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ANATOMICAL UNDERSTANDING OF *NEELA* AND *MANYA MARMA* BY VIRTUE OF CADAVERIC DISSECTION

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ABSTRACT

Neela and *Manya Marma* are situated on both sides of *Kantanadi* and if any injury occurs on these region, it may cause *Mookata, Swaravaikrita* and *Arasagrahi.* Though *Dhamani* is not *Marma Vastu, Acharya* specified the word *Dhamani* to describe these *Marma* but classified under *Sira Marma.* As there is sparse information about *Neela* and *Manya Marma* available in classics and controversial opinion regarding its structural entity, present work is taken up to find out exact location and possible structural entity of *Marma* in accordance with *Viddhalakshna* by means of cadaveric dissection and literature review. The neurovascular structures observed during dissection were common carotid artery, external carotid artery, internal carotid artery, internal jugular vein and vagus nerve. It is identified that *Neela* and *Manya Marma* can be considered as internal jugular vein, external carotid artery respectively and *Kantanadi* as larynx.

KEYWORDS: *Neela Marma; Manya Marma;* internal jugular vein; external carotid artery.

INTRODUCTION

Ancient scholars were well aware about the need of knowing the basic structures of human body for treating the diseases successfully and explicated human anatomy in *Shareera Sthana* in which further evidence based research is essential to validate the science. For true understanding of human anatomy, *Sushruta* emphazised the importance of cadaveric dissection which forms the fundamental elements and sets strong base for advance medical knowledge. *Marma* is one among the core concepts and unique principle in *Ayurveda* that

stands equally important in modern era, which need detailed scrutiny to assess the testimony in the field of science. *Marma* constitute the science of specific vital places in the body, where *Prana* resides.

Neela and *Manya Marma* are two each in number, situated on both sides of *kantanadi* and included under *Sira Marma* but mentioned the word *'Dhamani'* for denoting both the *Marma*.[1] *Indu* comments on *Ashtanga Sangraha* that *Neela* and *Manya* are *Sira Marma* and not *Dhamani*.[2] *Laghu Vaghbata* classified it under *Sira Marma* and he has described *Dhamani Marma* as separate entity.

As limited informations are available in classics and controversial opinion regarding the conformation of *Neela* and *Manya Marma*, present work is taken up to find out exact location and possible structural entity of *Marma* in accordance with *Viddhalakshana.*

MATERIALS AND METHODS

Source of data

- Literary review
- Cadaveric dissection

Method of Collection of Data

Conceptual study

- By reviewing classical text book of ayurveda, contemporary science, other related information from various journals, and critical analysis of the collected informations were done.

Cadaveric study

- By following Cunningham's manual of practical anatomy, layer by layer dissection of 6 human cadavers in the neck region was carried out and photographs were taken. Then analysis of explored structures with review of classical description and contemporary science were executed.

Observations on Dissection of Neck Region

The gross location of *Neela* and *Manya Marma* in the neck region was identified and dissection was performed. As per the dissection protocol, six different approaches were incorporated by exposing the structures and photographs were taken. In first approach dermatomes were marked in the neck region after demarcation of boundaries of neck. The

surface landmarks on anterior midline of neck were noted from chin to sternum as body of hyoid bone, laryngeal prominence, cricoid cartilage and rings of trachea. The skin was reflected and superficial fascia was observed. In second approach, dissection of anterior triangle of neck and exposure of related structures were done. In third approach, dissection of posterior triangle of neck and related structures were performed. In fourth approach, exposure of median structures of neck, suprahyoid muscle, infrahyoid muscle, thyroid cartilage, cricoids cartilage, cervical tracheal rings, thyroid gland and larynx upto jugular notch were done. In fifth approach, dissection of lower part of face, section of mandible, exposure of root of tongue, identification of taste buds on the dorsum of tongue along with palatine tonsil were identified. The neurovascular structures supplying to tongue noted, such as lingual artery, lingual vein and glosso pharyngeal nerve. In sixth approach**,** observation of major blood vessels and nerves that lie on either side of larynx was made. The carotid sheath which surrounds the internal jugular vein(IJV), common carotid artery (CCA), external carotid artery(ECA), internal carotid artery(ICA) and vagus nerve were observed. The ECA and its branches were exposed. Internal laryngeal nerve in the thyrohyoid interval was noted and external laryngeal nerve was followed downwards, deep to superior thyroid artery.

