https://doi.org/10.48047/AFJBS.6.13.2024.6714-6727

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

RETROSPECTIVE CADAVERIC OBSERVATIONAL STUDYOF SCIATIC NERVE BIFURCATION WITH RESPECT TO PIRIFORMIS MUSCLE.

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Volume 6, Issue 13, Aug 2024
Received: 15 June 2024
Accepted: 25 July 2024
Published: 15 Aug 2024
doi: 10.48047/AFJBS.6.13.2024.6714-6727

Abstract:

Background: Being the body's widest nerve the sciatic nerve gives two major Tibial and Common Peroneal components branches that form the nerve supply of the gluteal and posterior thigh region. They come from the ventral rami of the lumbosacral plexus' L4 to S3 spinal nerves. Underneath the Piriformis muscle, it leaves the pelvis through the greater sciatic foramen and travels to the knee in the back of the leg. This research aims to recognize the variations in the sciatic nerve's branching structure.
Methods: Sixty lower limb specimens from Thirty formalin-fixed cadavers (26 male and 4 female) were used in the investigation (52 Male & 8 Female). To reveal the sciatic nerve, the gluteal area and posterior compartment of the thigh were dissected. We observed and documented variations in the piriformis muscle's proximity to the sciatic nerve bifurcation.
Results: Of Sixty lower limb specimens, Fifty-five (92%) displayed normal sciatic nerve architecture, whereas the remaining 5 (8%) displayed abnormalities.
Result:
In our study, 92% of the specimens (55 specimens) were classified as type I, 5% (3 specimens) as type II, and 3% (2 specimens) as type III. Beaton and Anson's classification type IV, type V, and typeVI specimens are not present in our study.
Conclusion:
The SN's bifurcation does not vary during regular dissections, but occasionally we may detect dividedor undivided SN components, which should be taken into consideration when treating patients for sciatica, hip operations, and gluteal injection SN block. These variations in bifurcations should be noted by experts before continuing with the surgical treatment plan.
Key-words: Sciatic nerve, Tibial and Common Peroneal nerves, Bifurcation of the Sciatic nerve

Introduction:

Background

The longest and widest sciatic nerve gives off the tibial and the common peroneal components that constitute its branches. The initial common trunk for both parts is the lumbosacral plexus. The ventral rami of the L4 to S3 spinal nerves are what gives rise to the tibial component which comes from ventral branches. The ventral rami of the L4 to S2 spinal nerves come together to produce the common peroneal component which comes from dorsal branches [1].

The greater sciatic foramen, which is located below the piriformis muscle, is where the sciatic nerve exits the pelvis. It splits into the tibial nerve and common peroneal (fibular) nerves on the back of the thigh at a variety of levels close to the popliteal fossa.

The sciatic nerve divides into the tibial and common peroneal nerves at a fairly varied position. The popliteal fossa's apex is the most frequent location of its's division, where the middle and lower thirds of the thigh meet. The division can happen at any level higher than this, although it rarely happens lower. The main parts frequently depart from the sacral plexus separately and may pierce through the piriformis or may be superficial or deep to it [1]. From the sacral plexus to the lower portion of the popliteal fossa, it divides into the tibial and common peroneal nerves in a variety of ways, according to several authors [3–8].

The sciatic nerve supplies all the muscles below the knee, including the knee flexors. The piriformis syndrome, a common anatomical variety but an exceptionally rare entrapment neuropathy, makes the nerve vulnerable in posterior hip dislocation since it emerges from the pelvis. Iatrogenic injury is the most frequent reason for significant sciatic nerve damage (and the ensuing high-profile legal and medical claims). Incorrect therapeutic injections into the gluteus maximus muscle may cause damage to it. One per cent of patients who undergo total hip replacement or similar procedures also develop sciatic nerve palsy. Due to its rarity, fullsciatic nerve palsy typically affects the common peroneal nerve [1].

The piriformis syndrome, sciatica, and other neurological issues may be exacerbated by these structural changes [9]. Clinicians should consider this when formulating therapies that revolve around the sciatic nerve and its division in the lower extremity [2].

The objective of this study is to identify variations in the sciatic nerve's branching pattern in the gluteal region concerning the piriformis muscle.

