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Case Report

An unusual origin and intramuscular course of the sural nerve – a case report

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ABSTRACT

The sural nerve is usually formed by the medial sural cutaneous nerve and peroneal communicating nerve, branches of the tibial nerve and the common peroneal nerve, respectively. During routine dissection of the left leg of an elderly male cadaver the sural nerve was seen to arise entirely from the common peroneal nerve. The sural nerve on this side was found to have an intramuscular course through the gastrocnemius. To our knowledge this is the first case report of the sural nerve arising entirely from the peroneal communicating nerve and also having an intramuscular course through the gastrocnemius. On the right side, it was observed that the sural nerve was formed in the popliteal fossa and had contributions from both the medial sural cutaneous nerve and the peroneal communicating nerve. The sural nerve is clinically important as it is commonly used for biopsies, nerve conduction studies and as a convenient source for nerve grafting. In all these procedures, the formation and course of the sural nerve in the calf assumes great significance. © **Neuroanatomy. 2008; 7: 79–82.**

Key words [sural nerve] [origin] [common peroneal nerve] [intramuscular course] [gastrocnemius]

Introduction

The sural nerve (SN) supplies the skin of the inferolateral region of the leg and the lateral border of the foot. It is usually formed by contributions from both the tibial nerve (TN) and the common peroneal nerve (CPN). The branch from the TN, which is often more substantial, is called the medial sural cutaneous nerve (MSCN). The branch from the CPN is termed the peroneal communicating branch (PCN) [1]. We describe a case report of an unusual origin and course of the SN and discuss its clinical implications.

Case Report

During routine dissection of the left leg of an elderly male cadaver a large branch was seen arising from the CPN. It was subsequently identified as the SN. The lateral cutaneous nerve of the calf (LCN) was identified in its usual location. The TN did not contribute to the formation of the SN on this side. The SN coursed inferiorly, and passed in a tunnel just deep to the two heads of the gastrocnemius muscle in the upper half of the leg (Figure 1). It then emerged in the lower half of the leg and pierced the deep fascia to become cutaneous. Subsequently, it accompanied the small saphenous vein and passed behind the lateral malleolus to terminate at the distal end of the lateral border of the foot.

On the right side, it was observed that the SN had contributions from both the MSCN as well as the PCN. The MSCN and PCN formed the SN in the popliteal fossa, soon after their branching from the TN and CPN respectively. The contribution from the PCN was substantially greater. The SN then passed inferiorly, deep to the deep fascia, but superficial to the gastrocnemius muscle (Figure 2). Its subsequent course was similar to that on the left side.

Discussion

The pattern of formation of the SN has been broadly divided into three types A, B and C by Huelke (Figure 3) [2]. Type A is called the anastomotic type and receives a contribution from the TN, termed the MSCN and a contribution from the CPN called the PCN. Types B and C are non-anastomotic patterns of formation. In type B the contribution is entirely by the MSCN and type C entirely by the PCN. Other nerves such as the lateral cutaneous nerve of the calf and the posterior cutaneous nerve of the thigh may contribute to the formation of the sural nerve. Taking these unusual origins into account, more recently some authors have classified the pattern of formation of the sural nerve into more types [3,4].

In the present case type C was seen on the left side and type A on the right side. Types A and B are much more common as compared to type C. The incidence of type C is summarized in Table 1 [2-9]. It varies from 0% to 14% in various studies conducted throughout the world. These differences may be due to genetic variations in different races. The other factor that has to be taken into account is the wide variation in the sample size of the

