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Original Research Article

Position of Sciatic Nerve in Gluteal Region (Cadaveric Study)

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Conflict of interest: Nil

Abstract

Background: The sciatic nerve and its branches are most frequently injured mainly in the gluteal regions due to anatomical variations of nerve musculature and bony tuberosity around the sciatic nerve.

Method: 30 (thirty) adult human cadavers' gluteal regions are dissected as per the guidelines of Cunningham's manual. The length and breadth of the piriformis muscle, the distance between the sciatic nerve and the ischial tuberosity, and the midpoint of the sacrotuberous ligament were measured by digital vernier caliper.

Result: The relationship of the sciatic nerve in the gluteal region with adjacent structures has a significant p-value ($p<0.001$). The correlation of the morphanetric value of the piriformis muscle with the adjacent bony tuberosity and ligament with the sciatic nerve has a significant p-value ($p<0.001$).

Conclusion: The significant findings presented will assist clinicians, orthopedic surgeon, and anesthesiologists in treating sciatica in the gluteal region through appropriate diagnosis and potential treatment of gluteal pathology, enabling patients to lead normal social life.

Keywords: Sciatica, Piriformis, Ischial tuberosity, Sacro-taberous ligament.

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Introduction

The sciatic nerve is repeatedly involved in daily medical practices of anaesthesia, neurology, orthopaedic and rehabilitative medicine. The sciatic nerve and its branches are among the most frequently injured nerves within the human body. A possible reason for injury could be related to an inadequate knowledge of the anatomical variations of this nerve [1].

Embryologically, the tibial and common peroneal components initially develop as separate nerve bundles before they unite to form the sciatic nerve. Incomplete fusion or persistence of their independent developmental pathways may result in high division of the sciatic nerve [2]. While the sacral plexus and arterial network of the lower limb develop simultaneously within the mesenchyme of the developing limb bud.

Altered fusion or separation of the tibial nerve fascicles, along with the persistence of primitive vascular channels, may lead to the formation of the inferior gluteal nerve. It is proposed that 79.1% of the undivided sciatic nerve passes below the piriformis muscle, and the remaining 21% bifurcates before passing below the piriformis, which may compress the sciatic nerve [3]. The most prevalent deviation from the normal morphology in the gluteal regions keeps the patients restless due to neurological episodes [4].

Hence, an attempt is made to evaluate the morphometric study of the sciatic nerve and the bony landmarks, ligaments, musculatures adjacent to the sciatic nerve.

Material and Method

30 (thirty) male adult cadavers present in the anatomy department of SSPM Medical College and Life Time Hospital, Padve, Sindhudurg-416534, Maharastra, India, were studied.

Inclusive Criteria: Non-pathological, intact gluteal region and lower limb cadavers were selected.

Exclusion Criteria: Pathological, previously dissected, traumatic injuries and extensive tissue damage involving the gluteal region were excluded from the study.

Method: Dissection of the gluteal region was carried out as per the guidelines of the Cunningham

manual. Course of the sciatic nerve after its exit from the pelvis. The relationship of the sciatic nerve, the distance between the ischial tuberosity, and the midpoint of the sacrotuberous ligament length and breadth of the piriformis muscle were measured with a digital vernier caliper.

The duration of the study is March 2024 to December 2025.

Statistical Analysis: The distance of the sciatic nerve from bony elements and the sacro-tuberous ligaments' length and breadth of muscle were compared with the t-test and ANOVA test. The statistical analysis was carried out in SPSS software.



Figure 1:

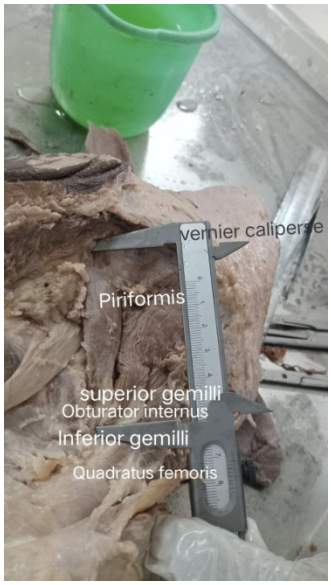


Figure 2:

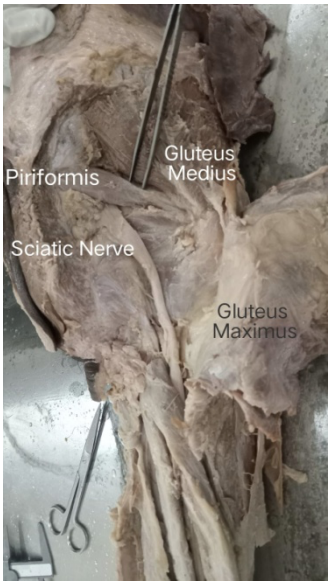


Figure 3:



Figure 4:



Figure 5:



Figure 6:

Observation and Results

Table-1: Study of relations of the sciatic nerve in the gluteal region.

