

Original Communication**VARIANT RELATION OF THE SCIATIC NERVE TO THE PIRIFORMIS MUSCLE: A CADAVERIC STUDY FROM NORTH INDIA****Virendra Budhiraja, Rakhi Rastogi, Sanjeev K Jain, Nidhi Sharma, Rohin Garg, Hina Nafees***Department of Anatomy Teerthanker Mahaveer Medical College and Research Centre, Moradabad (Uttar Pradesh), India***RESUMEN**

El nervio ciático sale de la pelvis y entra en la región glútea debajo del músculo piriforme como un único tronco. Tiene dos componentes: el nervio peroneo común y el nervio tibial. La relación variable del nervio ciático con el músculo piriforme y su longitud hace que el nervio sea vulnerable a las lesiones. Estudiamos la relación variable del nervio ciático en sesenta extremidades inferiores de treinta cadáveres y encontramos el nervio ciático emergiendo indiviso por debajo del músculo piriforme en el 68,33% de los casos, pero en el 31,66% el nervio ciático estaba dividido arriba en la pelvis. En el 18,33% de los casos el componente peroneo común emergió arriba y en el 13,33% de los casos emergió a través del músculo piriforme. Pensamos que tener un conocimiento adecuado sobre la anatomía del nervio ciático es bueno para los resultados clínicos.

Palabras Clave: *Nervio ciático, músculo piriforme, nervio peroneo común, nervio tibial*

ABSTRACT

Sciatic nerve leaves the pelvis and enters the gluteal region below the piriformis muscle as single trunk. It has two components common peroneal nerve and the tibial nerve. The variable relationship of sciatic nerve with the piriformis muscle and its long course makes the nerve vulnerable to injury. We studied sciatic nerve variable relation in sixty lower extremities of thirty cadavers and found the sciatic nerve emerging undivided below the piriformis muscle in 68.33% of cases but in 31.66% the sciatic nerve divided high in the pelvis. In 18.33% cases the common peroneal component emerged above and in 13.33% of cases it emerged through the piriformis muscle. We think proper knowledge of the anatomy of the sciatic nerve is good for clinical outcomes

Key Words: *Sciatic nerve, piriformis muscle, common peroneal nerve, tibial nerve*

INTRODUCTION

Sciatic nerve is the largest branch of lumbosacral plexus. It contains nerve fibers of L4, L5, S1, S2 and S3 spinal segments. Sciatic nerve enters the gluteal region after leaving the pelvis through greater sciatic foramen where it lies as a single trunk below the piriformis muscle. The nerve usually bifurcates into the tibial nerve and the common peroneal nerve at or near to superior angle of popliteal fossa (Standring et al, 2008). Variations at the level of bifurcation of the sciatic nerve are not uncommon (Prakash et al, 2010; Sabnis, 2012; Shewale et al, 2013). The long course and the variable relation of the sciatic nerve make it vulnerable to injury in clinical problems like- piriformis syndrome, posterior dislocation of hip joint, fracture of hip joint, total hip replacement and hemiarthroplasty (Yuen and So, 1999; Robert and Jolene, 2003; Paul et al, 1993; Pandian et al, 2006). Keeping in mind its clinical relevance in the present study we tried to bring some light to the variable relationship of the sciatic nerve with the piriformis muscle.

* *Correspondence to: Dr. Virendra Budhiraja*, Professor and Head, Department of Anatomy, Teerthanker Mahaveer Medical College and Research Centre, Moradabad (Uttar Pradesh), India. virendrabudhiraja1970@gmail.com

Received: 9 December, 2015. **Revised:** 13 January, 2016. **Accepted:** 26 January, 2016.

MATERIAL AND METHOD

The present study is an observational study. We observed emergence of the sciatic nerve in relation to the piriformis muscle in thirty cadavers (sixty lower extremities) obtained from the anatomy department of the Teerthanker Mahaveer Medical College and Research Centre. The anatomical relationship between the sciatic nerve and the piriformis muscle was classified according to Beaton and Anson (1937) classification into six types. The percentage of each type was calculated to compare the variables.

