

# High Division of Sciatic Nerve: A Cadaveric Study

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## ABSTRACT

**Introduction:** Several authors give significant numbers of reports regarding anatomical variation of high division of sciatic nerve. This variation (high division of sciatic nerve) may result in sciatica, nerve injury during deep intramuscular injections in gluteal region, piriformis syndrome, failed sciatic nerve block in anaesthesia and so on.

**Aim:** The present study describes the incidence of high division of sciatic nerve and its types among the cadavers preserved for dissection for a graduate teaching program.

**Materials and Methods:** During the routine cadaveric dissection for a graduate teaching program, observation of 60 gluteal regions in the 30 formalin-fixed adult cadavers

was done in relation to Sciatic nerve. Division of sciatic nerve, its site and types were noted.

**Results:** Variations in sciatic nerve division were found in five cadavers (16.67%) of which three were male and two were female. In one cadaver (3.33%), the common peroneal nerve passed above the piriformis and the tibial nerve below the piriformis. The tibial nerve and the common peroneal nerve were seen to leave the pelvis below the undivided piriformis separately in different sheath in four cadavers (13.33%) with high division of sciatic nerve.

**Conclusion:** Variations in the division of sciatic nerve are frequent and the knowledge regarding the same may be of use for surgeons so that they can take due care during related intervention and prevent complications.

**Keywords:** Nerve entrapment, Nerve injury, Piriformis syndrome, Sciatica

## INTRODUCTION

Sciatic is derived from a Greek word “Ischiadicus”. The sciatic nerve is also known as the ischiadic nerve or ischiatic nerve. It is the thickest nerve of body, arising from ventral rami of L4, L5, S1, S2 and S3 spinal nerves. It supplies the muscles of back of the thigh, leg and foot as well as the skin of leg, hip joint and knee joint [1]. It is 2 cm wide at its origin. Normally it emerges through the greater sciatic foramen, leaves the pelvis and enters into gluteal region by passing below piriformis as a single nerve enclosed by a single epineurial sheath. It then crosses posteriorly to the obturator internus, gamelli & quadratus femoris muscles. It divides into two terminal branches i.e., tibial and common peroneal usually at the lower part of the posterior compartment of thigh [2]. However, there are variations like its high division into terminal branches while still in pelvis and the branches leave the pelvis in various ways. This variation in the form of high division of sciatic nerve may manifest as piriformis syndrome, sciatica, unintentional nerve injury while giving deep intramuscular gluteal injections, failure of sciatic nerve block and other complications [3]. The present study describes the incidence of high division of sciatic nerve

and its types among the cadavers preserved for dissection for a graduate teaching program.

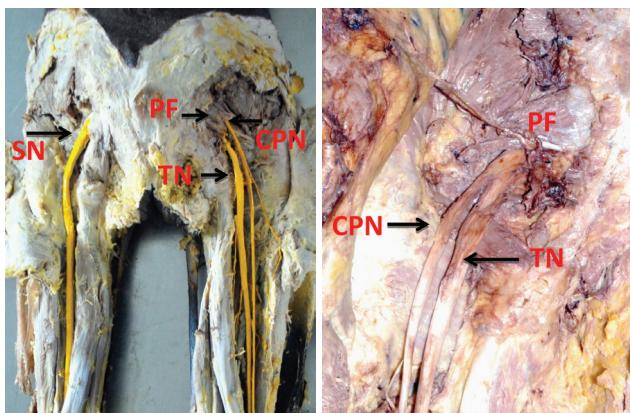
## MATERIALS AND METHODS

This observational descriptive study was performed during routine dissection for 1<sup>st</sup> year MBBS students in the Department of Anatomy, Government Medical College, Aurangabad, Maharashtra, India, 60 gluteal regions were examined in 30 formalin fixed cadavers for the period of three years, starting from 2012 till 2015. All the cadavers available for dissection during the study period were included. Sixteen of the cadavers were male and fourteen were female. The gluteus maximus was elevated to explore the piriformis and sciatic nerve. Observations were made regarding location of sciatic nerve, exit of sciatic nerve from pelvis and the level of division of sciatic nerve. Normally, in around 80-90% of subjects, bifurcation of sciatic nerve is observed at the superior angle of popliteal fossa [1].

## RESULTS

The sciatic nerve exited the pelvis below the piriformis and divided at the superior angle of popliteal fossa in 25 cadavers

(83.33%). Variations in sciatic nerve bifurcation were seen unilaterally in five cadavers (16.67%), of which three were male and two were female. In one cadaver (3.33%), the common peroneal nerve passed above the piriformis and the tibial nerve below the undivided piriformis [Table/Fig-1]. In four out of the 30 cadavers (13.33%), the sciatic nerve was seen to leave the pelvis below the undivided piriformis with its two components together but in separate sheaths [Table/Fig-2].