DISCUSSION

Kantanadi as larynx

To ascertain the possible structural entity of *Neela* and *Manya Marma*, prior understanding of *Kantanadi* is essential. *Sushruta* opined that *Mandala sandhi* is located in *Kanta*, further *Dalhana* clarifies that three *Mandala Sandhi* are present in *Kantanadi*.[3] *Kanta* means '*kantadhwani*'[4] which is a media responsible for phonation and *Nadi* refers to tubular structure.[5] Here we can perceive that *Dalhana* accurately pointed out on *Kantanadi* which is situated in *Kanta*. *Swarayantra* produces different kinds of sounds and covered with *Tarunaasthi* which connect upper part with *Jihwamoola* and lower part with *Klomanalika* or *Swasa nalika*.[6] In modern parlance also larynx is an organ for phonation, which is covered with cartilages and upper part connect with oropharynx where root of tongue is situated and lower part connect with trachea. Hence we can consider *Kantanadi* as larynx because it is an organ, which is hollow and tubular, present in throat region and accountable for voice production.

Neela Marma as *Sira*- A Vascular Structure

Sira is channel where continuous movement take place which carry substance from one place to another i.e '*Deshantharagamanathwath*' means '*Avayavanthara gamana'*.[7] Here the term *Avayavanthara* signifies that circulation of blood from one organ to another or deep at tissue level which implies the function of venous circulation.

As per *Sushruta, Sira* are classified into 4 types with distinct colour based on content flowing. He has specifically mentioned the word *'Neelasira'* in the context of *Pittavahasira* and *Pitta* being *Mala* of *Rakta, Pittavahasira* carries elements with sanguine character containing nitrogenous waste, ammonia etc.

As we mentioned earlier, *Neela Marma* is situated on both sides of *Kantanadi.* The possible vein situated bilaterally of larynx is IJV which is formed by continuation of sigmoid sinus carrying venous blood of metabolic waste driven out of brain after its complete function. IJV has pulsation which can be related with *Dhmana* property of *Dhamani*, hence it is denoted as *Dhamani* based on its function. As it carries *Pitta*, with *Neelavarna* and *Ushnaguna,* in other way metabolites from head. All this goes in favour of making structure most vulnerable and vital accounting for *Neela Marma.* From the above discussion we understand that *Sira* can be correlated as vein and IJV can be related with *Neela Sira*, as name itself indicates *Neela* under classification of *Sira*.

Manya Marma as *Dhamani*- A Vascular Structure

Dhamani are hollow tubes where *Dhmana* or *Spandana*[8] (throbbing action or pulsation) takes place which can be clearly appreciated in arteries. *Moola* of *Dhamani* is *Mahat* and synonym of *Mahat* is *Hridaya*. It means that *Dhamani* originate from *Hridaya* i.e arteries get originated from heart. *Sushruta* has emphazised on *Dhamani* and attributed all functions because these purvey *Tridosha, Rasa* and *Rakta*. *Urdhaga Dhamani* perceive *Sabda, Sparsa, Rupa, Rasa* and *Gandha*, out of which 2 *Dhamani* carry *Sabda* and 2 *Dhamani* carry *Rasa.*

Manya is *Dhamani* situated on sides of *Gala* and if there is no *Spandan* in *Manya*, it causes sudden death.[9] Similarly in the neck region carotid artery pulsation can be felt in anterior frontline of neck, on sides of larynx and anterior border of sternocliedo mastoid muscle. As *Manya Dhamani* is pulsatile and present on either side of *Kantanadi*, similarly CCA bifurcates at the level of thyroid cartilage and becomes ECA and ICA. The ECA gives out branches in the form of laryngeal artery (branch of superior thyroid artery), lingual artery,

facial artery and ascending pharyngeal artery. The atherosclerotic changes, trauma, compression etc causes *Viddhalakshana* in the form of *Mookata*, *Swara vaikrita* and *Arasgrahata*. The anatomical location of ECA and larynx give more similitude towards *Manya Marma* and *Kantanadi*. Hence conviction of *Sushruta* as *Manya Marma* situated on both sides of *Kantanadi* seems to be appropriate in this regard.