RESULTS

In forty one extremities (68.33%) the sciatic nerve emerged in gluteal region below the piriformis muscle as mentioned in majority of text books of anatomy. In nineteen extremities (31.66%) the two components of the sciatic nerve namely the tibial nerve and the common peroneal nerve separated early in the pelvis and emerged separately with relation to the piriformis muscle.

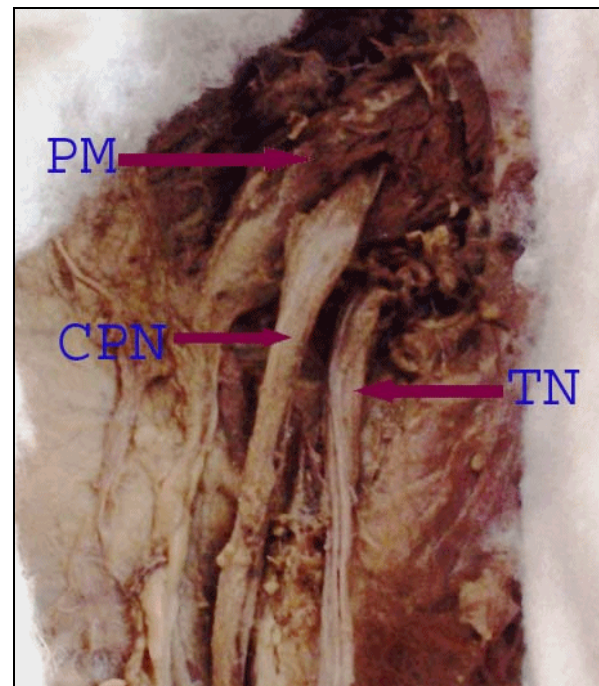


Figure 1 - Common peroneal nerve pierced the piriformis muscle and the tibial nerve emerged below it. PM- piriformis muscle, CPN- common peroneal nerve, TN- tibial nerve

