nerve & Tibial nerve.

Introduction: The sciatic nerve, a critical component of the human nervous system, plays a pivotal role in the motor and sensory functions of the lower limb. Its anatomical relationship with the piriformis muscle is of particular interest due to its implications for both clinical practice and surgical interventions [1]. Variations in the emergence of the sciatic nerve in relation to the piriformis muscle can influence the

presentation of sciatica, a common condition characterized by pain radiating along the nerve's distribution, and can complicate surgical procedures in the pelvic region.[6]

In Central India, a region with a diverse population, understanding the anatomical variations of the sciatic nerve is crucial for effective diagnosis and treatment. Despite the prevalence of sciatica and the frequent need for surgical intervention in this population, there is a notable paucity of localized studies examining these variations. This research aims to bridge this gap by systematically investigating the variations in the emergence of the sciatic nerve relative to the piriformis muscle in a Central Indian population.

By elucidating these anatomical variations, this study seeks to provide valuable insights that can enhance clinical outcomes, optimize surgical approaches, and contribute to a more nuanced understanding of regional anatomical differences. The findings are expected to inform both clinical practices and future research directions,[8,9] ultimately improving patient care and advancing our knowledge of sciatic nerve anatomy in this specific demographic.

Aim and Objectives:

- To investigate and document the variations in the emergence of the sciatic nerve in relation to the piriformis muscle in a Central Indian population, and
- To assess the implications of these variations for clinical practice and surgical procedures

Objectives

1. **Identify Variations:** To identify and categorize the different patterns of sciatic nerve emergence in relation to the piriformis muscle in a sample of the Central Indian population.
2. **Document Prevalence:** To determine the prevalence of each variation pattern within the studied population.
3. **Correlate Clinical Relevance:** To assess the clinical significance of these variations, particularly in relation to sciatica and piriformis syndrome.

Materials and Methods :

This study employs a cross-sectional design to examine the anatomical variations of the sciatic nerve in relation to the piriformis muscle within a Central Indian population. The study involves cadaveric dissection was photographed to ensure comprehensive data collection and analysis

- **Sample Size:** The study will include a sample of 64 adult human cadavers, selected from a regional anatomy lab or medical college. The sample size is chosen to provide a statistically significant representation of the Central Indian population.

- **Inclusion Criteria:** Adult cadavers of both sexes, with no known history of pelvic or lower limb surgery or trauma.
- **Exclusion Criteria:** Cadavers with any signs of anatomical deformities or abnormalities that could impact the study are excluded
- **Cadavers:** Preserved human cadavers obtained from local medical colleges or anatomy labs.
- **Dissection Tools:** Standard anatomical dissection tools, including scalpels, forceps, and scissors.

Methods

1. Dissection Procedure:

- **Preparation:** Cadavers will be prepared by removing the skin and superficial muscles to expose the piriformis muscle and sciatic nerve. All cadavers were examined or further dissected in order to identify the anatomy of the sciatic nerve and its orientation to the piriformis muscle. For those cadavers whose gluteal regions were not already dissected, we exposed the gluteal region cutting through the gluteus maximus, exposing the underlying piriformis muscle and sciatic nerve.
- **Identification:** The piriformis muscle will be identified and carefully dissected to expose its relationship with the sciatic nerve.
- **Variation Assessment:** The emergence patterns of the sciatic nerve in relation to the piriformis muscle will be documented. Variations will be classified according to recognized patterns, such as nerve emerging above, below, or through the piriformis muscle.
- **Documentation:** Photographs of different types of variations were taken. Will be made to document each variation.

2. Data Analysis:

- **Categorization:** The Three different variations will be categorized into Type I, II, and III based on Beatons and Anson's classification.
- **Prevalence Calculation:** The prevalence of each variation will be calculated and expressed as a percentage of the total sample.
- **Statistical Analysis:** Descriptive statistics will be used to summarize the findings. Comparative analysis may be conducted to assess any significant differences between genders or other subgroups within the sample.

