

Original Research Article

Sciatic nerve: Non-union of its components and clinical implication

Monica Baxla, Hare Krishna, Rati Tandon, Arthi Ganapathy, Saroj Kaler*

Department of Anatomy, AIIMS, New Delhi, India

Received: 02 December 2018

Accepted: 09 January 2019

***Correspondence:**

Dr. Saroj Kaler,

E-mail: sarojkaler@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Having prior anatomical knowledge of the anatomical variations is a must for the accurate and effective diagnosis of clinical conditions associated with the sciatic nerve. Sciatic nerve, the longest nerve in the human body has been of great interest for the clinicians and anatomists; though many studies have been conducted in the past to study its anatomical aspect. Till now high division or low formation of the sciatic nerve has been reported but this article highlights the non-union of the components of the sciatic nerve and its clinical outcomes. It had been observed that the common fibular and tibial nerve which arise separately from the sacral plexus remain separated throughout their course. They do not join to form the sciatic nerve. Non-union of the components can result in incomplete blockade of the nerve but selective blockade of one of the components can be done when needed. Aim of the study was to determine the level of formation and the level of division of the sciatic nerve.

Methods: Sixty-two lower limbs were taken from the Department of Anatomy, AIIMS, New Delhi and gluteal region was observed for common fibular and tibial nerve and their joining to form the sciatic nerve.

Results: Out of 62 lower limbs; 52 specimens showed formation within the pelvis but in 10 specimens the sciatic nerve did not form at any point. Division of the nerve in 52 specimens were at various levels on the posterior aspect of thigh.

Conclusions: While giving anaesthesia it's important to know the formation as well as division of the nerve for an effective lower limb block for various surgical interventions and in case of non union of tibial and common fibular nerve to form the sciatic nerve individual nerve block can be given.

Keywords: Anatomical variations, Anaesthesia, Common fibular and tibial nerve, Non-Union, Sciatic nerve

INTRODUCTION

Sciatic Nerve, one of the important and thickest nerve in the body having thickness of about 2cm at its origin. It is formed by the joining of common fibular (common peroneal) and tibial nerve which are the ventral division and dorsal divisions of ventral rami of lumbosacral trunk (L4-5) and the first three sacral (S1-3) spinal nerves respectively within the pelvis. These components are responsible for the nerve supply to the posterior aspect of thigh, anterolateral and posterior compartment of leg, dorsum and plantar aspect of foot. Sciatic nerve is also known by the name of ischiadic nerve. After its formation

in the pelvis; it usually comes out from the pelvis into the gluteal region through the greater sciatic foramen below the lower border of the piriformis and then the two components get separated at various levels proximal to the knee. As the nerve comes out; it is related to the muscle piriformis variably. The nerve exits the greater sciatic foramen along the lower border of the piriformis muscle or might pass through the muscle with one branch (usually the fibular component) piercing the muscle and the other branch (usually the tibial component) exiting through the lower border of the piriformis muscle.¹ The nerve as a single trunk emerging below piriformis is the most common of all these. In 83% of the people sciatic

nerve is single as it passes below piriformis.² Close relation of the sciatic nerve with the piriformis can be attributed to pain in the gluteal region or in the region of distribution of the sciatic nerve components due to the inflammation, irritation or hypertrophy of the muscle.³⁻⁵

Failure of popliteal block during surgical intervention is the result of variation in the anatomy of the sciatic nerve. Previous literatures have talked about the high division or low division of the sciatic nerve, but present study was done to observe the level of formation of the sciatic nerve and its relation to piriformis muscle as it leaves the pelvic cavity through the greater sciatic foramen. Involvement of the sciatic nerve in various medical fields such as anaesthesia, orthopaedics, rehabilitation, neurology; cadavers are the best way to study the anatomy of the nerve.⁶