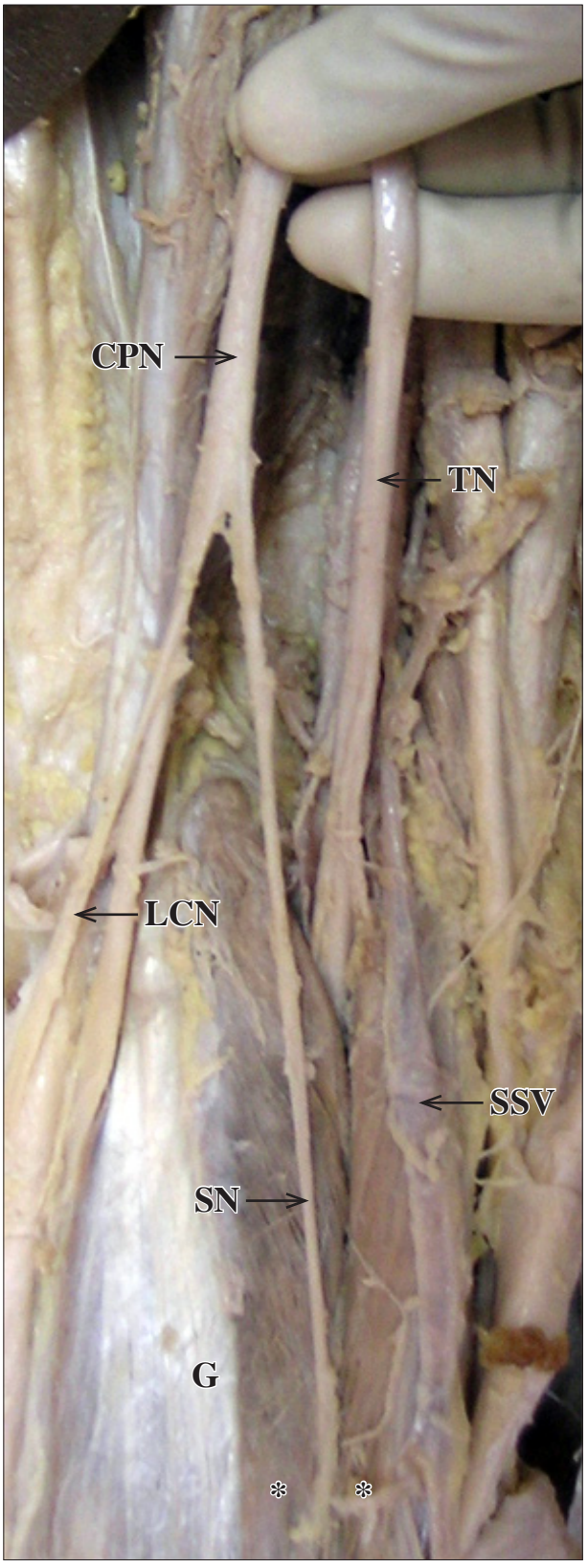

Figure 1. Formation of the sural nerve (***SN***) on the *left* side entirely from the common peroneal nerve (***CPN***). The point of entry of the SN into the gastrocnemius muscle (***G***) to undergo an intramuscular course is depicted by asterisks (*). Color version of figure is available online. *(**TN:** tibial nerve; **SSV:** short saphenous vein; **LCN:** lateral cutaneous nerve of the calf)*

Figure 2. Formation of the sural nerve (***SN***) on the *right* side from the medial sural cutaneous nerve (***MSCN***) and the peroneal communicating nerve (***PCN***) in the popliteal fossa. Color version of figure is available online. *(**TN:** tibial nerve; **CPN:** common peroneal nerve; **SSV:** short saphenous vein; **G:** gastrocnemius muscle)*

studies that have been conducted. No large studies have been conducted in Indian populations thus far. The type A pattern of formation is most often bilaterally present. Type C pattern is commonly unilateral and is usually combined with another pattern on the opposite side [2].

In our case the SN was formed in the popliteal fossa on the right side. This site of formation is uncommon. The point of joining of the MSCN and the PCN to form the SN is highly variable. The most common site of

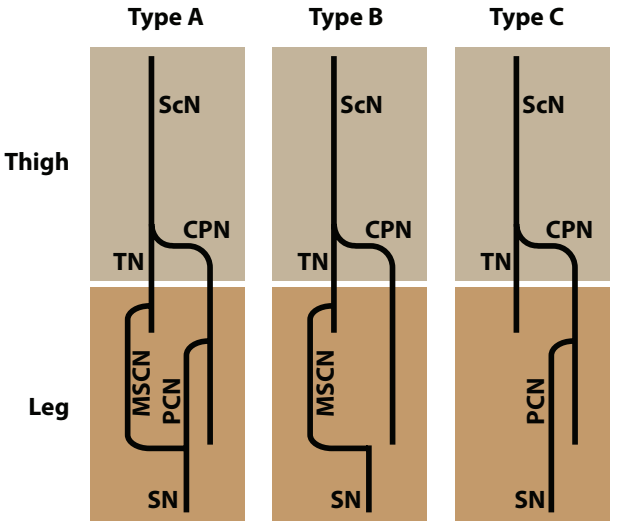

Figure 3. Schematic diagram showing the different types of formation of the sural nerve as described by Huelke [2]. *(**ScN:** sciatic nerve; **TN:** tibial nerve; **CPN:** common peroneal nerve; **MSCN:** medial sural cutaneous nerve; **PCN:** peroneal communicating nerve; **SN:** sural nerve)*

formation appears to be the middle third of the calf [3]. Various studies have revealed that the site of formation of the SN in the upper fourth of the leg occurs in between 3 to 24.3% of cases [2,4].

The contribution to the SN from the PCN was greater on the right side in the present case. The relative contributions of the MSCN and the PCN have been studied in cadavers as well as using nerve conduction methods [9]. The contribution from the MSCN is usually larger as compared to the PCN. However a study conducted in Thailand found that the mean diameter of the PCN was greater than that of the MSCN [6]. This could be due to racial differences in the populations that were studied.

An intramuscular course through the gastrocnemius was taken by the SN on the left side in the present case. In a study conducted in Brazil on 60 legs, such an intramuscular course of the MSCN, was noted in 4 (6.7%) legs. In one cadaver this was found bilaterally [10]. A recent case report also describes this finding unilaterally [11]. To our knowledge this is the first case report of the SN arising entirely from the PCN and also having an intramuscular course through the gastrocnemius muscle.

