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CASE REPORT

Report of a rare case of high division of the sciatic nerve over the superior gemellus muscle

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ABSTRACT

The sciatic nerve (SN), originating from the sacral plexus, is the largest nerve in the human body. Anatomically, it passes through the gluteal region, crossing the greater sciatic notch, and divides at the popliteal fossa into its terminal branches, the tibial and common fibular nerves, but there are variations in the level of this bifurcation, which are frequently found. The aim of this study was to report a case of high division of the sciatic nerve passing through the superior gemellus muscle, an anatomical variation considered relevant to clinical practice. The variation was found during the dissection of a male cadaver, in the left lower limb. The SI was divided as it entered the gluteal region, with the common fibular nerve on the upper margin of the superior gemellus muscle and the tibial nerve on the lower margin of the superior gemellus muscle. The two branches, tibial and common fibular, remained divided throughout the posterior extension of the lower limb. The occurrence of a high division of the sciatic nerve, as well as its path, is important during clinical-surgical approaches in cases of injuries that may affect parts of the gluteal or femoral regions, in addition to being correlated with a condition of nerve compression.

Keywords: superior gemellus muscle, sciatic nerve, gluteal region, anatomical variation

INTRODUCTION

Commonly known as the sciatic nerve, and in anatomical terminology as the sciatic nerve (SN), it originates from the sacral plexus (L4-S3) and is the largest and thickest nerve in the human body [1, 2]. Upon leaving the pelvic cavity, surrounded by a connective tissue sheath [3], it passes through the greater sciatic notch to the posterior region of the thigh, inferior to the piriformis muscle, and upon reaching the vicinity of the posterior region of the knee, more specifically in the popliteal fossa, it divides into two terminal branches: the tibial nerve (TN) and common fibular nerve (CFN) [3,4], where they subsequently innervate the structures of the hip, thigh, knee, leg, ankle, and foot [5].

The TN is formed by the ventral branches of the L4-S3 roots, while the CFN is composed of the dorsal branches of the ventral branches of the L4-S2 roots [1, 2].

Other anatomical configurations of the NI have been frequently reported in the anatomical literature, in which the bifurcation of the NI into NT and NFC occurred in different regions: pelvic, gluteal, proximal third, middle third, distal third of the posterior thigh, or popliteal fossa. Among the variations found by the authors regarding the height of the IN division, the pelvic region appeared in 7.1% of cases, 0.6% in the middle posterior third of the thigh, 12.7% in the distal third of the thigh, and 79.6% in the popliteal fossa [6]. In cases where the division of the IN occurred in the pelvic region, the nerve, upon leaving the pelvis, divided near the piriformis muscle. This variation had the ability to impact the morphology of the piriformis muscle and, in some cases, trigger piriformis syndrome, a condition marked by low back pain, pain in the buttocks, and pain in the back of the thigh [7, 8, 9].

The sciatic nerve is of great clinical importance, and there are several reported variations, but the high division of the sciatic nerve exiting inferior to the superior gemellus muscle in the present case report was mentioned in only one piece of literature found.

CASE REPORT

During dissection of the gluteal region of a male cadaver approximately 70 years of age, fixed with a 10% formalin solution, an anatomical variation of high division of the SI was observed (Figure 1).

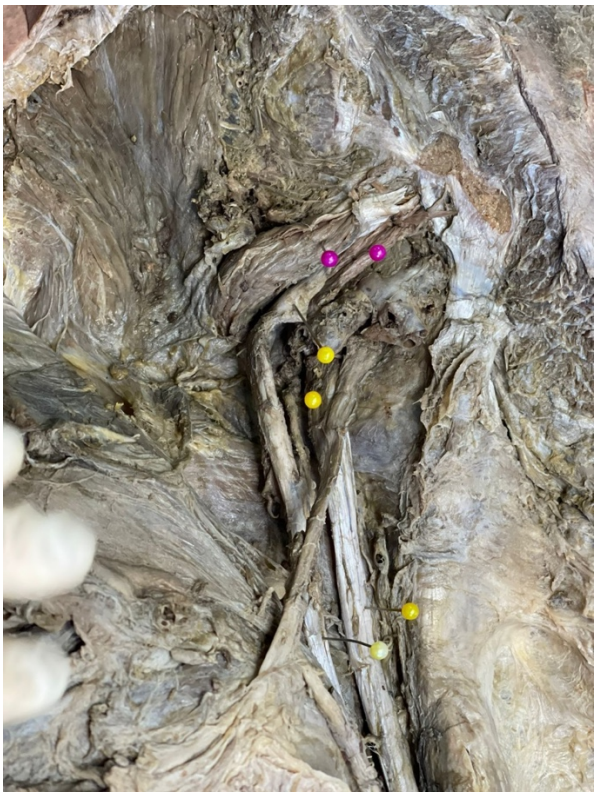

Figure 1. *Photograph of the posterior region of the hip, left side, showing the division of the sciatic nerve. The common fibular nerve passing superior to the superior gemellus muscle and the tibial nerve passing inferior to the muscle. (1) piriformis muscle, (2) superior gemellus muscle, (3) common fibular nerve, (4) tibial nerve.*

