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Anatomical Variations in the Loop of the Ansa Cervicalis

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ABSTRACT

Ansa hypoglossi or Ansa cervicalis is a U-shaped nerve loop present in the carotid triangle and embedded in the anterior wall of the carotid sheath. It's formed by the ventral rami of C1, C2, and C3 spinal nerves. It supplies all the infrahyoid muscles. It has a superior root from hypoglossal nerve carrying C1 fibers and an inferior root from C2 and C3 spinal nerves. As this root descends, it first winds around the internal jugular vein and then continues anteroinferiorly to join the superior root in front of the common carotid artery at the level of cricoid cartilage. To study the variations in the formation and branching patterns of the loop of ansa hypoglossi in embalmed cadavers. Observational study was conducted during routine dissection of head and neck region for undergraduate medical training, upon carefully reflecting the layers the ansa hypoglossi was dissected on both sides of the neck, loop formations and its variations were observed. Further observations were continued with another 5 cadavers (12 specimens - 6 right and 6 left from 5 male + 1 female). The observations showed high level loop - on the right side (Mixed & Lateral type), two branches from superior root on left side of the neck and innervating to thyrohyoid and superior belly of omohyoid (Lateral type) and double loop - on the right side (Mixed & Lateral type). Ansa hypoglossi variations are very important for head and neck Surgeons to avoid accidental nerve injury.

Keywords: ansa cervicalis, variation, innervation, branches, loops.

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Introduction

Ansa hypoglossi or Ansa cervicalis is a U-shaped nerve loop present in the carotid triangle and embedded in the anterior wall of the carotid sheath. It's formed by the ventral rami of C1, C2, and C3 spinal nerves. It supplies all the infrahyoid muscles. It has a superior root from hypoglossal nerve carrying C1 fibers and an inferior root from ventral rami of C2 and C3 spinal nerves. As this root descends, it first winds around the internal jugular vein and then continues anteroinferiorly to join the superior root in front of the common carotid artery at the level of cricoid cartilage [1, 2].

Aims and Objectives

To study the variations in the formation and branching patterns of the loop of ansa hypoglossi in embalmed cadavers

MATERIALS AND METHODS

This descriptive study was conducted using routine dissection of the neck regions of five male and one female cadaver, totaling 12 cadaveric necks sides [6 rights and 6 left, Fig.1] was dissected in the age group varying from 65-70years. The dissection involved the reflection of the skin, platysma, investing layer of the deep cervical fascia, and carotid sheath within the carotid triangle of the anterior triangle of the neck.

Figure 1: Neck regions of five male and one female cadaver.



The ansa hypoglossi was identified on the anterior wall of the carotid sheath, winding around the internal jugular vein before continuing antero inferiorly to join the superior root in front of the common carotid artery at the level of the cricoid cartilage. Only cadavers with an intact loop of the ansa hypoglossi were included in this study.

RESULTS AND OBSERVATIONS

The study identified three variations in the loop of ansa hypoglossi: high-level loops, low-level loops, and double loops.

High-level loop (Lateral type): This variation, where the loop formed between the superior [hypoglossal nerve carrying C1 fibers] and inferior roots [venral rami of C2 and C3 spinal nerves] above the cricoid cartilage and the loop was located on the internal jugular vein on the right side of the neck [Fig. 2].

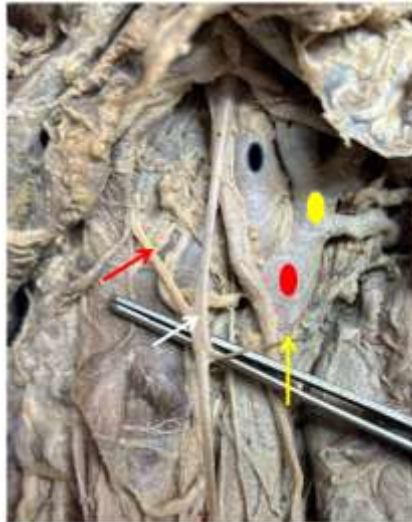


Figure 2: High level formation of loop

Figure 2: High-level loop - ansa cervicalis; red arrow-C1, C2 root, white arrow - loop; yellow arrow-nerve to superior belly of omohyoid; red oval shape-common carotid artery; blue oval shape-internal carotid artery; yellow oval shape-external carotid artery.

1. **Low-level loop (Lateral type):** A low-level loop, located below the cricoid cartilage, and the loop was located on the internal jugular vein on the left side of the neck [Fig. 3].

