



Anatomic Study of Superior Cluneal Nerves: Revisiting the Contribution of Lumbar Spinal Nerves

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■ **OBJECTIVE:** Superior cluneal nerve (SCN) entrapment neuropathy can result in low back pain and thus be confused with other pathologies (e.g., lumbar disk disease). Therefore we performed cadaveric dissection of the SCN to better understand its anatomy and segmental origin.

■ **METHODS:** Twenty sides from 10 Caucasian fresh frozen cadavers (6 females and 4 males) were used in this study. The diameter of the SCN, distance between the exit point of the SCN from the thoracolumbar fascia and midline, and distance between the exit point of the SCN from the thoracolumbar fascia and the posterior superior iliac spine to the medial and lateral SCN were measured. The segmental origins of the SCNs were verified.

■ **RESULTS:** Seventy-five percent of the dorsal rami of L1, 90% of L2, 95% of L3, 45% of L4, and 10% of L5 contributed to the SCN. The SCN was formed by 3 vertebral levels in 55% and by 4 vertebral levels in 30%. Three SCNs pierced the thoracolumbar fascia in 45%.

■ **CONCLUSIONS:** The origin of the SCN, which has been described in the textbook and literature for a long time, should be reconsidered on the basis of our study results.

However, recent anatomic studies revealed that T11 and L5 dorsal rami might also contribute to the SCN.^{1,4} This might explain why some patients have symptoms similar to those seen with lumbar disk disease when the superior gluteal region is compressed.

The SCN is usually depicted as having 3 branches: medial, intermediate, and lateral SCN^{5,6}; however, this number might be more as demonstrated by anatomic¹ and clinical studies.^{7,8} According to Konno et al,¹ 35% of cadavers had more than 3 branches running over the iliac crest. Therefore the precise description of these should be revisited and remapped. Therefore our goal was to investigate the morphology of the SCN in order to clarify all of its branches and their specific origin and relationship with the thoracolumbar fascia. Such information could lead to better surgical procedures, such as SCN release⁹ and SCN blockade² and a better understanding for diagnosing pathology in this region.

MATERIALS AND METHODS

In this study, the nerves running over the iliac crest to reach the skin of the superior gluteal region were defined as SCNs. Also, the SCN most medially located and most laterally located was defined as the medial SCN and lateral SCN, respectively. Any of the SCNs located between the medial and lateral SCN were defined as intermediate SCNs.

Twenty sides from 10 Caucasian fresh frozen cadavers (6 females and 4 males), whose age at death ranged from 54–89 years with a mean age of 73.5 ± 11.8 years, were used in this study. A skin incision was made 2 finger breaths superior to the iliac crest from the midline laterally. The superficial layer of the thoracolumbar fascia was detected, and the subcutaneous tissue was dissected inferiorly to identify SCN branches that pierced the fascia. The diameters of all SCNs were measured. The distance

INTRODUCTION

Entrapment of the superior cluneal nerve (SCN) presents with various symptoms, many of which mimic low back pain.^{1–4} Historically, it has been believed that the origin of the SCN is the dorsal rami of the L1, L2, and L3 spinal nerves.⁵

Key words

- Anatomy
- Low back pain
- Lumbar vertebrae
- Nerve compression syndrome
- Pseudosciatica

Abbreviations and Acronyms

SCN: Superior cluneal nerve

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between the exit point of the SCN from the fascia and the midline (Dmid) and the posterior superior iliac spine (Dp) of the medial and lateral SCN was measured (Figure 1). Subsequently, the SCNs were traced back to the vertebrae to reveal their segmental origins. Measurements in this study were made with a digital microcaliper (Mitutoyo, Kanagawa, Japan).

RESULTS

The Dmid for the medial SCN and lateral SCN was 67.4 ± 9.6 mm (range 52.6–86.2 mm) and 81.2 ± 11.4 mm (range 54.8–102.5 mm), respectively, and the Dp for medial SCN and lateral SCN was 51.4 ± 12.9 mm (range 30.7–71.8 mm) and 65.3 ± 13.4 mm (range 45.9 to 91.6 mm), respectively. The number of intermediate SCN ranged from 0–3 with a mean of 1.4. The diameter of the medial, lateral, and intermediate SCN was 1.52 ± 0.52 mm (range 0.70–2.69 mm), 1.51 ± 0.70 mm (range 0.45–3.36 mm), 1.42 ± 0.73 mm (range 0.57–2.96 mm), respectively.

