e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(7); 1627-1632

Original Research Article

Ultrasonographic Evaluation of Sciatic Nerve Bifurcation in Relation to Patient Height: A Prospective Observational Study

Gnanakannan G.[1], Sri Ranjani B.[2]

[1]Postgraduate, Department of Anesthesiology, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam, Chennai

[2]Postgraduate, Department of Anesthesiology, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam, Chennai

Received: 01-05-2026 / Revised: 25-06-2026 / Accepted: 12-07-2026
Corresponding Author: Dr. Gnanakannan G.
Conflict of interest: Nil

Abstract

Background: The Sciatic nerve demonstrates considerable anatomical variability in its level of bifurcation into the Tibial nerve and Common peroneal nerve. Such variability has significant implications for popliteal sciatic nerve block and regional anaesthesia outcomes. Anthropometric parameters, particularly height, may influence the anatomical level of nerve division; however, evidence remains limited.

Objectives: To compare the proportion of patients with sciatic nerve division within 10 cm from the popliteal crease between two height groups (<170 cm and >171 cm) using ultrasonography. Secondary objectives included evaluation of anatomical variations in division level, nerve thickness, depth from skin, and determination of the sciatic nerve–thigh coefficient in relation to anthropometric parameters.

Methods: This prospective observational study was conducted in the Department of Anaesthesiology at Chettinad Hospital and Research Institute in 2023. A total of 100 patients undergoing elective and emergency lower limb surgeries were divided into two groups based on height (<170 cm and >171 cm; n=50 each). Ultrasound was used to identify the sciatic nerve bifurcation. Distances measured included: (1) sciatic nerve division to popliteal crease, (2) greater trochanter to sciatic nerve division, and (3) greater trochanter to popliteal crease. Nerve thickness and depth from skin were also recorded. The sciatic nerve–thigh coefficient and its coefficient of variation were calculated. Statistical analysis was performed using SPSS version 21 and Microsoft Excel.

Results: The mean sciatic nerve division–popliteal crease distance was 40.87 ± 7.54 mm in the <170 cm group and 45.42 ± 8.63 mm in the >171 cm group ($p = 0.405$). The mean greater trochanter–sciatic nerve division distance was 305.55 ± 12.91 mm and 309.57 ± 12.23 mm in the respective groups ($p = 0.738$). The greater trochanter–popliteal crease distance was significantly higher in the >171 cm group (354.35 ± 14.69 mm vs. 346.87 ± 15.10 mm; $p = 0.027$). No statistically significant differences were observed in nerve thickness or depth between groups. A considerable anatomical variability in bifurcation level was identified in both height categories.

Conclusion: The level of sciatic nerve bifurcation exhibits substantial inter-individual variability and does not demonstrate a statistically significant association with height when assessed within 10 cm of the popliteal crease. These findings underscore the importance of ultrasound guidance during popliteal sciatic nerve block to enhance precision and reduce the risk of incomplete blockade. Recognition of demographic and anatomical variability may further optimize clinical outcomes in regional anaesthesia.

Keywords: Anthropometry, Bifurcation, Popliteal crease, Sciatic nerve, Ultrasonography.

DOI: 10.25258/ijcpr.18.7.243

Introduction

The Sciatic nerve, the largest peripheral nerve of the lower limb, arises from the lumbosacral plexus (L4–S3) and typically bifurcates into the Tibial nerve and Common peroneal nerve at or near the superior angle of the popliteal fossa.[1,2] Nevertheless, anatomical investigations have consistently demonstrated marked variability in the level of bifurcation. A meta-analysis by Tomaszewski KA (2016)[2] reported significant heterogeneity in sciatic nerve division patterns and relationships with the piriformis muscle, emphasizing the clinical importance of these variants. Similarly, Smoll NR (2010)[3] highlighted the surgical and anaesthetic implications of sciatic nerve variations, particularly in relation to nerve entrapment and procedural failure. Ultrasound-based studies have further confirmed the variability in the distance between the sciatic nerve division and the popliteal crease. Vloka

JD (2001)[4] demonstrated that bifurcation may occur at variable distances proximal to the popliteal crease, influencing the success of popliteal nerve blockade. Schwemmer U (2005)[5] reported considerable anatomical diversity in sonographic imaging of sciatic nerve division, reinforcing the necessity of imaging guidance. Furthermore, Shrestha U (2020)[6] documented variation in bifurcation level and nerve depth in volunteers, noting that division frequently occurred within 5–7 cm of the popliteal crease but could also be located more proximally.