- 1.3 (± 1.8) distance between ischial tubersity and sciatic nerve, 3.6 (± 1.4) distance between midpoint of sacro-tuberous ligament, t-test – 2.02 and $p < 0.001$ (p-value is highly significant).

Table-2:

Correlation of 5.2 (± 2.2) length of piriformis, 3.3 (± 1.5) breadth of piriformis, 4.5 (± 1.8) distance between ischial tuberosity and sciatic nerve, and 3.6 (± 1.2) distance between midpoint of sacro-tuberous ligament and sciatic nerve.

F value 7.64 and $p<0.001$ (p-value is highly significant).

Table 1: Relationship of sciatic nerve in gluteal region

Distance between Ischial tuberosity and sciatic nerve (Mean ± SD)	Distance between mid-point of sacro tuberous lig and sciatic nerve (Mean ± SD)	t- test	p-value
4.3 (± 1.8)	3.6 (± 1.4)	2.27	P<0.001

p-value is highly significant (p<0.001).

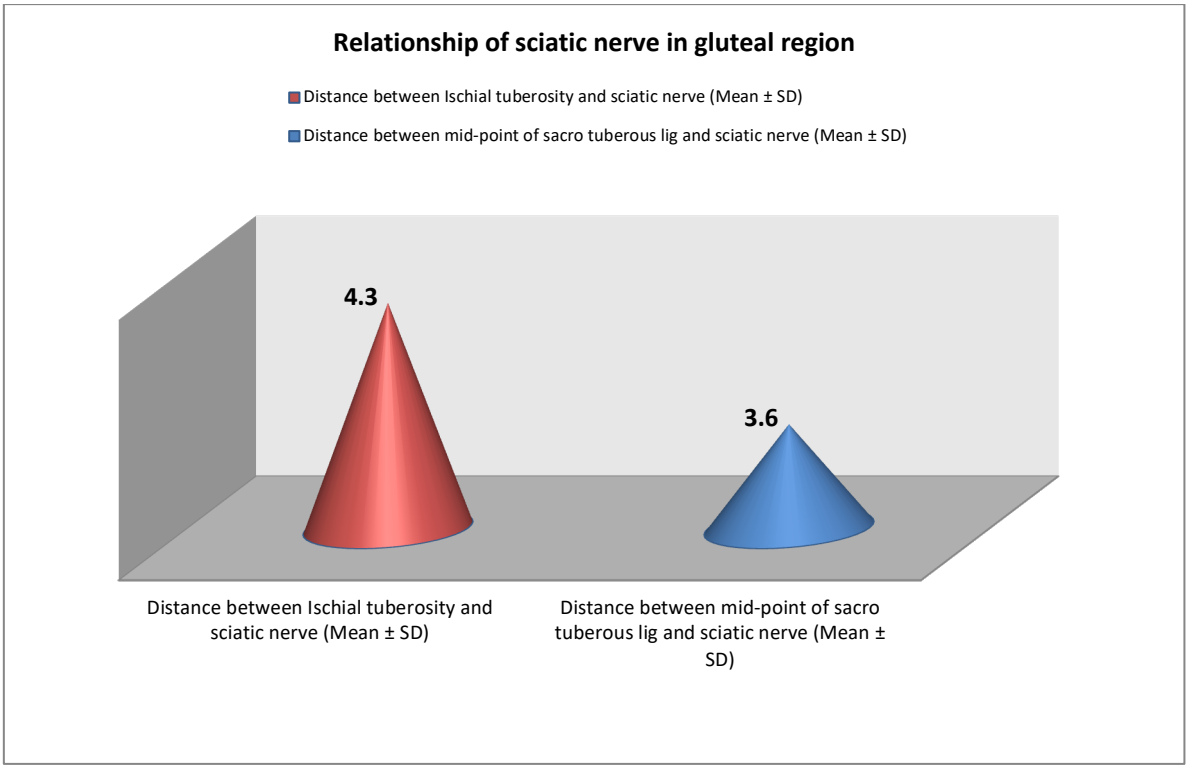


Figure 1: Relationship of sciatic nerve in gluteal region

Table 2: Correlation of related parameters (ANOVA Test)

Length of piriformis muscle (cms)	Breadth of piriformis muscle (cms)	Distance between Ischial tuberosity & sciatic nerve (cms)	Distance between mid-point of sacro tuberous lig& sciatic nerve (cms)	F value	P-value
5.2 (± 2.2)	3.3 (± 1.5)	4.5 (± 1.8)	3.6 (± 1.2)	7.64	P<0.001

p-value is highly significant (p<0.001).

