Content available at: https://www.ipinnovative.com/open-access-journals

IP Indian Journal of Anatomy and Surgery of Head, Neck and Brain

Journal homepage: https://www.ijashnb.org/

Case Report

Bilateral descendens vago-hypoglossi of ansa cervicalis

Sulochana Sakthivel[1]*, **Jahira Banu**[1]

[1] *Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India*

ARTICLE INFO

Article history:
Received 18-06-2024
Accepted 15-07-2024
Available online 01-08-2024

Keywords:
Vagus nerve
Hypoglossal nerve
Cervical nerves
Strap muscles
Anastomosis

ABSTRACT

Ansa cervicalis, a nerve loop formed by descendens hypoglossi contributed by C1 spinal nerve and descendens cervicalis, by C2 and C3 spinal nerves, innervates the infrahyoid muscles. An unusual formation of ansa cervicalis was noted in a 60-year-old female cadaver, bilaterally. On the left side, fibres from the hypoglossal and vagus nerves contributed to the formation of descendens vago-hypoglossi. Fibers from the ventral rami of C2 and C3 spinal segments ran downwards separately as a double descendens cervicalis and united at the loop formation. A similar variation was observed on the right side with a normal descendens cervicalis. The vago-hypoglossal anastomosis was longer on the left side than on the right. The neurofascial band between the vagus and hypoglossal nerve may lead to internal carotid artery stenosis. Ansa cervicalis is surgically significant, especially during laryngeal reinnervation procedures for recurrent laryngeal nerve palsy. The variation in the formation and course of the ansa cervicalis may significantly alter and complicate interventional procedures like neurorrhaphy, neck dissection or anterior cervical spinal approach.

1. Introduction

Ansa cervicalis is a neural anastomosis visibly resting on the anterior wall of the carotid sheath in the neck, where it is considered one of the main contents of the carotid triangle. This neural anastomosis connects the lower cranial nerves and the upper cervical spinal nerves by linking superior and inferior roots. The superior root is contributed by the hypoglossal nerve carrying C1 spinal fibres forming the descendens hypoglossi and an inferior root, by the C2 and C3 spinal fibres constituting the descendens cervicalis. Nerves to thyrohyoid and geniohyoid muscles are branches of the superior root, whereas branches from the nerve loop innervate the infrahyoid muscles such as sternothyroid, sternohyoid and omohyoid.[1]

The renewed interest in the variant anatomy of ansa cervicalis is due to the adoption of recent reconstructive surgical techniques to reinnervate the tongue and laryngeal musculature.[2] The recurrent laryngeal nerve is one of the commonly injured nerves in surgeries involving the thyroid gland, oesophagus, neck dissection, and anterior cervical spinal approach. Ansa cervicalis is utilized to reinnervate the laryngeal muscles in recurrent laryngeal nerve palsy.[2] Consequently, any variation in the formation and course of the ansa cervicalis may alter the outcome of neurosurgical procedures.

2. Case Report

During the routine dissection of a 60-year-old female cadaver, vago-hypoglossal anastomosis was observed bilaterally in the formation of the superior root of the ansa cervicalis. The cadaver had been legally donated to the Department of Anatomy following the guidelines of the

* *Corresponding author.*
E-mail address: sulo.ss@gmail.com (S. Sakthivel).

https://doi.org/10.18231/j.ijashnb.2024.011

Table 1: Vago-hypoglossal anastomosis reported in various studies in the literature.

Author	Type of Study	No. of cases	Side	Superior root	Inferior root
Verma et al.[3] 2005	Case report	1	Left	Hypoglossal nerve and vagus nerve fused for 3 cm. Vagus nerve gave off the superior root.	Normal
D' souza & Ray[2] 2010	Study	3/100	2 cases (Left)	Branched out from vagus	Normal
			1 case (Left)	Absent	-
Goyal & Jain[4] 2013	Case report	1	Right	Descendens hypoglossi joined the vagus and branched out from the vagus	Normal
Gopalakrishnan et al.[5] 2015	Case report	1	Left	Descendens hypoglossi fused with vagus	-
Nayak et al.[6] 2017	Case report	1	Right	Vagus and hypoglossal nerves	Medial to the internal jugular vein
Zhu et al.[7] 2020	Case report	1	Left	Vagus and hypoglossal nerves	-
Present report	Case report	1	Right Left	Branched out from vagus with contribution from the hypoglossal nerve on both sides	Normal Double descendens cervicalis - C2 and C3 nerves were separate.

