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A Study on Cervical Symphatetic Chain and Raynauds Phenomenon.

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Abstract: *The cervical part of the sympathetic trunk contains three interconnected ganglia - superior, middle and cervicothoracic. They send grey rami communicantes to all the cervical spinal nerves. The study was conducted on 157 cadavers (99 Male & 58 Female) bilaterally. Superior cervical ganglion was observed in all the cases. Middle cervical ganglion was found in 58.5% of the cases which lies between the common carotid artery in front and loop of inferior thyroid artery behind. Ansasubclavia extends from middle cervical ganglion to inferior cervical ganglion in 12.5% of the cases. Inferior cervical ganglion was observed in the 45% of the cases. The stellate ganglion was observed in 55% of the cases. The variations of the cervical sympathetic trunk were noted and photographed. Stimulated by the need of surgery, anatomy of the cervical sympathetic chain has acquired increasing importance. To diminish the potential risk of injury during surgery better surgical methods are to be developed.*

I. Introduction

The base of neck is a junction for thorax, neck and the upper limb. The density and diversity of its structures is of great interest from the anatomical point of view. The cervical part of the sympathetic trunk contains three interconnected ganglia - superior, middle and cervicothoracic. They send grey rami communicantes to all the cervical spinal nerves but receive no white rami communicantes from them.

Superior cervical ganglion is the largest of the three ganglia. It is located at the level of 2nd, 3rd cervical vertebrae and is formed by fusion of four cervical ganglia corresponding to C1-4 spinal nerves. The middle cervical ganglion is found at the level of sixth cervical vertebra and is formed by the fusion of fifth and sixth ganglia. The cervicothoracic ganglion, irregular in shape, is formed by the fusion of lower two cervical and first thoracic segmental ganglia. It lies between the base of the seventh cervical transverse process and the neck of first rib

Stimulated by the need of surgery, anatomy of the cervical sympathetic chain has acquired increasing importance. To diminish the potential risk of injury duringsurgery better surgical methods are to be developed especially in Raynaudsdisease .

II. Materials &Methods

The study was conducted on 157 cadavers (99 Male & 58 Female) bilaterally. Formalin fixed cadavers were placed in the supine position. Incision through the skin was made along the middle of the sternocleidomastoid muscle extending from mastoid process to sternal end of the clavicle.The incision was further extended to chin along the median plane and to mastoid process along the base of the mandible.

Sternocleidomastoid muscle was retracted laterally to expose the carotid sheath and its contents. Carotid sheath was removed and common carotid artery and internal jugular veinwas separated to locate the vagus nerve. Common carotid artery was retracted laterally to expose the sympathetic trunk posteromedial to it. Cervical sympathetic trunk was traced superiorly and inferiorly to locate the superior, middle and inferior ganglia. Inferior ganglion which frequently fuses with first thoracic ganglion to form the cervicothoracic ganglion (stellate) ganglion was identified in the region between seventh cervical transverse process and neck of first rib by completely displacing the vertebral artery laterally. Middle cervical ganglion was identified close to the sixth cervical transverse process by displacing inferior thyroid artery.

Cervical sympathetic chain was fully exposed from the base of skull upto its continuation with thoracic sympathetic chain. All the finer connections were dissected and exposed. The variations of the cervical sympathetic trunk were noted and photographed. All the data were analysed, compared with earlier work and conclusions were drawn.

III. Observation

Superior cervical ganglion:

Superior cervical ganglion was observed in all the cases. It is found in front of longuscapitis muscle and behind the internal carotid artery at the level of C2 and C3 vertebrae . No variation was observed in it in the present study.

Middle cervical ganglion:

Middle cervical ganglion was found in 58.5% of the cases which lies between the common carotid artery in front and loop of inferior thyroid artery behind. Ansasubclavia extends from middle cervical ganglion to inferior cervical ganglion in 12.5% of the cases. Communicating loop to vagus from middle cervical ganglion of cervical sympathetic trunk was also observed in 3.3% of the cases.

Inferior cervical ganglion:

Inferior cervical ganglion was observed in the 45% of the cases. The stellate ganglion was observed in 55% of the cases. It is identified by its connection to the T1 spinal nerve through communicant rami at the level of transverse process of C7 vertebra and behind the neck of 1st rib.