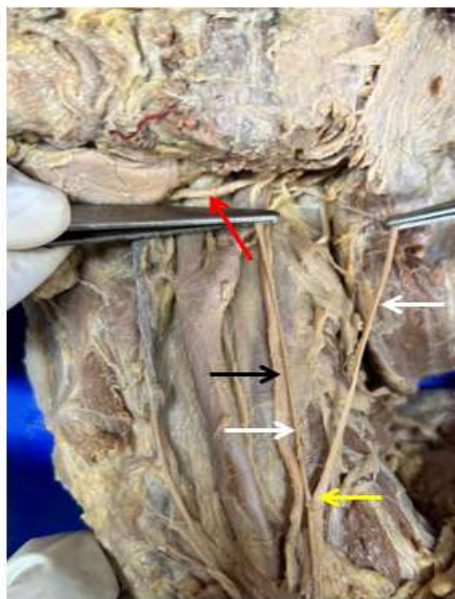


Figure 3

Figure 3: Low level loop - ansa cervicalis; red arrow-hypoglossal nerve; black arrow-vagus nerve; white arrow-superior and inferior roots; yellow arrow-loop of ansa cervicalis.

2. **Double high-level loops (Mixed & Lateral Type):** A double loop was noted on the right side of the neck, combining mixed and lateral type characteristics (loop one formed between branch from vagus nerve joined with descendens hypoglossi, loop two formed between loop one joined with C2, C3 ventral rami) on the internal jugular vein [Fig. 4].

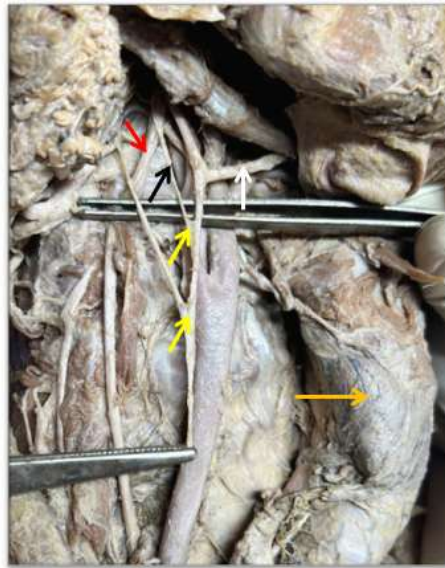


Figure 4

Figure 4: Double loop formation - ansa cervicalis; red arrow - vagus nerve, black arrow-communication between vagus and superior root; yellow root - loops; orange arrow-thyroid gland.

Double branches from superior root of ansa cervicalis: Two branches arising from the superior root of ansa cervicalis bilaterally and innervating to thyrohyoid and the superior belly of omohyoid muscles [Fig.5].

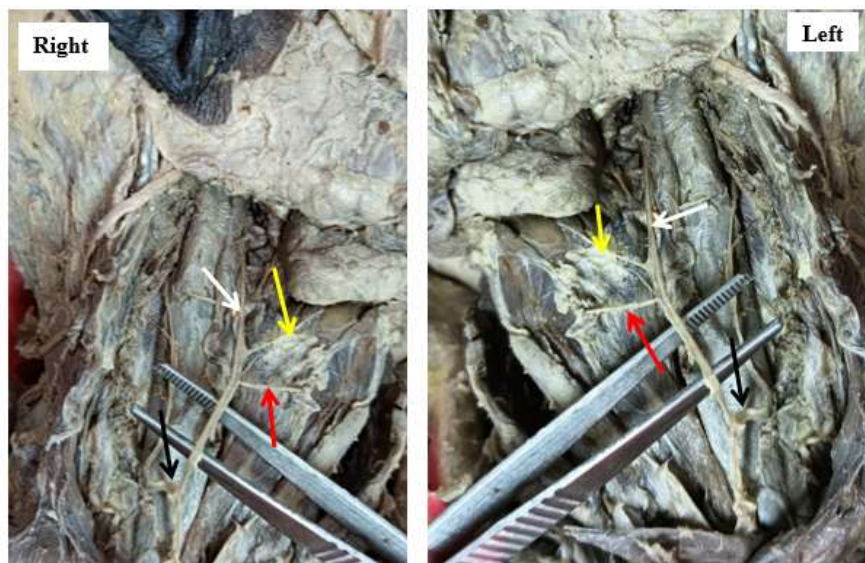


Figure 5

Figure 5: Double branches of ansa cervicalis on the right and left of the neck; white arrow-superior root; yellow arrow- branch to thyrohyoid; red arrow-branch to superior belly of omohyoid; black arrow- loop of ansa cervicalis.

