



Study of variations in medial sural cutaneous nerve, lateral sural cutaneous nerve and peroneal communicating nerve.

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Abstract:

The sural nerve complex includes the Medial sural cutaneous nerve (MSCN), Lateral sural cutaneous nerve (LSCN), Peroneal communicating nerve (PCN) and Sural nerve. The sural nerve is the most frequently used donor nerve for peripheral nerve grafting. LSCN can be an alternative to sural nerve in situations requiring a limited length of nerve graft material, the peroneal communicating nerve may also be harvested. Fifty lower limb specimens were dissected and data was collected. The study included 16 male and 9 female cadavers. MSCN was observed in all 50 specimens, out of which 74% specimens had normal course and 22% had a transmuscular course. LSCN was present in 82% of specimens. PCN was arising from Common Peroneal Nerve (CPN) directly in 16% and as a common trunk with LSCN in 14% of specimens. PCN was absent in 28% of cases. So knowledge of variation in these nerves will help the surgeons while considering these nerves for nerve grafting.

Key words: Medial sural cutaneous nerve, Lateral sural cutaneous nerve, Peroneal communicating nerve

Introduction:

The medial sural cutaneous nerve (MSCN), lateral sural cutaneous nerve (LSCN), peroneal communicating nerve (PCN) and sural nerve proper form the components of sural nerve complex.^{1,2} MSCN arises from the tibial nerve in popliteal fossa, usually a little below the level of knee joint. It runs downwards in the groove between two heads of gastrocnemius, most superficial muscle of the calf accompanied by the small saphenous vein usually medial to it but sometimes lateral. The common peroneal nerve, lateral smaller terminal branch of sciatic nerve begins at the superior angle of the popliteal fossa and follows closely to the medial border of biceps femoris tendon, along the superolateral boundary of popliteal fossa.³ The lateral sural cutaneous nerve arises from common peroneal nerve in popliteal fossa, on the lateral head of gastrocnemius and descends deep to the deep fascia. It descends along the lateral aspect of the

upper half of the leg. Lateral sural cutaneous nerve often gives rise to a peroneal communicating branch, which supplies the skin on the medial side of the lower part of the calf before joining the medial sural cutaneous nerve to form the sural nerve.^{4,5}

The sural nerve is the most frequent donor nerve used for peripheral nerve grafting.^{1,6} It has been suggested that Lateral sural cutaneous nerve can be an alternative to sural nerve for grafting, because its length and diameter are similar and the resultant sensory deficit would be less following grafting.¹ The Lateral sural cutaneous nerve can also be utilized in a sensate free flap for various reconstructive procedures. When a sural nerve is not formed, it is usually the MSCN that supplies the lateral surface of the leg, giving off lateral branches to the heel and forms the lateral dorsal cutaneous nerve.⁷ In situation requiring a limited length of nerve graft material, the PCN may also be harvested and the MSCN can be

preserved.¹ The knowledge of variations in the MSCN, LSCN and PCN will help the surgeons while considering these nerves for nerve grafting.

Materials and methods:

This study was done at Dept. of Anatomy at Sri Siddhartha Medical College, Tumkur. The study included 50 lower limb specimens. The data was collected by dissection method. By using dissecting instruments, two horizontal incisions was made, one at the junction of middle and lower one third of the thigh and another at the lower end of lateral malleolus. Then these two incisions were joined by vertical incision. The superficial fascia was exposed after reflecting the flap of skin. The sural nerve was identified along the side of lesser saphenous vein and then traced upwards. The deep fascia was exposed and the medial sural cutaneous nerve was traced between the two heads of gastrocnemius muscle, till its origin from the tibial nerve in popliteal fossa. The peroneal communicating branch was identified and traced upwards. PCN was traced from the point of union with MSCN upto its origin i.e., either from lateral sural cutaneous nerve or directly from common peroneal nerve. The data obtained were noted, analysed and compared with other studies.

Results:

Fifty formalin fixed lower limbs were dissected from 16 male and 9 female cadavers.

Medial Sural Cutaneous Nerve:

The MSCN was observed in all 50 specimens. The nerve took origin from the tibial nerve in popliteal fossa and descended between 2 heads of gastrocnemius deep to the deep fascia covering the muscle. The MSCN communicated with peroneal communicating nerve at various levels. In 37(74%) Specimens it had normal course

and in 11(22%) specimens had a transmuscular course, i.e., entrapped between the 2 heads of gastrocnemius (Image.1). It was more in male specimens. In 6 specimens MSCN was partly entrapped within the muscle.