NERVE LOOPS:

Ansasubclavia: First, Ansasubclavia, a nerve loop surrounding the first part of subclavian artery lateral to the origin of vertebral artery extending from middle cervical ganglion to inferior cervical ganglion (**Fig.1**) was observed in 53.3% of cases, and it was more common on the right side (62.5%) than on the left side (37.5%).

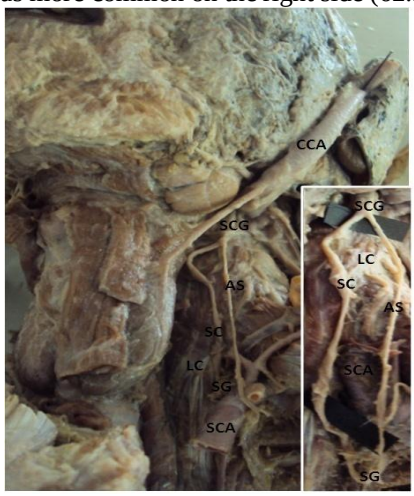

Fig.1: Ansa subclavia. SC – *Sympathetic Chain,* **AS** – *Ansasubclavia,* **LC**- *Longuscapitis,* **CCA** – *Common carotid artery,* **IJV**– *Internal jugular vein,***SCG** – *Superior cervical ganglion,* ***SG*** *– Stellate ganglion.*

Ansasubclaviahas been classified into three type based on classification given by **Paturet (1964)**. Ansasubclavia exists as multiple cords in 6.25% of the cases apart from being a single (68.75%) or a double cord (25%).

CONNECTING NERVE LOOPS TO VAGUS: The direct connecting nerve loop from the middle cervical ganglion of cervical sympathetic trunk to vagus nerve, superior to the subclavian artery was observed. This nerve loop was present in 3.3% of cases, only on the right side.

CONNECTING LOOP TO PHRENIC NERVE: The nerve loop connecting the cervical sympathetic trunk and phrenic nerve was observed in 10% (3/30) of the cases which extended from the interconnecting cord between the middle and inferior cervical ganglion to phernicnerve . It is seen frequently on the left side (66.5%) than on the right side (33.5%).

MULTIPLE VARIATION OF CERVICAL SYMPATHETIC TRUNK:

The co-existences of three variations of the cervical sympathetic trunk were observed in one case (ansasubclavia, nerve loop to phrenic and recurrent laryngeal nerves.

Ansasubclavia has multiple cords; extending from superior ganglia, middle ganglia and from the interconnecting cord, passing downward and fuse to form a single cord which attaches to the inferior cervical ganglion, surrounding the first part of subclavianartery. In addition, the nerve loops connecting interconnecting cord of cervical sympathetic trunk to phrenic and recurrent laryngeal nerve are also observed (3.3%).

IV. Discussion

The cervical sympathetic trunk is described classically to have three bilaterally placed ganglia; superior, middle and inferior. It differs essentially from other regionsof the sympathetic chain as segmentation of this part has become so obliterated, owing to fusion and division of the segmental ganglia (**Martin wrete, 1959**).

Superior cervical ganglion is the most consistent and largest ganglion of the cervical sympathetic trunk. It is usually fusiform, lies posterior to internal carotid artery, at the level of C1-C2 or C2-C3 vertebrae (**Hoffman, 1957, KalseyG, 2008, Kiray.A, 2005**). Bilateral ectopic superior cervical ganglion (**Kunwar.PBhatnagar, 2002**) was the only variation reported till date. Middle and vertebral ganglia between the superior and inferior cervical ganglia are considered as intermediate ganglia (**Mann (1914)**). These are relatively small and inconsistent (**Mitchell (1953)**). Intermediate ganglia are grossly demonstrable in only 58.5% of the cases and lie at the level of either C5 or C6 vertebrae in relation to inferior thyroid artery (**Hoffman (1957), Kiray.A (2005), ErdincCivelek (2008), Katrisis ED (1983)**).

Inferior cervical ganglion lies between the transverse process of C7 vertebra and neck of the first rib. In a few occasion, it lies at the level of intervertebral disc between C7- T1 vertebrae. Usually the inferior cervical ganglion is fused with the first thoracic ganglion to form the stellate ganglion. Sometimes the second thoracic ganglion may also contribute to its formation (**Kalsey.G (2008), Saylam CY (2009), Hoffman(1957)**). It is identified by its connections with seventh cervical and the first thoracic nerves (**Martin wrete (1959)**). Stellate ganglion is seen in 55% of the cases in the present study which is much lower than all the previous reports(**Kalsey.G (2008), Kiray.A (2005) andMarcer (2011).**

In addition to the above, four nerve loops of the cervical sympathetic trunk have been observed. They are

- ❖ Ansasubclavia,
- ❖ Connecting nerve loops to vagus,
- ❖ Connecting nerve loops to Phrenic Nerve,
- ❖ Connecting nerve loops to recurrent laryngeal Nerve.

