OPEN ACCESS
Scholars International Journal of Traditional and Complementary Medicine
Abbreviated Key Title: Sch Int J Tradit Complement Med
ISSN 2616-8634 (Print) |ISSN 2617-3891 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://scholarsmepub.com/sijtcm/

Original Research Article

Understanding Regional Anatomy of Indrabasti Marma- A Cadaveric Study

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DOI:10.21276/sijtcm.2019.2.6.2 | **Received:** 28.07.2019 | **Accepted:** 04.08.2019 | **Published:** 18.08.2019

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Abstract

The *Indrabasti Marma* is a *Mamsa Marma* and *Kalanthara Pranahara Marma*. Its location, size and *Viddha Lakshana* is mentioned in gross. But the detailed explanation of the anatomical structures is not mentioned. This study is undertaken to ascertain and locate the anatomical entity of *Indrabasti Marma*. The location of the *Marma* was determined according to the basis of classical description and anatomical structures were identified by dissection of upper and lower limbs in 3 cadavers available in the Department of Rachana Sharir,Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital. In the upper limb, the Radial artery along with associated neurovascular structures and the overlying Superficial Flexor group of muscles of forearm and in the lower limb, the Posterior Tibial artery, Peroneal artery, Tibial Nerve along with superficial group of calf muscles especially Soleus Muscle with its venous Sinuses are structures located at the point of *Indrabasti Marma*.

Keywords: *Marma*, *Indrabasti Marma*, Radial artery, Posterior Tibial artery, Soleus Muscle.

INTRODUCTION

The knowledge of Marma (vulnerable –vital point where biological molecules of life are sensitive and if damaged causes grievious effect over apart /b/or body) dates back to Vedic period [1]. The references of 107 *Marma*, Its classification, location, size, injury effect etc are available in the literatures of *Ayurveda*. They are classified on the basis of structure, region, prognosis, dimension and number [2].The *Indrabasti Marma* is *Shakhagata*, *Kalantharapranahara Marma* and it is a *Mamsa Marma*. It is four in number. The injury effect of this *Marma* is mentioned as *Shonita Kshaya(*loss of blood) and due to which death will be observed [3].

MATERIALS AND METHODS

Following the standard dissection procedure as per Cunninghams manual, anterior aspect of the forearm and posterior compartment of legs of 3 cadavers were dissected in the Department of Rachana Sharir, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital, Hassan.

Three adult cadavers irrespective of gender and with no injuries of the area of study were used. All the structures observed in the *Marma* location were recorded and photographs were taken. Location and anatomical structure of *Indrabasti Marma* were determined on the basis of cadaveric dissection and regional anatomy with the help of literary and observational study.

RESULT

In the forearm region the important anatomical structures observed are flexor group of muscles, Radial artery, Ulnar artery, Anterior interosseous artery, Anterior interosseous vein, Median nerve. In the posterior compartment of leg region the important structures observed are the Gastrocnemius and Soleus muscle with its venous sinuses, Posterior tibial artery, Peroneal artery, Tibial nerve, Flexor hallucis longus ,Tibialis posterior, Flexor digitorum longus

Fig-1: Length of forearm

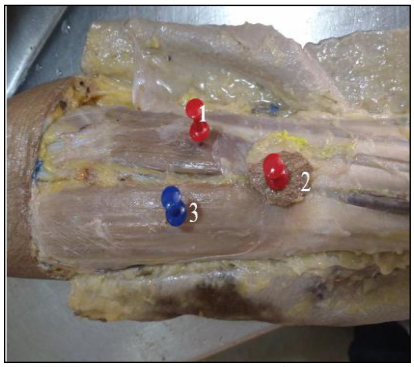

Fig-2: (1) Pronator Teres; (2) Point of Indrabasti Marma; (3) Brachioradialis Muscle