**[Table/Fig-1]:** Showing higher division of SN, tibial nerve passing below while common peroneal nerve passing above piriformis on the right side.

**[Table/Fig-2]:** Showing higher division of SN, tibial nerve and common peroneal nerve, both emerging beneath lower border of piriformis on the left side.

SN= Sciatic Nerve, CPN= Common Peroneal Nerve, TN = Tibial Nerve, PF= Piriformis.

## DISCUSSION

In our study, we found variations in sciatic nerve division in five cadavers (16.67%) of which three were male and two were female. In one cadaver (3.33%), the common peroneal nerve passed above the piriformis and the tibial nerve below the piriformis. The tibial nerve and the common peroneal nerve were seen to leave the pelvis below the undivided piriformis separately in different sheath in four cadavers (13.33%) with high division of sciatic nerve.

Beaton & Anson classification [4-6] of variation of sciatic nerve division,

**Type 1:** Undivided sciatic nerve below the undivided muscle.

**Type 2:** Divisions of sciatic nerve between & below the undivided muscle.

**Type 3:** Divisions of sciatic nerve above and below the undivided muscle.

**Type 4:** Undivided sciatic nerve between the heads.

**Type 5:** Divisions of sciatic nerve between and above the heads.

**Type 6:** Undivided sciatic nerve above the undivided muscle

Uluutku & Kurtoglu study had reported high division of sciatic

nerve in 26% of the cases. They reported type two pattern of high division of sciatic nerve (common peroneal nerve passing through the piriformis and tibial nerve below the piriformis) in 16% of cases and type three pattern of high division of sciatic nerve (common peroneal nerve passing above the piriformis and tibial nerve below the piriformis) in 10% cases [7]. Ugrenovic et al., found high division of the sciatic nerve either in the posterior femoral region or in the gluteal region in 27.5% of the specimens in a cadaveric study in 2005 performed on 100 foetuses. They have also highlighted that high division of sciatic nerve may cause an incomplete sciatic nerve block during the popliteal block anaesthesia. They also mentioned that it may cause piriformis syndrome [8]. Güvençer M et al., study found high division of sciatic nerve in 48% of the cases. They reported type 2 pattern of high division of sciatic nerve in 16% cases, type 3 patterns in 8.0% cases. They also found a different type of high division of sciatic nerve, other than Beaton & Anson classification, that is, the sciatic nerve already divided in pelvis and its two divisions emerged out below piriformis in 24% of the cases [9]. Similarly other authors, Pokorny et al., [10], Shailesh et al., [11], Saritha S et al., [1], AD. Shewale et al., [12], Mallikarjun A & Sangeetha V [13] and Mengistu D & Amanuel T [14] found high division of sciatic nerve in 20.9%, 8.2%, 8.0%, 26.67%, 8.0% and 8.0% of cases respectively [Table/Fig-3].

In the present study we found that the sciatic nerve exited the pelvis below the piriformis and divided at the superior angle of popliteal fossa in 83.33% of cases. In one of the cadavers (3.33%) type 3 pattern of Beaton & Anson classification was seen, that is, the common peroneal nerve passed above the piriformis and tibial nerve below the undivided piriformis. We

Author	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Saritha S et al., 50 lower limbs (2012) [1]	92.00%	2.00%	2.00%			
Uluutku & Kurtoglu, 25 foetuses (1999) [7]	74.00%	16.0%	10.0%			
M. Guvencer et al., 50 lower limbs (2009) [9]	52.00%	16.0%	8.00%			
Pokorny et al., 91 cadavers (2006) [10]	79.10%	14.3%	4.40%	2.20%		
Shailesh et al., 86 lower limbs (2011) [11]	91.80%	2.32%	5.81%			
AD Shewale et al., 90 lower limbs (2013) [12]	73.33%	11.1%	2.23%			

**[Table/Fig-3]:** Shows comparison between present study and previous studies.

also found one different type of high division of sciatic nerve, other than Beaton & Anson classification, that is, in 4 out of 30 cadavers (13.33%) the sciatic nerve was seen to leave the pelvis below the undivided piriformis with its two components together but in separate sheaths.

## LIMITATIONS

Limitations of the present study include small and convenience sample so the study could not give population prevalence in the geographical region. However, it does give an insight for us to suspect anatomical variations in relation to sciatic nerve division.

## CONCLUSION

Since centuries, cadavers comprise the best means to record anatomical variations of different structures of the body. Sciatic nerve injuries and entrapment pathology form a routine part of day-to-day medical practice. Sound knowledge regarding the course, division and branching pattern will help a medical professional in accurate diagnosis and management of conditions involving sciatic nerve. The present study, evaluating the incidence of abnormal (high) division of sciatic nerve may help clinicians in management of conditions associated with sciatic nerve. Also while performing operations; a surgeon should be aware of the variations in the normal branching pattern and divisions of the sciatic nerve.

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