DISCUSSION

Based on its position and relationship with the internal jugular vein, the ansa cervicalis can be classified into different types:

Medial Type: Both the superior and inferior roots are located deeper to the internal jugular vein.

Lateral Type: The inferior root is positioned anterior to the internal jugular vein.

Mixed Type: The ansa cervicalis forms double loops. In this type, the upper branch of the inferior root runs posterior to the internal jugular vein, while the lower branch travels anterior to it [3,4].

The present study observed lateral type [Fig.2-5] and mixed type [Fig.4].

Caliot et al., in 1986 and Loukas M in 2007 classified the loop of the ansa cervicalis into different types based on its variations in the neck. In our study of 12 sides of the neck, a double classic form of the ansa cervicalis was observed in seven sides of cadavers. Among these, five sides exhibited notable variations: a high loop on the right side, a low-level loop on the left side, and a double loop on the right side.^{1,5}

The Type III classification (hypoglossal-vagocervical ansa) by Rao TR et al, Kumar N et al., and Banneheka S et al., in 2008, identified communications between the ansa cervicalis and the vagus nerve using a surgical microscope. Their study proposed that this classification represents true nerve fibers connecting the hypoglossal, vagus, and cervical nerves, with potential implications for laryngeal reinnervation. Other studies have also described the formation of the ansa cervicalis: the upper loop is formed by the fusion of the descendens hypoglossi and descendens vagi, while the lower loop is formed by the descendens vagi and descendens cervicalis. In our study, double loops of the ansa were observed on the right side of the neck, formed by connections between the hypoglossal nerve, vagus nerve, and cervical nerves C1, C2, and C3 [Fig.4], [6-11].

The presence of a unilateral dual ansa was reported in a single case.¹² similarly, we observed this on the right side of the neck in a cadaver during our study [Fig.4].

In the present study, double branches were observed arising from the superior root of the ansa cervicalis bilaterally and providing innervation to the thyrohyoid and the superior belly of the omohyoid [Fig.5].

Although various studies have described the different formations and types of the ansa cervicalis, none have documented the presence of two branches arising from the superior root of the ansa cervicalis. Therefore, our study is the first to introduce a new and distinct type of ansa cervicalis to the literature.

Developmental significance

The muscles of the neck are derived from the differentiation of branchial arch mesenchyme and cervical somite. After being incorporated within the cranium, the hypoglossal nerve establishes communication with the upper cervical nerves to form the hypoglossocervical plexus. This plexus innervates the infrahyoid muscles, scalene muscles, prevertebral muscles, geniohyoid, and infrahyoid muscles [4,13].

Clinical Significance

Variations in the ansa cervicalis are of critical importance during surgical procedures involving the thyroid gland. Injury or transection of the ansa cervicalis, particularly the branches to the sternohyoid and sternothyroid muscles, can lead to voice and pitch disabilities. Repair can be achieved through anastomosis between the ansa cervicalis and the recurrent laryngeal nerve. Studies recommend selecting the common nerve trunk to the sternothyroid and sternohyoid muscles as the preferred option for repair due to its close proximity to the larynx and its size compatibility with the recurrent laryngeal nerve. Recently, the use of this common trunk for laryngeal reinnervation has been proposed as a simple, safe, and reliable method.

A thorough understanding of the anatomical relationships and variations of the ansa cervicalis is of paramount clinical importance for head and neck surgeons. It helps in recognizing potential variations during surgery, thereby reducing the risk of damaging nerves and vasculature, especially when performing neural blocks in regional anesthesia or nerve grafts. A comprehensive knowledge of the anatomy, variations, and clinical significance of the ansa cervicalis will enable more accurate preoperative assessments and enhance surgical precision [14-22].

CONCLUSION

While variations in the ansa cervicalis typically do not cause significant functional deficits, it is crucial for surgeons in the region to be aware of the anatomical variations, formation of loops and branching patterns of the nerve to prevent inadvertent damage. Injury to the ansa cervicalis can lead to impaired swallowing and phonation disorders, but it may also serve as a potential graft source for the reinnervation of paralyzed vocal cords.

