AN ANATOMICAL STUDY OF STHAPANI MARMA

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ABSTRACT

Marma Sharir a unique concept described by Acharya Sushurta solely can be accounted for half of Shalya Chikitsa. Marmas are the vital points which should be protected during surgeries. Acharyas have documented 107 Marmas; from which 37 are categorized under Urdhvatrayagata Marma. Sthapani Marma is one of them. Sthapani Marma located between the eyebrows and according to traumatic effect it is Vishalyghana type of Marma. Structurally it is Sira Marma and 1 in number. Aim of our study is to find out the appropriate position and structures related to Sthapani Marma. Another part of the study is to find out the applied aspects of this Marma. Observations are made on the basis of textual comparison from the Ayurvedic and modern literature and on the basis of cadaveric study. Study concludes that Sthapani Marma may be considered anatomically as glabella region and the anterior 1/3rd of superior sagittal sinus is responsible for traumatic result mentioned by Acharyas.

KEYWORDS: MARMA, STHAPANI, VISHALYGHANA, SIRA.

INTRODUCTION

Marma science is a part of Vedic literature and its first reference is found in “Rig-Veda”. Then on the progressive development of this science took place from Saraswati culture upto the Samhita Kaal. Marma sharir, a unique concept described by Sushurta Samhita solely can be accounted for half of Shalya Chikitsa, as these are the vital points which should be protected during surgeries. Most of the Ayurvedic Acharyas are of the view that the total numbers of Marmas are 107. Acharyas have also classified Marma into various categories.
such as Regional Marma, Structural dominance wise Marma and as per the injury effects. Regional Marmas are further divided into Urdhvarjugata, Udargata, Shakhagata and Prishthgata Marma. Urdhvarjugata Marmas are 37 in number and Sthapani Marma is one of them.

AYURVEDA AND STHAPANI MARMA
The term Sthapani means the thing by which anything is made stable. Yogi considered Sthapani as a very sensitive point for “Dharana”. Acharyas have accepted that the Sthapani Marma is situated in “Bhrumadhye”. It is categorized under Sira Marma, and 1 in number. As per injury effects it is Vishalyghana type of Marma means due to injury of this one survives if a Shalya remains lodged with in Marmasthana or if it comes out of suppuration, but he cannot survive if the Shalya is extracted out just after its penetration. Acharyas have accepted Ardhanguli Pramana (approx.1cm) of Sthapani Marma.

ANATOMY
The upper part of the skull is formed by the frontal bone, which underlies the forehead region above the orbits. It has 3 parts; Squamous, Nasal, Orbital part and 2 cavities (frontal sinuses). The squamous part forms the major portion of the bone and its external surface has a rounded tuberosity above the midpoint of each supraorbital margin. Superior-medial to each orbit and below the tuberosity there is a rounded palpable arch known as superciliary arch; the ‘glabella’ a small horizontal ridge, is easily palpable between the arches. The glabella may show the remains of the interfrontal suture, which usually close in the first postnatal year. The curved supraorbital margins of the orbital openings lie inferior to the superciliary arches. The lateral 2/3rd of each margin is sharp and the medial third rounded; a supraorbital notch or foramen lies at the junction between them, which transmits the supraorbital vessels & nerve. Muscles present in this area are frontal belly of occipitofrontalis, orbicularis & procerus. Supra trochlear artery lies slightly deep within this area & then it runs upwards by giving the subcutaneous branches to the skin of the forehead.

The internal surface of the frontal bone is concave. Its upper, median part displays a vertical sulcus whose edges unite below as the frontal crest. The sulcus contains the anterior part of the superior sagittal sinus. The crest ends in a small notch that is completed by the ethmoid bone to form a caecum. The anterior portion of the falx cerebri is attached to the margins of the sulcus & to the frontal crest.
1. **Frontal air sinus** - The paired frontal sinuses are located between the cortical tables (anterior and posterior table) of the frontal bone. The frontal sinuses on either side are separated from one another by the intersinus septum, although frequently the septum is not exactly midline and the larger sinus crosses the midsagittal plane to the contralateral side. These sinuses typically extend a short distance above the medial aspect of the eyebrow and posteromedially; they may reach into the orbital roof as far as the lesser wing of the sphenoid.

