



## ANATOMY OF ANSA CERVICALIS AND ITS VARIATIONS

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**ABSTRACT** **BACKGROUND:** The ansa cervicalis is usually used to re-innervate the larynx following recurrent laryngeal nerve paralysis in thyroid cancer, oesophageal cancer following lymphadenectomy. Variations have previously been reported on the formation and branching pattern of the ansa cervicalis loop. **Objectives:** The present study aimed to record anatomical variations of the formation of loop and branches of ansa cervicalis. **METHODS:** The study was done in Anatomy department, Assam Medical College, Dibrugarh, Assam. 30 numbers (15 cadaver x 2) of ansa cervicalis were studied. A thorough morphological study was done and the results were recorded. **RESULTS:** Normal anatomy & variations, if any, of the ansa cervicalis were noted and discussed with previous studies. **CONCLUSION:** Surgical procedures such as thyroplasty, arytenoid adduction, nerve-muscle pedicle implantation had been reported to cause iatrogenic injuries to the ansa cervicalis. Knowledge of the arrangement of loops and branches of the ansa cervicalis will be helpful for planning a safe surgery in the neck region.

**KEYWORDS :** roots of ansa cervicalis, variations of ansa cervicalis, nerves of neck

### INTRODUCTION

Ansa cervicalis is a nerve loop present in front of the carotid sheath. The infrahyoid muscles (extrinsic muscles of the larynx) are supplied through ansa cervicalis. It has two roots.

1. Superior root or descendens hypoglossi- a branch from the ventral rami of first cervical nerve (C1) joins the hypoglossal nerve and after a short course leaves that nerve as superior root of ansa cervicalis. It descends in front of the carotid sheath and joins the inferior root.
2. inferior root or descendens cervicalis- this nerve is formed by branches from ventral rami of second and third cervical (C2, C3) nerves. It appears from the lateral side of the internal jugular vein and joins the superior root to form "ansa cervicalis".

### Branches

1. The superior root supplies superior belly of the omohyoid muscle
2. The loop of ansa cervicalis gives branches to inferior belly of omohyoid, sternothyroid and sternohyoid muscles. [1]

Infrahyoid muscles namely, the sternohyoid, sternothyroid, thyrohyoid and omohyoid usually depress the hyoid bone during deglutition and during phonation.[2] Therefore, any injury to these muscles or their nerve supply would cause disturbance in phonation in professional voice users. [3] They stabilize the hyoid bone during depression of the mandible. The position of the hyoid bone is determined by the tone of infrahyoid and mylohyoid muscles. [1]

Anatomy of ansa cervicalis has recently gained popularity because of its use in surgical procedures like reinnervation of paralyzed larynx. Apart from laryngeal reconstructions ansa cervicalis is now being used for indirect facial nerve reconstruction and facial hypoglossal anastomosis.[4]

Variations in the formation of ansa cervicalis has been described in literatures. Therefore, the aim of this study, was to provide additional information to the existing data regarding the variations in the formation of ansa cervicalis.

### MATERIALS AND METHODS

The study was done in the Department of Anatomy, Assam Medical College, Dibrugarh, Assam. 15 fresh perinatal cadavers were dissected bilaterally following standard dissection procedures. The ansa cervicalis was identified. Its roots were traced to the origin and the branches arising from it were traced till their termination on the infrahyoid muscles. Any variations in its formation were identified and documented. Data were analyzed in percentage only due to limited no of specimens.

### RESULTS AND OBSERVATION

**Formation of typical loop:** Out of 30 specimens, typical loop formation was found in 21 specimens. (70%). Loop formation was

absent in 30%. (TABLE 1, Figure 1, Figure 2)

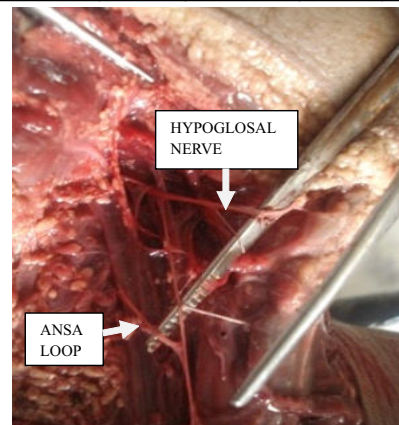
Right sided loop formation was found in 30% specimens. Left sided loop formation was found in 40% specimens. (TABLE 2)

**Table 1: Showing Loop Formation Of Ansa Cervicalis**

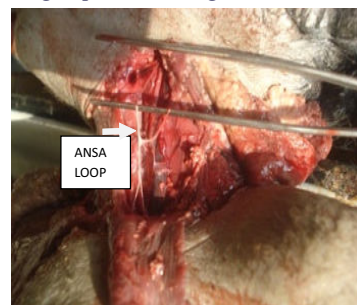
LOOP FORMATION	NO OF SPECIMEN	PERCENTAGE %
PRESENT	21	70
ABSENT	9	30
TOTAL	30	100

