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A Cadaveric Study of Sciatic Nerve; Sites of Division and Its Relation to Piriformis Muscle

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A B S T R A C T

Aim: This was a cross sectional cadaveric observational study aimed to determine the common sites of division of sciatic nerve in Sudanese cadaveric specimens and also to study the relation of the sciatic nerve to the piriformis muscle.

Methods: A total of 50 (48 males and 2 females) dissected cadaveric gluteal and thigh regions were involved and examined unilaterally for the sciatic nerve anatomy course. This involved the site of division of the nerve into its two components, common peroneal and tibial nerves, and its relation to piriformis muscle.

Results: Forty six (n=46/50, 92%) of sciatic nerves were observed to be divided after exciting the pelvis and pass below the piriformis muscle, and 4 (n=4/50, 8%) of sciatic nerves were observed to be divided inside the pelvis .The sites of division of sciatic nerve are as followings; 8% inside pelvis, 4% in the gluteal region, 18% in the upper third of the thigh, 34% in the middle third of the thigh, 24% in the superior angle of popliteal fossa and 12% at the center of popliteal fossa. In cases when the sciatic nerve divided inside the pelvis, the common peroneal nerve was observed to pierce the piriformis muscle in 2 cadavers (n=2/4, 50%), and in 2 cadavers (n=2/4, 50%) it was observed to pass below the piriformis muscle. No significant differences between left and right sides specimens were observed. While all tibial nerves pass below the piriformis muscle, when the sciatic nerve is divided inside the pelvis (n= 4/4, 100%).

Conclusion: The sciatic nerve site of division in Sudanese population is nearly the same reported in other populations worldwide. Knowledge of the sciatic nerve variations is mandatory for general and plastic surgeons, orthopedic surgeons, and neurosurgeons for better and safe practices.

Keywords*:* *Sciatic nerve, common peroneal nerve, tibial nerve, piriformis muscle.*

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INTRODUCTION:

Sciatic nerve is the largest nerve in the body, and it is the continuation of the major flat part of the sacral plexus, measuring 2cm in breadth. It is formed as the large anterior rami of spinal nerves (L4, L5, S1, S2, and S3) converge on the anterior surface of the piriformis muscle [1]. Sciatic nerve is really two nerves, tibial nerve derived from anterior (preaxial) divisions of the anterior rami, and the common fibular nerve derived from posterior (postaxial) divisions of the anterior rami, which are loosely bound together in the same connective tissue sheath [2]. Sciatic nerve supplies the posterior thigh muscles, all leg and foot muscles, and skin of the most of the leg and foot .It also supplies the articular branches to all joints of the lower limb. It supplies no structures in the gluteal region [3]. The point of division of the sciatic nerve into its major components enclosed within one sheath tibial and common peroneal is very variable. The common site is at the junction of the middle and lower thirds of the thigh, near the apex of the popliteal fossa [2]. The division may occur at any level above this, though rarely below it. It is not uncommon for the major components to leave the sacral plexus separately, in which case the common peroneal component usually passes through piriformis at the greater sciatic notch while the tibial component passes below the muscle [3].

Previous studies were conducted to determine the point of division of sciatic nerve in different populations. No enough previous studies were conducted in Sudan, so this study aimed to find any variation of the site of sciatic nerve division in Sudanese cadaveric specimens and to compare the results with previous studies done worldwide.

METHODS:

This study was a descriptive cross sectional cadaveric based study, conducted in 50 dissected cadaveric gluteal and thigh regions. The study was conducted in period between April 2019 to January 2020 at Medical colleges of different university in Khartoum state. Eighty four were males and 2 were females. The study involved unilateral samples to

determine the common site of division of the sciatic nerve. Data was collected using data collection sheet including the course of the sciatic nerve and the site of bifurcation. Data was analyzed by SPSS version 22.
Ethical approval was obtained from related faculties and universities committees.

RESULTS:

Unilateral 50 cadavers (48 (96%) male, and 2 (4%) females) were included in this study (figure 1). Out of these, 54% were right, and 46% were left side dissected sciatic nerves.

Forty six (n=46/50, 92%) of sciatic nerves divided after exciting the pelvis and pass below the piriformis muscle, and 4 (n=4/50, 8%) of sciatic nerves divided inside the pelvis (table 1) .The sites of division of sciatic nerve was 8% (4) inside pelvis, 4% (2) in the gluteal region, 18% (9) in the upper third of the thigh, 34% (17) in the middle third of the thigh, 24% (12) in the superior angle of popliteal fossa, and 12% (6) at the center of popliteal fossa (table 2 & figure 2).

