

A Study Of Sciatic Nerve And Its Variations With Its Clinical Significance

Dr. Haridass Geetha Sangeetha

Assistant Professor,

Institute Of Anatomy Madras Medical College Chennai, 600003

***Corresponding Author:**

Dr. Haridass Geetha Sangeetha¹

Senior Assistant Professor, Institute of Anatomy Madras Medical College Chennai-3

Dr. P.J. Seeja², Dr. Natarajan Bama³, Dr. S. Giridharan⁴

²Assistant Professor, Department of Anatomy, Stanley Medical College Chennai-1

³Senior Assistant Professor, Institute of Anatomy Madras Medical College Chennai-3

⁴Senior Assistant Professor, Govt. RSRM lying in Hospital, Stanley Medical College & Hospital, Chennai-1.

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Keywords: Common peroneal nerve, High division, Piriformis muscle, Sciatic nerve, Tibial nerve

Introduction

Sciatic nerve is the thickest nerve in the body and arise from spinal nerve roots of L4-S3. It leaves the pelvis through the greater sciatic foramen below the piriformis. It runs down undercover of gluteus maximus, midway between greater trochanter and ischial tuberosity. In the gluteal region it rests successively on the dorsal surface of ischium, tendon of obturator internus, quadratus femoris and adductor magnus. It then runs along the back of the thigh to about its lower one third, where it divides into tibial nerve and common peroneal nerve at a varying level but usually proximal to the knee

Beaton & Anson classification

1. Type 1: Undivided sciatic nerve emerges below the piriformis muscle
2. Type 2: Sciatic nerve division pass through and below the piriformis muscle
3. Type 3: Sciatic nerve division pass through and above the piriformis muscle
4. Type 4: Undivided sciatic nerve emerges above the piriformis muscle
5. Type 5: Sciatic nerve division pass above and below the piriformis muscle
6. Type 6: Undivided sciatic nerve emerges through the piriformis muscle

Aim Of The Study

1. To study the variation in the course of the sciatic nerve in reference to its level of division into Tibial nerve and common peroneal nerve and its relation to piriformis muscle
2. Classify the course of sciatic nerve according to Beaton and Anson classification.

Observation

Out of the 18 cadavers studied, unilateral high division of sciatic nerve was observed in 2 cadavers. In both the specimens, the division of sciatic nerve was within the pelvis, the common peroneal nerve was found passing through the fibers of piriformis and the tibial nerve passed below the piriformis.

In this study we observed a total number of 36 specimens.

Based on the Beaton and Anson classification two types in the course of sciatic nerve were observed.

Type 1 - Undivided sciatic nerve emerging below Piriformis muscle observed in 34 specimens (94.5%).

Type 2 - Divided sciatic nerve emerges through and below Piriformis muscle in 2 specimens (5.5%)

Discussion

It has been observed that sciatic nerve usually shows a lot of variations in its division, especially its high division. Many authors have attempted classification of high divisions of Sciatic Nerve. The best known classification is by Beaton and Anson's classification. This study builds on previous reports in literature and re-emphasizes the importance of identifying sciatic nerve bifurcation levels.

Beaton & Anson *et al* studied the relation of sciatic nerve and piriformis muscle and found that 84% of the undivided nerve pass below the piriformis muscle, 11% divided nerve pass through and below piriformis, 3% divided nerve pass through and above the muscle and 0.8% undivided nerve above piriformis.

Ugrenovic *et al* observed at the level of the sciatic nerve division and its relation to the piriformis muscle. According to them sciatic nerve left the pelvis below the piriformis in 96%, while in 4% the variable relations between sciatic nerve and piriformis muscle were detected.

Saleh *et al* concluded in their studies that sciatic nerve divided at a mean distance ranging from 0-115 mm above the popliteal fossa. An ideal popliteal block is by insertion of the needle at 100 mm above the popliteal crease *i.e.* proximal to division of sciatic nerve.

Saleh *et al.* mentioned in their studies that sciatic nerve division occurs at a variable level about the 50-180 mm above the knee and may account for frequent failures with popliteal blocks.