Age- and population-based variability has also been described. Segura-Grau E (2021)[7] demonstrated significant anatomical heterogeneity in sciatic nerve division across age groups, while Reinoso-Barbero F (2014)[8] identified proportional differences in sciatic nerve division between neonates and adults. These findings suggest that morphometric and demographic factors may influence the relative position of the bifurcation.[9,10,11] Despite these observations, limited research has specifically examined the relationship between anthropometric parameters—particularly height—and the level of sciatic nerve division in adult surgical populations.[12,13,14] Clarifying this association may assist clinicians in anticipating anatomical variation and optimising regional anaesthesia techniques, especially in settings where ultrasonography is unavailable.[15,16] Accordingly, the present study was designed to compare the proportion of patients with sciatic nerve division within 10 cm of the popliteal crease between two height-based groups using ultrasonography, and to evaluate associated anatomical parameters including nerve thickness, depth, and the sciatic nerve–thigh coefficient.

Aim and Objectives

Aim: To assess the association between patient height and the level of bifurcation of the Sciatic nerve using ultrasonography.

Primary Objective: To compare the proportion of patients with sciatic nerve division within 10 cm of the popliteal crease between two height groups (<170 cm and >171 cm).

Secondary Objectives

- To compare the distances from the sciatic nerve division to the popliteal crease and from the greater trochanter to the division in both groups.
- To assess sciatic nerve thickness and depth at the level of bifurcation.
- To calculate and compare the sciatic nerve–thigh coefficient in the two height groups.

Materials and Methods

Study Design and Setting: This prospective observational study was conducted in the Department of Anaesthesiology at Chettinad Hospital and Research Institute during the year 2023.

Study Population: A total of 100 patients scheduled for elective and emergency lower limb surgeries were included. Participants were divided into two groups based on height:

- Group I: <170 cm (n = 50)
- Group II: >171 cm (n = 50)

Inclusion Criteria

- Patients aged ≥18 years
- Patients undergoing lower limb surgeries
- Patients who provided written informed consent

Exclusion Criteria

- History of lower limb deformity or prior surgery affecting anatomy
- Local infection at the scanning site
- Refusal to participate

Ultrasonographic Assessment: Patients were positioned laterally. A high-frequency linear ultrasound transducer was placed transversely over the popliteal crease to identify the Sciatic nerve and its bifurcation into the Tibial nerve and Common peroneal nerve.

The following measurements were recorded:

1. Distance from sciatic nerve division to popliteal crease.
2. Distance from greater trochanter to sciatic nerve division.
3. Distance from greater trochanter to popliteal crease.
4. Thickness of the sciatic nerve proximal to bifurcation.
5. Depth of the sciatic nerve from the skin at the level of division.

The sciatic nerve–thigh coefficient was calculated as:

$$\begin{aligned}&\text{Greater Trochanter}\\&-\text{Sciatic Nerve Division Distance}\\&\div\text{Greater Trochanter}\\&-\text{Popliteal Crease Distance}\times 100\end{aligned}$$

The coefficient of variation was computed as standard deviation divided by mean × 100.

Outcome Measures: The primary outcome was the proportion of patients with sciatic nerve division within 10 cm of the popliteal crease in each height group. Secondary outcomes included comparative morphometric parameters and their association with anthropometric variables.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using SPSS version 21. Continuous variables were expressed as mean ± standard deviation and compared using appropriate statistical tests. Categorical variables were presented as frequencies and percentages. A p-value <0.05 was considered statistically significant.

Ethical Considerations: Institutional Ethical Committee approval was obtained prior to commencement of the study. Written informed consent was secured from all participants.

Results & Findings

A total of 100 patients were included in the study and divided equally into two height-based groups: Group I (<170 cm, n=50) and Group II (>171 cm, n=50). Baseline demographic variables were comparable between groups except for height and greater trochanter–popliteal crease distance, which showed statistical significance. The primary outcome—proportion of patients with sciatic nerve division within 10 cm of the popliteal crease—did not demonstrate a statistically significant difference between groups. Morphometric parameters including sciatic nerve division–popliteal crease distance, greater trochanter–sciatic nerve division distance, nerve thickness, and nerve depth from skin were comparable between groups.