Out of 20 sides, the vertebral level of the origin of the SCN was T12 on 2 sides (10%), L1 on 15 sides (75%), L2 on 18 sides (90%), L3 on 19 sides (95%), L4 on 9 sides (45%), and L5 on 2 sides (10%), respectively (Figure 2). The SCN originating from the L5 vertebral level pierced the iliolumbar ligament (Figure 3). Five out of 10 specimens (50%) had the same vertebral levels on the right and left sides as the origin of the SCNs. The total number of the vertebral levels of the origin of the SCNs on each side was 2 on 2 sides (10%), 3 on 11 sides (55%), 4 on 6 sides (30%), and 5 on 1 side (5%) (Figure 4). The total number of SCNs that pierced the thoracolumbar fascia and ran over the iliac crest to reach the skin of the superior gluteal region on each side was 2 on 4 sides (20%), 3 on 9 sides (45%), 4 on 4 sides (20%), and 5 on 3 sides (15%) (Figure 5). SCNs originating from L1, L2, and L3 were observed on 8 sides (40%). On 1 side (5%), dorsal rami of the L2 and L3 joined and formed a common trunk (Figure 6), and on another side (5%), the dorsal rami of the L1 and L2 merged to form a common trunk. On 2 sides (10%), the dorsal ramus of L3 divided into 2 branches proximal to the exit from the thoracolumbar fascia, which innervated the superior gluteal region as 2 separated branches.

DISCUSSION

Two thirds of adults suffer from low back pain due to a variety of etiologies.¹⁰ Previous studies of the SCN demonstrated that 1.6%–12% of all low back pain might be due to SCN entrapment neuropathy.^{11–13} Such pain could be induced by movements such as rolling over, lateral flexion and rotation, crouching, walking, standing, and sitting.^{13,14} SCN entrapment neuropathy might be treated by the local nerve block on a trigger point. Surgical treatment is indicated for patients who have failed conservative treatment.^{13,15–17} The number of SCNs has been reported as up to 6,¹ and the number of vertebral levels of origin have included up to 7 (from T11–L5)^{1,18} levels. The present study found that the proximal part of the SCN can anastomose with regional nerves deep to the thoracolumbar fascia. However, the SCN is still said to have just 3 branches: medial, intermediate, and lateral.¹²

As critical questions for diagnosis and treatment of SCN neuropathy include “which vertebral level is the common origin of the SCN,” and “how many SCNs do patients usually have?” the data collected in

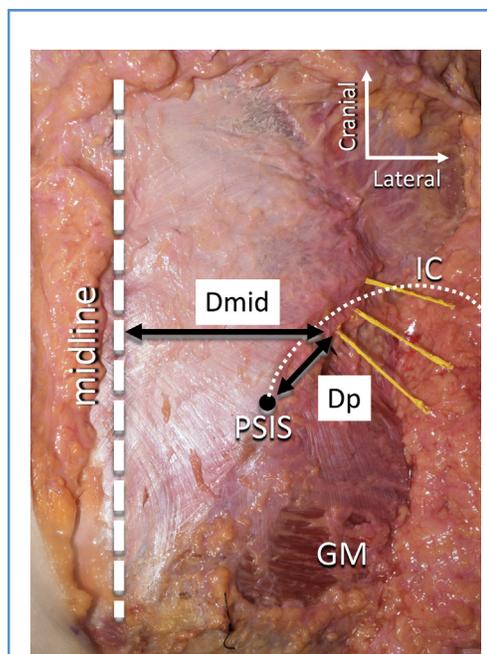


Figure 1. Measurement of each distance with a cadaveric picture. Dmid, distance between the exit point of the superior cluneal nerve (SCN) and the midline; Dp, distance between the exit point of the SCN and the posterior superior iliac spine; GM, gluteus maximus; IC, iliac crest; PSIS, posterior superior iliac spine.

the present study might be of use. We found that 75% of the dorsal rami of L1, 90% of L2, and 95% of L3 gave origin to the SCN. However, 45% of the dorsal rami of L4 and 10% of L5 also gave rise SCN.

