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THE ANSA CERVICALIS: VARIATIONS AND APPLIED SIGNIFICANCE

Anatomy

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ABSTRACT

Context: The infrahyoid muscles are innervated by branches arising from the loop of ansa cervicalis. Any injury to these muscles would cause disturbance in phonation. Anatomy of ansa cervicalis has recently gained popularity because of its use in surgical procedures like reinnervation of paralyzed larynx. This warrants a revisit to the variations in its formation, course and distribution. With the present study we aim to document anatomical variations of ansa cervicalis.

Methods and Material: Head and neck of 15 formalin fixed cadavers were dissected bilaterally according to standard dissection procedures in the Department of Anatomy, Mahatma Gandhi Medical College, Puducherry. The ansa cervicalis was identified. Its roots were traced to the origin and their branches till termination on the infrahyoid muscles. Any variations were identified and documented.

Results: Significant variations were noted in 4 of them. The variations ranged from short loop formation to no loop formation at all.

Conclusions: In the present study variations in formation and distribution of ansa cervicalis was observed in 26.6 % of cadavers. This implies that the variations are quite frequent.

KEYWORDS

Cadaver, infrahyoid, muscles, nerve, larynx

Introduction:

The ansa is a latin term meaning handle of a cup. Ansa cervicalis represents a loop of nerves that originate from cervical spinal nerves C1, C2, C3. [1] It has a superior root (descendens hypoglossi) consisting of the C1 fibres that pass along with the hypoglossal nerve, and the inferior root (descendens cervicalis) that is formed by the fibres of C2 and C3 spinal nerves.[2] The loop is embedded in anterior layer of carotid sheath and hence is closely related to contents of carotid sheath namely internal jugular vein, common carotid artery and vagus nerve.[3] In majority of individuals the loop is formed at the midway between hyoid bone and omohyoid muscle.[4] All the infrahyoid muscles are innervated by branches arising from the loop of ansa cervicalis which include sternohyoid, strenothyroid, superior and inferior belly of omohyoid. The geniohyoid and thyrohyoid are supplied separately by fibers of C1 which accompany hypoglossal nerve.

Main function of infrahyoid muscles is to support the laryngeal cartilages and hence help in maintaining phonation and deglutition. Therefore, any injury to these muscles or their nerve supply would cause disturbance in phonation in professional voice users.[5]

Anatomy of ansa cervicalis has recently gained popularity because of its use in surgical procedures like reinnervation of paralyzed larynx. Nerve muscle transplantation in paraglottic space using ansa cervicalis is done in cases of accidental recurrent laryngeal nerve injury as sacrificing this nerve branches doesn't cause any major functional or cosmetic deficit. RLN injury can occur in thyroidectomy or surgical procedures done for esophageal cancer. Branches of ansa cervicalis that is in close proximity to recurrent laryngeal nerve like the branch to sternothyoid can be used in unilateral vocal cord paralysis, to artificially create anastomosis between the ansa cervicalis and the recurrent laryngeal nerve. This will result in improved phonatory functions of the affected vocal cord. Apart from laryngeal reconsrtuctions ansa cervicalis is now being used for indirect facial nerve reconstruction and facial hypoglossal anastomosis.

Variations in the formation and distribution of ansa cervicalis have been documented in the past. However the recent use of ansa cervicalis for various reconstructional procedures and its close relations with major vessels and nerves of the neck warrants a revisit to the variations in its formation, course and distribution.[6, 4] Hence the present study aims at contributing to the already existing data regarding the anatomical variations of ansa cervicalis. This will provide surgeons a reference to the different variations of ansa cervicalis that can exist to avoid its accidental injury during surgical procedures

Subjects and Methods:

Study was done in the Department of Anatomy, Mahatma Gandhi Medical College, Puducherry. Head and neck of 15 formalin fixed cadavers were dissected bilaterally according to 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 were identified and documented in the form of pictures.

Results:

Among the 15 bilateral neck dissections done 12 cadavers showed the normal formation, course and distribution of ansa cervicalis. Significant variations were noted in 4 of them.

First variation was observed in one cadaver and unilaterally. Fibers from C1 joined with Hypoglossal nerve but did not communicate with C2 and C3. C1 fibers supplied the geniohyoid and thyrohyoid muscles. Rest of the infra hyoid muscles were directly supplied by nerve that came from C2 and C3 and there was no loop formation (figure 1).