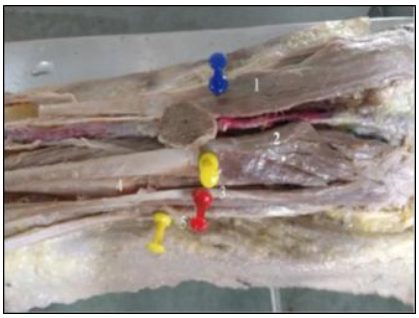

Fig-3: 1) Brachioradialis Muscle; 2) Flexor Carpi Radialis Muscle;3)Palmaris Longus; 4) Flexor Digitorum Superficialis; 5)Flexor Carpi Ulnaris

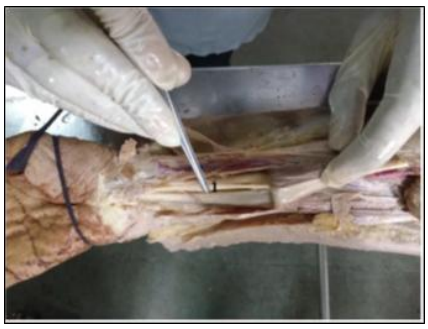

Fig-4: Median Nerve

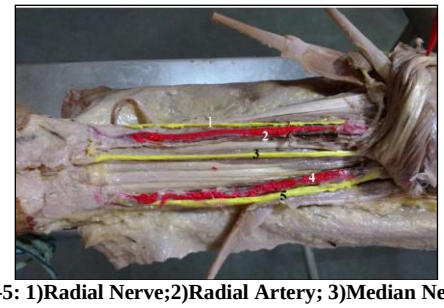

Fig-5: 1)Radial Nerve;2)Radial Artery; 3)Median Nerve; 4)Ulnar Artery;5) Ulnar Nerve

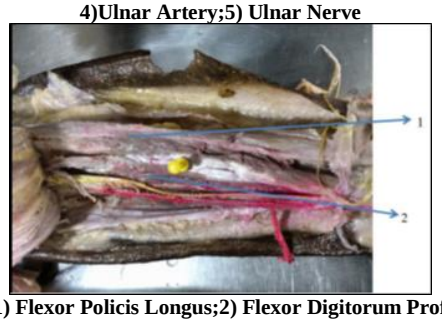

Fig-6:1) Flexor Policis Longus;2) Flexor Digitorum Profundus

Observations of the Lower Limb Dissection

Small saphenous vein, Sural nerve

Superficial Muscles of the Calf Region

Gastrocnemius muscle, Soleus muscle, Plantaris, Posterior Tibial Artery, Peroneal artery, Tibial nerve,