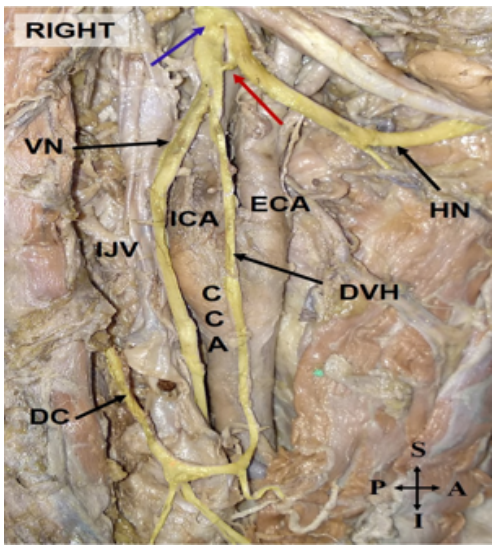

Figure 1: Descendens vago-hypoglossi (DVH) contributed by the hypoglossal (HN) and vagus nerve (VN) and the normal descendens cervicalis (DC).The red arrow shows the small contribution by HN. ECA – External carotid artery; ICA –Internal carotid artery CCA –Common carotid artery; IJV – Internal jugular vein.

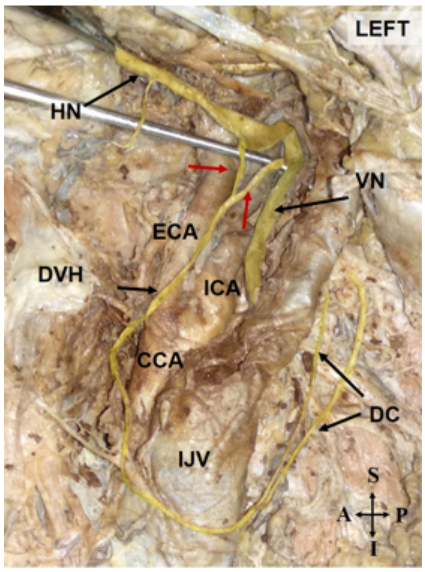

Figure 2: Left side of the specimen shows descendens vago-hypoglossi (DVH) contributed by the hypoglossal (HN) and vagus nerve (VN) and the double descendens cervicalis (DC).The red arrow shows the contribution by HN and VN. ECA – External carotid artery; ICA –Internal carotid artery CCA –Common carotid artery; IJV – Internal jugular vein.

Body Donation Program and had been approved for medical education and research.

On the right side, the vagus and the hypoglossal nerve fused with each other after exiting the hypoglossal and jugular foramen. Anterior to the internal carotid artery, the vagus and the hypoglossal nerves separated and continued their normal course. The vagus nerve gave a descending branch, which formed the superior root of ansa cervicalis. The superior root was contributed by a small branch from the hypoglossal nerve forming the descendens vago-hypoglossi. Descendens vago-hypoglossi coursed inferiorly,

initially between internal and external carotid arteries, and subsequently over the common carotid artery and formed the ansa cervicalis by anastomosing with the descendens cervicalis. No variation was noted in the formation of descendens cervicalis.Figure 1

On the left side, the superior root of ansa cervicalis was contributed by two branches arising from the hypoglossal and vagus nerves forming the descendens vago-hypoglossi, which had a similar course as that of the right side. The inferior root was formed by the fibres of ventral rami of C2 and C3 spinal nerves, which ran downwards as double descendens cervicalis and united with descendens vago-hypoglossi and formed the ansa.Figure 2 The nerves contributed by the vagus and hypoglossal nerves were longer and thicker compared to the right side. No variations were recognized in the branches that innervated the infrahyoid muscles on both sides.