MSCN had a very short course in one specimen (2%) in which aroused from tibial nerve in popliteal fossa and communicated with the peroneal communicating nerve (PCN) within the popliteal fossa to form the sural nerve. In 1(2%) communicated twice with the PCN. MSCN continued alone as sural nerve in 14 specimens. This type was found equally distributed in both right and left lower limbs (Table I).

MSCN in its course lies superficial to the gastrocnemius muscle and deep to the fascia covering the muscle. In the present study, it was observed that in 11 specimens, MSCN showed a variable course. In 5 specimens MSCN was completely entrapped throughout its course within the muscle. Remaining specimens there was unilateral entrapment. Incidence was seen more among right male specimens (4 cases). Bilateral entrapment was seen in a single male cadaver.

Lateral sural cutaneous nerve:

In present study, LSCN was present in 82% of specimens. LSCN was absent in 18% of specimens. LSCN was arising directly from CPN in 66% and as common trunk from CPN in 16% of cases (Table II). In one of the specimens, LSCN crossed the MSCN in the lower part of the back of leg and supplied the skin medial to the MSCN (Image II).

Table I: Overall observations in MSCN.

Overall observations	Male						Female						Total	
	Left		Right		Total		Left		Right		Total			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Normal course	13	81.3	12	75.0	25	78.1	6	66.7	6	66.7	12	66.7	37	74.0
Other findings	3	18.8	4	25.0	7	21.8	3	33.3	3	33.3	6	33.3	13	26.0
• Entrapped	3	18.8	4	25.0	7	21.8	2	22.2	2	22.2	4	22.2	11	22.0
• Communicates with PCN within PF	-	-	-	-	-	-	0	0.0	1	11.1	1	5.6	1	2.0
• communicates twice in its course	-	-	-	-	-	-	1	11.1	0	0.0	1	5.6	1	2.0
Total	16	100	16	100	32	100	9	100	9	100	18	100	50	100

Image I: Complete entrapment of MSCN.



Table II: Overall observations in LSCN

Observations	Male						Female						Total	
	Left		Right		Total		Left		Right		Total			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
a. Origin from CPN	10	62.5	8	50.0	18	56.2	7	77.8	8	88.9	15	83.3	33	66.0
b. Arise as common trunk from CPN with PCN	5	31.3	2	12.5	7	21.9	1	11.1	0	0.0	1	5.6	8	16.0
c. Absent	1	6.3	6	37.5	7	21.9	1	11.1	1	11.1	2	11.1	9	18.0
Total	16	100	16	100	32	100	9	100	9	100	18	100	50	100

Image II: Variation in course of LSCN.

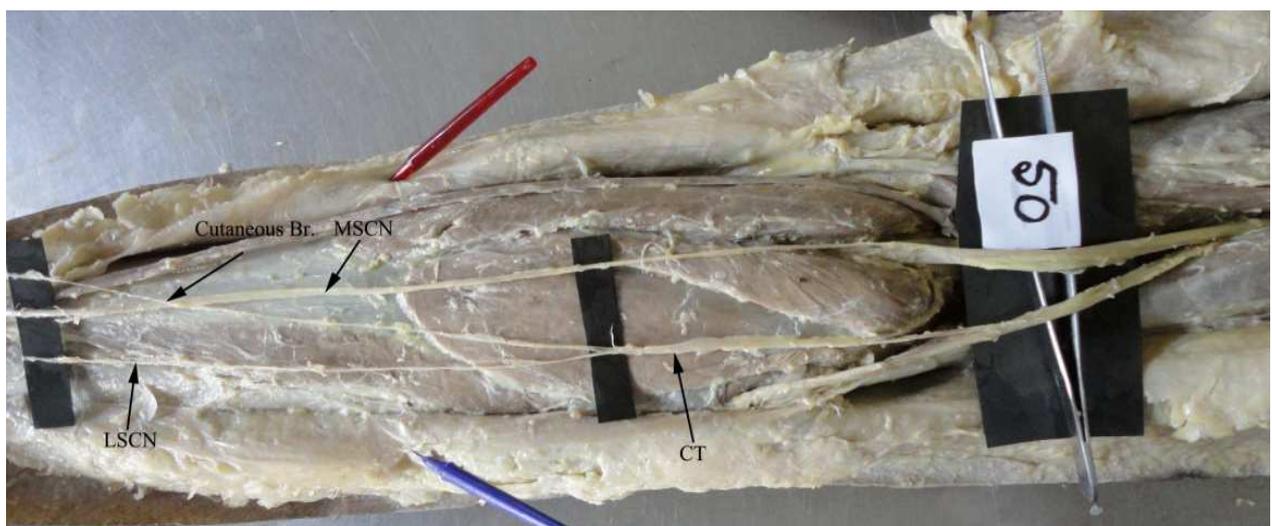
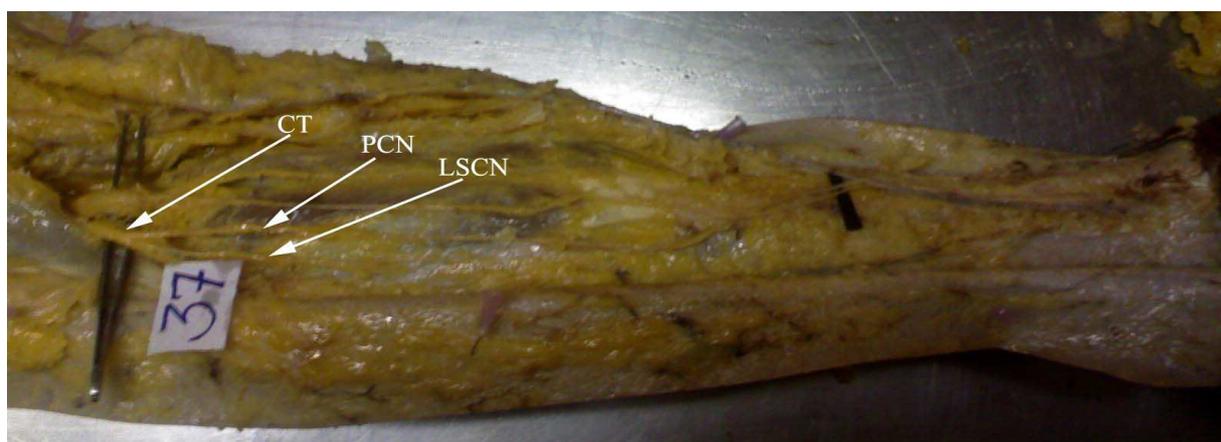


