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ANATOMY DESCRIBED IN PHANA MARMA W.S.R MODERN SCIENCE: A REVIEW ARTICLE

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ABSTRACT
A accomplish anatomical description of all that Marma represents is required in order to clarify material that is difficult to understand and to make it simpler to put it into practice. This is the reason why it is quite important to provide such a description. The purpose of this study is to shed light on the anatomical characteristics that are associated with Phana Marma and to depict such qualities. During the course of this examination, the literature that is associated with this Marma was utilized as the foundation for the investigation. In the first part of this section, we will begin with a compilation of the ancient Ayurvedic writings as well as the contemporary literature that is pertinent to the subject topic. Our investigation led us to the conclusion that the vessels that are situated in the postero-lateral area, deep within the nasal cavity, and more especially the Sphenopalatine Artery, have to be regarded as the injured component that is displaying traumatic repercussions. Following the completion of our investigation into these facets and the examination of the ancient literature, we arrived at this conclusion. Furthermore, we were able to shed light on the connection that exists between the pharyngeal entrance of the Eustachian tube and his Marma. This relationship was previously unknown to us. Prior to this point, we were unaware of this relationship.

KEYWORDS: Ayurveda, Phana Marma, Sharir.

INTRODUCTION
Marma science is a fundamental and vital aspect of Ayurvedic literature. The references are scattered across various ancient Indian texts, although the Shamhita Granthas are the principal source of its knowledge. The Sushruta Samhita, of all Samhitas, articulates the extensive concept of Marma Sharira and posits that knowledge of Marma is half of the complete comprehension of Shalya Tantra. Acharya Vagbhata in the Astanga Samgraha and Astanga Hridayam articulated a comparable viewpoint on Marma, though with certain alterations. Researchers continually examine these Marmas and their principles to improve their utilization in Ayurveda and modern surgical practices. The entire count of Marma is 107, with Phana Marma being one of the prominent head-seated Marmas among them. This Marma, situated deep within the nasal cavity, is designated as Vaikalyakara Marma, indicating its capacity to cause deformity; its injury leads to olfactory dysfunction. Partial or complete anosmia, the impairment of olfactory function, is a possible outcome linked to sinus surgeries, pituitary operations, and various craniofacial interventions. All these treatments are performed through the nasal cavity. Researchers primarily contend that the structure implicated in injury and consequent anosmia (partial or complete) is the olfactory pathway, namely the connection between the olfactory epithelium and the olfactory bulb. Thus, the Phana Marma is mostly considered to include the olfactory epithelium to the olfactory bulb. Phana Marma is categorized as Sheera Marma, signifying that the affected structure relates to the vessels situated deep within the nasal cavity, potentially leading to olfactory dysfunction upon destruction. In modern surgical literature, the sphenopalatine artery is often identified as the structure most frequently compromised during transnasal surgeries, in addition to the olfactory region. Injury during procedures may lead to considerable epistaxis, and this extensive hemorrhage could result in olfactory dysfunction. This study associates the Phana Marma with the sphenopalatine artery by synthesizing and clarifying Ayurvedic texts related to this Marma, and then associating it with the sphenopalatine artery through an examination of pertinent contemporary anatomical and surgical literature. The term "Phana" about Marma is insufficiently elucidated; what is the justification for its application? This investigation has been commenced for the subsequent reasons. This study seeks to identify the

precise structure associated with Phana Marma, considering its location, clinical manifestations of injury, the number of Marma, and the essential components involved.

REVIEW OF LITERATURE

Ancient Literature[1-5]

The term Phana refers to the broad head of a snake, like to a Darvi (a concave cooking vessel), characterized by its concave shape that can both enlarge and contract, reflecting the variations in the size of a snake's head.

Sushruta Samhita, Sharira Sthana 6/27

घ्राण मार्ग उभयतः स्रोतः मार्ग प्रतिबद्धे अभ्यन्तरतः फणे तत्र गन्ध अज्ञानम्।

Phana Marma is located bilaterally in the nasal cavity and is internally connected to a channel. Injury to this Marma results in anosmia.