Guvencer *et al.* observed in variations in the high division of the sciatic nerve and relationship between the sciatic nerve and the Piriformis. They said that 52% of sciatic nerve exited as whole nerve without any division, whereas in 48% a high division was observed.

The present study was done in 36 gluteal regions and high division were seen in 2 gluteal regions. In the present study 94.5% (34 gluteal regions) observed with emergence of undivided sciatic nerve below Piriformis muscle, this result is in close relation with Beaton *et al* (90%), Beaton & Anson *et al* (84.2%), Moore & Dalley *et al* (87.3%), Machado *et al* (82%).

In this study 5.5% (2 gluteal region) observed with divided sciatic nerve was within the pelvis, the common peroneal nerve was found passing through the fibers of piriformis and the tibial nerve passed below the piriformis, this result is in close relation with Beaton *et al* (7.1%), Beaton & Anson *et al* (11.7%), Moore & Dalley *et al* (12.2%).

Conclusion

The knowledge regarding the level of division of the sciatic nerve and the location where it leaves the pelvis is of great importance. Knowledge of this variation in the course of sciatic nerve is important clinically as it is a probable cause of sciatic nerve entrapment resulting in non discogenic sciatica, piriformis syndrome and intramuscular gluteal injections. The present study, evaluating the incidence of high division of sciatic nerve may help clinicians in management of conditions associated with sciatic nerve. Also while performing surgery; a surgeon should be aware of the variations in the normal branching pattern and divisions of the sciatic nerve.

References

1. Arifoglu Y, Sargon MF, and Tanyeli E, Yazar F: Double superior gemellus together with double piriformis and high division of the sciatic nerve. *Surg Radiol Anat* 19: 407–408, 1997
2. Babinski MA, Machado FA, Costa WS: A rare variation in the high division of the sciatic nerve surrounding the superior gemellus muscle. *Eur J of Morphol* 41[1]: 41–42, 2003
3. Barton PM: Piriformis syndrome: A rational approach to management. *Pain* 47: 345–352, 1991
4. Beaton LE, Anson BJ: The relation of the sciatic nerve and its subdivisions to the piriformis muscle. *Anat Rec* 70: 1–5, 1937
5. Beaton LE: The sciatic nerve and piriform muscle: Their interrelation a possible cause of coccygodynia. *J Bone Joint Surgery Am* 20: 686–688, 1938
6. Broadhurst NA, Simmons N, Bond MJ: Piriformis syndrome: Correlation of muscle morphology with symptoms and signs. *Arch Phys Med Rehabil* 85: 2036–2039, 2004