Table III: Observations in PCN.

Overall observations	Male						Female						Total	
	Left		Right		Total		Left		Right		Total			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
a. From CPN Directly	1	6.3	4	25.0	5	15.6	3	33.3	0	0.0	3	16.7	8	16.0
b. From common trunk	5	31.3	1	6.3	6	18.8	1	11.1	0	0.0	1	5.6	7	14.0
c. From LSCN	6	37.5	7	43.75	13	37.5	2	22.2	6	66.7	8	44.4	21	42.0
d. Absent	4	25.0	4	25.0	8	25.0	3	33.3	3	33.3	6	33.3	14	28.0
Total	16	100	16	100	32	100	9	100	9	100	18	100	50	100
Other findings														
a. Terminates within fossa	0	0.0	0	0.0	0	0.0	0	0	1	11.1	1	11.1	1	2.0
B .Twice communication	0	0.0	0	0.0	0	0.0	1	11.1	0	0.0	1	5.6	1	2.0
Total	0	0.0	0	0.0	0	0.0	1	11.1	1	11.1	2	16.7	2	4.0

Image III: PCN arising as common trunk.



Peroneal communicating nerve:

Peroneal communicating arises from the CPN commonly either directly or along with LSCN, and communicates with the MSCN usually in lower 3rd of leg to form the sural nerve. It may be absent and then its function is either taken by MSCN or LSCN.

PCN was arising from CPN directly in 8 cases (16%). PCN was arising as a common trunk with LSCN in 7 cases (14%)(Image 3). PCN was arising from LSCN in 21 cases (40%). PCN was absent in 14 cases (28%). In 2% PCN terminated within popliteal fossa and in 2% it communicated twice with MSCN (Table III).

Discussion:

Many authors have explained about the incidence of MSCN in the formation of sural nerve and considered it to be the main component of sural nerve. In study done by Coert H J et al MSCN was present in all the lower limbs. Minne et al could identify MSCN in only in 2.7% of cases.⁸ Huelke DF et al found MSCN absent in only one case and said it as a rare type.⁹

Shankar N et al has reported the origin of MSCN from the sciatic nerve in 1 out of 38 cases(2.6%).¹⁰

Table IV: Observations of LSCN in other studies.