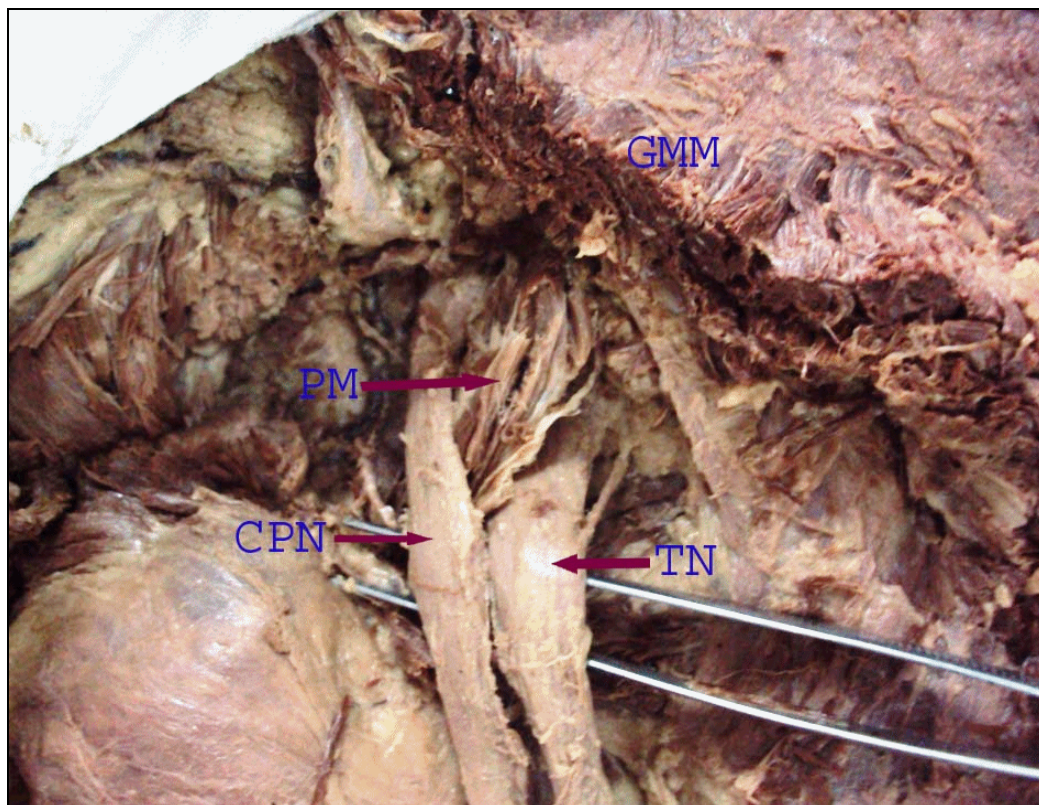


Figure 2 - Common peroneal nerve emerged above the piriformis muscle and the tibial nerve emerged below it. PM- piriformis muscle, CPN- common peroneal nerve, TN- tibial nerve, GMM-gluteus maximus muscle

Out of nineteen extremities in eight extremities (13.33%) the common peroneal nerve pierced the piriformis muscle and the tibial nerve emerged below it (Fig. 1). In eleven extremities (18.33%) the common peroneal nerve emerged above the piriformis muscle and the tibial nerve emerged below it (Fig. 2). We classified our observations in accordance to Beaton and Anson (1937) classification and represented them in

Table 1. We also observed one case where the common peroneal nerve emerged above and the tibial nerve emerged below the piriformis muscle, both the components again merge to form the main trunk of the sciatic nerve, which run for a short course as it leaves the gluteal region and again bifurcate into the common peroneal nerve and the tibial nerve (Fig. 3).

Type	Variations	Number of cases and percentage
I	Undivided nerve emerges below the undivided muscle	41/60 (68.33%)
II	Nerve component emerges between and below the undivided muscle	8/60 (13.33%)
III	The common peroneal nerve emerges above the piriformis muscle and the tibial nerve emerges below the piriformis muscle	11/60 (18.33)%
IV	The sciatic nerve undivided passes through the piriformis muscle	none
V	The common peroneal nerve emerges above the piriformis muscle and the tibial nerve emerges through the piriformis muscle	none
VI	The sciatic nerve undivided passes above the piriformis muscle	none

Table 1 - Relationship between the sciatic nerve and the piriformis muscle

DISCUSSION

Developmentally the nerves form two plexus for lower limb namely lumbar plexus and sacral plexus at the base of limb bud. As the plexuses grow into the limb they divide into ventral and dorsal components. The sciatic nerve formation occurs due to the approximation of dorsal and ventral components (Demiryurek et al, 2002). Failure of approximation of dorsal and ventral components leads to high division of the sciatic nerve in pelvic region as observed in 31.66% cases in the present study and some other studies like 11.11% (Shewale et al, 2013), 16.3% (Prakesh et al, 2010).

Depending upon emergence of the components of the sciatic nerve in relation to the piriformis muscle Beaton and Anson (1937) proposed a classification which describes relationship of the components into six types (type I-type VI). The most common is type I, which is considered as normal relationship where undivided nerve

emerges below undivided muscle. In most of the previous studies like Pokorny et al. (2006), Natis et al. (2014) and Smoll (2011) type I was found to be the most common variety as 79.1%, 93.6% and 83.1% respectively. In the present study it is also the most common variety but with lesser frequency (68.33%). Type II states that nerve components emerges between and below the undivided muscle. In this type the common peroneal nerve pierces the piriformis muscle while the tibial nerve emerges below it. In the present study type II relationship was observed in 13.33% cases which was found to be close to the other studies like 14.30% (Pokorny et al, 2006), 16% (Guvencer et al, 2009) but much higher to 4% (Anbumani et al, 2015). In type III the common peroneal nerve emerges above and the tibial nerve emerges below the piriformis muscle. Type III variation accounts for 18.33% in the present study which is much higher than 1.5% (Ugrenovic et al, 2005), 0.5% (Moore and Daily, 1999) and 10% (Pokorny et al, 2006)