After opening and retracting the skin and gluteus maximus muscle toward its origin, a high division of the sciatic nerve was observed, with the nerves present at the upper and lower margins of the superior gemellus muscle. This variation was found only unilaterally, in the left antimere, which remained divided throughout the entire posterior compartment of the thigh (Figure 2). The IN bifurcated at the upper margin of the gastrocnemius muscle, common fibular nerve, and lower margin of the gastrocnemius muscle, the tibial nerve, after which all nerves had their regular trajectories. The right gluteal region showed no variations.

This is a case report on anatomical variation found in cadaver dissection; therefore, it is exempt from ethical permission.

Figure 2. *Photograph of the posterior region of the hip and thigh, left side, showing the division of the sciatic nerve: (1) tibial nerve and (2) common fibular nerve.*

DISCUSSION

The tibial and common fibular nerves represent two divisions within the sciatic nerve that are manifested at the origin of the nerve in the early stages of embryonic development and retain their identity throughout their entire length, although they are joined in a common nerve by a connective tissue sheath [10].

Variations of the sciatic nerve are not uncommon, and division into various regions such as the pelvic region, gluteal region, middle third of the posterior thigh, popliteal fossa apex, and below the popliteal fossa are mentioned in the literature, always in relation to the piriformis muscle, unlike the present case, where the high division was found in relation to the superior gemellus muscle. However, the present case is similar to the cases observed in 2003 by Babinski et al. [11] and in 2023 by Amlam et al. [12], where the tibial nerve passed deeply to the superior gemellus muscle, while the common fibular nerve passed superficially to the muscle.

As the main basis for classifying variations of the sciatic nerve, the authors, Beaton and Anson [13], described six different types of arrangements between the IN and the MP: type 1 – the IS emerging from the pelvis as a single bundle and passing under the MP; type 2 – with the IS emerging divided from the pelvis, with the CNF perforating the MP and the NT passing under the MP; type 3 – the IS emerging divided from the pelvis, the CNF passing over and the NT under the MP; type 4 – the NI emerging from the pelvis as a single bundle that perforates the MP; type 5 – the formation of the NI as a single bundle only occurs after leaving the pelvis, with its fibular branches passing over and the

tibial perforating the MP, and only then does its formation occur; and type 6 – the NI emerging from the pelvis as a single bundle and passing over the MP.

Thus, high division of the NI is rare, can be unilateral or bilateral, and varies according to different studies and regions. When attempting to classify the variation presented, it does not fit into any of the categories of Beaton and Anson [13]. The classifications proposed to date specify the variations in the origin of the sciatic nerve in relation to the piriformis muscle [4,7]. In this case, the variation was in relation to the superior gemellus muscle, which encourages modifications to the current classification system. [14]

In this case report, the high division of the sciatic nerve was found in the pelvis, which may make it more susceptible to piriformis syndrome or sacroiliitis. Iatrogenic injuries during hip arthroplasty and similar surgeries and inadvertent damage have already been mentioned [15]. Some variations can also lead to ineffective anesthetic block of the SI [4,16].

Knowledge of the unusual variety of the sciatic nerve allows the surgeon to find and preserve the nerve during the given procedure, and MRI remains the gold standard imaging method for identifying sciatic nerve variants to avoid intraoperative injuries [7,13].

This variation of the sciatic nerve may correlate with embryology, in which during embryological development, at the base of the limb bud, the nerves contributing to the lower limb form two plexuses (lumbar and sacral), later as the elements of each of these plexuses grow into the limb, they are subdivided into dorsal and ventral components. The sciatic nerve is formed when the dorsal component of the sacral plexus (common fibular nerve) and the ventral component (tibial nerve) move downward during the sixth week of the embryonic stage [17]. The separate development of the tibial and common fibular divisions of the sciatic nerve could explain the source of nerve variants.

A subsequent study by Mandiola et al. [18], conducted on full-term human fetuses, showed that the sciatic nerve constitutes a single trunk in the plexus in 48% of cases, with the remaining percentage corresponding to the individualized existence of the tibial and common fibular nerves in the sacral plexus. The separation observed during embryonic development may remain in adults, reflecting the topographical relationships of the sciatic nerve in the gluteal region. In approximately 10% to 12% of people, this nerve enters the gluteal region already divided [19], with the tibial portion passing through the lower edge of the piriformis muscle and the common fibular portion crossing the piriformis muscle [20]. However, the left antimere was more variable in the observations and more frequent in males and whites [21].

CONCLUSION

In this case report, an unusual morphological type of sciatic nerve pattern is observed, emerging from the pelvis as a single bundle and passing inferior to the piriformis muscle. Knowledge of these variations should always

be kept in mind, especially by physicians who perform hip interventions, nerve blocks, and the diagnosis and treatment of piriformis syndrome, for example.