By employing these methods, the study aims to provide a comprehensive analysis of sciatic nerve variations in relation to the piriformis muscle, contributing valuable insights to anatomical knowledge and clinical practice in the Central Indian population.

Results & Observations:

Out of 64 cadavers dissected and examined for the variations of sciatic nerve emergence in relation to piriformis muscle, A total number of 15 (23%) cadavers shows variations and remaining 49 (77%) were sciatic nerve emerged normally

In the 23% of Cadavers variations in males shows 8% and females shows 16 %. All the variations examined are unilateral existence No bilateral variations found in this study . The total variations examined are categorized in to three types

Type I :High division of Common peroneal and tibial components (Fig :1)

Type II : Common peroneal nerve piercing the piriformis with tibial component being the normal (Fig :2)

Type III : Common peroneal nerve emerging above the piriformis and tibial component being normal.(Fig :3)

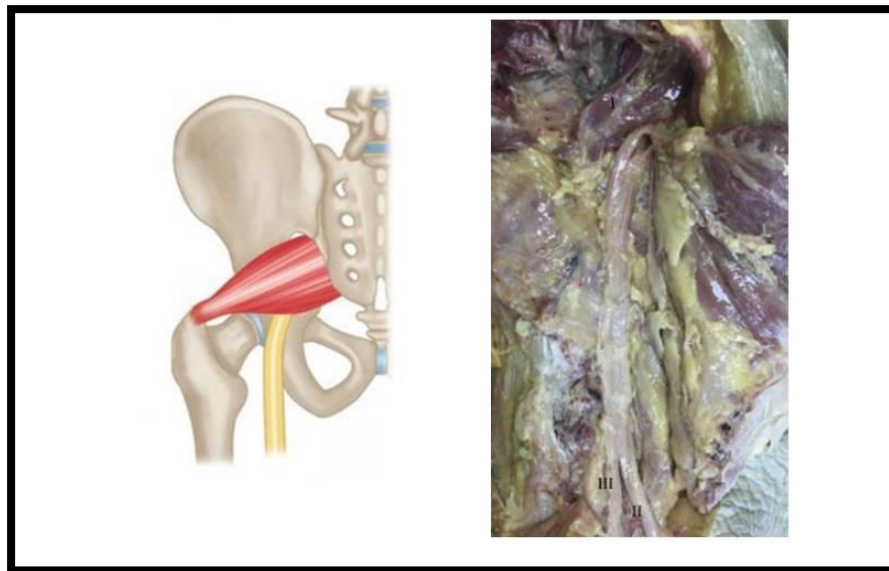


Fig : 1 -High division of Common peroneal and tibial components.(I-Piriformis muscle ,II - Tibial component, III- Common peroneal component

