

Variation In The Sciatic Nerve's Origin: A Cadaveric Study Among The Black African Population, Western Kenya.

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ABSTRACT

The sciatic nerve originates from the pelvic region, passes below the piriformis intact, and goes down to divide at the apex of the popliteal fossa to form the tibial and common peroneal nerve. It innervates the posterior aspect of the thigh, the knee joint, the leg, and the foot. It carries both motor and sensory nerve fibers. Variations of sciatic nerve can occur at the point of origin either intact or bifurcated, in relation to the piriformis muscles, at the level of its division, and the relations of tibial components and common peroneal nerve. This study focused on determining the variations at the origin of the sciatic nerve and comparing them on the left and the right side of the lower limbs as it exits the pelvic region. The study adopted a cross-sectional descriptive design. The study was conducted in three medical institutions and Yamane's (1977-1988) formula was used to derive 77 cadavers as sample size then later on stratified random sampling was also used in selecting the number of cadavers to be used in the study per university where the first institution had 38, second 21 and the third one 18. The right and the left lower limbs were dissected and the sciatic nerves were exposed and observed from the point of origin to the level of division. Descriptive statistics were used to analyze the mean and percentile in groups and chi-squares were used to test the significance of the variation in terms of laterality. Out of 154 sciatic nerves observed, 25(16.2%) had bifurcated at the origin and 8.4% of this variation was more on the left side as compared to the right (7.8%). There was no significant variation ($p < 0.827$) in laterality at the origin of the sciatic nerve. There was variation in the state of the sciatic nerve when it's exiting the pelvic region and the majority occurred on the right-sided lower limb than the left-sided lower limbs

Keywords: sciatic nerve, laterality, Variations.

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I. INTRODUCTION

The sciatic nerve(SN) originates from lumbosacral plexus L4-S3 spinal nerves and it gives innervations to lower limbs. It consists of two divisions, namely the common peroneal nerve, and tibia. These nerves arise from the lumbosacral plexus bound together as one large trunk. The tibial nerve is derived from L4 to S3 spinal nerves while common peroneal is derived from L4 to S2 spinal nerves(1).

The ventral and the dorsal roots from L4-S3 join together to form one common trunk that comes out of the pelvis as one nerve through the major sciatic foramen(2). In the majority of the population, the SN runs below the piriformis and in between greater trochanter and ischial tuberosity as one trunk but in other cases, the course of the nerve is variable. The nerve then descends along the posterior aspect of the thigh behind the hamstring muscles to the upper part of popliteal fossa. The nerve innervates hamstring muscles, all joints of lower limb, all muscles of the leg and foot, and also give cutaneous innervations(3).

Other studies found that the point at which the SN bifurcates into two is variable. It may bifurcate in the pelvis and travel down the thigh as two separate nerves or it comes out as one nerve and bifurcates along its course after passing the piriformis muscle(4). This nerve leaves the pelvic cavity and travels below the piriformis muscle as a single nerve then divides at the summit of the popliteal fossa. However, there may be numerous changes in both the path and dissemination of the sciatic nerve

The variations of the course of the sciatic nerve have become a big concern in recent years- Scientists who have established these variations have expressed concern that they might be a predisposing factor to certain clinical conditions like piriformis muscle syndrome, coccydynia, failure to achieve blockage of popliteal nerve and trauma to SN during administration of gluteal injection. The injury to the nerve predisposes to foot drop muscle atrophy and finally paralysis. The possible reason for iatrogenic nerve injury was the variant anatomy of

the SN. Different variants are found in different regions and different populations. Therefore, health care worker should understand the variant anatomy of the sciatic nerve as this knowledge help in understanding these clinical conditions

Knowledge of the anatomical differences of the SN on the origin, course, and distribution is important for surgeons, anesthetists, and other medical professionals to a avoid sciatic nerve injury during surgical procedures around hip and to guide in management of such unique cases. Studies have shown different variants in different regions and populations. Particular variants are more common in Far East compared to Europe (5).

This study aimed at understanding the sciatic nerve variants in the western Kenya population and if possible, develop new knowledge that help surgeons devise new protocols in approaches during procedures for example arthroplasty and popliteal nerve block among others

II. MATERIALS AND METHODS

The study was conducted in three medical institutions after being approved and licensed with the following reference numbers (MASU/DRPI/MUSUEC/01142/22), (405369), and (NACOSTI/P/23/24625). The study adopted a cross-sectional descriptive design. The study had a seventy-seven-sample size derived using the Yamane (1977-1988) formula and the study participants were purposively and conveniently selected for the study from the three institutions. To ensure equal distribution of cadavers per university, Strata population sampling was done, the first university had 38, the second had 21 and the last one had 18 cadavers, this was based on the availability of cadavers in each laboratory found in the three institutions. The right and left lower limbs were dissected, and sciatic nerves were exposed from the origin of piriformis up to their level of division. The data was obtained from study findings, put into an Excel sheet, and then uploaded into the SPSS 26. Descriptive statistics such as mean and percentile were used to analyze the state of the sciatic nerves when exiting the pelvis as either intact or bifurcated and a chi-square was done to test the difference between the variation of the right and left sciatic nerves when exiting the pelvic region and the $p \leq 0.05$ was found be of statistically significant. Data were presented in tables and figures.