Dalhana's Commentary on Sushruta Samhita, Sharira Sthana 6/27

घ्राणित्यादि घ्राण मार्गस्य द्वयोः पार्श्वयोः अभ्यन्तर विवर सम्बद्धे फणे |

Acharya Dalhana asserts that Phana Marma is situated in both nasal passages, laterally positioned, and intimately associated with the internal openings.

Ashtanga Samgraha, Sharira Sthana 7/37

घाण मार्ग उभयतः श्रोत्र मार्ग प्रतिबद्ध अभ्यन्तरतः फणे तयोर्गन्ध अज्ञानम् |

Phana Marma is defined as a bilateral structure located on each side of the nose cavity and internally connected to the auditory system. Injury to this Marma results in anosmia.

Ashtanga Hridayam, Sharira Sthana 4/30

फणे उभयतः घाण मार्ग श्रोत्र पथानुगो अन्तरगला स्थितो वेधात् गन्धविज्ञान हरणः |

Phana Marmas are found bilaterally adjacent to the nasal route, intricately associated with the auditory canals and positioned internally within the throat area (Gala Pradesh). Damage to these Marmas leads to the inability to recognize odors.

Sarvanga Sundari Commentary on Ashtanga Hridayam, Sharira Sthana 4/30

फणविव संस्थानम रूपमणयोः फणविति नाम |

The Sarvanga Sundari commentary asserts that Phana Marmas possess the traits (Sansthana) and shape (Rupa) of a Phana, hence justifying their classification as Phana Marmas.

Description of Phana Marma Description of Phana Marma[6]

Name of Marma	Phana
Number	Two
Site	Ghrana Marga Ubhayataha Srotomarga Ptratibaddhe Abhyantartaha
Type (acc. to Rachana)	Sira Marma
Type (acc. to Aaghtaja Parinama)	Vaikalyakara Marma
Type (acc. to Pramana)	1/2 Angula
Sign if injured	Loss of perception of smell

Modern Literature

Nasal Anatomy

The nose functions as both a respiratory and olfactory organ. It is partitioned into two segments - **a) External Nose -** A conspicuous, pyramidal structure composed of both bony and cartilaginous elements.

b) Internal Nose/Nasal Cavity[7] - The nasal cavity is an irregularly shaped area situated between the roof of the oral cavity and the base of the skull, spanning from the external nares to the posterior nasal apertures, referred to as choanae. The nasal cavity connects to the nasopharynx by the choanae. The nasal cavity is divided by a vertical, midline osseocartilaginous septum. Each hemisphere of the nasal cavity consists of a vestibule, floor, roof, medial wall, and lateral wall.

The lateral wall structure consists of cartilage, bone, and soft tissues. The cartilaginous framework comprises the superior nasal cartilage, the inferior nasal cartilage, and three or four lesser cartilages of the ala. The skeletal framework consists, from anterior to posterior, of the nasal bone, frontal process of the maxilla, lacrimal bone, ethmoidal labyrinth with superior and middle conchae, and inferior nasal concha. Perpendicular plate of the palatine bone, including its orbital and sphenoidal processes, and the medial pterygoid plate of the sphenoid bone. The sphenopalatine foramen is situated in the posterior region of the lateral wall of the nasal cavity.[8]

The sphenopalatine foramen, a fissure, transmits the sphenopalatine artery together with the nasopalatine and superior nasal nerves from the pterygopalatine fossa (fig. 1). It is situated posterior to the middle meatus, superiorly limited by the body and concha of the sphenoid, inferiorly by the superior margin of the perpendicular plate of the palatine bone, and anteriorly

and posteriorly by the orbital and sphenoidal processes of the palatine bone, respectively.