7. Chen WS: Bipartite piriformis muscle: An unusual cause of sciatic nerve entrapment. *Pain* 58: 269–272, 1994
8. Chiba S: Multiple positional relationships of nerves arising from the sacral plexus to the piriformis muscle in humans. *Kaibogaku Zasshi* 67[6]: 691–724, 1992
9. Foster MR. Piriformis syndrome. *Orthopedics* 25[8]: 821–825, 2002
10. Guvencer M, Akyer PŞ, İyem C, Tetik S, Naderi S: The topographic location and the relation of the piriformis muscle and the sciatic nerve. *Surg Radiol Anat* 30: 467–474, 2008
11. Kırıcı Y, Yazar F, Ozan H: The neurovascular and muscular anomalies of the gluteal region: an atypical pudendal nerve. *Surg Radiol Anat* 21[6]: 393–396, 1999
12. Kırıcı Y, Ozan H: Double gluteus maximus muscle with associated variations in the gluteal region. *Surg Radiol Anat* 21[6]: 397–400, 1999.
13. Kosukegawa I, Yoshimoto M, Isogai S, Nonaka S, Yamashita T: Piriformis syndrome resulting from a rare anatomic variation. *Spine* 31[18]: 664–666, 2006
14. Machado FA, Babinski MA, Brasil FB, Favorito LA, Abidu-Figueiredo M, Costa MG: Anatomical variations between sciatic nerve and piriform muscle during fetal period in human. *Int J Morphol* 21[1]: 29–35, 2003
15. Mas N, Ozekşi P, Ozdemir B, Kapakin S, Sargon MF, Celik HH, Yener N: A case of bilateral high division of the sciatic nerves, together with a unilateral unusual course of the tibial nerve. *Neuroanatomy* 2: 13–15, 2003
16. Moore KL, Dalley AF: *Clinical Oriented Anatomy*, 4th edition, Baltimore Lippincott Williams&Wilkins, 1999, 558
17. Ozaki S, Hamabe T, Muro T: Piriformis syndrome resulting from an anomalous relationship between the sciatic nerve and piriformis muscle. *Orthopedics* 22[8]: 771–772, 1999
18. Papadopoulos EC, Khan SN: Piriformis syndrome and low back pain: A new classification and review of the literature. *Orthop Clin Am* 35: 65–71, 2004
19. Pecina M: Contribution to the etiological explanation of the piriformis syndrome. *Acta Anat[Basel]* 105:181–187, 1979
20. Pokorny D, Jahoda D, Veigl D, Pinskerova V, Sonza A: Topographic variations of the relationship of the sciatic nerve and the piriformis muscle and its relevance to palsy after total hip arthroplasty. *Surg Radiol Anat* 28: 88–91, 2006
21. Sayson SC, Ducey JP, Maybrey JB, Wesley RL, Vermilion D: Sciatic entrapment neuropathy associated with an anomalous piriformis muscle. *Pain* 59: 149–152, 1994
22. Silver JK, Leadbetter WB: Piriformis syndrome: Assessment of current practice and literature review. *Orthopedics* 21[10]: 1133–1135, 1998
23. Standring S: *Gray's Anatomy, The anatomical basis of clinical practice*. 39. edi. Spain: Elsevier Churchill Livingstone, 2005:1403,1404,1446
24. Ugrenovic S, Jovanovic I, Krstic V, Stojanovic V, Vasovic L, Antic S, Pavlovic S: The level of the sciatic nerve division and its relations to the piriform muscle. *Vojnosanit Pregl.* 62[1]: 45–49, 2005
25. Uluutku MH, Kurtoğlu Z: Variations of nerves located in deep gluteal region. *Okajimas Folia Anat Jpn* 76[5]: 273–276, 1999.

Tables & Figures

Comparison of variations in the high division of the sciatic nerve and relationship between the sciatic nerve and the piriformis is given in the table below.

“Table 1 : Comparison of variations in the high division of the sciatic nerve and relationship between the sciatic nerve and the piriformis”

NAME OF THE STUDY	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	TYPE 6
Beaton & anson ⁴ et al	84.2%	11.7%	3.3%	0.8%		
Beaton ⁵ et al	90%	7.1%	2.1%	0.8%		
Uluutku&Kurtoğlu ²⁵ et al.	74%	16%	10%			
Moore&Dalley ¹⁶ et al.	87.3%	12.2%	0.5%			
Chiba ⁸ et al.	66%	34%				
Machado ¹⁴ et al.	82%	16%	2%			
Pokorny ²⁰ et al	79.1%	14.3%				
Present study	94.5%	5.5%				