**Table 2: Showing Variation Of Loop Formation Of Ansa Cervicalis On Both Sides**

LOOP FORMATION	RT SIDE	PERCENT %	LT SIDE	PERCENT
PRESENT	9	30	12	40
ABSENT	6	20	3	10



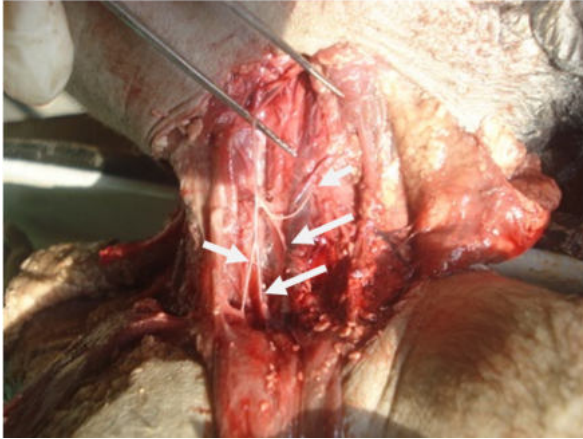
**Figure 1- showing loop formation right side**



**Figure 2- showing loop formation left side**

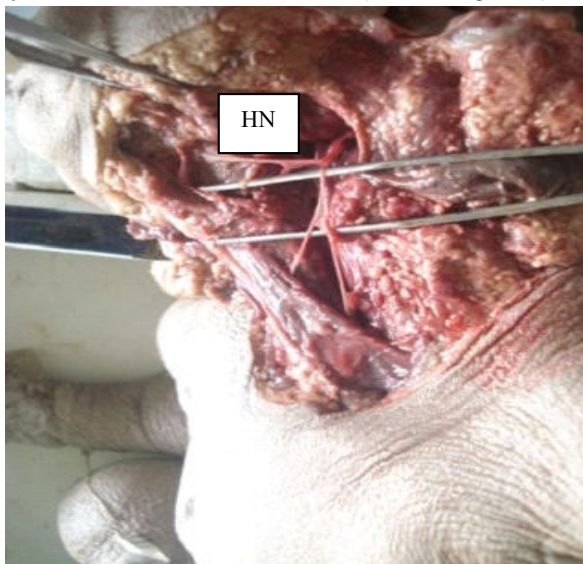
**Level of loop formation:** In 13.33% specimens, the loop was short and formed at a higher level i.e., at the level of hyoid bone. (Figure 2). In rest of the specimens' loop was found in between hyoid bone and omohyoid muscle (86.67%) (Figure 1)

**Branches of ansa cervicalis:** When loop was formed, all the branches were seen properly. Branches to superior belly of the omohyoid muscle, inferior belly of omohyoid, sternohyoid and sternohyoid muscles were found as usual. (Figure 3)

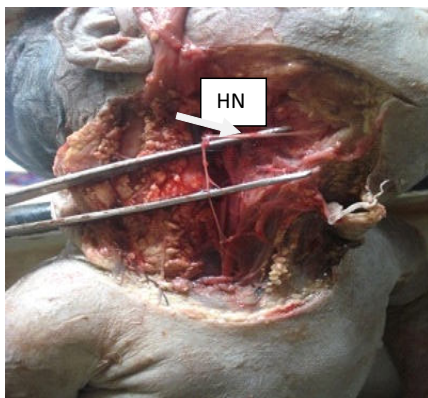


**Figure 3- showing branches of ansa cervicalis**

**Ansa cervicalis without loop:** In 30% specimens ansa cervicalis showed no loop formation. Superior root or descendens hypoglossi descended in front of the carotid sheath and gave branches to infrahyoid muscles. Inferior root was not found. (Table 1, 2, Figure 4,5)



**Figure 4: showing absence of loop of ansa cervicalis (left side) (HN- hypoglossal nerve)**



**Figure 5: showing absence of loop of ansa cervicalis (right side)**

## DISCUSSION

Variations of ansa cervicalis are not so rare. It could be even absent bilaterally, and replaced by vagocervical plexus, formed by fibres from the vagus nerve and branches, coming from C1 and C2 [5]. This type of variation was not observed in the present study.

Based on the level of the loop with respect to the omohyoid muscle, ansa cervicalis was divided into 3 categories. The loop at the level of the hyoid bone was classified as high level ansa. The loop in between the hyoid bone and the omohyoid muscle was classified as intermediate ansa. The loop below the omohyoid muscle was classified as low level ansa. [6] Lydia S et al found high ansa in 5% hemi necks, intermediate ansa in 87.5% hemi-necks and low ansa in 7.5%. The present study showed greater percentage of intermediate, long ansa (87%), which was similar to Lydia S et al. [6]

The ansa usually may be found between the sheaths of the sternocleidomastoid muscle and the common carotid artery, superficial to the internal jugular vein; sometimes it may lie in the carotid sheath between the carotid artery and the jugular vein; rarely may it lie dorsal to both the artery and vein. (Bergman et al., 1988) [7].