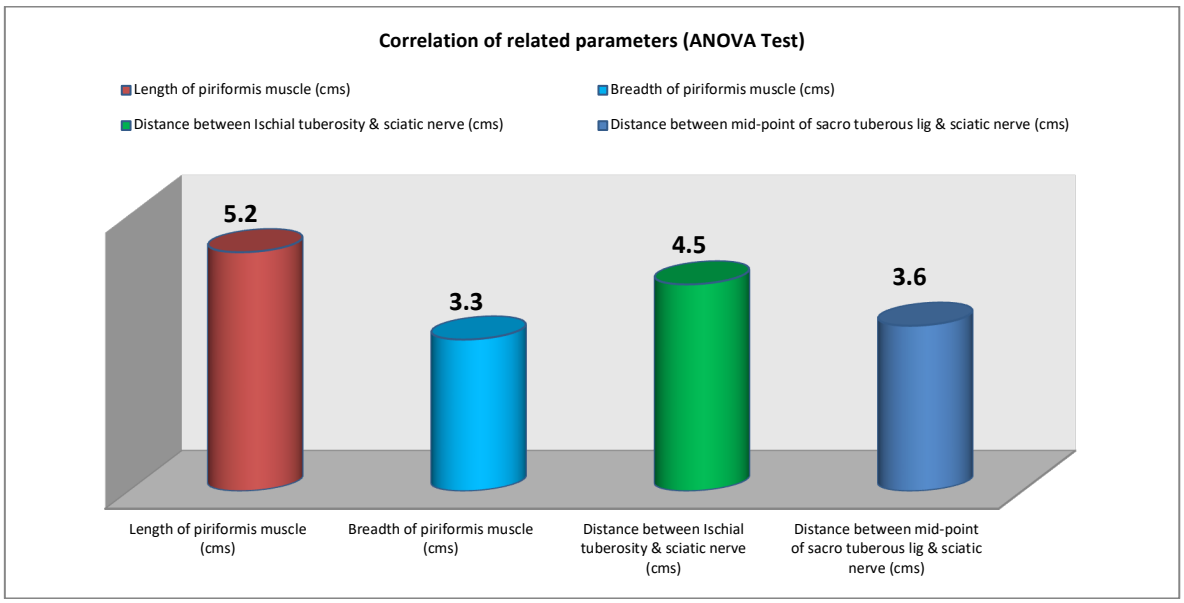


Figure 2: Correlation of related parameters (ANOVA Test)

Discussion

Present study of the position of the sciatic nerve in the gluteal region (cadaveric study). The relationship of the sciatic nerve in the gluteal region with the ischial tuberosity and sacrospinous ligament has a significant p-value (Table 1). The correlation of the morphometric value of the piriformis with the sciatic nerve, the distance with the ischial tuberosity, and the sacrotuberous ligament has a significant p-value (Table-2). These findings are more or less in agreement with previous studies [5,6,7] (figures 1,2,3,4,5,6).

A number of techniques performed in and out of the operation theater after requiring access to this region. If complications within the gluteal region occur, resulting from surgical complications or the presence of unknown variations within the region, there could be considerable and permanent impairment to the structures of the lower limb. These complications range from general irritation to loss of sensation in the posterior compartment of the thigh, foot, or the entire lower limb [8]. It is also reported that the common fibular nerve pierced 10% to 20% of the piriformis. Moreover, in 2% to 4% of the population, the common peroneal nerve passes above the piriformis muscle [9]. The fusion of the piriformis with the gluteus medius muscle is rarely observed in 1.18% of cases. The bifurcation of the sciatic nerve in the pelvic region was 12.5% to 14.8% in different populations [10].

The embryological reason behind variations of the sacral nerve is the premature division of the sciatic nerve because the sciatic nerve develops from two plexuses of the lower limb, the lumbar and sacral, at the base of the limb bud in the fetus. Later components of both plexuses get divided into dorsal and ventral roots. The large dorsal component of the sacral plexus (common fibular) and ventral (tibial) move downwards close together to form the sciatic nerve. Both the components of the sciatic nerve develop separately in embryonic life and maintain their individual identity throughout their extent [11].

Apoptosis takes place if neurons are ineffective at attaining a sufficient amount of specific neurotrophic factors during synaptogenesis. Apoptosis of collaterals may endow them with mature neuronal architecture. In surplus, a reduced amount of expression of one or multiple factors may be accountable for variations in the formation, relation, and distribution of the motor nerve fibers [12].

Summary and Conclusion

The position of variations of the sciatic nerve in the cadavers has embryological significance because of the premature division of the sciatic nerve. It may result in nerve injury during deep intramuscular injections in the gluteal region, piriformis syndrome, failed sciatic nerve block in anaesthesia and injury during posterior hip operations and innumerable surgical interventions. This condition may resemble sciatica and be caused by it. Confusions while treating sciatica patients, so these types of variations should be kept in mind while dealing with not only sciatica due to intervertebral disc herniations also.

Limitation of study: Owing to the remote location of the research centre, the small number of cadavers and lack of the latest techniques, we have limited findings and results.

The Ethical Committee of SSPM Medical College and Life Time Hospital, Padve, Sindhudurg-416534, Maharastra, India approve this research work.

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