METHODS

Cadavers donated to the Department of Anatomy of All India Institute of Medical Sciences, New Delhi, India for research and study purpose were taken for this study and were dissected. The study was conducted from December 2015 to January 2018. Total 62 lower limbs were dissected. Both sides of gluteal region were dissected and compared for bilateral or unilateral presentation. In those cases where formation of sciatic nerve (union of common fibular and tibial nerve) was within the pelvic cavity and came out as a single nerve and then bifurcated on the posterior aspect of thigh was not traced to the pelvic cavity. Sciatic nerve was exposed in the thigh, gluteal region till its origin in the pelvic cavity in those cases only where sciatic nerve came out separately below piriformis or one of the components was seen to be exiting the pelvic cavity by piercing the piriformis or sacral plexus forming common fibular and tibial nerve. All specimens were examined for the level of formation of the sciatic nerve and its relation to the piriformis muscle. Details were recorded, and photograph was taken.

RESULTS

The total number of lower limbs used for this study was 62. Out of which in 52 specimens the sciatic nerve was seen as a single trunk coming out from the pelvic cavity below the lower border of the piriformis muscle. That means the formation of the nerve has occurred within the pelvis and the nerve has emerged as a single trunk below the lower border of the piriformis which is the usual course in most of the cases. The nerve then divided at various levels in the posterior aspect of the thigh. In 3 of the specimens we found that the components (CFN and TN) of sciatic nerve were seen emerging separately below the lower border of piriformis muscle as in Figure 1A. The components were traced above to their origin into the pelvic cavity; after the formation of the CFN and TN from ventral and dorsal divisions of the sacral nerves; they did not unite to form the sciatic nerve as seen in Figure 1B.

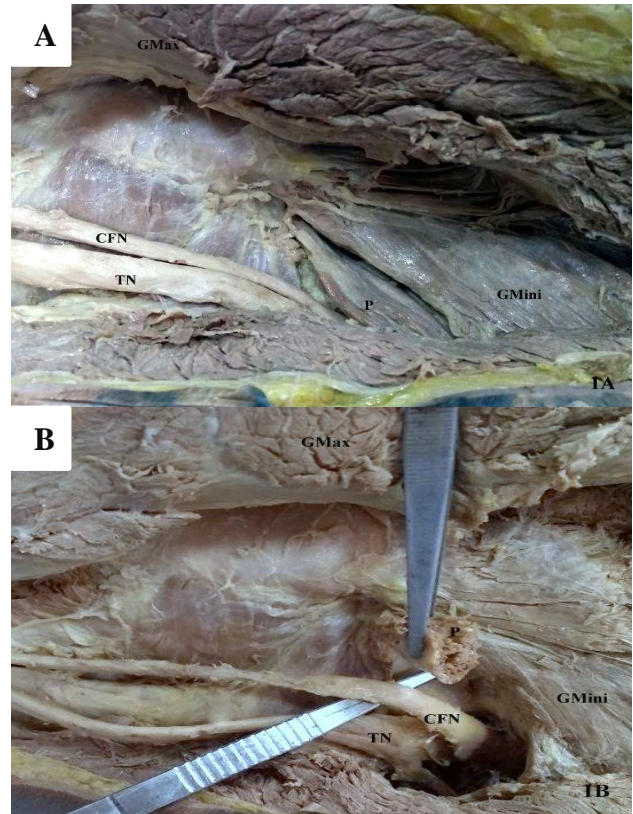


Figure 1: Showing CFN and TN. A) Showing CFN and TN coming out separately below piriformis. B) showing CFN and TN remain separated from the beginning.