Deep Muscles of the Back of the Leg

Flexor hallucis longus, Tibialis posterior, Flexor digitorum longus

Fig-7: Point of *Indrabasti Marma* of lower limb

Fig-8: Point of *Indrabasti Marma* of lower limb

Fig-9: Two bellies of Gastrocnemius muscle

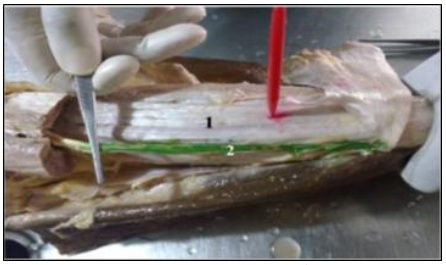

Fig-10:1)Soleus Muscle;2)Tendon of Plantaris Muscle

Fig-11:1)Venous Sinuses of Soleus Muscle

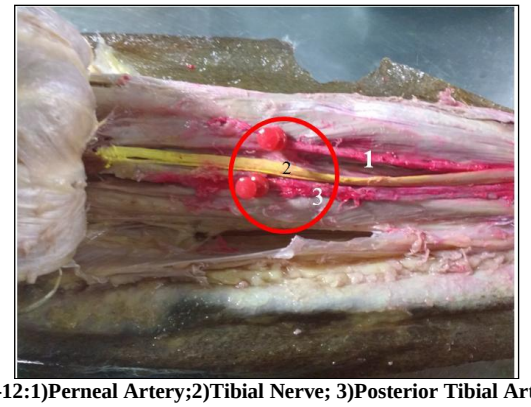

Fig-12:1)Perneal Artery;2)Tibial Nerve; 3)Posterior Tibial Artery

Fig-13:1)Flexor Hallucis Longus;2) Tibialis Posterior;3) Flexor Digitorum Longus

DISCUSSION

The *Indrabasti Marma* is categorized as, *Kalantharapranahara Marma* . Its size is mentioned as half *Anguli*. The *Indrabasti Marma* comes under *Mamsa Marma*,. Dimension of this *Marma* is about *Ardhaangula*(half of 1.96cm) If any injury to the *Mamsa Marma* occurs, it will lead to continuous bleeding, blood that is more thin and watery in nature causing pallor due to loss of blood (*Pandutva*) further leading to, *Indriya agjnana*(loss of perception through senses) and *Ashu Marana* (immediate death)[4] . As per the description, *Indrabasti Marma* is four in number, two in *Urdhwasakha* and two in the *Adhosakha*

Location Of *Indrabasti Marma* In Lower Limb

As per the reference available from classics, *Adhosakhagata Indrabasti Marma* is situated in the middle of the calf region in line with the heel. "*Janghayormadhye*" means middle of the calf region.

Location Of *Indrabasti Marma* In Upper Limb

In upper limb the site of *Indrabasti Marma* is taken as that of *Adhosakha* and accordingly the forearm region which lies in between *Koorpara* and *Manibandha Sandhi* were marked and exactly the midpoint was pin-pointed and with the measurement of *Ardhangula* marking was done as it is the counterpart of the calf region in the upper limb

Based On structural entity

Indrabasti Marma belongs to *Mamsa Marma*(muscular)

Based On Cadveric Observation In Lower Limb

In the lower limb after reflecting the skin, it was observed that there was a huge bulk of muscles called calf. A point was marked with the dimension of *Ardhangula*(1cm) and nailing was done in the center at a distance of Twelve *Angula* from heel which was exactly falling at midpoint of leg region. Keeping the skin intact in marked area a vertical incision was taken and skin was reflected. Just below the skin, Superficial fascia was seen at the level of the marked area of locating *Indrabasti Marma* the structures seen were Sural Nerve and Short Saphenous Vein The site was falling at a point which forms the junction between muscular component of the two heads of Gastrocnemius and commencement of the tendinous extension which is called as Achilles tendon or Triceps surae. Further the site which was marked as *Indrabasti Marma* contains united part of the two heads of Gastrocnemius and Soleus under which the Posterior Tibial Artery and the Peroneal Artery and Tibial Nerve were located. Further the Soleus muscle had numerous venous sinuses which acts as the peripheral heart. The Soleal vein, acting as a storage vein (so-called venous sinus), is initially more prone to circulatory stasis. The huge pads of muscles to secure these vessels may be the reason why *Acharyas* has classified *Indrabasti Marma* as *Mamsa* Marma.

The Case Reports In Support Of Importance of *Indrabasti Marma* Importance of Venous Sinuses related to Soleus muscle

Soleus veins have been implicated as the site of Deep Vein Thrombosis initiation. Soleus veins drains mainly into the posterior tibial, fibular and communicating veins[5].

Discussion Based On *Pramana*

The Ayurvedic texts have mentioned the particular dimension of each *Marma*. *Marma* is classified under four categories as half, one, two, or four *Angula* in *Pramana*.The measurement of one Angula is approximately 2 cms [6].On the basis of classical description and practical observation. Upper limb- In the upper limb the Radial Artery which is more superficial than the Ulnar Artery was observed passing between the Flexor group muscles at the exact point

which was marked as *Indrabasti Marma* In lower limb, in the marked region of *Indrabasti Marma* within the *Ardhangula Pramana*, there were Sural Nerve, Short Saphenous Vein and tendinous part of Gastrocnemius and Soleus muscle, with venous sinus, lying deep to it were observed. Neurovascular structures like Posterior Tibial Artery and Peroneal Artery and Tibial Nerve were observed at that particular nailed area lying still deeper.