3. Discussion

Ansa cervicalis is formed by superior and inferior roots with contributions from the ventral rami of the upper three cervical spinal nerves. Ansa cervicalis has three neural components: hypoglossal, vagal and cervical components. Variation in the formation of the ansa according to the contributions of these neural components has been classified into five different groups.[8] In type I, the descendens hypoglossi and descendens cervicalis did not unite to form the ansa. Type II was the normal formation of ansa cervicalis. The type-III variation was formed by two loops, the hypoglosso-vagal ansa and vago-cervcial ansa, whereas type-IV had a single loop formed by vago-cervical ansa. In Type V, the hypoglossal component had the C1 fibres, and the cervical component had the C1, C2, and C3 fibres without the formation of ansa.[8] In the present report, the superior root was formed by the vagal and hypoglossal components, and the inferior root was formed by the cervical component, which could be described as a type III variation. Moreover, the vagus and hypoglossal nerves on the right side fused below the jugular foramen, and a similar case has been reported by Verma et al.[3] A few authors have reported the unusual presentation of superior root with contributions from the vagus and hypoglossal nerves which is enlisted in Table 1.

Vagal-hypoglossal communications can be classified as true or false based on whether they are formed by nerve fibres or connective tissue, respectively. In false communications, the nerves were connected by connective tissue, whereas in true communications, an exchange of nerve fibres was observed. Fibres of the superior root originate from the cervical plexus even though they pass through the vagus nerve.[9] Thus, in true communications, the branches of the vagus nerve that appear to innervate infrahyoid muscles were branches from cervical nerves.

A transverse neurofascial band found between the vagus and hypoglossal nerves might result in isolated mid-cervical stenosis of the internal carotid artery.[10] In addition, handling the muscular branches from the vagus to the infrahyoid muscles during surgical procedures can lead to vasovagal shock.[2,11] Iatrogenic injuries to the ansa cervicalis result in weakness of the infrahyoid muscles. Such injuries have been reported in surgical procedures like thyroplasty, arytenoids adduction, and nerve-muscle pedicle implantation, which leads to a change in the voice quality due to the loss of support to the laryngeal cartilage during vocal cord movement.[2,3]

Ansa cervicalis is widely used for nerve reconstructive procedures in facial nerve or recurrent laryngeal nerve injury for reinnervation. The main advantages of using ansa cervicalis are its easy accessibility, proximity to the injured nerves, and availability of sufficient length to mobilise the nerve for reconstructive procedures. However, its proximity to the great vessels warrants undue care in avoiding injury to the internal jugular vein and carotid arteries.[2] In cases of vocal cord paralysis due to pathological or iatrogenic damage to the recurrent laryngeal nerve, laryngeal reinnervation is carried out, and nerve-muscle transplantation in sub-glottic space using ansa cervicalis is considered a method of choice.[2] Laryngeal reinnervation has resulted in excellent to normal function of the vocal cords. In addition to their proximity to the recurrent laryngeal nerve, the thickness of the superior root and the branch to the sternothyroid muscle contribute to tension-free anastomosis.[4,12]

In facial nerve palsy, ansa cervicalis is preferred over the commonly used hypoglossal nerve for reanimation of the face to avoid complications like defective speech and difficulty in deglutition due to tongue hemiatrophy. Such complications could be minimized by combining surgical procedures such as facial-hypoglossal anastomosis, myoplasty, and distal hypoglossal-ansa cervicalis anastomosis, which emphasizes the surgical significance of ansa cervicalis in neurosurgical procedures.[4,13] Vagus nerve stimulation is a treatment of choice for treatment-resistant epilepsy to reduce the frequency of seizure episodes, and contraction of the infrahyoid muscle during the procedure might cause an intra-interventional complication.[5] Ansa cervicalis stimulation as a treatment for obstructive sleep apnea is a newly developed therapy for respiratory neurostimulation.[14]

During development, the cervical myotome is divided into a dorsal part, the epimere, and the ventral part, the hypomere, by the developing transverse processes of vertebrae. The myotomes are innervated by the dorsal and ventral rami of the spinal nerves, respectively. Scalene and infrahyoid muscles develop from the ventral part of the hypomere and are supplied by ventral rami. The occipital myotomes develop into the intrinsic and extrinsic muscles

of the tongue, which extend ventrally and shift cranially and are innervated by the hypoglossal nerve. Branches of the vagus nerve innervate the muscles developed from the fourth and sixth pharyngeal arches.[15,16] The proximity of these myotomes could be the basis for the variations in the neural components of the ansa cervicalis.