III. RESULTS

Table 4.1: Frequency distribution of the origin of the sciatic nerve

		Frequency	Percent
State of SN when exiting Pelvis	Bifurcated	25	16.2
	Intact	129	83.8
	Total	154	100.0

A total of 154 lower limbs were observed, 25(16.2%) SN was bifurcated and 129 (83.8%) sciatic nerves were intact (Table 4.1)

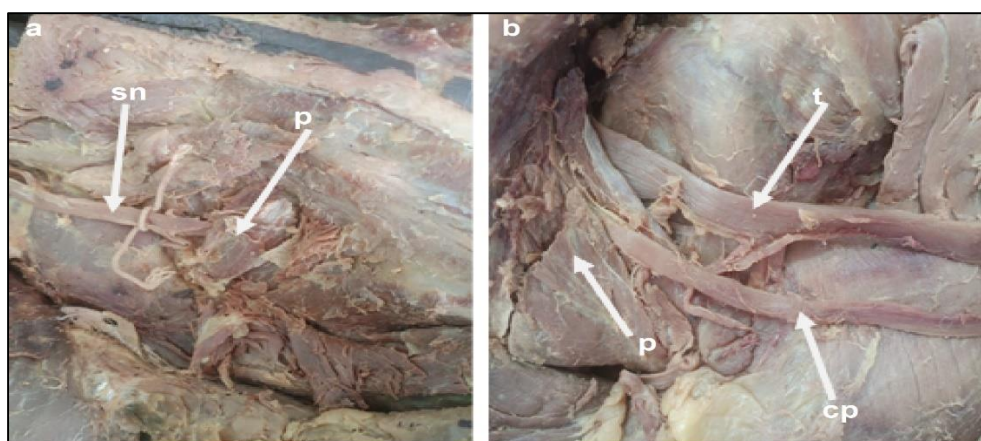


Figure 4.1 State of the Origin of the sciatic nerve

Key: SN- the sciatic nerve, T- tibial nerve, CP- common perineal. a- intact b- bifurcated and p- piriformis
Normally, the sciatic nerve exits as one nerve passing below the piriformis muscle on its way to the thigh region (Figure 4.1a) However in some cases the nerve exits already divided into two the tibial nerve and the common peroneal nerve as shown in Figure 4.1b

Table 4.2: Comparison between right and left sciatic nerve when it is exiting the pelvis.

		SIDE		Total	
		Right	Left		
State of nerve when exiting the pelvis	Bifurcated	Count	12	13	25
		% of Total	7.8%	8.4%	16.2%
	Intact	Count	65	64	129
		% of Total	42.2%	41.6%	83.8%
Total		Count	77	77	154
		% of Total	50.0%	50.0%	100.0%

The frequency of bifurcation of the sciatic nerve when exiting the pelvis was higher (8.4%) on the left as compared to the right at (7.8%) (Table 4.2).

Table 4.3: Test for significance between right and left sciatic nerve when it is exiting the pelvis.

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)		Exact Sig. (1-sided)
Pearson chi-square	.048 ^a	1	0.827		
Continuity correction	0.000	1	1.000		
Likelihood ratio	0.048	1	0.827		
Fisher's exact test				1.000	0.500
Linear-by-linear association	0.047	1	0.828		
N of valid cases	154				

There was no statistically significant ($p < 0.827$) variation between the origin of the right and left sciatic nerve as it exits the pelvic region. (Table 4.3).

IV. DISCUSSION

In the normal standard anatomy of the origin of the sciatic nerve, the sciatic nerve normally passes below the piriformis intact as it exits the pelvic region. The current study recorded 129 (83.8 %) sciatic nerves passing below the piriformis muscles and was intact, 25 (16.2 %) sciatic nerves had bifurcated when exiting the pelvic region. Other literature (6) recorded similar findings where 85% of the sciatic nerve exited the pelvic region intact and 15% had divided at the origin when exiting the pelvic region in a meta-analysis that was done on 45 studies in 7068 lower limbs observed. Another meta-analysis (7) recorded that 77% of sciatic nerves passing below the piriformis muscles were intact, and 23% of sciatic nerves had bifurcated when exiting the pelvic region.

The current study findings were also in tandem with (8) who recorded 131 (79.9%) sciatic nerves passing below the piriformis muscles and were intact, 20 (20.1 %) sciatic nerves had bifurcated when exiting the pelvic region, a study done in Nairobi Kenya. A study done in India (9) also recorded 46 (92%) sciatic nerves passing below the piriformis muscles and were intact, and 4 (8 %) sciatic nerves had bifurcated when exiting the pelvic region. Other authors from Ethiopia (10) recorded 42 (75%) sciatic nerves passing below the piriformis muscles and were intact, and 14 (25 %) sciatic nerves had bifurcated when exiting the pelvic region. The variations observed in the state of the sciatic nerve when it is exiting the pelvic region can lead to entrapment of its this early division leading to syndromes such as coccydynia, pyriformis, and sciatica which some of the patients present with, and sometimes it takes time to know its etiology. A study done in Uganda (11) recorded a 77.5 % of sciatic nerves passing below the piriformis muscles and were intact, and 22.5% of sciatic nerves had bifurcated when exiting the pelvic region.

It was observed that the frequency of bifurcation of the sciatic nerve when exiting the pelvis was higher at 8.4% in the left as compared to the right at 7.8% as seen in Table 4.2. These findings are in tandem with those (12) in Ethiopia who found out 8% of divisions occurred within the pelvis region in Figure 1 of their study but lower than (8) 20.1% in the Kenyan population. This observation is contrary to the findings of (13) who found that sciatic nerve separation on the upper third on the right side was 23.3% and 20% on the left side in a fetal-based study while evaluating sciatic nerve variations and clinical implications. The study suggests that the two branches of the sciatic nerve develop separately during the embryonic stages of life and they maintain the same anatomical structures however, they might reunite later on which might be a basis for anatomical variations and a recipe for clinical complications.

V. CONCLUSION

There was variation in the state of the sciatic nerve when it's exiting the pelvic region.

Most sciatic nerve variations occurred within the pelvis region of the right-sided lower limb than the left-sided lower limbs.

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