Subjects and Methods:

The Department of Anatomy GSL Medical College and General Hospital acquired 60 lower limbs (52 males and 8 females) from 30 (26 male and 4 female) formalin-fixed cadavers without any gross disease for this investigation. The General Hospital ethics committee and GSL Medical College both granted the proper consent. From 2016 to 2019, the study was conducted while medical undergraduate students were taking their regular dissection classes. The lower extremities of the cadaver were all consecutively numbered with the letters "M" for males and "F" for females. The structures hidden by the gluteus maximus muscle were exposed during dissection of the gluteal area. The relationship between the piriformis muscle and the sciatic nerve and its branches was identified, noted, and photo documented. To observe the sciatic nerve's path and branching variations, the posterior compartment of the thigh was also dissected.

Design of the study and statistical evaluation

In the current study, we chose units at the time of data collection using the convenience sampling (non-probability sampling) method. All accessible cadavers devoid of obvious pathology were used in the study, and the information gathered was documented. The examination of potential variations likewise employed the same statistical methodology. This research found differences in the sciatic nerve with high and low divisions. An independent prospective sample from the lower limbs' gluteal and posterior thigh regions was used to examine the frequency of anatomical changes. The percentages of the sciatic nerve's anatomical variations were recorded. Frequency tables and figures are used to display the results.

Results:

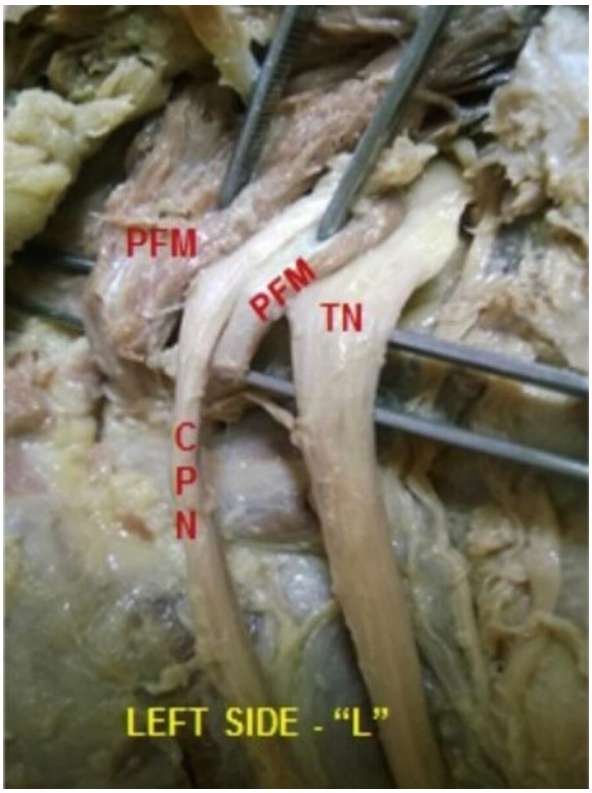
1. For this investigation, 30 formalin-fixed cadavers with 60 lower limbs each were utilized. 55 of their lower limbs (or 92%) displayed the sciatic nerve's normal structure. The sciatic nerve has variations in five lower limbs (8%) of the population.
2. In Four out of Eight female lower extremities, variations in the sciatic nerve division pattern were found.
3. Both sides of the cadaver with index F2 (Figs. 1 and 2) showed increased division; the tibial nerve crossed the piriformis muscle and the common peroneal nerve went through it.
4. The tibial nerve and common peroneal nerve went underneath the piriformis muscle in a female cadaver with the index number F3 (Figs. 3 and 4).
5. One male lower extremity out of 52 showed unilateral higher division.
6. In the right lower leg of the male cadaver with index M26 (Fig. 5), the common peroneal nerve and tibial nerve both travelled through the piriformis muscle.

Table - 1

Name of the investigation	Type						Trifurcation of the Nerve
	I	II	III	IV	V	VI	-
Present Study 60 gluteal regions	92%	5%	3%	-	-	-	-
Beaton & Anson 120 cadavers [10]	84.2%	11.7%	3.3 %	0.8%	-	-	-
Beaton 240 cadavers [11]	90%	7.1%	2.1 %	0.8%	-	-	-
Anbumani T.L et al 50 lower limbs [14]	90%	4%	4%	-	-	-	2%
M. Guvencer et al., 50 lower limbs (2009) [19]	52	16%	8%	-	-	-	-
Pokorny et al. 91 cadavers [22]	79.1%	14.3%	4.4%	2.2%	-	-	-
Ugrenovic et al. 100 fetuses [23]	96%	2.5	1.5%	-	-	-	-
Shailesh et al., 86 lower limbs [24]	91.80%	2.32%	5.8 1%	-	-	-	-
Saritha S et al., 50	92%	2%	2%				