Discussion on *Marmavastu*

Marma is an assemblage of *Mamsa*, *Sira*, *Snayu*, *Asthi* and *Sandhi* which is termed as *Marmavastu*. *Neela* and *Manya Marma* are *Sira Marma* situated in the lateral aspect of neck on either side of *Kantanadi*. It is termed as *Manya pradesha* - the region where predominant vascular structures (*Sira marma)* are present. The other structural entity related with this *Marma* in and around are as follows. *Mamsa* component constitute intrinsic muscles of larynx, muscles of tongue, palate, lips etc. *Snayu* component include vagus nerve, glossopharyngeal nerve, lingual nerve etc. *Asthi* comprise of thyroid, cricoids, arytenoids cartilages etc. *Sandhi* component consist of cricothyroid, thyro arytenoids joints etc.

Discussion on *Viddhalakshana* of *Neela* and *Manya Marma*

Neela and *Manya Marma* are classified under *Vaikalyakara Marma*, i.e on injury of these *Marma* leads to disability. There is an explicit symptoms on injury of *Neela* and *Manya Marma* mentioned by *Sushruta* and *Vridha Vaghbhata* as *Mookata*, *Swaravaikrita* and *Arasagrahi*.

Discussion on *Mookata*

Aggravated *Vata* along with *Kapha* causes obstruction of *Sabdavahi Dhamani* and produces *Mookata*[10] (loss of voice or speech). As mentioned earlier *Sabdavahidhamani* produces *Sabda* hence we can understand that *Dhamani* ascribe the functions of *Sabda*. The main organs attributed to speech include lungs, trachea, larynx, tongue, palate, uvula, teeth and lips. The arterial supply of larynx by superior thyroid artery is a branch of ECA. Superior laryngeal artery, branch of superior thyroid artery supplies to the larynx which inturn derives from ECA. The lingual artery supplies to tongue, which is a branch of ECA. The ECA is the principal supply of blood to lips via facial artery giving rise to superior and inferior labial arteries lateral to angle of mouth. The arterial supply to palate from ascending palatine artery, which is branch of facial artery, originated from ECA and from greater palatine artery, a branch of maxillary artery which sequently arise from ECA. Here we recognize that blood

supply to structures related with speech are mainly from ECA and its branches. Likewise venous blood flow from larynx, tongue, lips are drained into IJV.

Waheed et al states that when carotid artery is injured bluntly, the sudden trauma usually initiates hematoma formation. Individuals with carotid artery contusion may have symptoms related to laryngeal and tracheal injuries including dysphonia, hoarseness of voice, dysphagia etc.[11]

William et al conducted prospective case study in 128 patients who have undergone carotid endarterectomy to find out cranial nerve dysfunction resulting in motor speech abnormality. Patients were evaluated before operation, two days and six weeks following surgery and noted gross voice changes and changes in tongue motion. Among this 30% showed changes in superior and recurrent laryngeal nerve function. Integrated motor speech was interpreted as abnormal in 15%. At six weeks post surgery many deficits had resolved and showed 4.5% incidence of superior and recurrent laryngeal nerve.[12]

Discussion on *Swaravaikrita*

Hoarseness of voice is the most commonly occurring entity in voice disorders. Hoarseness (dysphonia) is defined as a disorder characterized by altered vocal quality, pitch, loudness, or vocal effort that impairs communication or reduces voice-related quality of life. Functional dysphonia is due to vocal over use or abuse. vocal cord paralysis occurs during surgeries such as thyroidectomy, carotid endarterectomy and anterior cervical spinal injury. Vagus nerve is confined within carotid sheath as it courses down the neck, rendering it susceptible to injury from neck truma or neck mass.[13]

Discussion on *Arasagrahi*

The term *Arasagrahana* refers to the condition where unable to perceive taste. Kezrian reports that the hypoglossal nerve and the lingual neurovascular bundles travel in the inferolateral portions of the tongue base. Neurovascular injury can produce airway, tongue weakness or numbness, and taste disturbance.[14]

Cowart BJ states that head trauma and upper respiratory viral infections may contribute taste dysfunction.[15]