In cases where the sciatic nerve divided inside the pelvis (4 cadavers) , the common peroneal nerve was observed to be piercing the piriformis muscle in 2 cadavers ((n=2/4, 50%) , and in 2 cadavers (n=2/4,50%) it was observed to be passed below the piriformis muscle. While all tibial nerves pass below the piriformis muscle, if the sciatic nerve is divided inside the pelvis (n= 4/4, 100%).
No significant differences between left and right sides specimens.

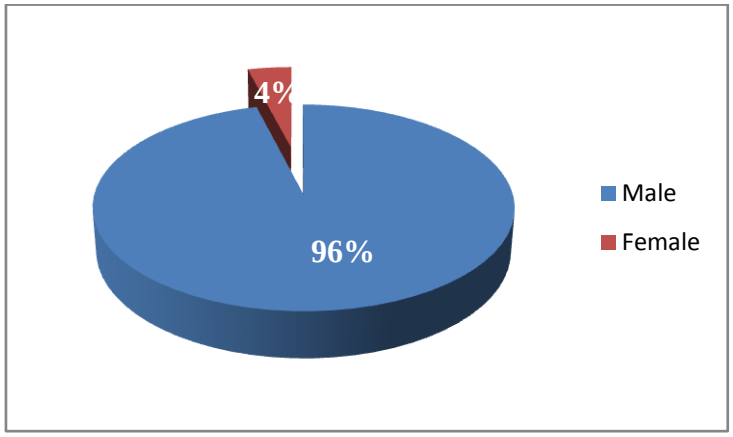

Figure (1); Distribution of gender among the study cadavers, (n=50)

Table (1): Relation of Sciatic Nerve to Piriformis muscle; (n=50)

Relation of Sciatic Nerve to Piriformis muscle	Frequency	Percent
Sciatic Nerve Below the muscle	46	92.0
Sciatic Nerve pierces or passes above the muscle	4	8.0
Total	50	100.0

Table (2); The Site of Division of Sciatic Nerve; (n=50)

Site division	Frequency	Percent %
Inside the pelvis	4	8.0
Gluteal Region	2	4.0
Upper Third of The Thigh	9	18.0
Middle Third of The thigh	17	34.0
Superior Angle of Popliteal Fossa	12	24.0
Center of Popliteal Fossa	6	12.0
Total	50	100.0

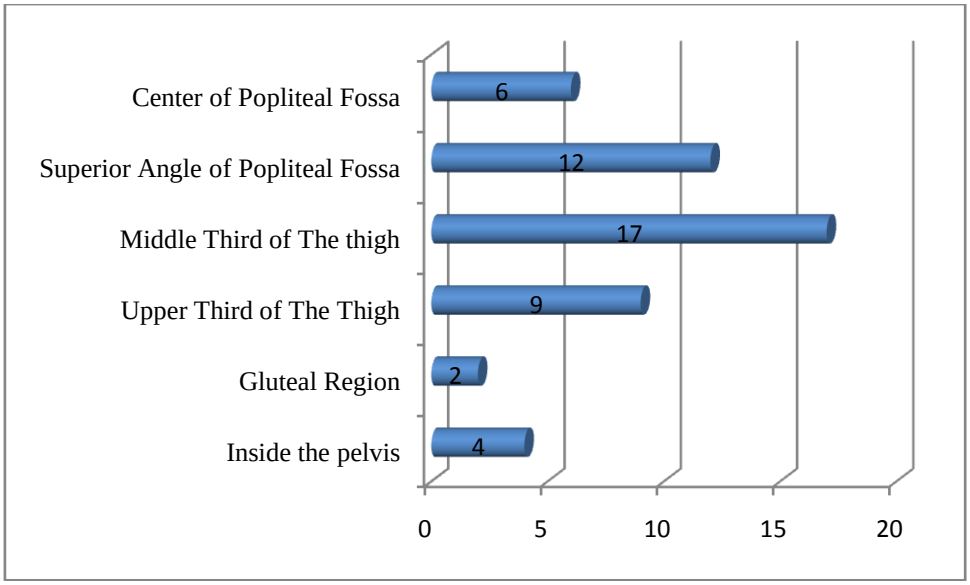

Figure (2); The Site of Division of Sciatic Nerve; (n=50)

DISCUSSION:

Most of the text books of anatomy, orthopedic, and surgery, state that the sciatic nerve bifurcation levels are important in clinical and treatment aspects [4]. Normally undivided sciatic nerve passes out through greater sciatic foramen below piriformis and divides at the apex of the popliteal fossa in 85 to 89 % [5]. Interpretation of the nerve variation in the limbs requires a consideration of Phylogeny and development of the sacral plexus.