lower limbs (2012) [26]							
Kumar Jha et al [27]	92.5%	2.5%	5%	-	-	-	-

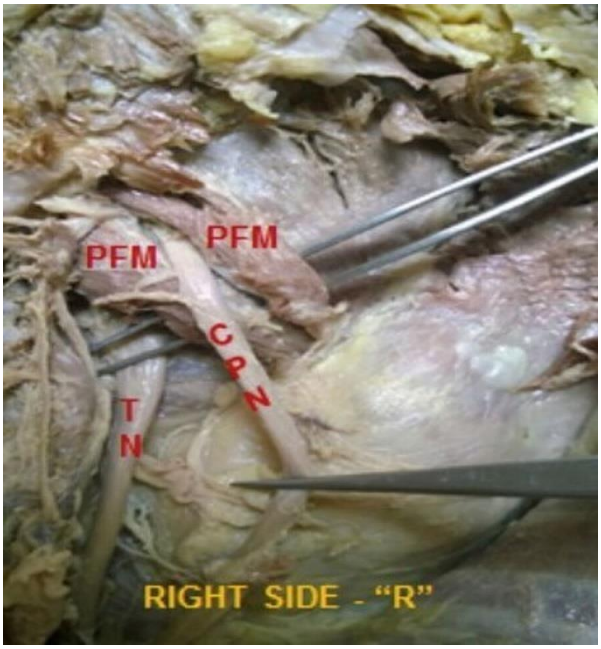
Figure 1 - Female cadaver - left side: F 2.



Tibial nerve (TN) emerging under the piriformis muscle

Common peroneal nerve (CPM)passing through the piriformis muscle (PFM)

Figure 2: Female cadaver, right side: F 2.



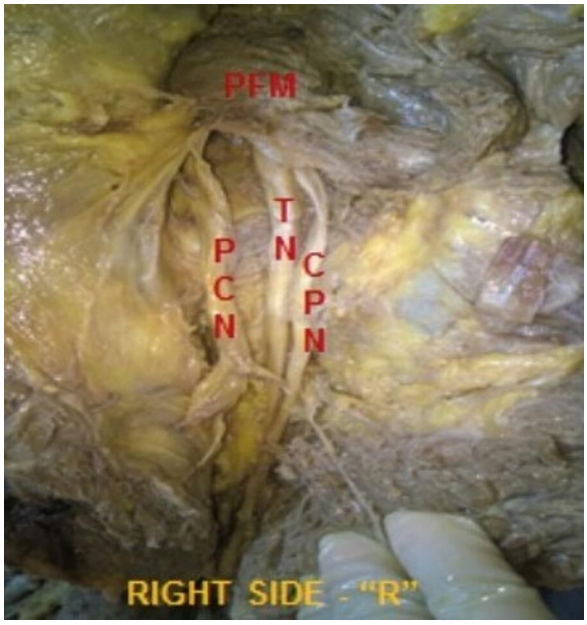
Tibial nerve (TN) emerging beneath the piriformis muscle

Common peroneal nerve (CPN)passing through the piriformis muscle (PFM)

Figure 3: Female cadaver: left side F 3

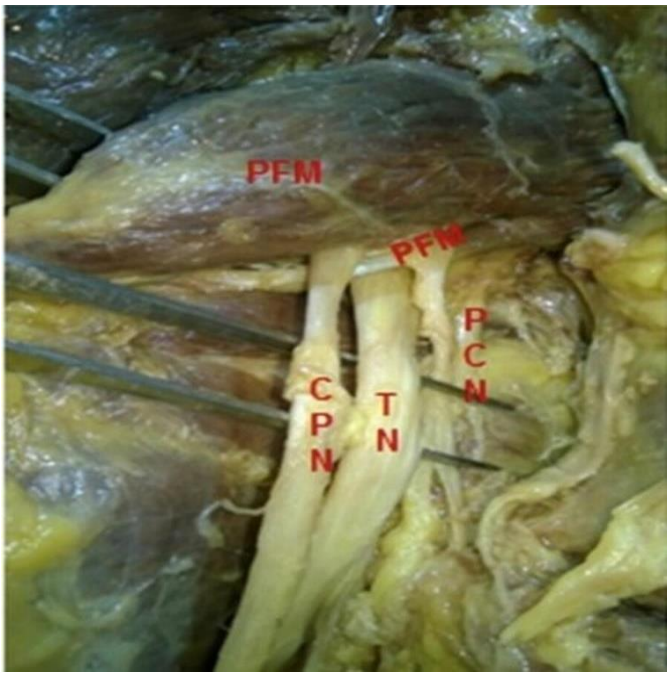
Common peroneal (CPN)and tibial nerve (TN)components emerge beneath thepiriformis muscle on the left side.