Given the clinical importance of the sciatic nerve, it is vital to study the many patterns of variations, as we believe that further research is needed to clarify the embryological aspects of how the sciatic nerve varies in relation to the piriformis muscle and especially the superior gemellus muscle, since they develop together as the lower limb bud elongates.

This report is of great relevance to the literature in that it exposes a very rare variation of high division of the sciatic nerve passing through the superior gemellus muscle.

Disclosure of interest. The authors declare that they have no competing interest.

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REFERENCES

1. Lewis S, Jurak J, Lee C, Lewis R, Gest T. Anatomical variations of the sciatic nerve, in relation to the piriformis muscle. Translational Research in Anatomy
v.5, 2016, 15-19.
2. Mallikarjun A, Sangeetha V. Study of variant anatomy of sciatic nerve J. Clin. Diagn. Res., 8 (2014), pp. AC07-AC09.
3. Khan A A, Asari M A, Pasha M A. The sciatic nerve in human cadavers - high division or low formation? Folia. Morphol (Warsz). v. 75, n. 3, p. 306-310, 2016.
4. Berihu B A, Debeb Y G. Anatomical variation in bifurcation and trifurcations of sciatic nerve and its clinical implications: in selected university in Ethiopia. BMC. Res. Notes., v. 2, n. 8, p. 633, 2015.
5. Lucas J P, Sandouka A, Rosenthal O D. Coexistence of Brachial Plexus-Anterior Scalene and Sciatic Nerve-Piriformis Variants. Cureus. v. 12, n. 7, p. e9115, 2020.
6. Bergsteedt B J, Cilliers K, Greyling L M. Bifurcation of the sciatic nerve: A descriptive study on a South African cadaver cohort. Morphologie, v. 26, n. S1286-0115(21)00068-0, 2021.
7. Natsis K, et al. Anatomical variations between the sciatic nerve and the piriformis muscle: a contribution to surgical anatomy in piriformis syndrome. Surg. Radiol. Anat, v. 36, n. 3, p. 273-80, 2014.
8. Guvençer M, et al. Variations in the high division of the sciatic nerve and relationship between the sciatic nerve and the piriformis. Turk. Neurosurg. v. 19, n. 2, p. 139-44, 2009.
9. Adibatti M, Sangeetha V. Study on variant anatomy of sciatic nerve. J Clin Diagn Res., v. 8, n. 8, p. AC07-9, 2014.

10. Bardeen C R, Elting A W. A statistical study of the variations in the formation and position the lumbo-sacral plexus in man. Anat Anz, v.19, p.209-39, 1901.
11. Babinski, M.A.; Costa, W.S. A rare variation in the high division of the sciatic nerve surrounding the superior gemellus muscle. European Journal of Morphology, 2003, vol. 41, n1, p.41-42.
12. Amlan A, Ansari AW, Bhingardeo AV, Chandrupatla M, Bojja S A. Rare Variation of High Division of the Sciatic Nerve and Associated Neuromuscular Variations in the Gluteal Region. Cureus. 2023 Apr 5;15(4):e37187.
13. Beaton L E, Anson B J. The relation of the sciatic nerve and of its subdivisions to the piriformis muscle. The Anatomical Record, v. 70, n. 1, p. 1-5, 1937.
14. Poutoglidou F, et al. Sciatic Nerve Variants and the Piriformis Muscle: A Systematic Review and Meta-Analysis. Cureus., v. 12, n. 11, p. e11531, 2020.
15. Rajendiran R, Manivasagan M, Anandkumar S. Anomalous common peroneal nerve supplying the gluteus maximus muscle with high division of sciatic nerve. Anat J Africa. 2015, 4:551-4.
16. Sulak O, et al. Anatomical relation between sciatic nerve and piriformis muscle and its bifurcation level during fetal period in human. Surg. Radiol. Anat., v. 36, n. 3, p. 265-72, 2014.
17. Sawant S P. A case of bilateral trifurcation of sciatic nerve and its variant formation of sural nerve. World Research Journal of Orthopedics. v.1, 2013, p.07-10.
18. Mandiola E L, Hernández P H, Hofer U P, Crovetto E, Ortega E. Variaciones anatomicas del origen del nervio isquiatico (en fetos humanos de término). An Anat Norm, v.4, p.40-3, 1986.
19. Patel S V, et al. A variation in the high division of the sciatic nerve and its relation with piriformis muscle. Natl. J. Med. Res., v. 1, n. 2, p. 27-30, 2011.
20. Shastrakar R, Nakhate M, Sawant V G. Study of variation in the high division of sciatic nerve and its relationship with the piriformis muscle. Med. Res. Chron., v. 2, n. 3, p. 359-365, 2015.
21. Ogeng'o J A, et al. Variant anatomy of sciatic nerve in a black Kenan population. Folia Morphol (Warsz), v.70, n. 3, p. 175-9, 2011.