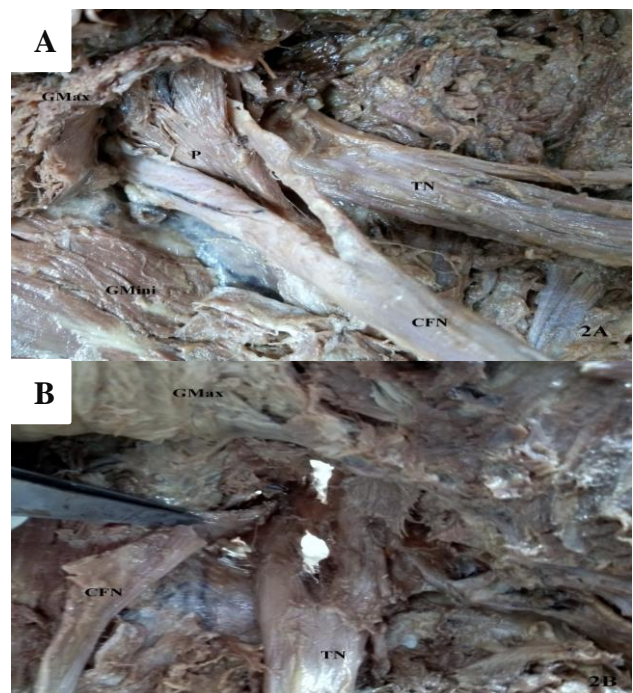


Figure 2: A) Showing CFN coming out above piriformis and also full formation of CFN in the gluteal region. B) Showing CFN and TN to be separate.

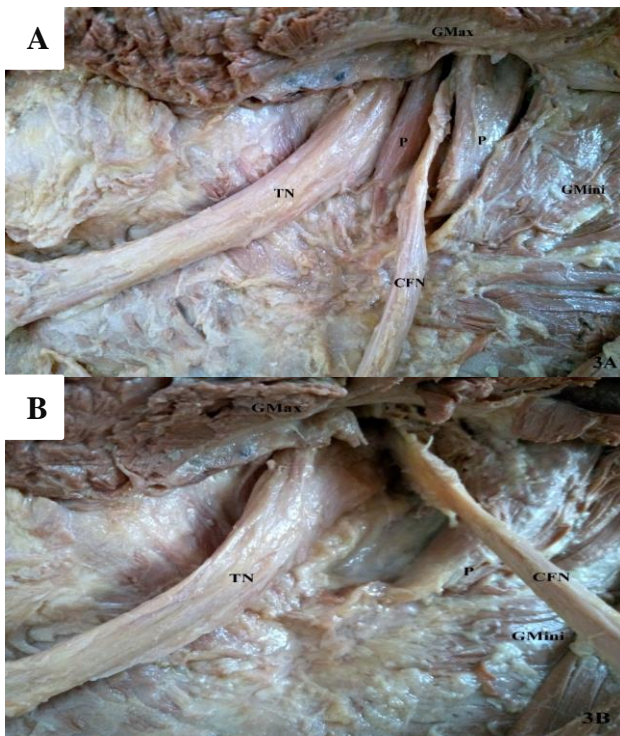


Figure 3: A) Showing CFN piercing the piriformis and tibial nerve below piriformis, B) Showing components of sciatic nerve to be separate.