Libor Machalek et al found an uncommon form of ansa cervicalis, placed medially to the internal jugular vein. All roots were connected posterior to the carotid sheath and the produced nerve trunk ran through this sheath. The terminal branching towards the infrahyoid muscles was standard.[8] In the present study, all ansa cervicalis were found anterior to carotid sheath.

Venugopal et al have reported a case with no loop formation.[9] In the present study, 30% of specimens showed no loop formation. In those situations, inferior loop was found absent.

Arthi Ganapathy et al noted a variation unilaterally in a cadaver that superior and inferior roots of Ansa cervicalis were absent. The fibres from C1 were seen accompanying hypoglossal nerve and supplying the geniohyoid and thyrohyoid muscles. Fibres from C2 and C3 joined the vagus just below the level of styloid process and in the neck region a branch from the vagus nerve was seen supplying the rest of the infrahyoid muscles.[4] But, in the present study, superior root was present in all the specimens.

Lydia S et al reported bifurcated origin of the superior root from the hypoglossal nerve, and multiple origins of inferior root fibres from the spinal accessory nerve, C1, C2, and C3 spinal nerves.[3] Bifurcated origin of the superior root or multiple origin of inferior were not observed in the present study.

Absence of the inferior root of ansa cervicalis was reported by Challa and collaborators [10]. Iskren B et al found that in very few cases the superior root was formed usually, however there was no inferior root: the loop was formed by junction of fibres from C1, C2 and C3 at one point. [11] In the present study also inferior root was absent in 30% of specimens. An absent inferior root has been described by Babu, where the fibres derived from the C2 and C3 spinal nerves joined the superior root independently.[12]

Arthi Ganapathy et al observed that variations in formation and distribution of ansa cervicalis was 26.6 % of cadavers [4] which was almost similar to the present study where 30% showed variations in different aspects.

## CONCLUSION

Apart from the standard variability of origin, atypical cases of ansa cervicalis have been described. Because of close proximity to major vessels and nerves in the neck, a good understanding of the topography and morphology of this loop is essential during surgery. The position of the hyoid bone is determined by the tone of infrahyoid muscles which are supplied by branches from ansa cervicalis. Knowledge of anatomy of ansa cervicalis is not only important for nerve construction surgeries, but also for operations in the neck, so as to avoid injuring the structures that are closely related to it. Any variation in the course, contributing roots or branching pattern of the ansa cervicalis, potentially modifies or complicates the procedures relating to this nerve.

## REFERENCES:

- [1] Sampath Madhyastha, Manipal manual of clinical anatomy: vol 2, 1<sup>st</sup> ed; pg 290-294. 2015
- [2] Borley NR: Ansa cervicalis. In: Standring S, Collins P, Crossmen AR, Gatzoulis MA, Healy JC, et al. editors. Gray's anatomy: the anatomical basis of clinical practice. 40th ed. Edinburgh: Elsevier Churchill Livingstone; p. 981. 2008
- [3] Lydia S Quadros, Lokadolalu Chandrachary Prasanna, Antony Sylvan D'souza, Amoldeep Singh, Sneha Guruprasad Kalthur: . Unilateral anatomical variation of the

- ansa cervicalis; amj 2015;8(5):170–173]
- [4] Arthi Ganapathy, Prabavathy Gajendran, Raghuram Kuppasamy: the ansa cervicalis: variations and applied significance; Volume-6 | Issue-9 | September-2017 | ISSN No 2277 - 8179 | IF: 4.176 | IC Value: 78.46
  - [5] Abu-Hijleh, M. F. Bilateral absence of ansa cervicalis replaced by vagocervical plexus: case report and literature review. – Ann. Anat., 187 (2), 2005, 121-125.
  - [6] 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, Vol 1(2):69-74. ISSN 2321-4287.
  - [7] Bergman, R. A.; Thompson, S. A.; Afifi, A. K. & Sadeh, F. A. Compendium of human anatomic variations. Text, atlas and world literature. Baltimore-Munich: Urban and Schwarzenberg, 1988. p.137
  - [8] Libor Machalek\*, Jiri Charamza, Katerina Kikalova, Milada Bezdekova: A variant case of ansa cervicalis © IJAV.2009; 2: 150–152.
  - [9] Venugopal sp, mallula sb, ansa cervicalis – without loop, int j anat var, 2010, 3:153–155
  - [10] Challa, R. G., R. Veeramani, A. Karuppusamy. Bilateral double looped ansa cervicalis with absence of inferior root-a case report. –EJPMR, 4 (6), 2017, 589-592
  - [11] Iskren B. Velikov, Irina I. Stoyanova: Rare variations of ansa cervicalis; Acta morphologica et anthropologica, 25 (3-4) Sofia 2018
  - [12] Babu PB. Variant inferior root of ansa cervicalis. *Int J Morphol.* 2011;29(1):240–3. [Google Scholar]