In 55% (11/20), the SCN had 3 vertebral levels of origin. Interestingly, only 45%, less than half, had 3 SCNs, which have been classified as medial, intermediate, and lateral branches in the

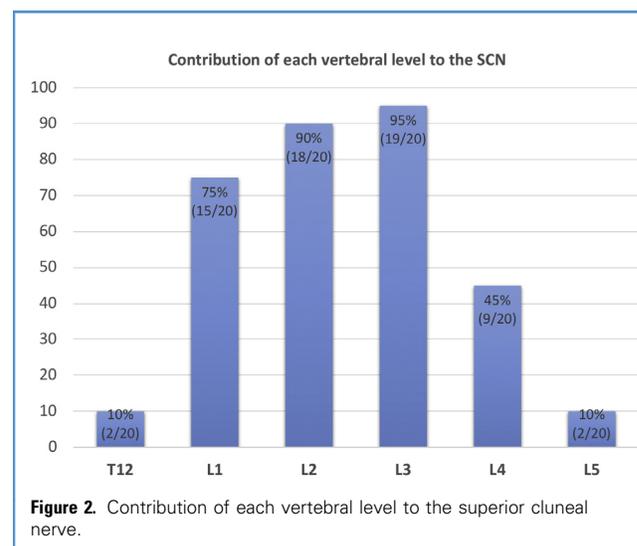


Figure 2. Contribution of each vertebral level to the superior cluneal nerve.

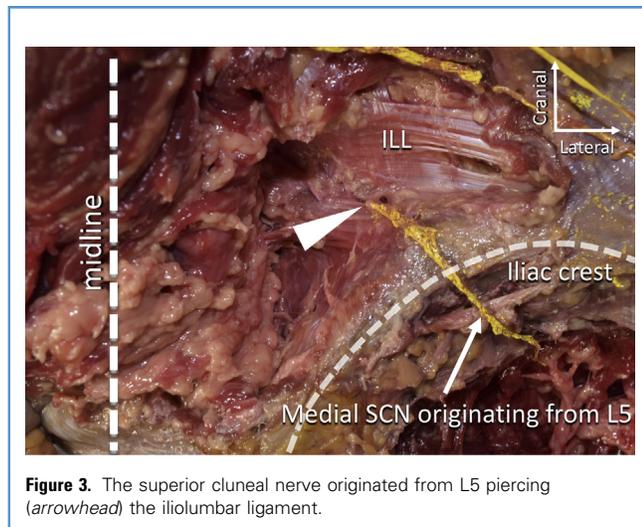


Figure 3. The superior cluneal nerve originated from L5 piercing (arrowhead) the iliolumbar ligament.

literature.⁶ The other 55% had more than or fewer than 3 SCNs. Of these, 35% had more than 3 SCNs (4 in 20%, 5 in 15%) and this is similar to an earlier study.¹ According to Iwanaga et al,¹⁹ 55% of the iliac crests had a bony groove and osteofibrous tunnel for the medial SCN and these authors speculated that the medial SCN could be compressed in this bony tunnel, resulting in pain. Kuniya et al.¹² concluded that not only the medial SCN but also the intermediate and lateral SCN could travel in a similar tunnel; however, the majority of the tunnels described are for the medial SCN. Thus locating the medial SCN might be crucial for pain management.

Iwamoto et al¹³ made a skin incision 7 cm lateral to the midline on the iliac crest to identify and release the SCN with a nerve stimulator and used landmarks based on previous studies.^{3,6} The diameters of the medial, intermediate, and lateral SCNs were 1.52, 1.42, and 1.51 mm, respectively. These branches are large enough to find during surgical procedures.