Table 1: Mean Age Distribution

Variable	<170 cm (n=50)	>171 cm (n=50)	p-value
Mean Age (years)	45.95 ± 12.73	44.82 ± 11.28	0.456

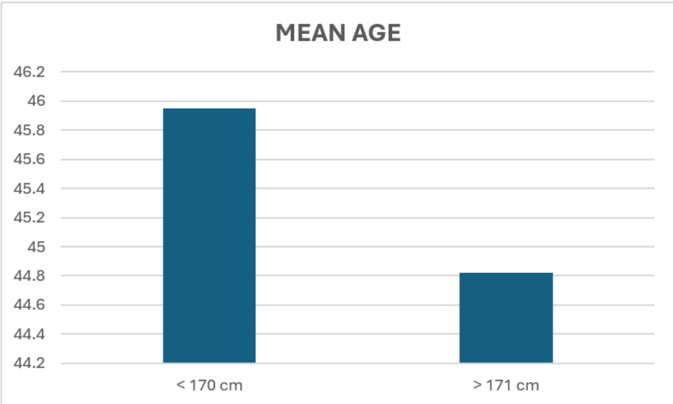

Figure 1: Mean Age Distribution

The mean age was comparable between the two height groups (<170 cm and >171 cm). The difference was not statistically significant (p = 0.456), indicating that age distribution was similar in both groups and unlikely to influence the primary outcome.

Table 2: Gender Distribution

Gender	<170 cm	>171 cm	p-value
Male	14	36	<0.00001*
Female	26	4	

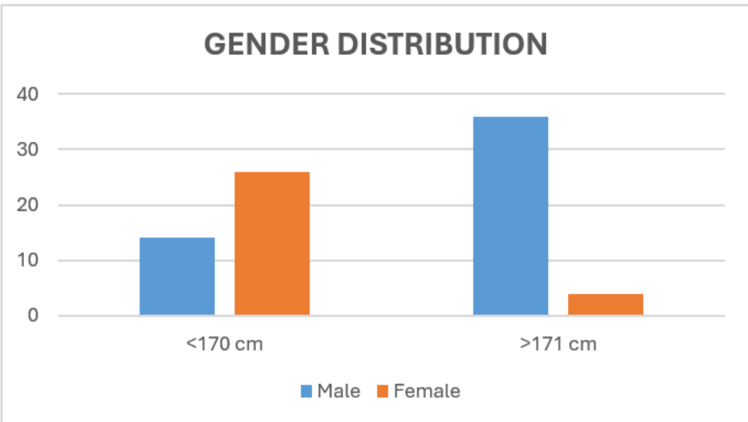

Figure 2: Gender Distribution

A higher proportion of males was observed in the >171 cm group, while females predominated in the <170 cm group. The difference was statistically significant (p < 0.00001), reflecting expected biological variation in height distribution rather than an anatomical effect.

Table 3: Anthropometric Parameters

Variable	<170 cm	>171 cm	p-value
Height (cm)	160.02 ± 7.43	174.92 ± 2.72	<0.0001*
Weight (kg)	64.55 ± 9.42	74.45 ± 8.08	0.342
BMI (kg/m²)	23.17 ± 2.97	24.32 ± 2.48	0.267
Greater Trochanter–Popliteal Crease (mm)	346.87 ± 15.10	354.35 ± 14.69	0.027*

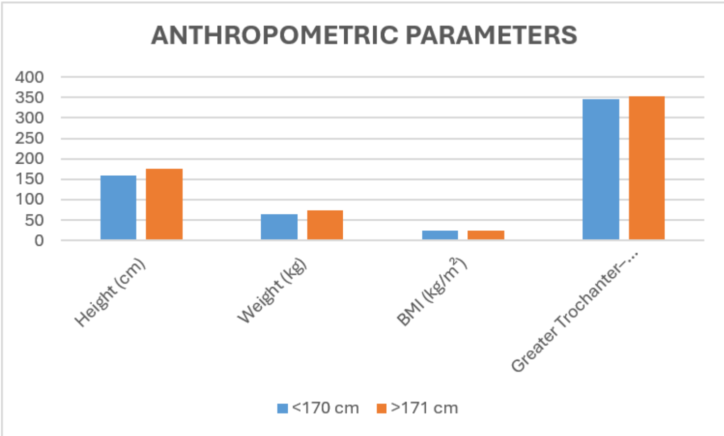

Figure 3: Anthropometric Parameters

Height differed significantly between groups ($p < 0.0001$), confirming appropriate group categorisation. Weight and BMI showed no statistically significant difference ($p > 0.05$), indicating comparable body composition. The greater trochanter–popliteal crease distance was significantly higher in the taller group ($p = 0.027$), which reflects proportional limb length differences.