ANSA SUBCLAVIA

Ansasubclavia is a nerve loop connecting the middle cervical ganglion to inferior cervical ganglion of the same side and surroundsthe first part of subclavian artery (**Vieussens (1864), Caliot et al (1984)**). In the present study it is seen in 53.3% of cases which is lower than that reported by **Caliot et al (1984)** (83%).

CONNECTING NERVE LOOPS TO VAGUS AND RECURRENT LARYNGEAL NERVE

Nerve loop connecting cervical sympathetic trunk to both vagus and recurrent laryngeal nerve was observed only in 3.3%, on the right side. It is lower than the findings of **Caliot et al (1984)** which is 8% and 13% respectively on both side**.** According to him, occurrence of this variation is slightly more frequent on the right side.

CONNECTING NERVE LOOP TO PHRENIC NERVE:

Nerve loop extending from the middle cervical ganglion directly to phrenic nerve is observed in 10% of the cases and present equally on both sides. It is again lower than the **Caliot et al (1984)** study (28%).

In **1994Kanagasuntheram**and**Dharshini** suggested that sympathetic ganglia are associated mainly with intersegmental vessels such as the intercostal and lumbar arteries and that the differences seen in the neck region are due to the disappearances of most of the cervicalintersegmental arteries and subsequent modifications that follow during development. This results in the fusion of upper four cervical ganglia in relation to the developing external carotid artery, which seems to provide the necessary inductive stimulus. Furthermore, anteroinferior migration of the heart, its corresponding arch arteries and the dorsal aorta bring about the subclavian artery rotation and positioning of the stellate ganglion behind the vertebral artery.

The physiological functions of ansasubclavia are derived largely from animal models. Electric stimulationof ansasubclaviaproduces an overflow of norepinephrine and cyclic adenosine monophosphate (cAMP) levels into the coronary sinus. It activates the chronotropic and inotropic responses of the heart. There is some evidence that the ansasubclavia functionally modulates the muscles of respiration by controlling the triangularissterni (Transverse Thoracis). In dogs expiration is actively facilitated by activation of the triangularissterni. Spontaneous quiet expiration in human is a passive process. However, the human triangularissterni is a primary muscle of expiration during active expiration and its neural activation is largely coupled with that of the abdominal muscles.

Thus both the anatomical patterns and the extent of variations in the ansasubclavia and anastomoses between the cervical sympathetic-vagus or between cervical sympathetic- phrenic nerves present an important

opportunity for future anatomical investigation (**Loukas.M(1998)**). Future investigations will provide more insight regarding the clinical anatomy and physiological functions of ansasubclavia.

Clinically in severe stage of Raynauds phenomenon and in Acrocynosis (a painless non paroxysmal condition) affecting young females the cyanosis of the fingers, and especially legs, is accompanied with parasthesia and chilblains. In severe cases cervical symphatectomy is essential.

V. Conclusion

The cervical sympathetic chain, though important surgically and functionally, has not been well documented anatomically. The three ganglia; superior, middle and inferior, apart from communicating with each other through alternate channels like ansasubclavia communicate with other important nerve trunks in the deep strata of the neck like the vagus, phrenic and recurrent laryngeal nerves. Occasional case reports of such communications have been often reported by various authors but their incidence has been seldom cited. Occurrence of all the three variations in a single case is rare and one such case has been observed in the present study. Similarly the incidence of occurrence of various types of ansacervicalis has been studied here.

Cervical and cervico-thoracic sympathectomies have become common surgical procedures in the treatment of patients with epilepsy, Raynaud's syndrome and vascular disorder of upper extremities. However sympathectomy fails to achieve complete sympathetic denervation. Cervical sympathetic trunks are at high risk during anterior approach to the subaxial cervical spine for the surgical treatment of several disorders including cervical disc herniation and cervical spondylitic myelopathy. For instance, connecting nerve loop from cervical sympathetic trunk to recurrent laryngeal nerve can be misunderstood as non recurrent laryngeal nerve during thyroid surgeries. In severe cases cervical symphatectomy is essential in Raynauds disease. Hence complete knowledge of variations of cervical sympathetic trunk is essential to minimize the injuries to it.