Discussion On *Indrabasti Marma* As *Kalanthara Pranahara Marma*

Indrabasti Marma can be included under *Kalanthara Pranahara Marma* as there is *Rakta Dhatu Kshaya* leading to *marana*.[7]In the upper limb, the hemorrhage is due to the injury of Radial Artery and Anterior Interosseous Artery which is under the cover of Flexors of forearm. In the lower limb the cause of hemorrhage is the injury of Posterior Tibial Artery, Short Saphenous Vein and Soleus muscle with the Soleal Sinuses

Discussion Of *Indrabasti Marma* Based On Cadveric Observation In Lower Limb

In lower Limb *Indrabasti Marma* is situated in the calf region.This *Marma* is constituted by *Mamsa* but the *Aghatajaparinaam* give rise to vascular symptoms. Hence, in this region, on superficial aspect there is short saphenous vein over the substance of calf muscles. There are many sinuses and perforating veins within the soleus and under the cover of which Posterior tibial artery with Venae commitants is also present. The fracture of Tibia and fibula may give rise to acute Compartment syndrome in which there is obstruction of venous outflow leading further swelling and muscle ischemia. In clinical practice it is seen that the general surgery or deep injury over the calf region may give rise to life threatening complication i.e. deep vein thrombosis. In this condition pulmonary embolism is very dangerous consequence going to manifest. In deep vein Thrombosis (DVT) edema, Leg pain, Tenderness, warmth or erythema of the skin over the area of thrombosis are exhibited. Erythema of the skin shows the involvement of *Shonita* In one of the study the anatomic form of connections of soleal vein and its position related to calf muscles itself inhibits the detachment of thrombi from the site of formation and its further circulation causing Pulmonary Thromboembolism. Though even if loss of blood is not seen in local area if the thrombi is successful in entering the pulmonary artery leading to PTE. Signs of a pulmonary thromboembolism include low blood oxygen levels, rapid breathing, rapid heart rate, and sometimes a mild fever severe cases can lead to fainting, abnormally low blood pressure, and sudden death. The most accepted explanation is the theory of local venous hypertension when the intraluminal venous pressure exceeds the interstitial pressure within the compartment allowing a continuous venous flow Increasing interstitial pressure leads to an increased intraluminal venous pressure preventing vascular collapse. This leads to a decreased gradient between arterioles and veins, which in turn decreases capillary blood flow within the affected compartment[8] This can be correlated with *Shonitha Kshaya* and ischemic changes in the region. One of the study says that there will be irreversible nerve and muscle damage begin after 5 to 6 hours of Ischemia[9]. More recent clinical studies revealed that muscle necrosis occurs within the first 3 hours[10]**.** This may be the reason why *Acharya Sushrutha* has classified *Indrabasti Marma* as a *Mamsa Marma*, though vascular injuries with bleeding and odema are the main cause.

By considering the effect of injury in the calf region and its pathophysiology it is revealed that there is a main role of blood and blood vessels in manifesting the life threatening conditions like DVT, thromboembolism, compartment syndrome etc. therefore the *Sushruta's* thought about *Indrabasti Marma* stand true.

CONCLUSION

Location of *Indrabasti Marma* was found to lie on the vascular structure at the level of mid of the forearm and mid of calf in lower limb. The discussion related to *Kalanthara Pranaharatva* of *Indirabasti Marma* has confirmed by studies done on conditions like compartment syndrome, Vascular injury leading to bleeding thereby loss of blood further leading to odema and ischemic changes having an impact on muscular component of the area leading to further necrosis of the muscles due to reduced capillary permeability and loss of function.

As the neurovascular structures were placed under the cover of muscles i,e. the flexor group of muscles in the upper limb and the calf muscles in the lower limb might be the reason why *Acharyas* have mentioned it be a *Mamsa Marma*.

Hence the study of *Indrabasti Marma* which is *Ardhangula Pramana*, *Mamsa Marma* situated in *Janghyor Madhye* and *Prokoste Madhye* is proved by literary and practical observation

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