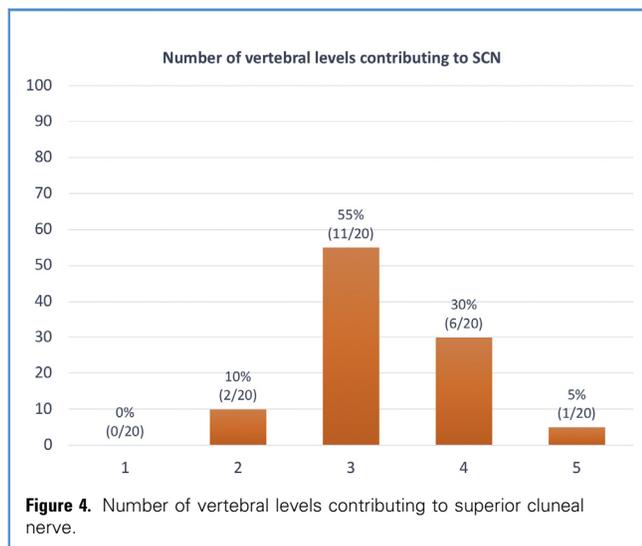


Figure 4. Number of vertebral levels contributing to superior cluneal nerve.

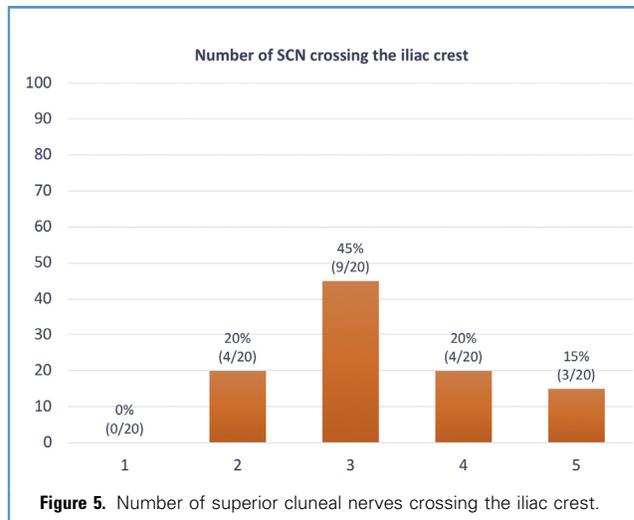


Figure 5. Number of superior cluneal nerves crossing the iliac crest.

According to Kuniya et al,¹² the medial SCN was located 71.0 mm lateral to the midline and the present study demonstrated that the medial SCN pierced the thoracolumbar fascia 67.4 mm lateral to the midline.

Knowledge of the variations of the nerves and the fascia they travel in can decrease patient morbidity and improve diagnoses.²⁰⁻²⁵ This anatomic study adds to our overall knowledge of the little discussed SCN and demonstrates their variations in regard to their course and source.

CONCLUSIONS

The majority of the dorsal rami of L1, L2, and L3 contributed to the SCN. L4 and L5 also contributed to the SCN in 45% and 10%, respectively. The number of vertebral levels that formed the SCN was 3 in 55% and 4 in 30%. The number of SCN piercing the thoracolumbar fascia was 3 in 45%. In other words, only 45% had

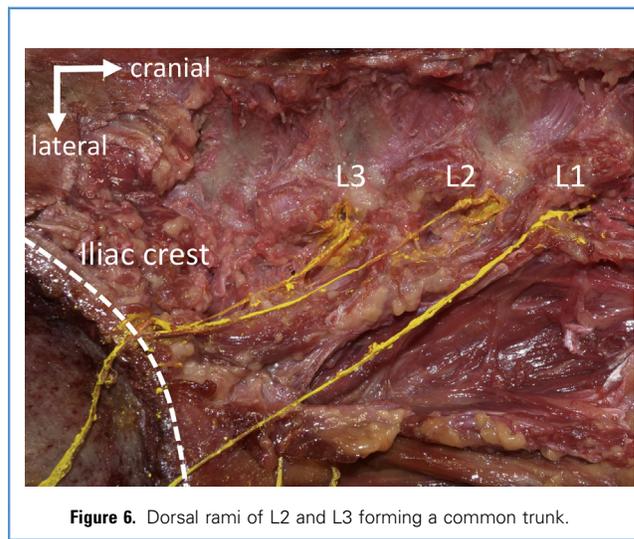


Figure 6. Dorsal rami of L2 and L3 forming a common trunk.

a medial, intermediate, and lateral branch as mentioned in previous studies. The origin of the SCN should be reconsidered on the basis of our study results. These results also might help

physicians and surgeons who treat low back pain, especially pain not related to more common etiologies, such as disk disease and foraminal stenosis.

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