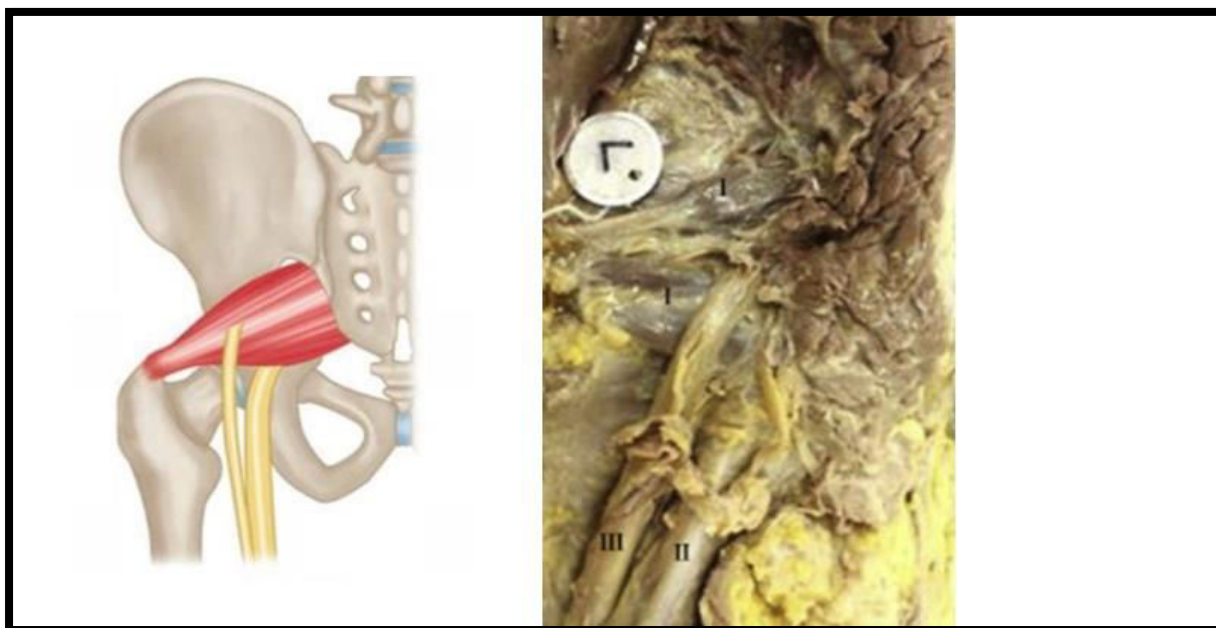


Fig : 2 -: Common peroneal nerve piercing the piriformis with tibial component being the normal course (I-Piriformis