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REFERENCES

- [1] Caliot P, Dumont D, Bousquet V, Midy D. A note on the anastomoses between the hypoglossal nerve and the cervical plexus. *Surg Radiol Anat.* 1968; 8:75–9.
- [2] Tubbs RS, Salter EG, Oakes WJ. Anatomic landmarks for nerves of the neck: a vade mecum for neurosurgeons. *Neurosurgery.* 2005;56(2 Suppl):256-60.
- [3] Olry R, Haines DE. Ansa hypoglossi or ansa cervicalis? That is the question. *J Hist Neurosci* 2002; 11:302-4.
- [4] Kikuchi T. A contribution to the morphology of the ansa cervicalis and the phrenic nerve. *Kaibogaku Zasshi.* 1970; 45:242–281.
- [5] Loukas M, Thorsell A, Tubbs RS, Kapos T, Louis Jr RG, Vulis M, et al. The ansa cervicalis revisited. *Folia Morphol (Warsz)* 2007; 66:120–5.
- [6] Rao TR, Shetty P, Rao SR. A rare case of formation of double ansa cervicalis. *Neuroanatomy* 2007, 6:26-27.
- [7] Kumar N, Patil J, Mohandas R, Sirasanagandla, Nayak S, Guru A. Rare case of double looped ansa cervicalis associated with its deep position in the carotid triangle of the neck. *Ann Med Health Sci Res* 2014;4(Suppl 1):S29-31.
- [8] Banneheka S. Anatomy of the ansa cervicalis: nerve fiber analysis. *Anat Sci Int* 2008; 83:61-7.
- [9] D'souza AS, Ray Biswabina. Study of the formation and distribution of the ansa cervicalis and its clinical significance. *Eur J Anat* 2010, 14(3):143-148.
- [10] Abu-Hijleh MF. Bilateral absence of ansa cervicalis replaced by vagocervical plexus: a case report and literature review. *Ann Anat.* 2005, 187:121-125.
- [11] Jyothi SR, Dayakshini KR. Variation in the formation of ansa cervicalis on right side. *Anatomica Karnataka* 2013, 7(1):81-83.
- [12] Babu PB. Variant inferior root of ansa cervicalis. *Int J Morphol* 2011, 29(1):240-24.
- [13] Kitamura S, Nishiguchi T, Okubo J, Cen K, Sakai A. An HRP study of the motoneurons supplying the rat hypobranchial muscles: central localization, peripheral axo course and soma size. *Anat Rec.* 1986; 216:73-81.
- [14] Brondbo K, Jacobsen E, Gjellan M, Refsum H. Recurrent laryngeal nerve – ansa cervicalis nerve anastomoses: A treatment alternative in unilateral recurrent nerve paralysis. *Acta Otolaryngol.* 1992; 112:353-357.
- [15] Prades JM, Gavid M, Dubois MD, Dumollard JM, Timoshenko AT, Peoc'h M. Surgical anatomy of the ansa cervicalis nerve: which branch to use for laryngeal reinnervation in humans? *Surg Radiol Anat* 2015; 37:139-45.
- [16] Chhetri DK, Blumin JH. Laryngeal reinnervation for unilateral vocal fold paralysis using ansa cervicalis nerve to recurrent laryngeal nerve anastomosis. *Oper Tech Otolaryngol Head Neck Surg* 2012; 23:173-7.
- [17] Lydia S. Quadros, Nandini Bhat, Arathy Babu, Antony Sylvan D'souza. Anatomical variations in the Ansa cervicalis and innervation of infrahyoid muscles. *Int J Anat Res*, 2013;02:69-74.
- [18] Paraskevas GK, Natsis K, Nitsa Z, Mavrodi A, Kitsoulis P. Unusual morphological pattern and distribution of the ansa cervicalis: a case report. *Rom J Morphol Embryol.* 2014;55(3):993-6. PMID: 25329134.
- [19] Quadros LS, Prasanna LC, D'souza AS, Singh A, Kalthur SG. Unilateral anatomical variation of the ansa cervicalis. *AMJ.* 2015;8(5): 170–173.

- [20] Kikuta S, Jenkins S, Kusukawa J, Iwanaga J, Loukas M, Tubbs RS. Ansa cervicalis: a comprehensive review of its anatomy, variations, pathology, and surgical applications. *Anat Cell Biol.* 2019 Sep;52(3):221-225.
- [21] Sakthivel S, Banu J. Bilateral descendens vago-hypoglossi of ansa cervicalis. *IP Indian Journal of Anatomy and Surgery of Head, Neck and Brain.* 2024;10(2):48-51.
- [22] Lassiter, E., Keating, J. M., Tarter, K., Saxton, K., Yerubandi, S., Habib, S., Bailey, B., & Maklad, A. (2024). An Independent C1 Nerve Root Variant of the Ansa Cervicalis: A Case Report. *Anatomia*, 3(1), 8-15.