

Morphological Variations in the Loop of the Ansa Cervicalis

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ABSTRACT

Introduction: thymus gland is an infrequently observed structure in the cadaveric dissection. It is a primary lymphoid organ, which is made up of two lobes and enveloped by a capsule. It involutes at the time of puberty and is eventually replaced by the fatty tissue, which is known as remains of thymus. Thymus receives the nutrition by the branches of internal mammary artery and inferior thyroid artery. During our routine dissection procedure performed for the medical students, we observed only 2 cases over the past 10 years. The knowledge of anatomy of thymus will be enlightening to the students. The details of its morphology is supportive to radiologists and surgeons for the differential diagnosis. This will help in preventing the biopsy.

Keywords: Dissection; Mediastinum; Puberty, Thymus gland.

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 cadavers, total of twelve cadaveric neck were

dissected in the age group varying from 65-70years (6 right-sided and 6 left-sided) (Fig.1). 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.

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 (ventral 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 1. Neck regions of five male and one female cadaver.

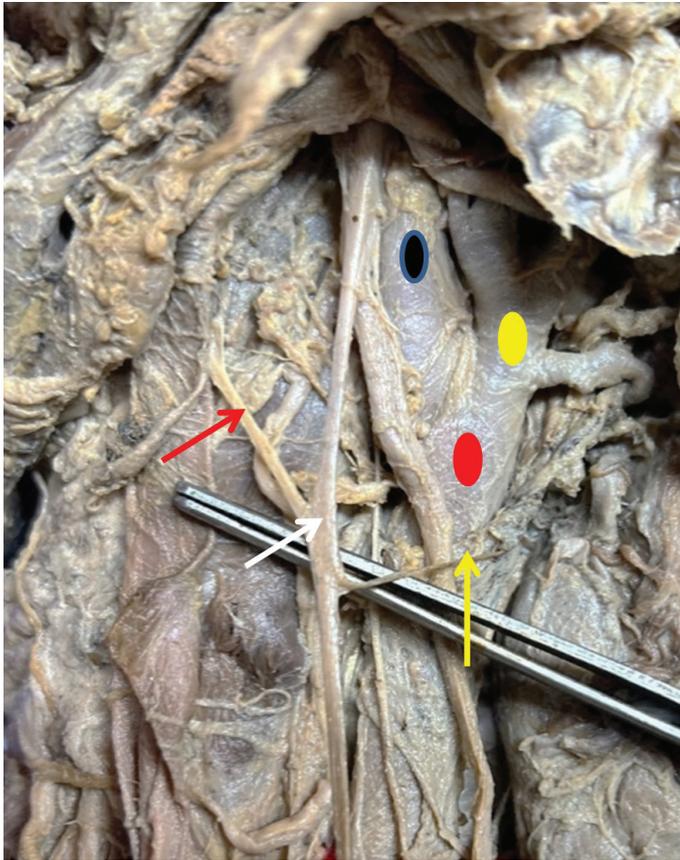


Figure 2. High-level loop - ansa cervicalis; red arrow-C1, C2 root, white arrow - loop; yellow arrow-nerve to superior belly of omohyoid; red oval shape-common carotid artery; blue oval shape-internal carotid artery; yellow oval shape-external carotid artery.

