

A VARIATION IN THE HIGH DIVISION OF THE SCIATIC NERVE AND ITS RELATION WITH PIRIFORMIS MUSCLE

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ABSTRACT

The aim of the study was to describe and analyze sciatic nerve variation especially the higher division within the lesser pelvis and its different routes of exit from pelvis. The sciatic nerve (SN) separates into its branches, the tibial and common peroneal nerves, outside the pelvis. However, it may rarely be separated within the pelvis. In such cases, the tibial nerve and the common peroneal nerve may leave the pelvis through different routes. These variations may cause nerve compressions under other anatomic structures, resulting in non-discogenic sciatica. 86 gluteal regions were examined in 43 formalin-fixed adult cadavers from different medical colleges of Gujarat region. From the study we found higher division of sciatic nerve bilaterally mainly in the female which is very rare and unilateral higher division of sciatic nerve which is also rare. The differences in the exit routes of these two nerves are important for surgeons, as this is the area of frequent surgical manipulation, nerve injury during deep intramuscular injections in gluteal region, failed sciatic nerve block in anesthesia and injury during posterior hip operations.

Keywords: Sciatic Nerve, Piriformis, variation, gluteal region, lesser pelvis.

INTRODUCTION

Sciatic nerve is a broad, thickest and the largest nerve of body, arising from sacral plexus. The sciatic nerve is formed in the pelvis by joining anterior divisions of L4-S3 spinal nerve roots. It is almost 2 cm wide at its origin near the sacral plexus. Normally it emerges through the greater sciatic foramen, leaves pelvis and enters into gluteal region by passing below piriformis as a single nerve encompassed by a single epineurial sheath. It divides subsequently into two terminal nerves i.e., tibial nerve and common peroneal nerve (common peroneal nerve), usually at superior angle of popliteal fossa. There are both motor and sensory fibers in it. The motor branches of the nerve supply the posterior group of thigh muscles as well as two joints of the lower limb: femoral and knee joint. Its sensory branches supply the whole tibial and foot areas with the exception of the anteromedial tibial region and the medial margin of the foot.

There may be numerous variations both in the course and distribution of the nerve. The main variations concern the relationship of the nerve to piriformis. Sometimes it divides high, while still in pelvis into its terminal branches that leave pelvis in a number of ways. Accordingly they are classified into different types in relations to piriformis muscle.

High division of SN is usually unilateral or bilateral, that leads to compression of nerve resulting in piriformis syndrome, incomplete block of SN during popliteal block anesthesia and have a clinical importance in the etiology and pathogenesis of sciatica etc. This compression on nerve causes paralysis or paresis of the respective muscles and adequate sensory disturbances. In that case one cannot flex the lower limb in the knee joint. External version and plantar flexion of the extremity are also affected.

MATERIAL AND METHODS

Here we are studied on high division of sciatic nerve with in pelvis and variations in its outcome from greater sciatic foramen in relation to piriformis muscle. For this we observed 43 adult (male & female) cadavers with no pathology were used for this study. 86 gluteal regions of 40 adult (male & female) cadavers fixed with formalin were evaluated in routine dissection at various medical colleges of Gujarat region. Out of this 43 pairs of lower extremities we observe 6 pairs of lower extremities at Medical College, Bhavnagar in year 2010 and 7 pairs in recent year 2011 at routine dissection, 8 pairs observed at Medical College, Surat, 12 pairs observed at Medical College, Baroda and 10 Pairs

observed at PDU Medical College, Rajkot in routine dissection procedure in recent year 2011.

In order to reveal the high division of the main trunk of the sciatic nerve into terminal branches we carefully identifying every branch (wider than 2 mm) originating from the main trunk, the relation of main trunk and its terminal branches to the piriform muscle. The level of sciatic nerve division was described topographically, i.e. according to the region where the division took place.

