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Unusual pattern of branches and ganglions of cervical sympathetic trunk- single case study with clinical implications

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Abstract

During routine dissection for didactic purposes, we found unusual branching pattern of cervical sympathetic trunk. In our case cervical sympathetic trunk had not only superior, middle, and inferior ganglia, but also presented two more ganglia in its main course. One of accessory ganglia was identified to be vertebral ganglion and presented with vertebral loop. All three cardiac cervical nerves emerged from another, extravertebral ganglion, which was supplied from sympathetic trunk. We are convinced that variability of cervical sympathetic trunk is clinically significant in surgery of head, neck, and cervical spine as well as in anatomy education. Therefore, we present our case showing a possible variation of this structure.

Running title: cervical sympathetic trunk – branches and ganglions

Keywords: dissection; cadaver; sympathetic trunk; ganglion; human

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Introduction

Cervical sympathetic trunk is known for its variability [1]. Said variability may play significant role in head and neck surgery, and cervical spine surgery. Knowledge of possible variations is crucial to avoid complications such as Horner syndrome or damage to the cervical cardiac nerves. Most research papers are focused on anatomy of cervical ganglia and discuss variability in their size and location[1,2]. In our case report we would like to emphasize the variability of branching and accessory ganglia in cervical sympathetic trunk.

Case report

During routine dissection for didactic purposes, we found unusual branching in sympathetic trunk. Cadaver was a 77-year-old woman whose cause of death is unrelated to investigated variation. Body for dissection was obtained through Conscious Donation Program conducted by our institution. The group of preparators consisted of experienced anatomists and clinicians as well as medical students – so-called near pear teachers. Research team has proven scientific and dissection experience [3–9].

In dissected cadaver location of cervical sympathetic trunk (CST) and superior, middle, and inferior cervical ganglia was normal [10–12]. Neck was dissected on both sides and both left and right CST were examined. Right CST had a typical structure and left CST presented itself in less common variation, thus described in our paper.

In our case superior cervical ganglion was located at the level of C1-C4 vertebrae and had three branches. One of the branches coursed medially and directed towards middle cervical ganglion, therefore we consider it a main interganglionic branch. Other two branches coursed more laterally and after short run reconnected forming an accessory extravertebral ganglion. The lateral additional interganglionic branch had a small branch connecting it with vagus nerve (**Fig. 1-3**).

In the course of the main interganglionic branch, just below the superior ganglion, we found a small accessory ganglion. Accessory ganglion had a branch connecting it with medial accessory interganglionic branch. About 5 centimeters below there was the middle cervical ganglion at the level of C5 vertebra. Middle cervical ganglion gave another interganglionic branch. Just below the middle cervical ganglion there was another accessory ganglion identified in the course of interganglionic branch. By its location we judged on the basis of Kiray et al. work [1] that it to be vertebral ganglion. Vertebral ganglion emitted two branches which circled around vertebral artery forming vertebral loop.

On the internal margin of the first rib the stellate ganglion was present. It gave another interganglionic branch which connected it to thoracic sympa-