muscle ,II – Tibial component, III- Common peroneal component)

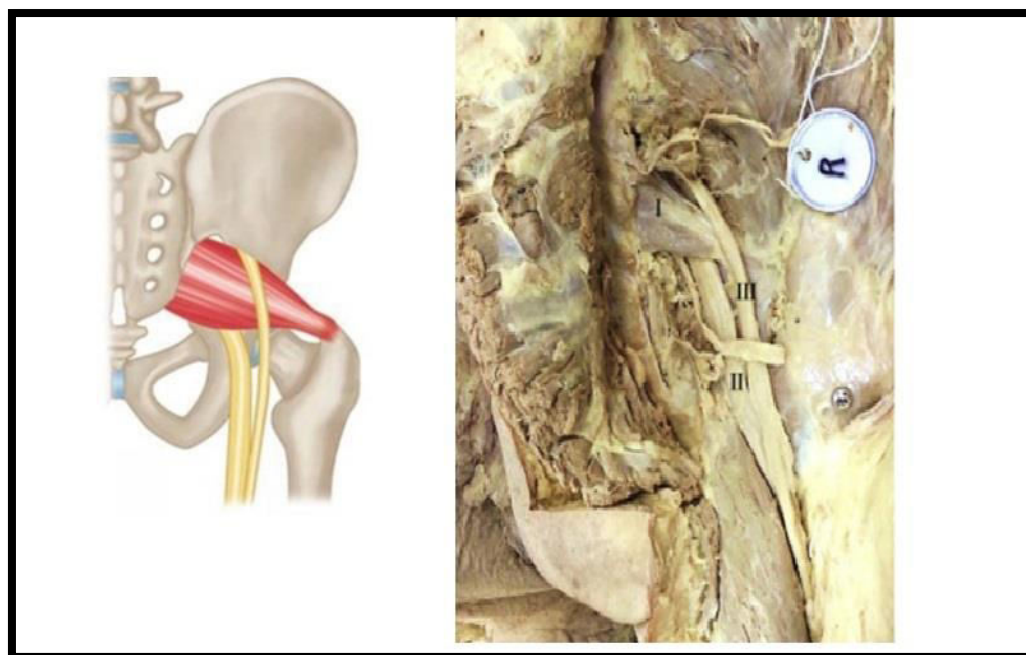
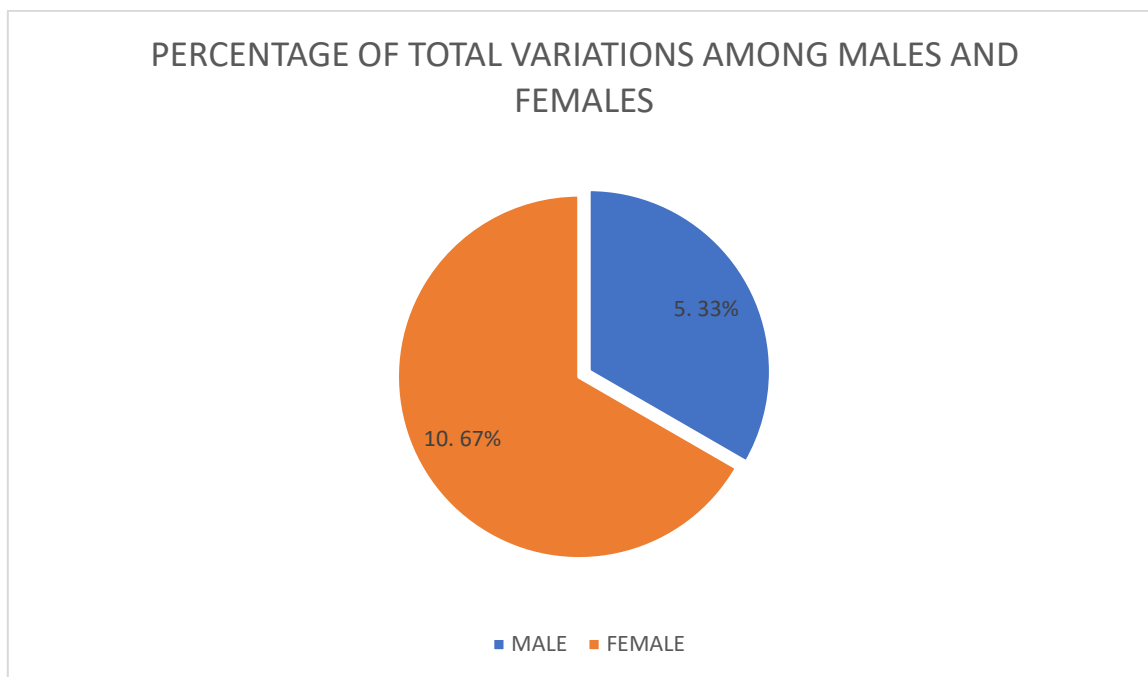