For this first the gluteus maximus was elevated to explore the piriformis, the superior gemellus, the obturator internus, the inferior gemellus and the quadratus femoris. Following proper exposure of the pelvis, the evidence of variation in the Sciatic Nerve was recorded. The location where the SN exits the pelvis and the level of the Sciatic Nerve division were all recorded.

Additional calculation was performed to compare left and right extremities as well as those taken from individuals of different sexes.

RESULTS

In this study 43 adult (male & female) cadavers so total 86 gluteal regions were examined.

Table 1: Shows sex wise distribution

No. of Lower extremities	Male	Female
Out of 86 Lower Extremities	64	22

Three types of course of sciatic nerve is observed when it comes out of the lesser pelvis to gluteal region and in different relation with Piriformis muscle.

Type I: Sciatic nerve as a single trunk comes out below piriformis. (Fig. no.-1)

Type II: Sciatic nerve already divided in pelvis and its two divisions comes out below piriformis.

Type III: Sciatic nerve already divided in pelvis and its two divisions comes out differently from pelvis, one (Common Peroneal) comes out after piercing piriformis & Other (Tibial) comes out below Piriformis. (Fig. no.-2 & 3)

Also Higher division is different on right side and left side or it is bilateral. For above types following results were observed.

Table 2: Shows side wise distribution of various types

	Type I	Type II (Right/Left)	Type III (Right/Left)
No. of cases out of 86 lower extremities	79	1 Bilaterally	1 Bilaterally 3 Unilaterally (2 Right + 1 Left Side)
Total 86	79	2	5

Higher division is also different in male and female. For that following results were observed.

Table 3: Shows sex wise distribution of various types

Gender	Type I	Type II	Type III
Male	62	0	2
Female	17	2	3

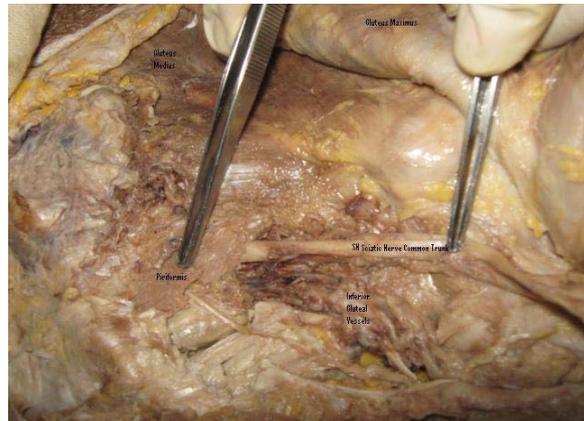


Fig 1: Type I variation of sciatic nerve



FIG 2: shows type III variation of sciatic nerve (bilaterally)

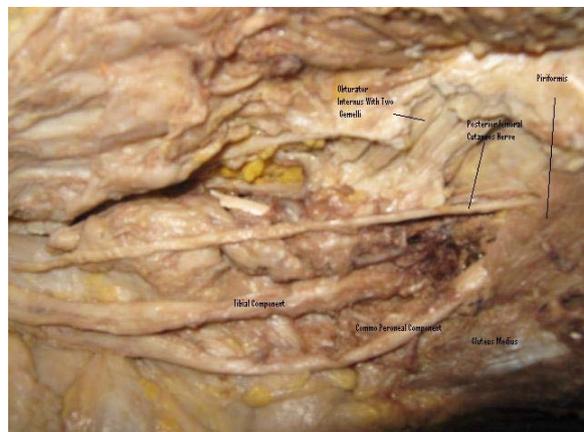


FIG 3: Shows type III variation of sciatic nerve (unilaterally)

DISCUSSION

According to different study, it shows that there are many variations in sciatic nerve division especially in higher divisions. There are different types of high divisions of sciatic nerve within pelvis, usually bilateral and if it is unilateral then other side will mostly remain normal. The high division of sciatic nerve is rare and also we found another two types of higher divisions of sciatic nerve on two sides in same cadaver as found in our study.