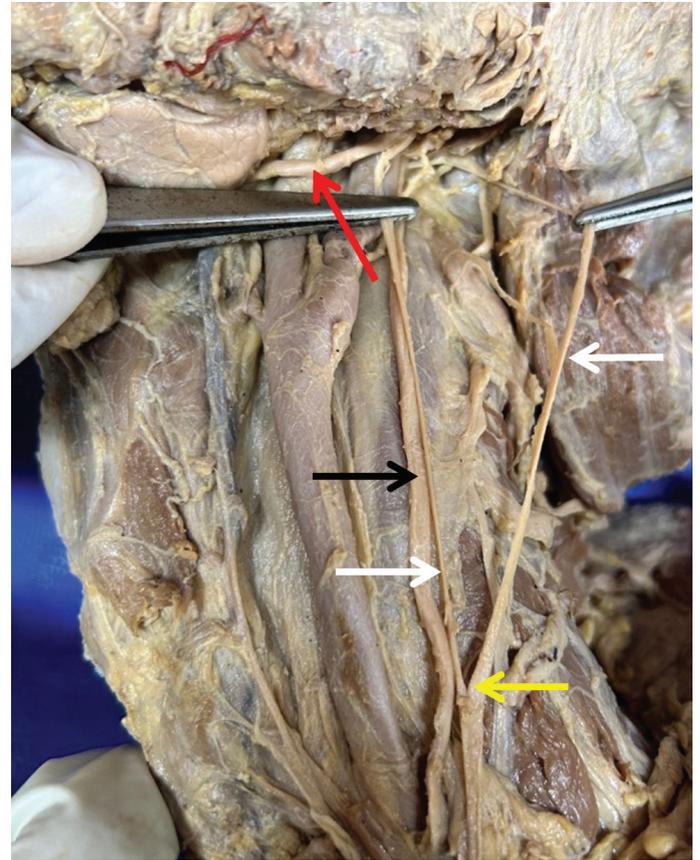


Figure 3. Low level loop - ansa cervicalis; red arrow-hypoglossal nerve; black arrow-vagus nerve;white arrow-superior and inferior roots; yellow arrow-loop of ansa cervicalis.

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).

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).

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).

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

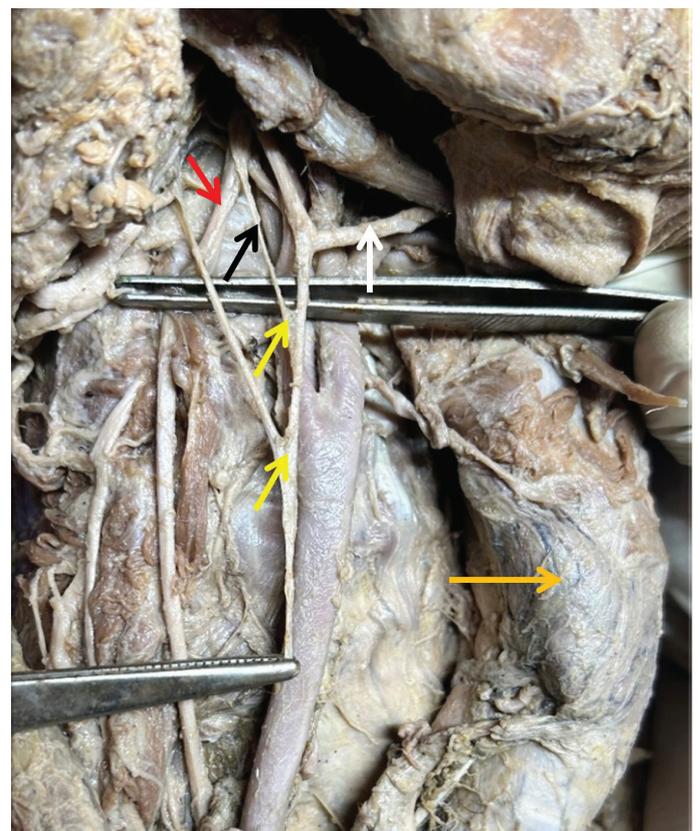


Figure 4. Double loop formation - ansa cervicalis; red arrow - vagus nerve, black arrow-communication between vagus and superior root; yellow root - loops; orange arrow-thyroid gland.