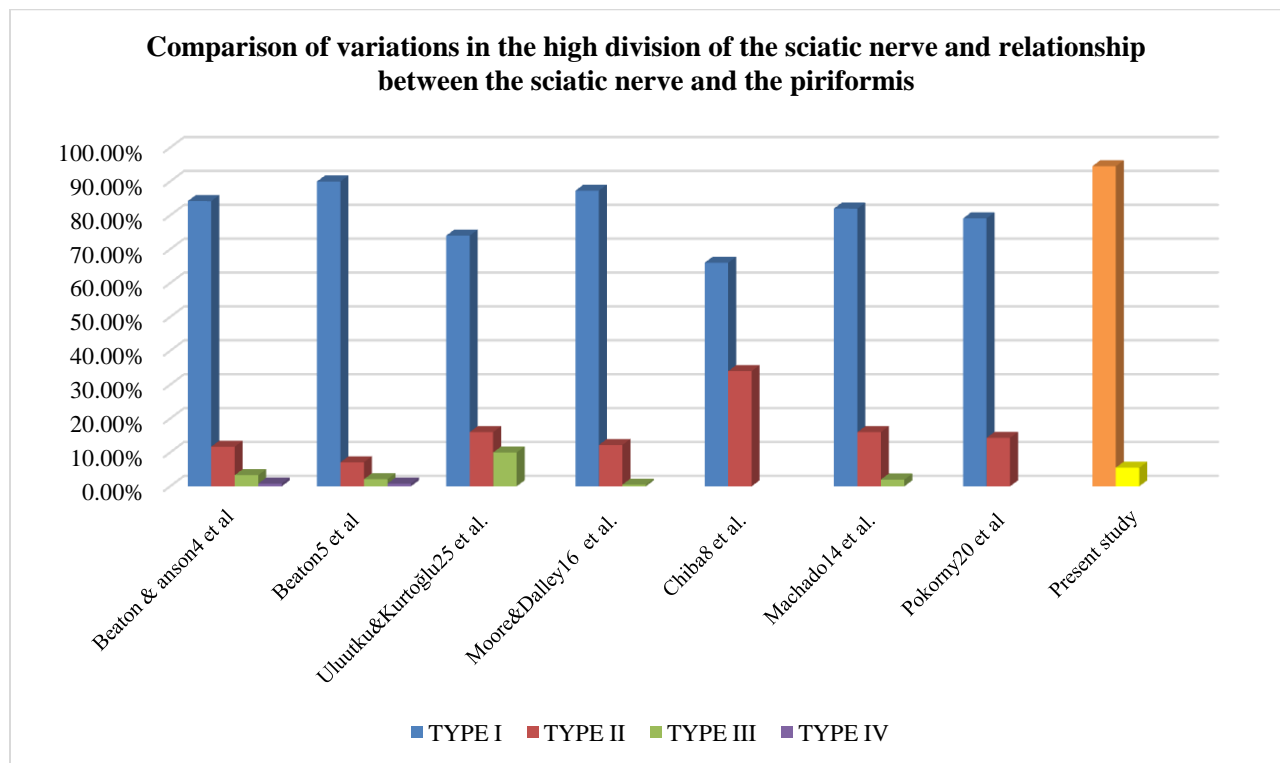
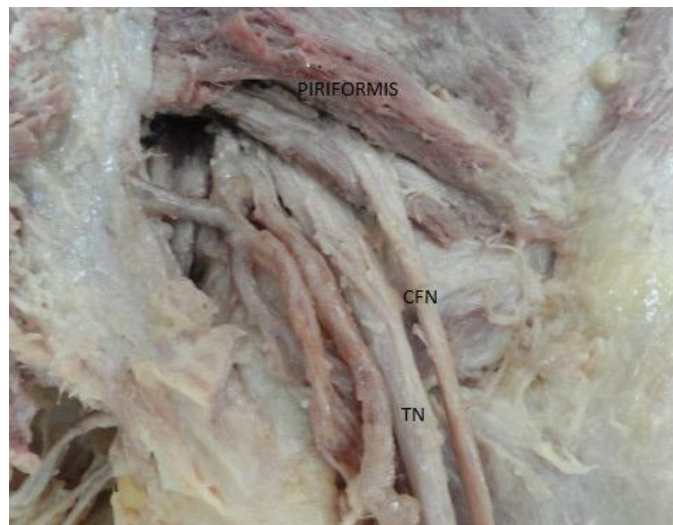


Figure 1 : Type 1 - Undivided sciatic nerve emerging below Piriformis muscle



Figure 2 : Type 2 - Sciatic nerve division passes through and below Piriformis muscle



CFN - Common Fibular Nerve or Common Peroneal Nerve

TN - Tibial Nerve

SG - Superior Gemelli