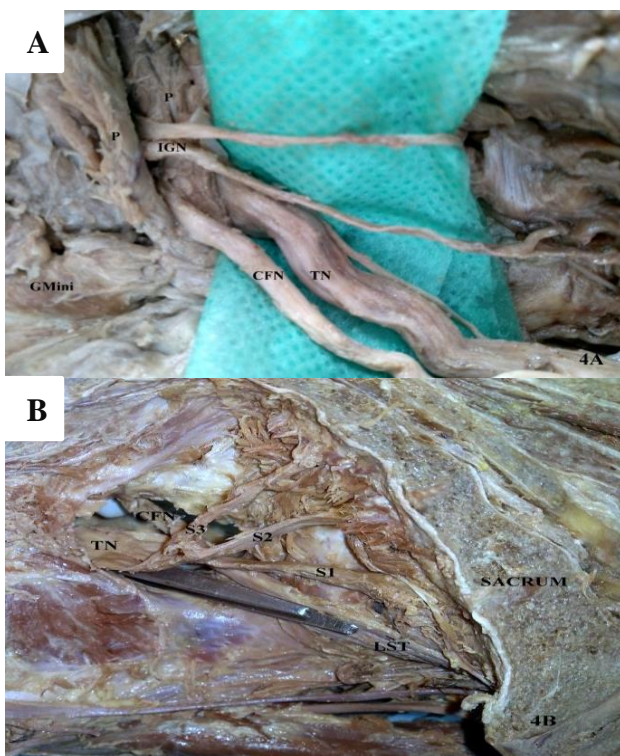


Figure 4: A) Showing CFN and IGN periecing piriformis and tibial nerve below the muscle, B) Showing components of sciatic nerve to be separate.

In another specimen CFN emerged above the piriformis and one of the sacral nerve is joining it outside the pelvis, in the gluteal region (Figure 2A). In this case the complete formation of CFN has taken place in the gluteal region and the components of sciatic nerve remained separate. In 6 other specimens CFN was seen to be emerging from the pelvis by periecing the piriformis muscle and the TN emerging from the lower border of the muscle (Figure 3A). On further exploration of sacral plexus it was observed that CFN and TN after forming did not unite (Figure 3B). In 1 of the specimens along with the CFN, the inferior gluteal nerve emerged by piercing the piriformis and TN emerged below it (Figure 4A). Sacral nerve exploration showed common fibular and tibial nerve to be separate after their formation.

DISCUSSION

The knowledge regarding the formation and the level of division of the sciatic nerve and the location where it leaves the pelvis is of clinical significance. Till now sciatic nerve had been studied by various authors for its level of division and its relation to the piriformis muscle but present study deals with the level of formation. Khan AA and his associates have documented a low formation of the sciatic nerve in one of their specimen. That is after emerging from the pelvic cavity separately, the components of the sciatic nerve joined to form a single nerve trunk in the upper part of the posterior aspect of the thigh.⁷ Sharma S and his associates have reported in a single specimen of non-formation of the sciatic nerve when traced into the pelvis.⁸ In the present study we had observed the components coming out from the pelvic cavity separately but did not join to form the sciatic nerve at any point on the posterior aspect of thigh. In three of the specimens the components of the nerve emerged separately below the lower border of piriformis and in seven specimen the common fibular nerve was seen to be periecing the piriformis and coming out of the pelvic cavity. All these ten specimens showed non- formation of the sciatic nerve when traced to the pelvic cavity which means that after emerging from the sacral plexus the components remained separate.

During anaesthesia of the lower limb incomplete blockage of the sciatic nerve in the popliteal fossa had been seen as a result of variation in the level of division of the nerve as tip of the needle is inserted and held next to the main trunk of the nerve before its division into its components.^{9,10} Both the components of the sciatic nerve can be blocked separately by double injection technique where both the components are identified and anaesthetized separately for an effective sciatic nerve block.¹¹ According to the Gray's Anatomy the sciatic nerve divides at the junction of middle and lower thirds of the back of thigh but the division is not constant which is why regional anaesthesia fails. Local anaesthetic when injected may affect only one of the components causing incomplete block. The needle is inserted near the nerve before its separation into its components hence blocking

of nerve in the popliteal fossa will result in incomplete blockage.¹² Division of the sciatic nerve at various levels in the posterior aspect of thigh is common. The nerve may divide in the popliteal fossa. or at the angle of popliteal fossa. In the present study 52 specimen showed formation of the nerve in the pelvis and emerged as a single nerve trunk below piriformis. In 11 (17.7%) specimens the nerve separated in the upper part of thigh, 24 (38.7%) in the middle of the thigh and in 17 (27%) in the upper part of the popliteal fossa but none of the specimen showed division in the popliteal fossa. This variation is not uncommon.