2. **SUPERIOR SAGITTAL SINUS**[6] - The superior sagittal sinus usually begins at the foramen cecum, just anterior to the crista galli. It runs backwards, grooving the inner surface of the frontal bone, the adjacent margins of the parietal bones, and the squamous part of the occipital bone. Near the internal occipital protuberance it deviates to one or other side, and is continued as the corresponding transverse sinus. Superior sagittal sinus is triangular in cross-section & gradually increase in size as it passes backwards. The superior sagittal sinus receives following tributaries –

   i) Superior cerebral veins which never open into the venous lacunae.
   ii) Parietal emissary veins.
   iii) Venous lacunae, usually three on each side which first, receives the diploic and meningeal veins, and opens into the sinus.
   iv) Occasionally, a vein from the nose opens into the sinus when the foramen caecum is patent.

**MATERIALS AND METHOD**

- Classical literature, modern literature, books, thesis, journals, articles, internet materials were reviewed for the topic and related information and references were collected and analyzed scientifically to determine the anatomical aspect of *Sthapani Marma*.
- Dissection of regional anatomical study on *Sthapani Marma* was carried out in 2 male cadavers in P. G. dept. of *Rachana Sharir, Rishikul Campus, UAU, Haridwar*.
- The method of dissection was followed by the Cunningham’s Manual of Practical Anatomy Vol.3.
DISSECTION FINDINGS - After cadaveric study these anatomical structures were observed in the glabella region superficially and deep within 1-2 cm.

Table I: Underlying structures related to Sthapani Marma.

<table>
<thead>
<tr>
<th>Muscles</th>
<th>Vessels</th>
<th>Nerves</th>
<th>Bone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procerus, Orbicularis oculi,</td>
<td>Supratrochlear vessel,</td>
<td>Supratrochlear nerve,</td>
<td>Frontal bone with</td>
</tr>
<tr>
<td>Frontal belly of</td>
<td>Supraorbital vessel,</td>
<td>Supraorbital nerve,</td>
<td>frontal air sinus.</td>
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<tr>
<td>occipitofrontalis.</td>
<td>Diploic veins,</td>
<td></td>
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<tr>
<td></td>
<td>Superior sagittal sinus</td>
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Discussion as “Bhrumadiye” - Sthapani Marma situated between the eyebrows. Eyebrow is an area above the eye that follows the shape of the lower margin of the brow ridge. The ridges are most prominent medially and are joined to one another by a smooth elevation named the “glabella”. On the basis of Samhitas and concerned from various modern
literatures; the region of *Sthapani Marma* lies at the ‘Glabella’ region. **Table I** shows the underlying structures related to *Sthapani Marma*.

**Discussion as “Sira Marma”** - *Sthapani Marma* is the *Sira Marma*. In generally *Sira* considered as vessels; but *Pandit Gangadhar Shastri* has considered *Sira* as nerves.\[^7\] In the glabella region - supratrochlear vessel, supraorbital vessel, Diploic veins, Superior sagittal sinus, and Supratrochlear and supraorbital nerves were observed.

**Discussion as “Vishalyghana Marma”** - It is *Vishalyghana* type of *Marma* means due to injury of this one survives if a *Shalya* remains lodged with in *Marmasthana* or if it comes out of suppuration, but he cannot survive if the *Shalya* is extracted out just after its penetration.

- Supratrochlear vein units with supraorbital vein to form the facial vein. Facial veins connected with cavernous sinus and there are chances of infections of cavernous sinus through the infected wound.
- Diploic veins are valveless channels traveling between the inner and outer tables of the calvaria in the diploic space. Infection of the frontal sinus spreads through the diploë either to the subperiosteal space or to the subdural / subarachnoid space via valveless flow. As the diploic space serves as a site for CSF circulation, fistulas that occur here pose a high risk for potential meningitis and other infections. Bleeding from diploic veins can result in an acute subdural hematoma.\[^8\]
- Any injury to supraorbital and supratrochlear nerve causes Paresthesia, Dysethesia, Anesthesia to the affected area.

> From the above discussed point it may be hypothesized that frontal emissary veins and anterior facial veins, supratrochlear and supraorbital nerve cannot produce Vishalyghana like condition.

- The frontal air sinus may be considered as posterior to posterior wall of sinus, there are important structures like superior sagittal sinus, and falx cerebri. Frontal sinus fractures account for only 5-12% of maxiofacial injuries. However, the majority of these fractures are the result of high velocity injuries such as motor vehicle accident, assaults and sporting events. Nondisplaced (less than 1-2 mm) anterior table fractures can be observed with little risk of long term morbidity. Fractures with greater displacement (2-6 mm) present little risk of mucocele formation; however, the risk of an aesthetic deformity
increases with the degree of displacement. Posterior table fractures are complex due to risk of CSF leak, meningitis and mucocele formation.[9] This is the evidence that frontal air sinus injury has frequent chance to become dangerous and may involve dura mater, with its dural sinuses, may also cause bleeding and leaking of cerebrospinal fluid through nose.