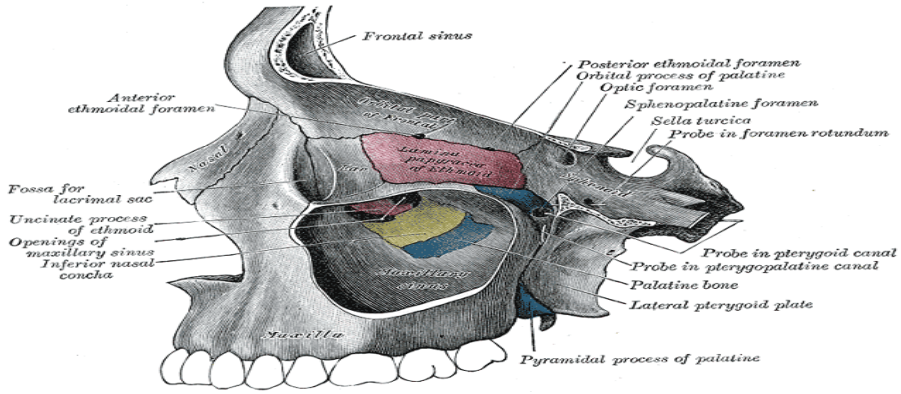

Fig. 1: Showing sphenopalatine foramen. (https://en.wikipedia.org/wiki/Sphenopalatine_foramen)

It is primarily situated in the superior nasal meatus, occasionally between the superior and middle nasal meatus, and less frequently at the level of the middle nasal meatus. It is located posteriorly, nearly at the choanae. The contents of the sphenopalatine foramen include the sphenopalatine artery, the posterior superior lateral nasal nerve, and the nasopalatine nerve.[9]

Nasal and olfactory mucosae

▪ The olfactory region (upper one-third) is limited to the superior nasal concha, the corresponding portion of the septum, and the neighboring roof. It is adjacent to olfactory epithelium. The olfactory mucosa covers approximately 5 cm^2 of the posterior superior areas of the lateral nasal wall, incorporating the upper portion of the vertical segment of the middle concha. The structure consists of a yellowish-brown pigmented pseudostratified epithelium with microvilli, olfactory receptor neurons, sustentacular cells, and two varieties of basal cells, positioned above a subepithelial lamina propria that houses subepithelial olfactory glands (of Bowman) and bundles of axons from the olfactory receptor neurons that pass through the mucosa towards the cribriform plate. All these structures serve a role in olfaction.

The respiratory region comprises the remaining two-thirds of the cavity. The respiratory epithelium comprises the predominant surface of the nasal cavity, including the conchae, meatuses, septum, floor, and roof, excluding the superior area of the olfactory cleft.

Vascular Supply

The sphenopalatine artery serves as the principal circulatory supply of the nasal fossa.[10] The Sphenopalatine artery divides into two primary vessels, the septal artery and the posterior lateral nasal artery, before to exiting the sphenopalatine foramen.[11] Documented cases exist in which the sphenopalatine artery incurs injury (pseudoaneurysm) during transsphenoidal pituitary or faciomaxillary surgery.[12] The anterior and posterior ethmoidal arteries are the primary vessels supplying the ethmoid sinus, septum, and anterior skull base.[13]

The olfactory mucosa and olfactory neurons situated in the postero-superior region of the nasal cavity are supplied with blood by a dense vascular network derived from branches of the external and internal carotid arteries, the sphenopalatine artery, and the anterior and posterior ethmoidal arteries. The anterior and posterior ethmoidal arteries arise from the ocular artery, a branch of the internal carotid artery. The anterior and posterior ethmoidal arteries, along with the sphenopalatine artery, provide large anastomotic networks that supply the olfactory mucosa.

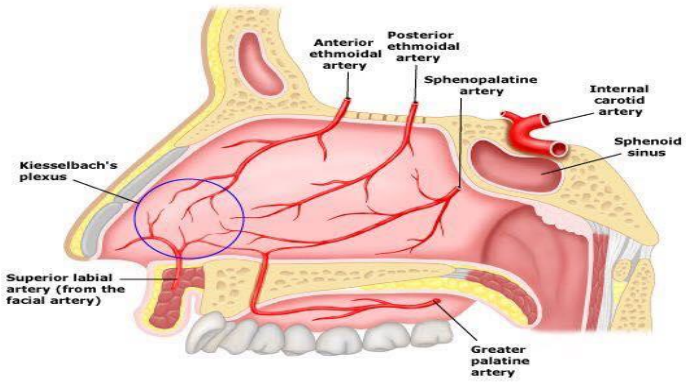

Fig. 2: Showing anastomosis between sphenopalatine artery and ethmoidal artery. https://www.sciencedirect.com/topics/medicine-and-dentistry/posterior-ethmoidal-artery