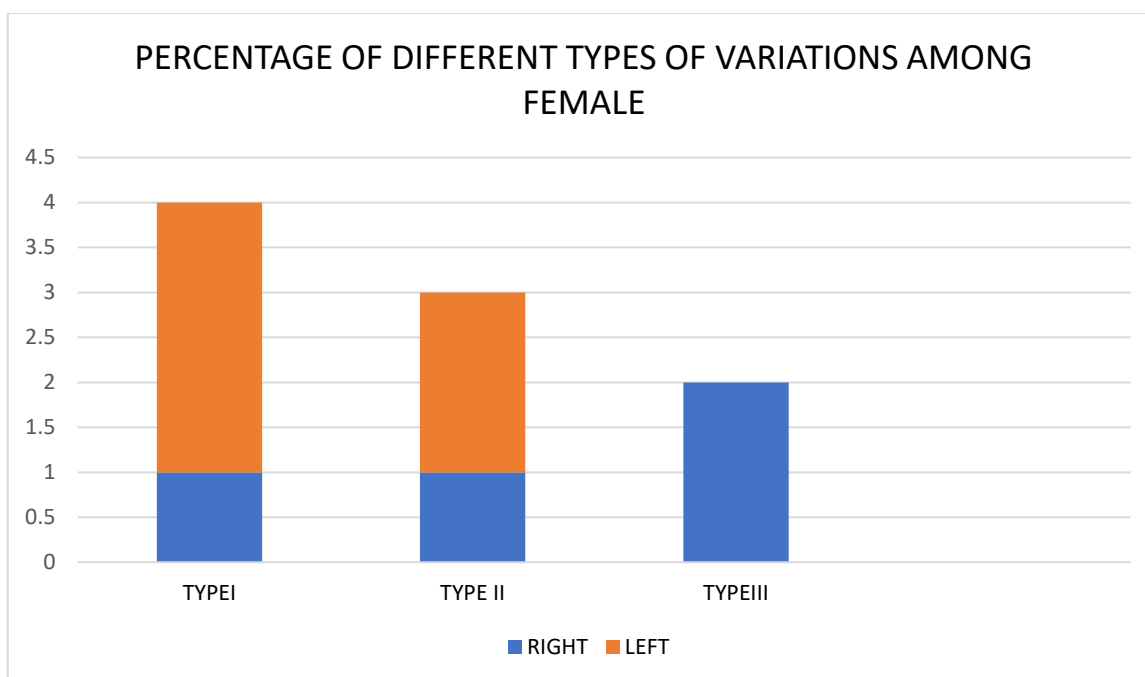
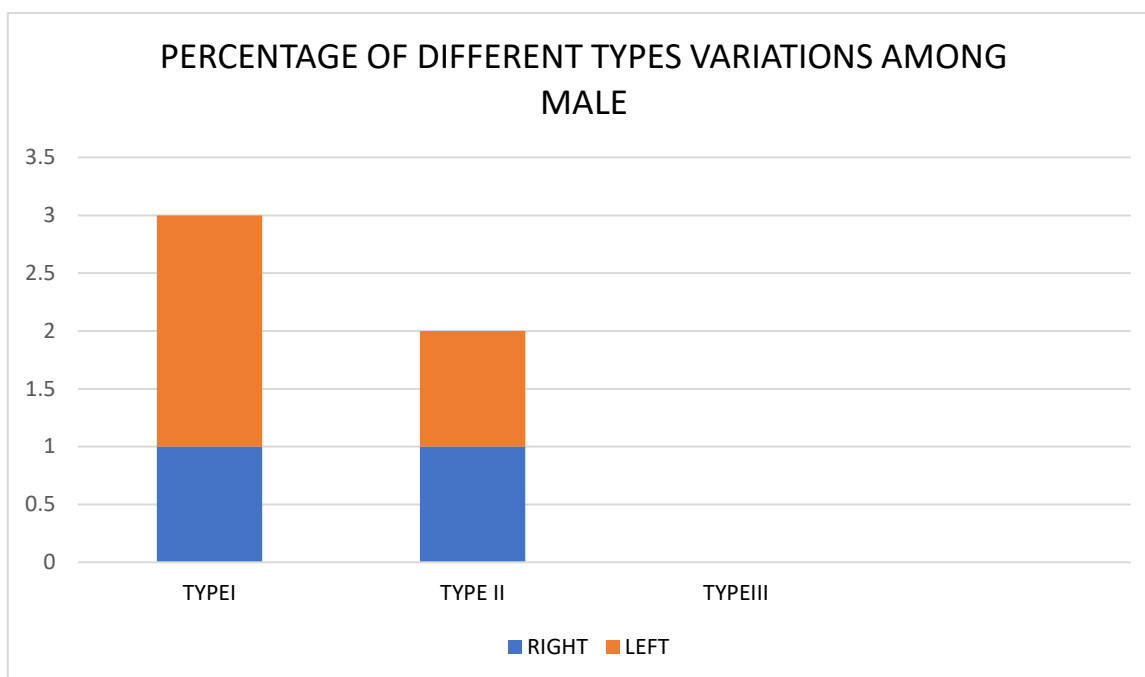
Fig : 2 -: Common peroneal nerve emerging above the piriformis and tibial component being normal(I-Piriformis muscle ,II – Tibial component, III- Common peroneal component)