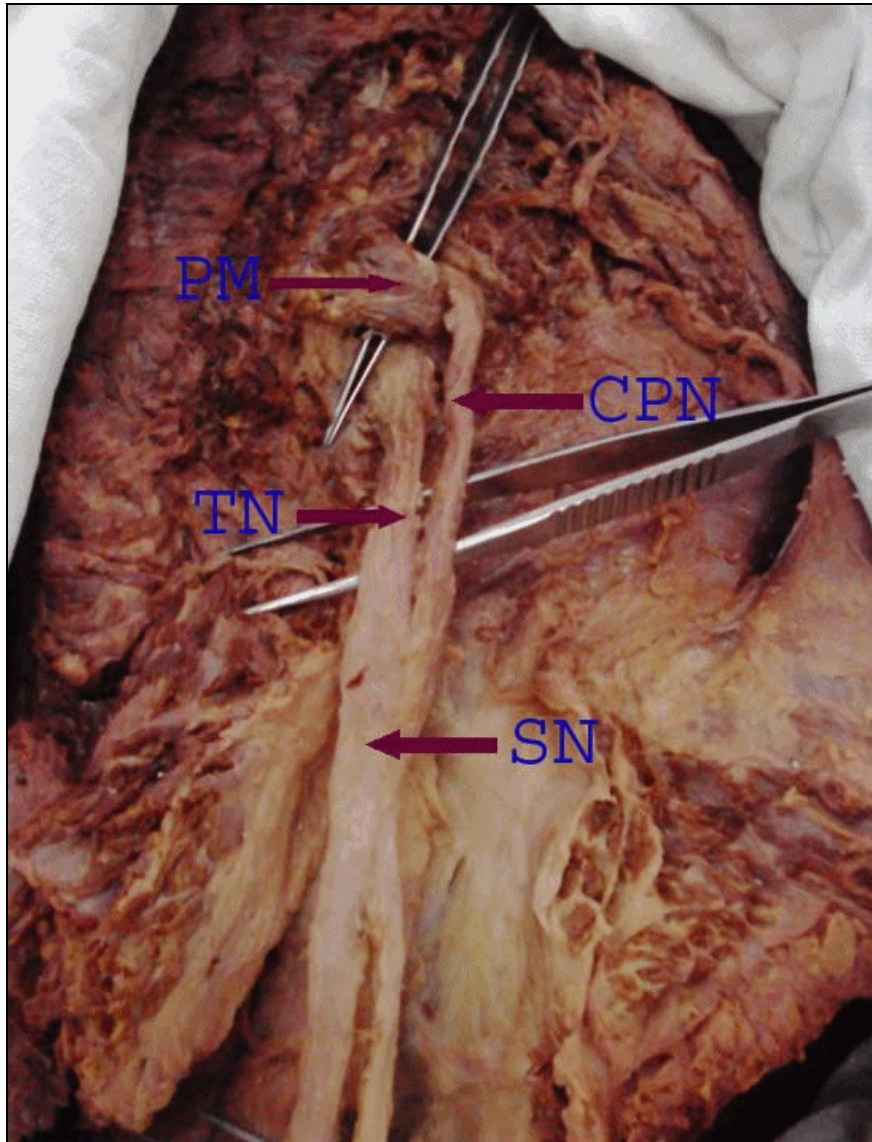


Figure 3 - Common peroneal nerve emerged above the piriformis muscle and the tibial nerve emerged below it and then merges to form the sciatic nerve. PM- piriformis muscle, CPN- common peroneal nerve, TN- tibial nerve, SN-sciatic nerve

We did not find any case of type IV, type V and type VI. We found an interesting case where the common peroneal nerve emerges above and the tibial nerve emerges below the piriformis muscle and the two components merged to form the main trunk of sciatic nerve, but later on at the lower margin of the gluteal region separated again as the common peroneal nerve and the tibial nerve.