Nasopharynx Anatomy[14]

It is the upper segment of the pharynx. It is located posterior to the nasal cavity (originating from the choanae) and extends from the base of the skull to the soft palate or the horizontal plane intersecting the hard palate. The roof is formed by the basisphenoid and basiocciput. The anterior floor comprises the soft palate, whereas posteriorly, there is an opening termed the nasopharyngeal isthmus, which enables contact between the nasopharynx and the oropharynx. Anterior to the nasopharynx is an opening referred to as the posterior nasal apertures or choanae, connecting it to the nasal cavity. The rear wall of the nasopharynx is formed by the arch of the atlas vertebra.

The lateral wall contains the pharyngeal opening of the Eustachian tube, situated 1.25 cm posterior and inferior to the posterior extremity of the inferior turbinate. The Eustachian tube is a passage that connects the nasopharynx to the middle ear. The Eustachian tube opening is a vital reference point for endoscopic evaluation of multiple middle ear and nasopharyngeal disorders, as well as for transnasal entry to the infratemporal fossa.[15]

Encompassing Structure of the pharyngeal orifice of the Eustachian tube

The tubal aperture is about trapezoidal and is bordered superiorly and posteriorly by the tubal elevation, consisting of mucosa that covers the protruding pharyngeal end of the cartilage of the pharyngotympanic tube. A vertical mucosal fold, termed the salpingopharyngeal fold, descends from the tubal elevation posterior to the aperture and encases the salpingopharyngeus within the pharyngeal wall; a smaller salpingopalatine fold extends from the antero-superior angle of the tubal elevation to the soft palate anterior to the aperture. The tubal elevations surrounding the pharyngeal entrance approximate the form of a serpent's hood. Evidence indicates that injury to the pharyngeal portion of the Eustachian tube during surgical procedures leads to partial deafness.[14]

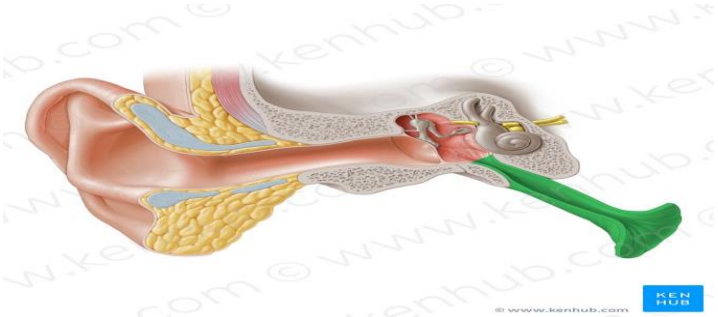

Fig. 3: Showing elevation around the pharyngeal opening of Eustachian tube in the nasopharynx., https://www.kenhub.com/en/library/anatomy/eustachian-tube

Surgical interventions, such as sinus surgery, turbinectomy, adenoidectomy, and maxillary advancement, may result in the damage of the cartilaginous Eustachian tube. Scarring from concurrent procedures, such as adenoidectomy, may impact the patency of the Eustachian tube. These surgical procedures may induce scarring or anatomical changes, leading to lasting impairments in ear function as a result. Chronic middle ear effusion resulting from Eustachian tube obstruction may lead to hearing impairment.[16]

DISCUSSION

Due to the fact that Marma is the science that contains a great deal of concealed information, Phana Marma is regarded to be both a Vaikalyakara Marma (which is associated with deformities) and a Sira Marma (which is associated with blood vessels). In addition to being connected to the olfactory nerve and the olfactory bulb, it is located deep within the nasal passageways on both sides of the sinuses.