Table 4: Sciatic Nerve Morphometric Measurements

Parameter	<170 cm	>171 cm	p-value
SN Division–Popliteal Crease (mm)	40.87 ± 7.54	45.42 ± 8.63	0.405
Greater Trochanter–SN Division (mm)	305.55 ± 12.91	309.57 ± 12.23	0.738
Nerve Thickness (mm)	16.27 ± 1.76	16.92 ± 1.70	0.808
Nerve Depth from Skin (mm)	29.40 ± 8.54	29.97 ± 6.87	0.177

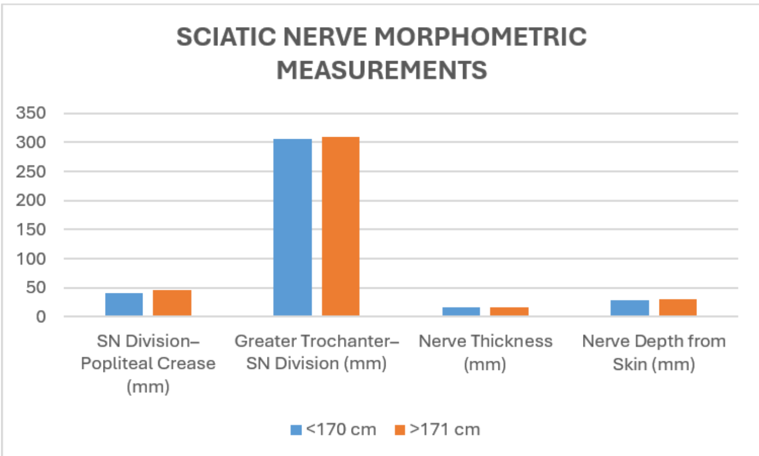

Figure 4: Sciatic Nerve Morphometric Measurements

The mean distance from sciatic nerve division to the popliteal crease did not differ significantly between groups ($p = 0.405$). Similarly, the greater trochanter–sciatic nerve division distance showed no significant variation ($p = 0.738$). Sciatic nerve thickness and depth from skin were also comparable ($p > 0.05$).

Although taller individuals demonstrated greater overall limb length, the level of sciatic nerve bifurcation relative to the popliteal crease did not significantly differ between height groups. This suggests that patient height does not meaningfully influence the anatomical level of sciatic nerve division within 10 cm of the popliteal crease.

Discussion and Conclusion

The present study evaluated the relationship between patient height and the level of bifurcation of the Sciatic nerve using ultrasonographic assessment. Although taller individuals demonstrated significantly greater limb length—as reflected by the greater trochanter–popliteal crease distance—the level of sciatic nerve division relative to the popliteal crease did not differ significantly between the two height groups. These findings suggest that absolute body height does not substantially influence the distal bifurcation level of the sciatic nerve within 10 cm of the popliteal crease.

Anatomical variability in sciatic nerve division has been extensively documented. Vloka JD reported that the sciatic nerve may divide at varying distances proximal to the popliteal crease, with important implications for popliteal nerve block. Similarly, Schwemmer U demonstrated significant diversity in sonographic localisation of sciatic nerve bifurcation, reinforcing the need for imaging guidance. A meta-analysis by Tomaszewski KA further confirmed considerable heterogeneity in sciatic nerve morphology and branching patterns across populations.

In the present study, the mean sciatic nerve division–popliteal crease distance was slightly greater in the taller group; however, this difference was not statistically significant. This observation aligns with prior reports suggesting that while limb length increases proportionally with height, the relative anatomical position of nerve bifurcation remains comparatively constant. Shrestha U observed that sciatic nerve bifurcation most frequently occurs within 5–7 cm of the popliteal crease, irrespective of demographic variability. Similarly, Segura-Grau E demonstrated age-related anatomical heterogeneity but did not establish a strong correlation with height in adults. The absence of a significant association between height and bifurcation level in this study may be explained by proportional scaling of lower limb structures. Although taller individuals have increased thigh length, the relative position of the sciatic nerve division along the thigh axis appears to maintain a consistent proportional relationship. This concept is supported by the comparable sciatic nerve–thigh coefficients observed between groups. Therefore, while absolute distances vary with stature, the anatomical ratio governing bifurcation remains relatively stable.