LSCN	Bardeen ¹⁷ (1907)	Huelke ¹⁵ (1958)	Ortiguela et al ¹ (1987)	Coert & Dellon ⁸ (1994)	Uluutku., et al ² (2000)	Present study
Present	100%	78%	95%	96%	100%	82%
Absent	0%	22%	5%	4%	0%	18%

Ugrenovic S et al have reported that MSCN present in 99% of cases¹¹, while Uluutku H et al² detected in 95% and Ortiguela et al¹ in 100% of cases study. Ugrenovic S et al have reported that MSCN originated from the posterior surface of the tibial nerve within popliteal fossa and was present in all the cases. Similar observations were made in the present study. Hence MSCN is the most consistent component of sural nerve. In one of the specimen MSCN aroused from tibial nerve in popliteal fossa and communicated with the PCN within the popliteal fossa to form SN. Williams DD in his study has reported conditions in which MSCN of a left leg was quite short ending in the skin on the medial side of superior one third of the leg.¹²

Lateral sural cutaneous nerve (lateral cutaneous nerve of calf) arises as one of the cutaneous branch of Common peroneal nerve often from a common trunk along with PCN.¹⁴ In present study LSCN was present in 82% of specimens. Ortiguela et al found LSCN present in 95% of cases.¹

Few authors reported the absence of LSCN. Coert H J et al⁸ has reported that LSCN was absent in 4% of cases and Aktan Ikiz ZA¹³ has observed in 16.7% of cases.

In present study, LSCN was absent in 18% of specimens (Table IV). In 2 specimens MSCN and LSCN had separate courses (6.7%) in a study done by Aktan Ikiz ZA.¹³ Similar observations were made in the present study where two specimens showed separate course of MSCN and LSCN (4%). Williams DD has described in some cases PCN and LSCN arose as a common trunk from the CPN in 1.55% of cases. Andreassi found PCN and LSCN to arise by a common trunk from the CPN in majority of cases.¹²

In present study, LSCN arose as a common trunk from CPN and in both the sexes it accounted for 16 %. LSCN was seen arising from a common trunk of CPN in seven male cadavers (21.9%), among which five were in left leg and two in right leg. Similar type of origin was seen in a single left leg of a female cadaver (5.6%). Incidence of origin of LSCN from the common trunk was seen more in males. LSCN had a normal course in all the specimens, descended downwards over the lateral head of gastrocnemius beneath the deep fascia and terminated by giving cutaneous branches (Table II). In one of the specimens, LSCN crossed the MSCN in the lower part of the back of leg and supplied the skin medial to the MSCN.

Peroneal communicating nerve (sural communicating nerve) arises near the fibular head often as a common trunk with LSCN from CPN. It was also called as the communicating ramus of the lateral sural cutaneous branch of the CPN.¹⁴

The nomenclature applied to the lateral sural cutaneous nerve contribution is confusing. It is termed the peroneal (fibular) communicating branch by some authors. In the present study it is considered as PCN. Williams DD have mentioned about the authors describing the PCN as arising in all or the majority of the cases from LSCN and few describing the PCN arising alone in majority of cases or in

common with the LSCN from the CPN. Williams DD observed that PCN arose from the CPN in 93% of cases, from LSCN in 1.17% of cases and in 1.55% PCN and LSCN both arose from a common trunk from the CPN.¹²

PCN originated from LSCN in 93.7% cases in study by Ortiguera et al.¹ Huelke DF observed that, out of the 159 sides PCN arose directly from the CPN in 54.7%, usually as a branch separate from the lateral sural cutaneous nerve (41.5%). The PCN was a terminal branch of LSCN in one third of specimens, and arose from a trunk common to it and the LSCN in 12%.¹⁵

Huelke DF had observed that the PCN was absent in 19.7% of the 198 cases, and due to its absence typical sural nerve is not formed in these cases. In 22% of cases PCN was the only branch of the CPN to the posterior aspect of leg, the LSCN being entirely absent.⁹ In present study, PCN arose directly from CPN in 10 cases (20%). PCN and LSCN arose from a common trunk in 52% of specimens and it was absent in 28% of specimens, hence in these there was no formation of typical sural nerve (Type A) (Table III). Present study resembles findings of the study done by Huelke et al.¹⁵ In a study by Mahakkanukraha P et al showed additional sites of union of MSCN and the PCN at a point anywhere between the popliteal fossa to the ankle, with two SN's formed in middle 3rd of leg (1.9%) and 26 (25.5%) at or just below the ankle.¹⁶ Similar case was seen in one specimen in present study. First communication was at the lower angle of popliteal fossa and the other in distal third of leg.

Conclusions:

Sural nerve formation includes many components in variable proportions. It also differs in the site of union of these components. Length of the SN also varies and this expansible length of the nerve

helps in nerve grafting procedures which may require more than 9 cm of length. The components which form the SN that is the PCN and LSCN can also be used for the same because of their caliber.

So knowledge of variations in components of sural nerve complex i.e., MSCN, LSCN and PCN may help to guide during surgeries in the region.

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