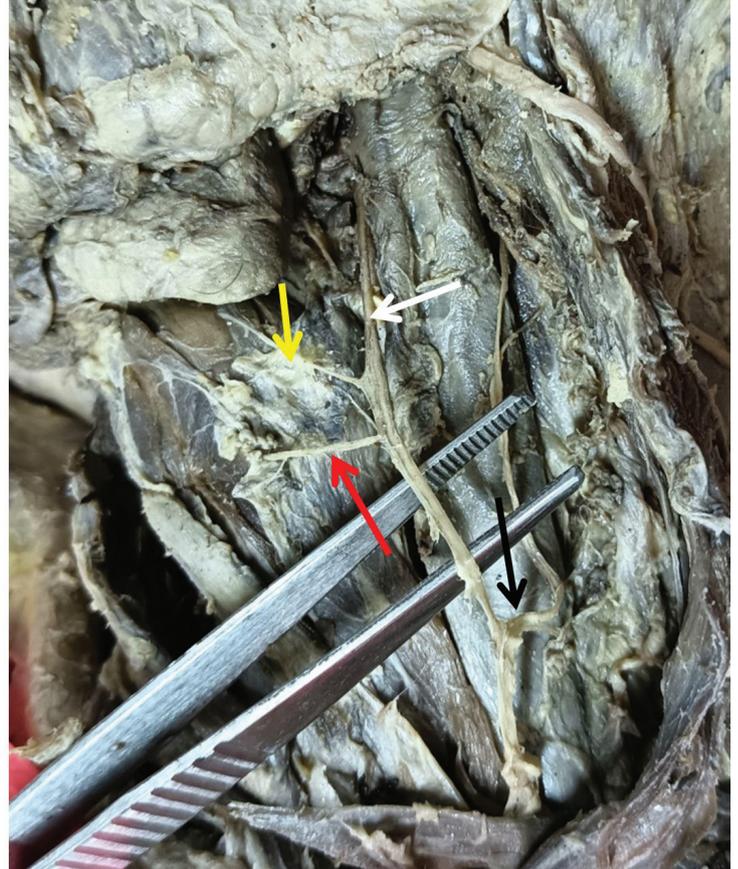
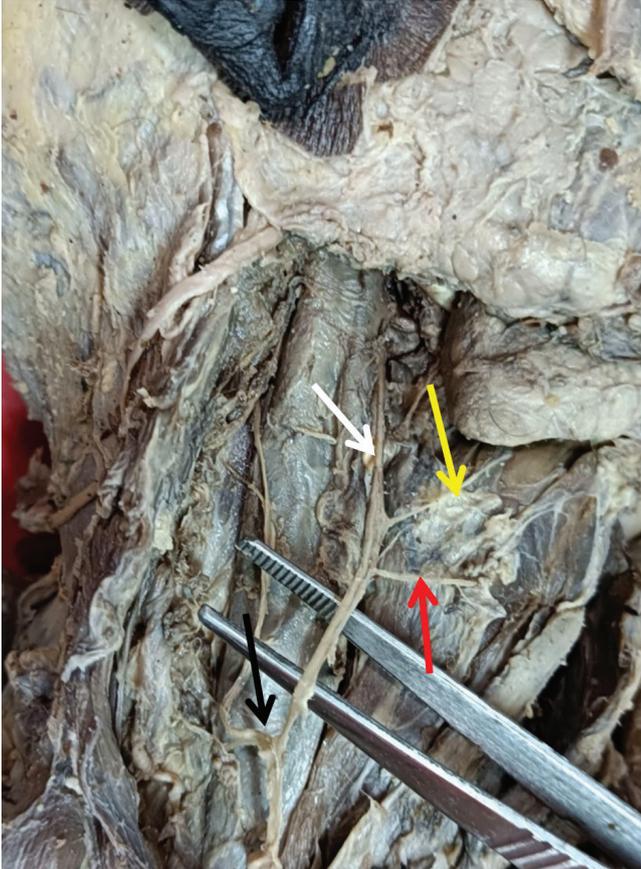


Figure 5. Double branches of ansa cervicalis on the right and left of the neck; white arrow-superior root; yellow arrow- branch to thyrohyoid; red arrow-branch to superior belly of omohyoid; black arrow- loop of ansa cervicalis.

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 (hypoglosso-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)^{6,7,8,9,10,11}.

The presence of a unilateral dual ansa was reported in a single case¹² 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 somites. 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^{14,15,16,17,18,19,20,21,22}.

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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Mini Curriculum and Author's Contribution

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