The proper knowledge of variations in the formation, course and division of the sciatic nerve is helpful to avoid complications during anaesthesia and surgery as high division of the sciatic nerve may sometimes lead to failure of the sciatic nerve block at the popliteal fossa. Although variable relation of the sciatic nerve with

the piriformis muscle is not the sole reason for the piriformis syndrome but some variations like type III explains the anatomical basis of the piriformis syndrome. We compared our results with previous studies and also brought into light a rare variation. We think that the knowledge of anatomy of the sciatic nerve is helpful for clinical outcomes.

Conflict of Interest

None

Source of Funding

None

Ethical Approval

The work was approved by Institutional research committee and ethical committee.

Informed Consent

The present study (a cadaveric study) is on human donated bodies to the department of anatomy by their relatives with consent to use them for teaching and research purposes.

Author's Contributions

All the authors contributed to the research. Dr. Virendra Budhiraja, Dr. Rakhi Rastogi, Dr. Sanjeev K Jain, Dr. Nidhi Sharma, Dr. Rohin Garg and Dr. Hina Nafees helped in planning, observations and analyzing the results.

REFERENCES

- Anbumani TL, Thamarai SA, Anthony AS.* 2015. Sciatic nerve and its variations: An anatomical study. *Int J Anat Res* 3: 1121-27.
- Demiryurek D, Bayramoglu A, Erbil M, Aldur MM, Mustafa ES.* 2002. Bilateral divided piriformis muscle together with high division of sciatic nerve. *Gazi Med J* 13: 41-44.
- Guvencer M, Iyem C, Akyer P, Tetik S, Naderi S.* 2009. Variations in the high division of the sciatic nerve and relationship between sciatic nerve & the piriformis. *Turk Neurosurg* 19: 139-44.
- Moore KL, Dalley AF.* 1999. Clinical oriented anatomy, 4th ed. Baltimore Lippincott Williams and Wilkins 558.
- Natsis K, Totlis T, Konstantinidis GA, Paraskevas G, Piagkou M, Koebke J.* 2014. Anatomical variations between the sciatic nerve and the piriformis muscle: a contribution to surgical anatomy in piriformis syndrome. *Surg Radiol Anat* 36: 273-80.
- Pandian JD, Bose S, Daniel V, Singh Y, Abraham AP.* 2006. 11: 165-71.
- Paul RF, Marc FS, Anthony WK, Milton L.* 1993. Injury to sciatic nerve associated with acetabular fracture. *The journal of bone and joint surgery* 75: 1157.
- Pokorny D, Jahoda D, Veigl D, Pinskerova V, Sonsa A.* 2006. 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.
- Prakash, Bhardwaj AK, Devi MN, Sridevi NS, Rao PK, Singh G.* 2010. Sciatic nerve division: a cadaveric study in the Indian population and review of literature. *Singapore Med J* 51: 721-23.
- Robert FH, Jolenefox RN.* 2003. Sciatic nerve injuries associated with traumatic posterior hip dislocation. *American journal of emergency medicine* 21: 545-48.
- Sabnis AS.* 2012. Anatomical variations of sciatic nerve bifurcation in human cadavers. *Journal of clinical research letters* 3: 46-48.
- Shewale AD, Karambelkar RR, Umarji BN.* 2013. Study of variations in the division, course and termination of the sciatic nerve. *Journal of Krishna institute of medical sciences university.* 2: 62-68.
- Smoll NR.* 2010. Variations of the piriformis and sciatic nerve with clinical consequence: a review. *Clin Anat* 23: 8-17.
- Stranding S, Berkowitz BKB, Hacknay CM, Ruskell IGL.* 2008. The anatomical basis of clinical practice 40th ed. New York. Churchill and Livingstone
- Ugrenovic S, Jovanovic I, Krstic V, Stojanovic V, Vasovic L, Antic S, Pavlovic S.* 2005. The level of the sciatic nerve division and its relations to the piriformis muscle. *Vojnosanit pregl* 62: 45-49.
- Uluutku MH, Kurtoglu Z.* 1999. Variations of nerves located in deep gluteal region. *Okajimas folia Anat Jpn* 76: 273-76.
- Yuen EC, So YT.* 1999. Sciatic neuropathy. *Neurol Clin* 17: 617-31.