Many studies have documented symptoms produced by the entrapment of the SN by fascia or scar tissue. However penetration of the gastrocnemius by the SN has been rarely described. This anomalous course should be considered in any pain that occurs in the distribution of the SN due to suspected entrapment [10]. The SN is usually considered to be a purely sensory nerve, except for the sympathetic fibers supplying smooth muscle and sweat glands in the skin. However motor fibers to skeletal muscle have been rarely observed to travel in the SN. One study in Japan showed communications between the TN and the SN in the lower part of the leg in some cadavers.

Table 1. The frequency of type C pattern of formation of the sural nerve in various studies conducted throughout the world.

Author	Year	Country	Type of study	N	F
Bardeen [2]	1906	USA	C	76	1 (1.3%)
Gluschkow [2]	1918	Russia	C	Unknown	4%
Kosinski [2]	1924	Poland	C	234	14 (6%)
Catania [2]	1924	Italy	C	94	13 (14%)
Andreassi [2]	1931	Italy	C	144	2 (1.4%)
Ssokolow [2]	1933	Russia	C	500	18 (3.6%)
Mogi [2]	1938	Japan	C	180	0
P'an [2]	1939	China	C	286	15 (5.2%)
Williams [2]	1954	USA	C	257	1 (0.4%)
Huelke [2]	1958	USA	C	352	1 (0.3%)
Uluutku [4]	2000	Turkey	C (newborn)	40	0
Mestdagh [5]	2001	France	C	74	1 (1.3)
Mahakkanukrauh [6]	2002	Thailand	C	152	0
Kim [7]	2003	Korea	C	14	0
Ugrenovic [3]	2005	Serbia	C (foetal)	200	3 (1.5%)
Sekiya [8]	2006	Japan	C	31	0
Kim [9]	2006	Korea	NC	94	0

(C: cadaveric study; NC: nerve conduction; N: number of lower limbs examined; F: frequency and percentage of Type C sural nerve*)*

This could be the pathway by which motor fibers enter the SN [12]. Whether the SN fibers that pass through the gastrocnemius also supply motor fibers to it has yet to be elucidated. This variation should also be kept in mind by surgeons while operating on this area.

The SN is clinically important as it is commonly used for biopsies, nerve conduction studies and as a convenient source for nerve grafting. In all these procedures, the formation and course of the SN in the calf assumes great significance. A recent case report describes a case of partial palsy of the CPN after harvesting of the SN. It was later found that the SN arose solely from the CPN [13]. In order to reduce the complications as a result of harvesting the SN, it has been suggested that the PCN or the MSCN be used instead [7]. However in cases where the SN arises entirely from the PCN this may not be advantageous. Thus, the unusual origin and course of the SN as described in this study has to be borne in mind while performing the procedures described above.

References

[1] **Standring S, Berkovitz BKB, Hackney CM, Ruskell IGL.** Gray's Anatomy. The Anatomical basis of clinical practice. **39th Ed., Edinburg, Churchill & Livingstone, 2005; 1505.**

[2] **Huelke DF.** A study of the formation of the sural nerve in adult man. **Am. J. Phys. Anthropol. 1957; 15: 137–145.**

[3] **Ugrenovic S, Vasovic L, Jovanovic I, Stefanovic N.** Peculiarities of the sural nerve complex morphologic types in human fetuses. **Surg. Radiol. Anat. 2005; 27: 25–29.**

[4] **Uluutku H, Can MA, Kurtoglu Z.** Formation and location of the sural nerve in the newborn. **Surg. Radiol. Anat. 2000; 22: 97–100.**

[5] **Mestdagh H, Drizenko A, Maynou C, Demondion X, Monier R.** Origin and make up of the human sural nerve. **Surg. Radiol. Anat. 2001; 23: 307–312.**

[6] **Mahakkanukrauh P, Chomsung R.** Anatomical variations of the sural nerve. **Clin. Anat. 2002; 15: 263–266.**

[7] **Kim YT, Moon JS, Kim JK.** Anatomical investigation of sural nerve and its contributing nerves. **J. Korean Acad. Rehabil. Med. 2003; 27: 723–726. (Abstract)**

[8] **Sekiya S, Suzuki R, Miyawaki M, Chiba S, Kumaki K.** Formation and distribution of the sural nerve based on nerve fascicle and nerve fiber analysis. Sural-tibial nerve communications in humans. **Anat. Sci. Int. 2008; 81: 84–81.**

[9] **Kim CH, Jung HY, Kim MO and Lee CJ.** The relative contributions of the medial sural and peroneal communicating nerves to the sural nerve. **Yonsei. Med. J. 2008; 47: 415–422.**

[10] **Pimentel ML, Fernandes RMP, Babinski MA.** Anomalous course of the medial sural cutaneous nerve and its clinical implications. **Braz. J. Morphol. Sci. 2005; 22: 179–182.**

[11] **George BM, Nayak S.** Sural nerve entrapment in gastrocnemius muscle – a case report. **Neuroanatomy. 2007; 6: 41–42.**

[12] **Sekiya S, Kumaki K.** Sural-tibial nerve communications in humans. **Anat. Sci. Int. 2002; 77: 140–144.**

[13] **Schubert HM, Wechselberger G, Hussl H, Schoeller T.** Peroneal nerve lesion after sural nerve graft harvest: An unusual complication - case report. **Microsurgery. 2005; 25: 54–56.**