This study builds on previous reports in literature and re-emphasis the importance of identifying sciatic nerve bifurcation levels. Sciatic nerve pattern of bifurcation on the right and left side and in male and female were not significant.

Height of an individual and level of bifurcation of the nerve are not related to each other [6]. Topographic variations of the relationship of the sciatic nerve and piriformis muscle and its relationship was studied by Pokorny et al.[7]. The authors studied 91 cadavers and found an atypical relationship in 19 cadavers (20%). In their study, individual variations were found. According to them, sciatic nerve exists below the piriformis muscle in 79.1% cases, it separates into 2 divisions, one branch passing through the muscle and other below it (14.3%). An un split nerve passes through piriformis muscle in 2.2%. They reported the incidence of anatomical variation of both sciatic nerve and piriformis is 15-30%.

The level of the sciatic nerve division and its relation to the piriformis muscle was also studied by Ugrenovic and etal [8]. According to them, sciatic nerve left the pelvis through the infra- piriformis foramen in 192 lower limbs (96% cases), while in 8 lower limbs (4%) the variable relations between SN and piriformis muscle were detected. Common peroneal nerve penetrated the piriformis and left the pelvis in 5 limbs (2.5%) ,and tibial nerve left the pelvis through the infra-piriformis foramen. In 3 limbs (1.5%) Common peroneal nerve was present above the piriformis and tibial nerve was below the piriformis. The present study showed typical 92% but atypical 8% of sciatic nerve (has variable relation to piriformis muscle).

Sharma [9] , Observed in routine dissection of 60 years male cadaver that two divisions of sciatic nerve were separate in the gluteal region on both the sides with tibial nerve passing below the piriformis and Common peroneal nerve piercing the piriformis muscle.

The high division may account for failures in the popliteal block. Similar feature was observed in our study. The division of the SN in the popliteal fossa is related to anatomical implications for popliteal nerve block. Vloka etal [10], concluded in their study 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 etal [11], mentioned in their study 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.

Variations in the high division of the sciatic nerve and relationship between the it and the Piriformis were studied by Guvencer and etal [12], Their study included 25 male cadavers .Their results reported a 52% of cases of sciatic nerves that exited as a single nerve without any division, whereas in 48% a high division was observed. According to them,

24% of cases common peroneal nerves left the pelvis above, and tibial nerves below the piriformis. Our study included 50 cadaveric limbs. The results of anatomical variations were only seen in 4 cadavers in our study with high division of sciatic nerves in 4 lower limbs (8%).The differences in their exit routes of these two nerves are important clinical etiology of sciatica and require reviewing the piriformis syndrome. A rare variation in the high division of the sciatic nerves surrounding the superior gemellus muscle was observed by Babinski et al [13]. In their paper they described a new anatomical variation in which the common peroneal nerve passed superior and tibial nerve inferior to superior gemellus muscle. Such variations may contribute to piriformis syndrome, coccygodynia and muscle atrophy. This type of variation was not seen in our study. Arifoglu et al [14] reported a case with double superior gemellus and double piriformis muscles associated with the sciatic nerve dividing high and passing between the two Piriformis. It has not previously been described in the literature. Supernumerary superior gemellus and piriformis muscles may exert pressure on the sciatic nerve and should be taken into account by the clinicians. Similar sciatic nerve divisions were not found in our cadavers.

Table (3): below shows comparison between the results of this study and results of previous studies regarding site of bifurcation of sciatic nerve.

Table (3): comparison between the results of this study and results of previous studies regarding site of bifurcation of SN

Studies	Typical sciatic nerve	Atypical sciatic nerve
Guvence study	**52%**	**24%**
Pokorny study	**79.1%**	**20.9%**
Natsis study	**93.6%**	**6.4%**
Present study	**92%**	**8%**

CONCLUSION:

The common site of sciatic nerve division in Sudanese was the middle third of the thigh. Some times SN divides inside pelvis. Results of the present study agreed with results of previous studies done worldwide. The present study represents a report of the common sites of division of sciatic nerve in Sudanese. The sciatic nerve site of division in Sudanese population is nearly the same reported in other populations worldwide. Knowledge of the sciatic nerve variations is mandatory for general and plastic surgeons, orthopedic surgeons, and neurosurgeons for better and safe practices.

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Authors' contributions:

Yasser Seddeg Abdulghani. Made substantial contributions to conception and design of the study and performed data collection and analysis and interpretation as well as provided administrative, technical, and article writing.

Hadbaa Ghazi Hussain; design of the study and performed data collection and analysis and interpretation as well as provided article writing.

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