Another variation regarding the sciatic nerve is its relation to piriformis as it exits through the greater sciatic foramen. High division of sciatic nerve that is formation and division within the pelvic cavity has been reported.^{13,14} while high division of sciatic nerve with common fibular nerve passing through piriformis muscle and tibial nerve below the muscle has also been observed causing entrapment of the nerve (common fibular) between the two heads of the piriformis leading to piriformis syndrome characterized by pain in the gluteal region and along the distribution of that nerve.¹⁵ In the present study in the 7 specimens we had observed this type of arrangement. Common fibular nerve emerging above the piriformis while tibial nerve from the lower border of the muscle and then joined to form a single nerve trunk. This type of arrangement we did not see in our study.

CONCLUSION

Sciatic nerve block is given for hip, ankle and foot surgery and for amputating the lower limb. Being an important nerve of the lower extremity, the sciatic nerve formation and level of division must be kept in mind by the anaesthetists for an effective blockade and in cases of non formation of the sciatic nerve; the components can be blocked separately as desired.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Standring S. Gray's Anatomy. 40th ed. Elsevier Churchill living stone; 2009:1576.
2. Hopayian K, Song F, Riera R, Sambandan S. The clinical features of the piriformis syndrome: a systematic review. Eur Spine J. 2010;19(12):2095-109.
3. Barton PM. Piriformis syndrome: a rational approach to management. Pain. 1991;47:345-52.

4. Papadopoulos EC, Khan SN. Piriformis syndrome and low back pain: a new classification and review of the literature. Orthop Clin Am. 2004;35(1):65-71.
5. Brooks JB, Silva CA, Soares SA, Kai MR, Cabral RH, Fragoso YD. Anatomical variations of the sciatic nerve in a group of Brazilian cadavers. Revista Dor. 2011 Dec;12(4):332-6.
6. Khan AA, Asari MA, Pasha MA. The sciatic nerve in human cadavers-high division or low formation? Folia Morphol. 2016;75(3):306-10.
7. Sharma S, Khullar M, Ahmad M. Direct origin of tibial nerve and common peroneal nerve from lumbosacral plexus. JK-Practitioner. 2012;17(1-3):54-57.
8. Benzon HT, Kim C, Benzon HP, Silverstein ME, Jerico B, Prillaman K, et al. Correlation between evoked motor response of the sciatic nerve and sensory blockade. Anesthesiology. 1997;87:548-52.
9. Hadzic A, Vloka JD, Kitain E, Lesser JB, April EW and Thys DM. Division of the sciatic nerve and its possible implications in popliteal nerve blockade. Anesthesiology. 1996;85(3A):A733.
10. Paqueron X, Bouaziz H, Macalou D, Labaille T, Merle M, Laxenaire MC, et al. The lateral approach to the sciatic nerve at the popliteal fossa: one or two injections? Anesth Analg. 1999;89:1221-5.
11. Murray JM, Derbyshire S, Shields MO. Lower limb blocks. Anaesthesia. 2010 Apr;65:57-66.
12. Mengstu DK, Dawit HW. Anatomical variations in the level of bifurcation of the sciatic nerve in Ethiopia. Exp Clin Anat. 2015;14:1-4.
13. Sabnis AS. Anatomical variations of sciatic nerve bifurcation in human cadavers. J of Clin Research Letters. 2012;3(2):46-8.
14. Lewis S, Jurak J, Lee C, Lewis R, Gest T. Anatomical variations of the sciatic nerve, in relation to the piriformis muscle. Trans Res Anat. 2016;5:15-9.
15. Shwetha K, Dakshayani KR. Bilateral high division of sciatic nerve. Int J Res Med Sci. 2014;2(4):1785-7.
16. Natsis K, Totlis T, Konstantinidis GA, Paraskevas G, Piagkou M and Koebke J. Anatomical variations between the sciatic nerve and the piriformis muscle: a contribution to surgical anatomy in piriformis syndrome. Surg Radiol Anat. 2014;36:273-80.

Cite this article as: Baxla M, Krishna H, Tandon R, Ganapathy A, Kaler S. Sciatic nerve: Non-union of its components and clinical implication. Int J Res Med Sci 2019;7:438-41.