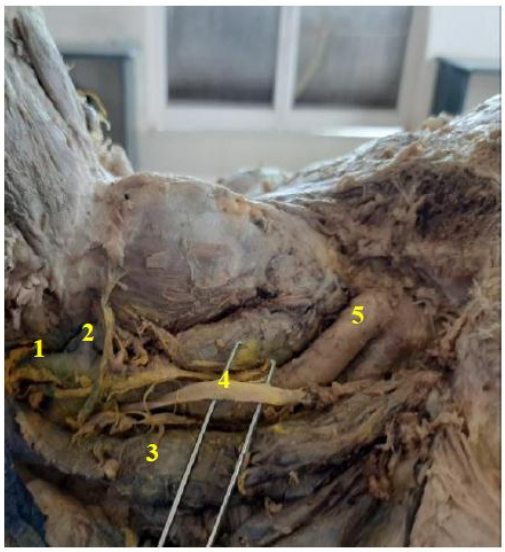
Hulsbomer reported, a patient with carotid dissection and ipsilateral ageusia in the anterior two thirds of the tongue, presumably from a lesion of the chorda tympani. Ageusia in carotid

dissection is explained by the close anatomic relation of the internal carotid artery and the chorda tympani in the short petrous bone. Reduced perfusion of the vasa nervorum can be excluded as another cause, because the chorda tympani is supplied only from branches of the external carotid artery.[16]

From this we infer the relation of neuro vascular entity of *Neela* and *Manya Marma* which causes *Mookata, Swaravaikrita* and *Arasagrahi* as *Viddhalakshna*. Because of close relation of glossopharyngeal nerve, lingual artery with hypoglossal nerve, superior thyroid artery with superior larngeal nerve and inferior thyroid artery with recurrent laryngeal nerve, injury on vascular structures causing neurological insufficiency.

While analyzing the case reports of speech difficulty and loss of taste sensation, related with vascular injury, we understand that there is close association of neurovascular structure. Hematoma formation in carotid arteries precipitate the derangement of speech and taste functions. If distinct nerve is supplied by artery is damaged then derangement of function or necrosis occurs. ECA and IJV supplies and drains the blood from particular structure concern with speech and loss of taste. If any disarray occurs in vascular supply, it causes neurological deficit.

Dissected photographs



1) Hypoglossal nerve
2) External carotid artery
3) Internal jugular vein
4) Vagus nerve
5) Common carotid artery

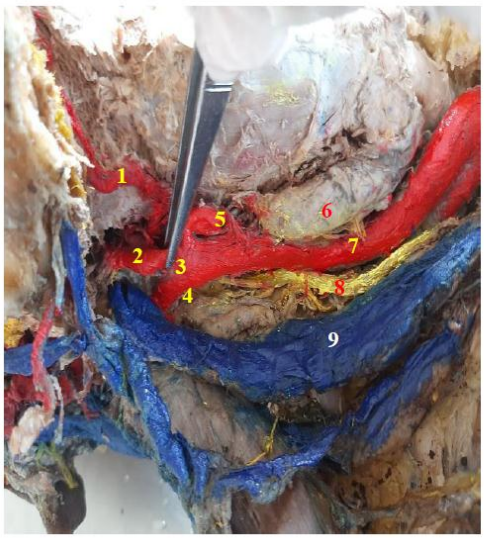
Fig no.1: Carotid triangle & contents.

1) Glossopharyngeal nerve
2) Hypoglossal nerve
3) Root of ansa cervicalis

Fig.no 2: Nerves in carotid sheath.

1) Glossopharyngeal nerve
2) Hypoglossal nerve
3) Root of ansa cervicalis

Fig.no.3: Carotid sinus.



1) Lingual artery
2) External carotid artery
3) Carotid sinus
4) Internal carotid artery
5) Superior thyroid artery
6) Rt lobe of thyroid gland
7) Common carotid artery
8) Vagus nerve
9) Internal jugular vein

Fig.no.4: Anterior view of dissected neck.

CONCLUSION

On the basis of various literature review, cadaveric dissection and observations, following conclusions are drawn. *Neela Marma* can be considered as IJV, *Manya Marma* as ECA and *Kantanadi* as larynx.

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