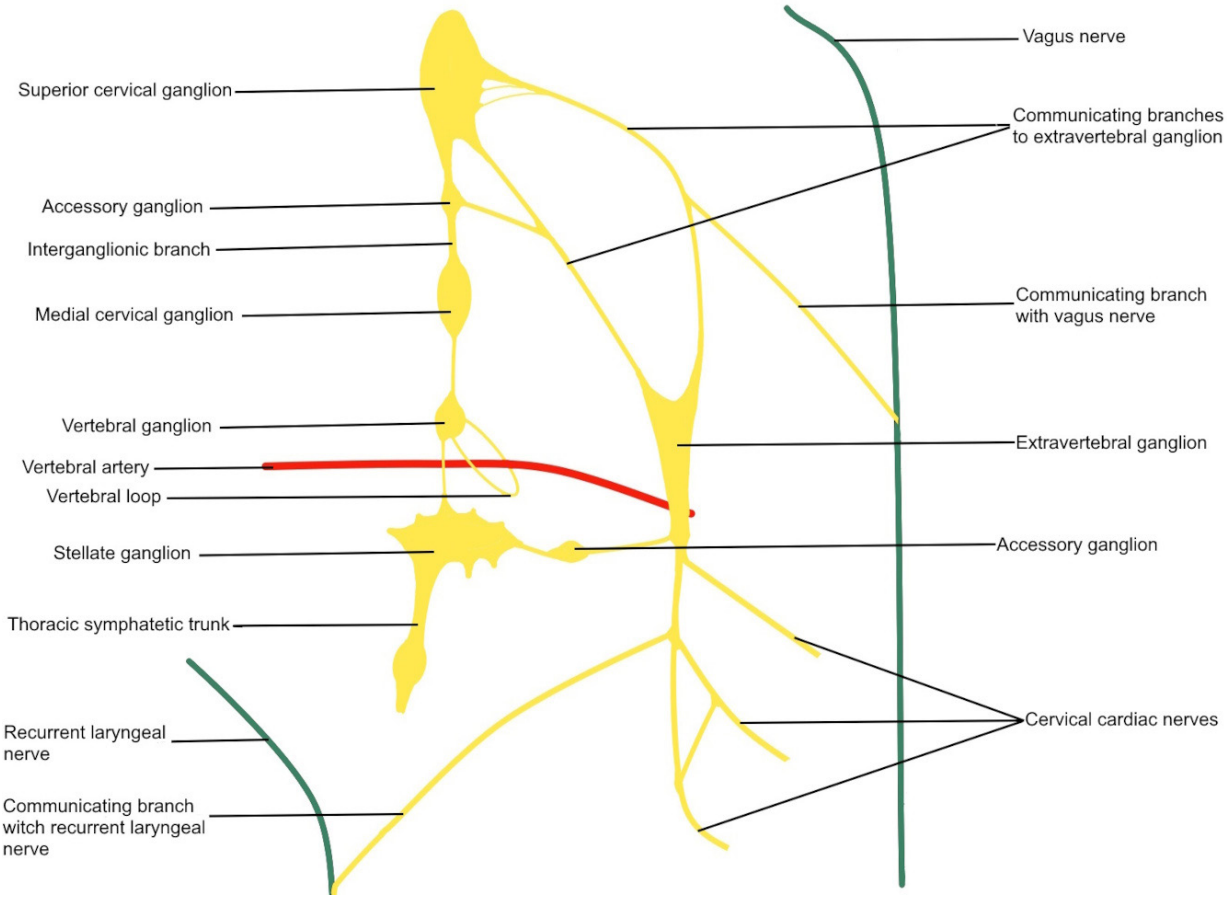


FIGURE 1 Case report scheme

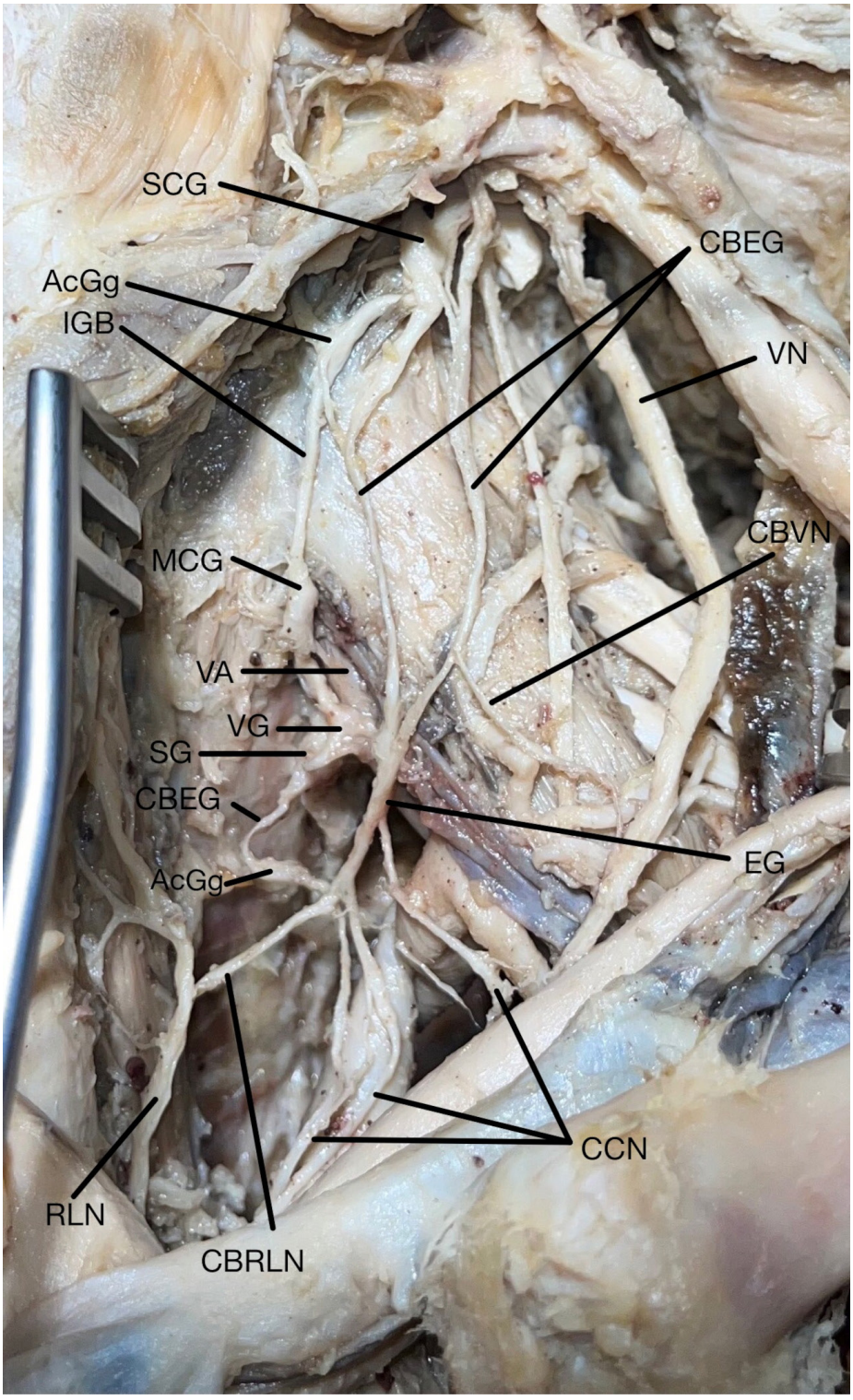


FIGURE 2 General view of the dissected specimen. SCG – superior cervical ganglion; CBEG – communicating branches with extravertebral ganglion; AcGg – accessory ganglia; IGB – interganglionic branch; VN – vagus nerve; MCG – medial cervical ganglion; CBVN – communicating branch with vagus nerve; VA – vertebral artery; VG – vertebral ganglion; VL – vertebral loop; EG – exravertebral ganglion; CBEG – communicating branch with extravertebral ganglion; CCN – cervical cardiac nerves; RLN – reccurrent laryngeal nerve; CBRLN – communicating branch with reccurrent laryngeal nerve

thetic trunk, in which no variability was detected. Stellate ganglion also gave a branch connecting it with previously mentioned extravertebral ganglion. In the middle of this branch, we discovered another small ganglion.

Extravertebral ganglion gave three branches directed caudally. We identified those as cervical cardiac nerves. These nerves did not originate each from their respective ganglions, but rather emerged from this accessory extravertebral ganglion, which