Clinically, these findings have practical implications for regional anaesthesia. Popliteal sciatic nerve block techniques based solely on fixed landmark distances may not account for inter-individual anatomical variation. Even though height does not significantly predict bifurcation level, considerable variability was observed within each group. This reinforces the importance of ultrasonographic guidance to visualise the Tibial nerve and Common peroneal nerve components directly, thereby minimising the risk of incomplete blockade.

The study has certain limitations. First, it was conducted at a single centre, which may limit generalisability. Second, gender distribution differed between groups due to natural height variation, which may introduce confounding factors, although nerve morphometry did not differ significantly. Future multicentric studies incorporating larger and more diverse populations may further clarify the influence of anthropometric parameters on sciatic nerve anatomy.

while limb length parameters increase with height, the level of sciatic nerve bifurcation relative to the popliteal crease does not demonstrate a statistically significant association with stature. Ultrasonographic assessment remains essential for accurate localisation and optimal clinical outcomes in popliteal sciatic nerve block.

References

1. Standring S. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 39th ed. London: Churchill Livingstone; 2005.
2. Catala M, Kubis N. Gross anatomy and development of the peripheral nervous system. Handb Clin Neurol. 2013;115:29–41.
3. Smoll NR. Variations of the piriformis and sciatic nerve with clinical consequence: a review. Clin Anat. 2010;23(1):8–17.
4. Vloka JD, Hadzić A, April E, Thys DM. The division of the sciatic nerve in the popliteal fossa: anatomical implications for popliteal nerve blockade. Anesth Analg. 2001; 92(1): 215–217.
5. Schwemmer U, Markus CK, Greim CA, Brederlau J, Roewer N. Sonographic imaging of the sciatic nerve division in the popliteal fossa. Ultraschall Med. 2005;26(6):496–500.
6. Shrestha U, Lama Moktan S, Shrestha SB. Ultrasonographic assessment of the distance of sciatic nerve bifurcation from the popliteal crease and its depth from skin in volunteers. Kathmandu Univ Med J. 2020;18(70):176–180.
7. Segura-Grau E, Díez Sebastián J, Reinoso-Barbero F. The influence of age on the anatomical variability of sciatic nerve divisions in the thigh: an ultrasound study. Surg Radiol Anat. 2021;43(12):2031–2037.
8. Reinoso-Barbero F, Saavedra B, Segura-Grau E, Llamas A. Anatomical comparison of sciatic nerves between adults and newborns: clinical implications for ultrasound guided block. J Anat. 2014;224(2):108–112.
9. Tomaszewski KA, Graves MJ, Henry BM, et al. Surgical anatomy of the sciatic nerve: a meta-analysis. J Orthop Res. 2016;34(10):1820–1827.
10. Natsis K, Totlis T, Konstantinidis GA, et al. Anatomical variations between the sciatic nerve and the piriformis muscle. Surg Radiol Anat. 2014;36(3):273–280.

11. Poutoglidou F, Piagkou M, Totlis T, et al. Sciatic nerve variants and the piriformis muscle: a systematic review and meta-analysis. Cureus. 2020;12(11):e11531.
12. Prasad A, Perlas A, Ramlogan R, et al. Ultrasound-guided popliteal block distal to sciatic nerve bifurcation shortens onset time. Reg Anesth Pain Med. 2010;35(3):267–271.
13. Sala-Blanch X, de Riva N, Carrera A, et al. Ultrasound-guided popliteal sciatic block with a single injection at the sciatic division results in faster block onset than the classical nerve stimulator technique. Anesth Analg. 2012; 114(5): 1121–1127.
14. Barrington MJ, Lai SL, Briggs CA, et al. Ultrasound-guided midthigh sciatic nerve block: a clinical and anatomical study. Reg Anesth Pain Med. 2008;33(4):369–376.
15. Atoni AD, Oyinbo CA, Francis DAU, Tabowei UL. Anatomic variation of the sciatic nerve: prevalence and bifurcation loci. Acta Med Acad. 2022;51(1):52–58.
16. Ro TH, Edmonds L. Diagnosis and management of piriformis syndrome: a rare anatomic variant analyzed by magnetic resonance imaging. J Clin Imaging Sci. 2018; 8:6.