Of all the three different types of variations Type -I shows maximum percentage (9%) and Type II being the least (6%) of prevalence ,Type III variation is not identified among the Male cadavers .The percentage of Type- I variation is more prevalent in females compare to other two Types (Type II (9% and Type III (9%)).Out of 5% of Total variations left sided limb shows maximum in males and females 60% compared to right sided limb variations.



TYPE OF VARIATION	Male cadavers(32)		Total % of variations	Female cadavers(32)		Total % of variations
	Rt.side(16)	Lt.side(16)		Rt.side(16)	Lt.side(16)	
TYPE I	1	2	9%	1	3	13%
TYPE II	1	1	6%	1	2	9%
TYPE III	-	-	0	2	1	9%

Table :1 Showing Total percentage of Different types of variations among males and females



Discussion:

The sciatic nerve is a significant anatomical structure that passes through the pelvis to the lower extremities. Its relationship with the piriformis muscle has been a subject of interest due to the variations that may contribute to clinical conditions like sciatica. The present study aimed to explore these variations in sciatic nerve emergence in relation to the piriformis muscle in a Central Indian population, with particular focus on male and female subjects.

Anatomical Variations of Sciatic Nerve and Piriformis Muscle:

The relationship between the sciatic nerve and the piriformis muscle is variable, with the nerve either emerging above, below, or through the muscle. In normal anatomy, the sciatic nerve passes below the piriformis. However, variations such as the nerve passing through or above the piriformis muscle have been reported in the literature[6,5]. These variations may influence the pathogenesis of piriformis syndrome, a condition associated with sciatic nerve compression due to abnormal anatomical relationships.

Our study found that, in the Central Indian population, the most common anatomical pattern was the sciatic nerve passing below the piriformis in both males and females,[3,5] which concurs with the majority of studies in other populations. However, a considerable number of individuals exhibited the sciatic nerve emerging either through or above the piriformis muscle, particularly in females. This finding suggests that sex-specific anatomical differences may play a role in the occurrence of these variations, as has been reported in some studies in other geographic regions.

Gender Differences:

The observed variations in sciatic nerve emergence between males and females are noteworthy. Females in our study were found to have a higher incidence of sciatic nerve passing through or above the piriformis muscle when compared to males. This could be attributed to differences in pelvic anatomy between genders. In females, the broader pelvic shape and greater width of the pelvic inlet may influence the path of the sciatic nerve, making variations more common. These differences are consistent with previous studies suggesting that the incidence of sciatic nerve variants is higher in females due to their unique pelvic morphology.

Additionally, hormonal influences and differences in the musculoskeletal development between genders may also contribute to these variations. Female hormones, such as estrogen, could potentially impact muscle tone and connective tissue elasticity, which might affect the positioning of the piriformis muscle and sciatic nerve.

Clinical Implications

Understanding these anatomical variations has important clinical relevance, especially in the diagnosis and management of conditions like piriformis syndrome and sciatic nerve entrapment. Variations in the emergence of the sciatic nerve can complicate the clinical presentation of sciatica, particularly in individuals where the nerve passes through or above the piriformis muscle, leading to compression or irritation of the nerve. In such cases, patients may present with symptoms similar to those of a herniated disc or lumbar radiculopathy, but with a different underlying cause.

Given the increased frequency of such variations in females, clinicians should maintain a high index of suspicion for piriformis syndrome when treating female patients presenting with lower limb pain or sciatica. Diagnostic imaging techniques, including MRI and CT scans, may help confirm the presence of nerve compression in these atypical anatomical settings.

Moreover, surgical procedures like piriformis release or nerve decompression may need to be adjusted depending on the specific relationship between the sciatic nerve and piriformis muscle. Surgeons should be particularly cautious when dealing with patients exhibiting atypical nerve paths, as failure to account for these variations could lead to incomplete resolution of symptoms or unintended nerve damage.

Conclusion: In conclusion, this study underscores the significant anatomical variations in the emergence of the sciatic nerve in relation to the piriformis muscle in a Central Indian population, with notable differences between males and females. These findings highlight the importance of considering such variations in clinical practice, particularly when diagnosing and treating conditions related to sciatic nerve entrapment. Future research incorporating imaging techniques and larger sample sizes will further enrich our understanding of these anatomical relationships and their clinical implications.

Conflicts of Interest: Nil

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