Many authors have attempted classification of high divisions of sciatic nerve, below there are six different types of higher divisions which was observed in previous studies of different researchers.

Beaton & Anson^{1, 2} classified variations of the piriformis and SN in 120 specimens in 1937, and in 240 specimens in 1938. Their classification, known as the Beaton & Anson classification, is as follows:

- Type 1:** Undivided nerve below undivided muscle
- Type 2:** Divisions of nerve between and below undivided muscle
- Type 3:** Divisions above and below undivided muscle
- Type 4:** Undivided nerve between heads
- Type 5:** Divisions between and above heads
- Type 6:** Undivided nerve above undivided muscle

And for the above types different researchers got results as mentioned below.

Table 4: Shows comparison between present study and previous studies

Name of Investigators	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Beaton & Anson ¹ 120 cadavers	84.2%	11.7%	3.3%	0.8%		
Pecina ¹⁵ 130 cadavers		6.15%				
Beaton ² 240 cadavers	90%	7.1%	2.1%	0.8%		
Chiba ³ 14 extremities		34%				
Uluutku&Kurtoğlu ²¹ 25 fetuses	74%	16%	10%			
Ugrenovic et al ²⁰ 100 fetuses	96%	2.5%	1.5%			
Moore&Dalley ¹³ 650 extremities		12.2%	0.5%			
Pokorny et al ¹⁶ 91 cadavers	79.1%	14.3%	4.4%	2.2%		
Sayson et al ¹⁷						Single case
Current study 86 extremities	91.8%					

In present study, we found only type 1 variation (91.8%) of sciatic nerve from above 6 types. We also found two different types other than mentioned above.

Two different types other than above are as follows:
 Type II: Sciatic nerve already divided in pelvis and its two divisions comes out below piriformis.
 Type III: Sciatic nerve already divided in pelvis and its two divisions comes out differently from pelvis, one (Common Peroneal) comes out after piercing piriformis & Other (Tibial) comes out below Piriformis. (Fig. no.-2 & 3)

So from the present study we found 2.32% variation of type II and 5.81% variation of type III.

Here we also found higher division of sciatic nerve side wise. We found bilateral division in 2 cases and unilateral division in 3 cases. So these higher divisions of type II& type III on right side are 4.65% and on left side is 3.48%.

We also found sex wise difference in our present study. According to our study, these higher divisions of type II& type III in male are 3.12% and in female is 22.72%.

Table 5: Shows sex wise percentage of various types

Gender	Type I	Type II	Type III
Male(64 extremities)	96.87%	0%	3.12%
Female(22 extremities)	77.27%	9.09%	13.63%

The study of Ewa Okraszewska⁴ shows no difference in sciatic nerve variation connected with sex were found, but our study disagree with the findings of above mentioned study.

From this study mainly in Gujarat region shows that it is more significance for female than males and mainly it is bilateral but unilateral variation is also seen.

CONCLUSION

The anatomical knowledge regarding variation about the level of division of the sciatic nerve and the location where it leaves the pelvis of great importance. The variations in division of sciatic nerve in gluteal region such as above are very important for surgeons, as this is the area of frequent surgical manipulation. This knowledge will not only help surgeon to take care during surgery, but help to plan accordingly during various surgical interventions and management of this region. This high division results in sciatica, nerve injury during deep intramuscular injections in gluteal region, piriformis syndrome, failed sciatic nerve block in anesthesia and injury during posterior hip operations. This also motivates radiologist to repeat MRI on other side, as there can be differences on two sides. This knowledge is also very important for nurses and junior doctor to prevent deep intramuscular injection hazards in gluteal region. The differences in the exit routes of these two nerves are important in clarifying the clinical etiology of nondiscogenic sciatica. These variations

require reviewing the piriformis syndrome. Sciatic nerve is a useful example for illustrating individual variety, which could be observed even in small groups⁴.

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