- Superior sagittal sinus is a midline vein without valves or tunica muscularis that courses along the falx cerebri, draining many of the cerebral structures surrounding it.

Clinical significance of sinus[10] - due to its multiple connections including its significant role in draining the cerebral hemispheres as well as receiving blood from the diploic, meningeal and emissary veins from the scalp, there are multiple complications and pathological processes that can affect the Superior sagittal sinus. It is prone to thrombosis, presenting with various features from headache, hemiparesis, 6th nerve palsy, papilledema, nausea and seizures.

Superior sagittal sinus thrombosis is of extreme clinical importance due to the irreversible consequences that can occur secondary to the increased intracranial pressure that is associated with dural vein occlusion. Due to its major role in CSF circulation, obstruction of the vein leads to dysregulation of the normal CSF drainage pathway potentially causing increased intracranial pressure. Another mechanism of increased intracranial pressure in these instances is due to the edema produced after venous occlusion.

In addition to direct thrombosis of the vessel the superior sagittal sinus is often implicated in the development of meningiomas due to its intimate proximity to the falx cerebri. When intracranial pressure increases, there is increased reverse flow of venous blood through the emissary and diploic veins of the scalp and cranium, leading to increased rates of scalp, skull and intracranial hemorrhage.

- The importance of traumatic dural venous sinus injury lies in the probability of massive blood loss at the time of trauma or emergency operation result as a high mortality rate during the perioperative period. When there is a linear skull fracture parallel to the sinus or a depressed skull fracture penetrating the sinus, the surgeon should be prepared for the possibility of potentially fatal venous sinus injury, even in the absence of hematoma.[11]
- The most common site of dural venous sinus injury is the anterior & middle one third of superior sagittal sinus. Location of sinus injury is very important in terms of perioperative
mortality & morbidity. Meier et al. reported that 17% of the patient with sinus injury in the anterior 1/3\textsuperscript{rd} of superior sagittal sinus results in death.\cite{12}

- Significant dural sinus injury occurs in 1.5-5\% of all head injuries and injury to superior sagittal sinus accounts for 70-80\% of these. Since Cushing’s review of 219 military head injuries in World War I, containing 14 cases of dural sinus injury with a mortality rate of 79\%. The clinical presentations of patients with significant venous injury vary with both mechanism and location. These patients suddenly deteriorate when the unwary surgeon moves tamponading bone fragments resulting in massive hemorrhage and air embolism.\cite{13}

- DU Trevou and Van Dellen (1992) have observed that “when the wounding instrument remains embedded within the skull and brain the prognosis is remarkable good with appropriate management but if the weapon is levered free by the assistant, the resulting arc of blade movement within the brain may be devastating”.\cite{14}

➢ From the above discussed point it may be opined that injury of superior sagittal sinus can produce Vishalyghana like conditions. The bleeding from subdural space or from superior sagittal sinus may be the alternative for Sushurta to claim his Marma as Sira Marma in structural type.

**Discussion regarding the Prama\-na and number of Sthapani Marma** — Prama\-na of Sthapani Marma is Ardhanguli (approximate 1cm), and the Sthapani Marma is 1 in number. The superior sagittal sinus usually begins at the foramen cecum, just anterior to the crista galli and one in number. Anteriorly the crista galli attached along with the posterior table of frontal sinus. If the antero-posterior diameter of the frontal sinus is taken into consideration then the average diameter is 1.8 cm. The mean FS A-P size has been reported within the range of 7.2 and 10.5 mm in various studies, Lands berg et al. reported the mean FS A-P size as 7.2 mm, Farhat et al. as 7.9 mm, Angelico et al. as 8.1 mm and Jacops et al. as 10.5 mm.\cite{15}

From the above discussed point it may be thought that A-P size of FS can vary from 1 to 2 cm. and also person to person it can vary. It also makes sense that why Acharyas have asked to take Swa-Angula Prama\-na.

**CONCLUSION** — Thus it concluded that anatomically Sthapani is the glabella region and the anterior 1/3\textsuperscript{rd} of superior sagittal sinus is responsible for traumatic result mentioned by Acharyas.
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