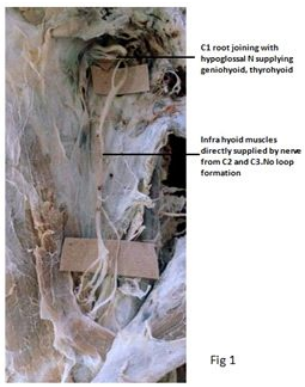

Fig 1

Another variation was observed in two cadavers and bilaterally. Superior and inferior roots of ansa cervicalis were formed normally but the branches to infrahyoid muscles did not come from the loop directly.

Instead a single nerve arose from the loop and after travelling a short distance it branched to supply the infrahyoid muscles. Thyrohyoid and geniohyoid were supplied by C1 fibers accompanying the hypoglossal nerve. In both the cadavers the loop was short and formed at a higher level i.e. at the level of hyoid bone. (Figure 2)

Fig 2

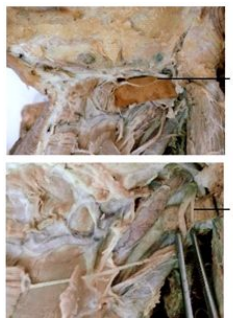

Fig 3

The third variation was noted in one cadaver unilaterally. 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. (Figure 3)

Discussion:

Banneheka[7] reported that the ansa cervicalis derived from a combination of C1-C4 spinal segments, with C1-C3 being the most frequent pattern (87.5%). In the present study, the ansa cervicalis was contributed by then C1-C3 routes in all cases. Wide variations with regard to origin, course and distribution types of ansa cervicalis have been reported in literature. Venugopal et al[8] have reported a case with no loop formation. The ventral rami of C1 and C2 integrated with the hypoglossal nerve and C2 and C3 rami united to form the inferior root. In the present study fibers from C1 joined with Hypoglossal nerve but did not communicate with C2 and C3. C1 fibers supplied the geniohyoid and thyrohyoid muscles. Rest of the infra hyoid muscles were directly supplied by nerve that came from C2 and C3 and there was no loop formation. Desouza et al[9] have shown in a case the ventral ramus of C1 joined the vagus nerve. The ventral rami of C2 and C3 joined the vagus nerve separately at different levels. The infrahyoid muscles received their nerve supply directly from the vagus. Such variations were also reported by Caliot et al[10] and Rath et al[11] in their respective studies. The formation of vagocervical complex. Verma et al[12] have reported a different pattern of formation of vagocervical complex in their case report. Vagus nerve fused with the hypoglossal nerve immediately after its exit from the skull. The vagus nerve supplied branches to the sternohyoid, sternothyroid and superior belly of the omohyoid muscles and contributed to the formation of the superior root of the ansa cervicalis. The inferior root of the ansa cervicalis was formed by the C2 and C3 nerves. Inferior belly of the omohyoid muscle was supplied by the loop of the ansa cervicalis . In the present study it was noted 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. This variation was noted unilaterally in a single cadaver.

Literature review has shown many other unique variations. Agarwal et al[13] have reported a double fused Y shaped loop pattern of ansa cervicalis (AC) on the right side of the neck of a 50 years old male cadaver. Paraskewas etal[14] have reported that the ansa cervicalis' loop, which was formed underneath the superior belly of the omohyoid muscle, provided a branch for the sternothyroid muscle, from which two recurrent rami were arising. These two rami joined together forming an unusual triangular nerve formation. The neural trunk formed by the union of the aforementioned two rami perforated the inferior belly of the omohyoid muscle and was directed towards the ipsilateral sternocleidomastoid muscle[5]. Though in the present study such variations were not seen these reports only add to the wide diversity in the formation course and distribution of ansa cervicalis.

Conclusion:

in the present study variations in formation and distribution of ansa cervicalis was obsereved in 26.6 % of cadavers. This implies that the variations are quite frequent. With increasing incorporation of branches of ansa cervicalis in reinnervation of paralyzed larynx and nerve muscle transplantation procedures surgeons should have profound knowledge of the plethora of variations with which the ansa cervicalis may present.

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