4. Conclusion

Ansa cervicalis is a nerve of surgical importance, and it is essential to be aware of the variations in its formation. Variations in its origin, course or distribution may significantly alter the neurosurgical interventions. Knowledge about this variation will be helpful for radiologists in diagnosing isolated mid-cervical stenosis and for neurosurgeons in interventional procedures.

5. Source of Funding

None.

6. Conflict of Interest

None.

References

1. Standring S, Anatomy GS. The anatomical basis of clinical practice. Newyork: Elsevier; 2016. p. 463–4.
2. D′souza AS, Ray B. Study of the formation and distribution of the ansa cervicalis and its clinical significance. *Eur J Anat*. 2010;14(3):143–8.
3. Verma R, Das S, Suri R. Unusual organization of the ansa cervicalis: a case report. *Braz J Morphol Sci*. 2005;22:175–7.
4. Goyal N, Jain A. Ansa cervicalis - variable course of the superior root. *Eur J Anat*. 2014;18(1):34–7.
5. Gopalakrishnan CV, Kestle JRW, Connolly MB. The “vagal ansa”: a source of complication in vagus nerve stimulation. *J Neurosurg Pediatr*. 2015;15:535–8.
6. Nayak SB, Shetty P, Reghunathan D, Aithal PA, Kumar N. Descendens vagohypoglossi: rare variant of the superior root of ansa cervicalis. *Br J Oral Maxillofac Surg*. 2017;55:834–5.
7. Zhu A, Mohan S, Richmon JD, Jowett N. An Anatomic Variant of the Ansa Cervicalis Precluding Its Use as a Donor Nerve. *Ann Otol Rhinol Laryngol*. 2020;129(1):78–81.
8. Jelev L. Some unusual types of formation of the ansa cervicalis in humans and proposal of a new morphological classification. *Clin Anat*. 2013;26:961–5.
9. Chhetri DK, Berke GS. Ansa cervicalis nerve: review of the topographic anatomy and morphology. *Laryngoscope*. 1997;107(10):1366–72.
10. Banneheka S, Tokita K, Kumaki K. Nerve fiber analysis of ansa cervicalis-vagus communications. *Anat Sci Int*. 2008;83:145–51.
11. Ranval TJ, Solis MM, Barnes RW, Vitti MJ, Gagne PJ, Eidt JF. Isolated symptomatic midcervical stenosis of the internal carotid artery. *Am J Surg*. 1994;168(2):171–4.
12. Prades JM, Gavid M, Dubois MD, Dumollard JM. Surgical anatomy of the ansa cervicalis nerve: which branch to use for laryngeal reinnervation in humans? *Surg Radiol Anat*. 2015;37:139–45.
13. Noorozian M, Bayat M, Farahani RM, Abdollahifar MA, Azimi H, Zadeh AN, et al. A Case Report: Rare Communication of Ansa Cervicalis. *Anato Sci J*. 2015;12:199–202.
14. Kent DT, Schwartz AR, Zealear D. Ultrasound Localization and Percutaneous Electrical Stimulation of the Hypoglossal Nerve and Ansa Cervicalis. *Otolaryngol Head Neck Surg*. 2021;164(1):219–25.
15. Arey LB. Developmental Anatomy. 6th ed. Bombay: Asia Publishing House; 1961. p. 431–2.
16. Hamilton WJ, Mossman HW, Hamilton B, Human M. Boyd and Mossman’s Human Embryology. London: Macmillan Press Ltd; 1976. p. 551–8.

Author biography

Sulochana Sakthivel, Additional Professor https://orcid.org/0000-0002-5113-1647

Jahira Banu, Senior Resident https://orcid.org/0000-0003-1717-1298

Cite this article: Sakthivel S, Banu J. Bilateral descendens vago-hypoglossi of ansa cervicalis. *IP Indian J Anat Surg Head, Neck Brain* 2024;10(2):48-51.