References

[1]. **Caliot.P, Bousquet.V, Cabaine.P et al.** The nerve loops crossing below subclavian artery and their anatomical variations.Anatclini. 1984. 6:209-213.
[2]. **Calzolari, Misso, Monocelliet al.** Non- recurrent inferior Laryngeal Nerves and sympathetic, inferior laryngeal anastomotic branches.Chir Ital.2008. 60(2):221-225.
[3]. **Ebraheim, Lu J, Yang.H et al.** Vulnerability of the sympathetic trunk during the anterior approach to the lower cervical spine.Spine. 2000. 25:1603-1606.
[4]. **EminGwleyik.**Three variations of the laryngeal Nerve in the same patient; a case report. Journal of medical case reports.2008. 5:266.
[5]. **Erdinccivelek, Aykutkarasu, Tufancansever et al.** Surgical Anatomy of the cervical sympathetic trunk during anterolateral approach to cervical spine.Eur spine J.2008. 17:991-995.
[6]. **Hoffman HH.** An analysis of the sympathetic trunk and rami in the cervical and upper thoracic regions in man.Annzeles Surgery. 1957. 145: 94-107.
[7]. **Hollinshead WH.** Anatomy for surgeons.3nd Ed. Philadelphia: Harper & Row. 1954. vol 1. 490-494.
[8]. **Hyun Min Cho et al.** Anatomical variations of rami communicantes in the upper thoracic sympathetic trunk.Eur spine J. 2004. 9:256-259.
[9]. **Kanagasuntheram R, Dharshini**. The cervical sympathetic trunk; a new hypothesis.Ann Acad med Singapore. 1994. 23:923-928.
[10]. **Katritsis**. Anatomical observations on the intermediate ganglionof the cervical sympathetic trunk.Anatanz.1983. 154:33-38.
[11]. **Kalsey G, Mukherjee RN, Patnaik V.V.** The comparative study of the cervical sympathetic chain. Journal of anatomical society of India. 2008. 49: 26-30.
[12]. **Kiray A, Arman C, Naderiset al** Surgical Anatomy of the cervical sympathetic trunk.Clinical anatomy, 2005. 18: 179-185.
[13]. **Kunwar.PBhatnagar et al.** A case of bilateral ectopic superior cervical ganglia in man. Journal of anatomy.2002. 7:56-59.
[14]. **Loukas.M, X.L. Zhan, Tubbs.Ret al.**TheAnsasubclavia; a review of the literature. Folia morpho. 2000. 6:209-213.
[15]. **Lyons AJ, Mills CC.** Anatomical variants of the cervical sympathetic chain to be considered during neck dissection. Brit J oral maxillofacial surg.1998. 36:180-182.
[16]. **Marcer.N et al.** An anatomical investigation of the cervicothoracic ganglion.Clinical anatomy. 2011. 16:143-147.
[17]. **Martin wrete**The anatomy of the sympathetic trunks in man. Journal of anatomy. 1959. 93:448-459.
[18]. **Paturet**Traited'anatomieHumaine1984. Vol 1.masson et cie edit. Paris.
[19]. **Reza Hejazi** Cervical sympathetic trunk and its relations to cervical fascia. ACTA medicairanica1980, 22:181-190.
[20]. **Romanes GJ** Cunningham's Textbook of Anatomy, 12th Edition 1981 Oxford, Oxford University Press.
[21]. **Ronald A Bergman, AdelkAfifi, RyosukeMiyauchi** Inferior Cervical Ganglion. Illustrated encyclopedia of human anatomic variation,1975.
[22]. **Saylam CY et al**Neuroanatomy of the cervical sympathetic trunk: a cadaveric study,Journal of anatomy**.** 2009. 12:32-35.
[23]. **Susan Standring,**Gray's Anatomy: The anatomical basis of clinical practice. 39th Ed. London: Churchill Livingston.2004.
[24]. **ThejodharPulakunta, Bhagath Kumar potu, M.S.Rao et al**Unusual External branch of the superior laryngeal nerve: a case report. cases journal. 2009. 2:24-28.
[25]. **Vieussens** Description anatomiquedesneris, planche XIII, 1864.