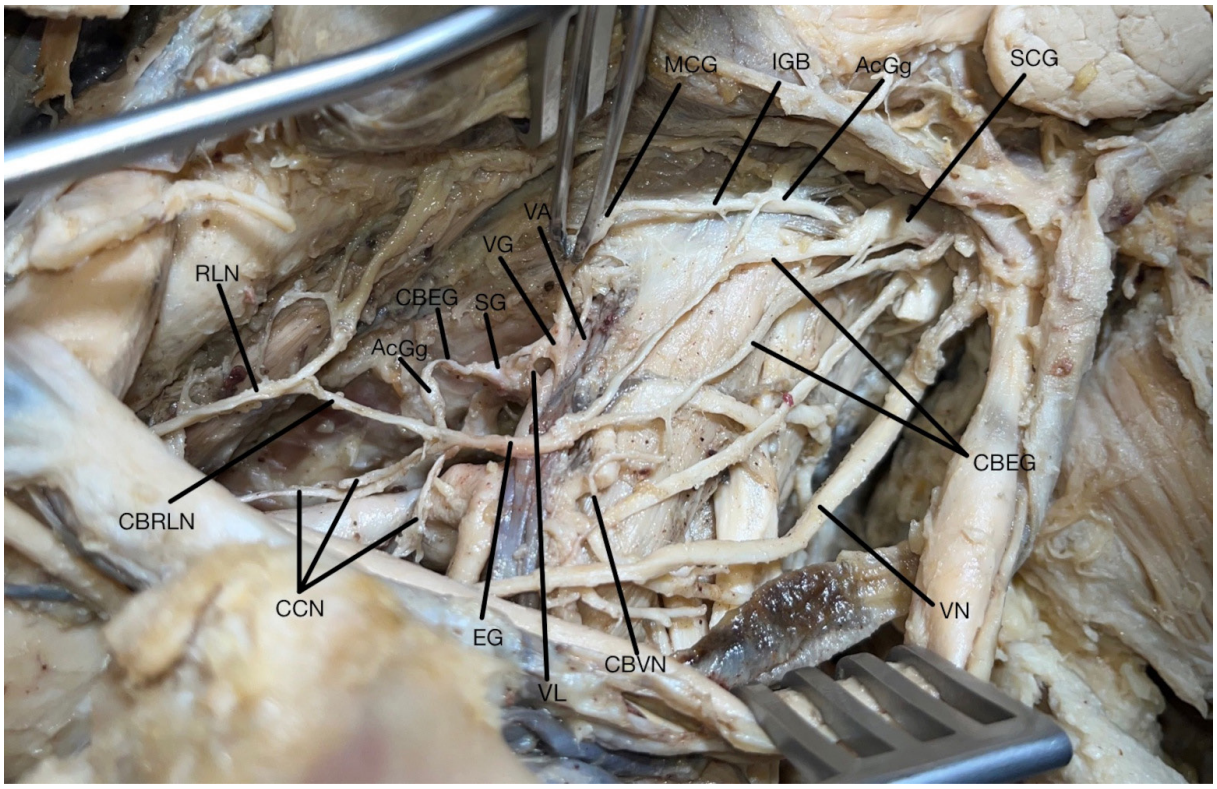


FIGURE 3 A precise view of the described variability. SCG – superior cervical ganglion; CBEG – communicating branches with extravertebral ganglion; AcGg – accessory ganglia; IGB – interganglionic branch; VN – vagus nerve; MCG – medial cervical ganglion; CBVN – communicating branch with vagus nerve; VA – vertebral artery; VG – vertebral ganglion; VL – vertebral loop; EG – exravertebral ganglion; CBEG – communicating branch with extravertebral ganglion; CCN – cervical cardiac nerves; RLN – reccurrent laryngeal nerve; CBRLN – communicating branch with reccurrent laryngeal nerve

hindered identification of fibers emerging from individual cervical ganglia. Among these three cervical cardiac nerves, the two more medial ones were connected by additional branch. The most medial cervical cardiac nerve was also connected with recurrent laryngeal nerve by singular branch.

Discussion

Specific expertise in anatomical variations of the cervical part of sympathetic trunk is extremely important, especially when performing various surgical procedures in the anterior and anterolateral region of the neck[11,12] , as well as other procedures, such as stellate ganglion blocks (SGB) using ultrasound techniques [12]. Special attention to the variability of the cervical part of sympathetic trunk should also be paid during surgical procedures in the inferior region of the cervical spine and during interventions, requiring transverse transection of the musculus capitis longus[13]. Other surgeries that require detailed knowledge of the diversity of CST include neck dissection [14,15] and cervical esophagectomy [16]. The structural variability of the cervical sympathetic trunk should also be taken into consideration during corpectomy [17] and thyroidectomy [14] because the accidental damage to the CST during these procedures may lead to Horner's syndrome [14-17]. The anatomical variations of CST should also be considered during head, neck, and mediastinal surgical procedures. We are convinced that familiarity with the anatomical variant discovered by us may be useful when performing procedures involving the cervical part of the sympathetic trunk. We also hope that we will draw more attention of surgeons and research scientists towards important, but often discounted topic, which is structural variability of the cervical part of sympathetic trunk.

Conclusions

We feel strongly that knowledge on possible variations of cervical sympathetic trunk should be expanded. We believe expanding this scope of anatomical knowledge would help surgeons to avoid complications in various procedures and would be beneficial to morphological sciences.

Ethical approval

The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration. All of the bodies were obtained through an informed donation program.

Since each deceased admitted to the research unit has given informed, notarized consent to participate in the program in accordance with the opinion of the chairman of the local bioethics committee, there is no need to obtain committee approval in this case. Despite this, the authors have approval from the bioethics committee authorizing them to do anatomical research – positive opinion from the local bioethics committee – no. 135/2023.

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Conflict of interest
The authors declare no conflict of interest.

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