Figure 4: Female cadaver: right side F 3



Common peroneal (CPN) and tibial nerve (TN) components emerging below the piriformis (PFM)on the right side

Figure 5: Male cadaver: right side: M26



Common peroneal nerve (CPN) passing through the substance of piriformis (PFM)muscle and tibial nerve (TN) passing under the piriformis muscle (PFM)

Discussion:

The sciatic nerve is entrapped in the buttock and posterior hip region and is referred to as non-discogenic and extra pelvic entrapment in the piriformis syndrome. The current study intends to investigate the cadavers obtained from in and around Rajahmundry, Andhra Pradesh to add to the previous data and support the findings of bifurcating SN and its relation with piriformis muscle are likely contributors to non-discogenic sciatica as well as other pain etiologies [15,16].

In their research, Michel et al. present a variety of techniques used to manipulate the hip stabilization and mobility muscles to mimic sciatic discomfort brought on by piriformis entrapment. To diagnose piriformis syndrome, they devised a three-step procedure that included passive stretchings, such as the Freiberg, FAIR (Flexion-Adduction-Internal Rotation), or HCLK (Hell-Contralateral Knee) manoeuvres, an active manoeuvre, such as the Beatty, Pace, and Nagle, or the FAIR test, and finally palpation of the piriformis muscle itself [12,13].

The common fibular nerve, the tibial nerve, and the vast dorsal component of the sacral plexus all descend together to create the sciatic nerve [1, 4, and 5.] At various points in their genesis, the common peroneal and tibial components diverge from one another [1, 4, and 5.] The literature contains several studies on the variability in sciatic nerve branching.

Beaton and Anson classified the sciatic nerve and the piriformis muscle into six types using 120 specimens from 1937 and 240 specimens from 1948 [10, 11.]

Their classification is as follows:

Type I: Undivided nerve below the undivided muscle

Type II: Divisions of the nerve between and below the undivided muscle

Type III: Divisions above and below the undivided muscle

Type IV: Undivided nerve between heads

Type V: Divisions between and above heads

Type VI: Undivided nerve above the undivided muscle

According to Anbumani TL et al. [14] in their study involving 50 lower limb specimens, Type I was 90%, Type II and III was 4%, and the remaining 2% was reported as sciatic nerve trifurcation. A 70-year-old donated embalmed male cadaver with an unusual sciatic nerve trifurcation on the backs of both thighs amid the popliteal fossa was the subject of a case report by Dr Sharad Kumar [9,] which was also reported by Birhane et al as 5% and is not found in our current study [17]. In a case reported by Bakici et al., bilateral Type B was found in a male cadaver of a 55-year-old Caucasian American [18]. In our study, 92% (55 specimens) of the sciatic nerve variation to Piriformis muscle variation fall into Type I, 5% (3 specimens) fall into Type II, and 3% (2 specimens) fall into Beaton and Anson's classification type 4, type 5, and type 6 specimens are not present in our study.

Guvencer et al's study found that Types I, II, and II were 52%,16%, and 8% [19.] According to Pokorny et al., Type 4 and the first three Types were both reported in 91 cadavers [22]. In 100 fetuses, Ugrenovic et al. found Types I, II, I, and II in 96%, 2.5%, and 1.5% of the cases [23] respectively which closely coincides with the present study. Except for the study conducted by Sabnis A.S et al, where Type 1 was observed to be 7% [25,] One should exercise caution when encountering such exclusions. Only one Type VI case was documented by Sayson et al and Ozaki et al [20, 21].

Type I, II, and III were found in other studies by Shailesh et al., 86 lower limbs 91.80%, 2.32%, 5.81% [24,] Saritha S et al., 50 lower limbs (2012) 50 extremes 92%, 2%, and 2% [26] Ameet et al. reported in 40 lower limbs 92.5%, 2.5%, and 5% Type 3 [27], are slightly similar to our study's data.

Conclusion

The present study is an addition to previously done many studies. There is no particular test or method to be used to categorize sciatic nerve division except for dissecting the region or through a radiological approach. Radiologists, surgeons and anaesthetists should bear in mind these variations when carrying out the sciatic nerve blocks or any other procedures related to this region. Piriformis muscle syndrome is one other disorder where it may be a cause of compression of the sciatic nerve and care should be taken when releasing the muscle tightness while injecting corticosteroids, anaesthetic agents, and muscle relaxants or botulinum toxins etc. Though there are numerous studies on the sciatic nerve by different authors, future studies of nerve variations will still add up to the existing knowledge.

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