Acharya Sushruta mentioned the phrase “Srotomarga Pratibaddhe,” but Acharya Vagbhatta observed “Shrotra Marga Pratibaddha” and “Srotra Pathanugo” in relation to the location of Phana Marma. “Srotomarga” denotes any channel via which an entity passes, but “Pratibaddhe” indicates ‘bound’, ‘tied’, or ‘closed’.This Marma is intimately linked to the auditory canal. Dalhana's commentary on this phrase indicates that the Phana Marma is closely associated with the Vivara (opening) situated deep within the nose on the "Parshava" or lateral wall. Dhalhana's comments implies the existence of the Eustachian Tube opening at the onset of the nasopharynx, but not stating it clearly. The auditory link situated in the nasal cavity and nasopharynx is referred to as the 'Pharyngeal Opening of the Eustachian Tube.' Acharya utilized the term “Srota Marga Pratibadha” to signify the Eustachian Tube pharyngeal opening as a distinctive marker, defined by a certain shape for identification and its proximity to the vital point (Sphenopalatine Artery). The Sphenopalatine Foramen and artery are situated beneath the mucosal membrane and are indiscernible upon superficial examination; hence, a more accessible landmark is necessary for the precise identification of the region that must be protected during Shalya Karma. Both Sushruta and Vagbhata take Phana Marma into consideration, and their classification of it falls within the Vaikalyakara Marma and the Sira Marma categories. It is situated in the very interior of the nasal passages, particularly on

both sides of the nasal passages, and it is attached to the nose in the form of Bahirsrotas. The impairment known as gandha agyan, also known as anosmia, is the result of an injury that occurs at this marma.

This tube is situated 1.25 cm posterior to the inferior nasal concha. From this distance, we can deduce that the pharyngeal opening of the Eustachian tube is situated near the sphenopalatine foramen, positioned at the level of the middle or superior nasal concha. In a midsagittal section of the head and neck, the Eustachian tube entrance is surrounded by elevations: anteriorly by the Salpingopalatine fold, superiorly by the cartilaginous elevation, and posteriorly by the Salpingopharyngeus fold. The elevations form a prominence that resembles the contour of a snake's hood surrounding the opening. This Marma is designated as Phana Marma. In his analysis of Astanga Hridayam, Acharya Arundutta observed that this Marma has 'Lakshana' (characteristics) and 'Rupa' (shape) similar to the 'Phana or snake hood'. In "Amarkosha," Acharaya delineated the form and attributes of Phana, indicating that it is concave and has the ability to contract (Sankocha) and expand (Vistara). The elevation around the Eustachian tube opening is concave, and its muscular structure allows for contraction and expansion. The term "Phana" refers to a proximate feature distinguished by a concave form and motion akin to that of Phana. The origin of the Sphenopalatine Artery, the Sphenopalatine Foramen, and the elevated margin surrounding the Pharyngeal Opening of the Eustachian Tube are situated in the lateral wall. The commentators cite the term "Parsavyo." The Phana Marma is situated in the lateral regions of the nasal cavity.

Phana Marma is categorized as Vaikalya Kara Marma, and damage to this region leads to alterations in olfactory perception. The Sphenopalatine Artery, entering the nasal cavity through the Sphenopalatine Foramen, anastomoses with the ethmoidal arteries, supplying the entire olfactory mucosa. The sphenopalatine artery is the principal source of blood supply to the nasal mucosa; hence, injury to this artery compromises the function of the olfactory mucosa, leading to diminished efficacy of the olfactory epithelium, glands, and nerves. Ultimately, it diminishes olfactory perception. As a Vaikalya Kara Marma, injuries to this area may lead to hearing dysfunction due to the closeness to the Eustachian Tube.

This work elucidates the deficiencies in the comprehension of Phana Marma and facilitates the exploration of alternate etiologies for olfactory abnormalities beyond damage to the olfactory system. Further research may aid surgeons in understanding an alternative cause of olfactory loss in faciomaxillary surgeries.

CONCLUSION

We are able to correlate Phana Marma with the Sphenopalatine Artery at the precise position where it passes through the sphenopalatine foramen and enters the nasal cavity. This is contingent upon the circumstances, amount, fundamental anatomy, traumatic effect, and layout of the situation. Phana is a hood-shaped feature that is located near to Phana Marma, which is the elevated edge of the Eustachian Tube Pharyngeal Opening. The term "Phana" makes reference to this feature. In addition, the shape of the olfactory bulb is comparable to that of the snake hood (Phana). It's possible that this is where the nomenclature of marma comes from. In conclusion, the characteristics of Phana marma that Sushruta has presented can be seen to be significantly relevant to the anatomical structures that have been discussed earlier.

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