

Involvement of Structural Anatomy with Rujakar Marma; Assessment through Cadaver Dissection

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ABSTRACT

Marma representing the sense of vital parts of the body, which causes death on traumatic injury or pain similar to death and often use in the sense of *Jivasthan* and *Sandhistan*. Total 107 *marmas* are explained in Ayurveda and *Rujakar marma* is one among the prognostic classification and are eight in number as *Manibandha* (wrist joint) *marma* (two in number), *Gulpha* (ankle joint) *marma* (two in number) and *Kurchashira marma* (four in number; both in upper and lower extremities). *Rujakar marmas* are the areas where any injury causes pain and this is due to minimum tissue damage. The study is taken in account to identify the *Rujakar marma* according to site based on underlying anatomical structures.

The structural anatomical composition of *Rujakar marmas* were thoroughly reviewed, correlated and analyzed with the knowledge of modern sciences. Dissection of area related to *Rujakar marmas* were done on four cadavers (3 male & 1 female) with help of modern text of human Anatomy. And the involvement of anatomical structures was identified in accordance to *marma vastu* (*mamsa*, *shira*, *snayu sandhi*, *asthi*) and other Ayurvedic literatures.

All the data gathered from cadaver dissection were reviewed, compared with the ancient literatures and concluded that *Manibandha marma* is radio-carpal joint as well as distal radioulnar joint and its allied structures, *Gulpha marma* is talocrural joint and distal tibiofibular joint as well as its allied structures, anatomically *Kurchashira* of *urdhvasakha* (upper limb) includes the midcarpal joint, intercarpal articulations with its allied structures and

Kurchashira of *adhosakha* (lower limb) includes the Talo-calcaneo-navicular joint and its allied structures.

Keyword: Marma, Rujakar, Manibandha, Gulpha, Kurchashira

1. INTRODUCTION

The science of *marma* or *marma vidya* is extraordinary and dynamic Ayurvedic therapy that has tremendous value in health, longevity, spiritual practice and diseases. *Marma* representing the sense of vital parts of the body, which causes death on traumatic injury or pain similar to death and often use in the sense of *Jivasthan* and *Sandhistan*. [1-4]

According to Ayurved total 107 *marmas* are explained and classified under five heads as, 1. *Shadanga/avayava* (Regional), 2. *Asraya* (Structural), 3. *Vyapath* (Prognostic), 4. *Mana* (Dimensional), & 5. *Sankhya* (Numerical). [5-10] *Rujakar marma* is one among the *prognostic classification* and are eight in number. [9] Among them four are present in *Bahu* (upper limb) namely, *manibandha* (wrist) and *kurchashira* and four in *Sakthi* (lower limb) namely, *Gulpha* (ankle) and *kurchashira*. [9] These 107 numbers of *marma* has been structurally presents in human body and classified into five types depending on the structures involved like *Mamsa* (muscles), *Sira* (blood vessels), *Snayu* (nerve or tendons or ligament), *Asthi* (bones) and *Sandhi* (joints) while *Astanga hriday* has classified them

into six types by including structure like *Dhamani*.^[5,11] *Vayu* and *Agni mahabhoota* are predominant in these *marma* and any injury to them leads to *Ruja* (Pain).^[12] *Rujakara marmas* are the areas where any injury causes pain and this is due to minimum tissue damage.^[13] Pain is the first sign of morbidity of any tissue. This phenomenon has already been observed in Indian classics by *Sushruta*.

The concept of *marma* is a great contribution of *Sushruta* in Ayurved and be treated as mirror of surgery as it has been mentioned 107 vital points in various parts of the body, which should be carefully dealt during surgery & should always be protected from injury, as the component of life or vital energy (*prana*) rest in them.^[14] It is itself a treatise on Surgico-anatomical learning. The diseases affecting these areas were considered to be having a very bad prognosis. Moreover, the diseases not affecting the *marma pradesha* are relatively easy to cure. *Susruta* opines the diseases affecting the *marmasthana* are comparatively difficult to cure but can be cured with much strenuous effort.^[15]

Marma shastra was enumerated for the benefit of patients who undergo *Salya chikitsa*. The surgeons are advised not to disturb any *marma* or rather, protect even the neighborhood *marma sthana* from blunt or sharp instruments and also the *kshara* (caustics) or *Agni* (cautery) for the successful completion of surgery. If these *marma sthanas* are disturbed by any of the instruments, the patient probably dies or may be deformed even if he survives.^[16,17]

The dimension of *marmas* were elaborated to make the surgeon aware of these structures and to avoid being hurt during surgery. A proper knowledge of the structure, dimension, lesion or injury and location contribute much to the perception and practice of *Salyatantra*. Hence medical authorities have described the *marmas* to have covered half the scope of *Salyatantra*.^[16,18]

Therefore surgical procedures to be performed very carefully or vigilantly

after considering the measurement of the *marma's* area, signs & symptoms, consequences and prognosis, as injury even on the margins of *marma* leads to deformity or death.

In this consequence, identification of *marma* according to site based on underlying anatomical structures and understanding the concept with scientific way, the study is taken in account to access the structures involved in these *marma pradesh*.

2. MATERIALS

Available literature on *Marmas* from *Ayurvedic* texts, modern text books etc. were referred. Four Cadavers (3 male & 1 female) and a Dissection kit is taken into account for this research work.

3. METHODOLOGY

3.1 Source of Data

All the information on *marma* with reference to *Rujakar marma* was compiled from ancient Ayurvedic literatures, research papers, journals, previous dissertations and authentic internet sources. The structural anatomical composition of *Rujakar marmas* were thoroughly reviewed, co-related and analyzed with the knowledge of modern sciences.

Cadaveric dissection was done in the dissection hall of department of *Sharir rachana*, Mahaveer College of Ayurvedic Science, Rajnandgaon, Chhattisgarh. Four Cadavers were selected based on inclusion & exclusion criteria. While studying the dissected cadaver, photo images were taken with the help of digital camera.

3.2 Inclusion criteria: Cadaver with fully developed body parts, either sex, having natural death and preserved by proper methods of preservation.

3.3 Exclusion criteria: Cadavers having external injuries, accidental death, burn injuries, chronic diseased condition.

3.4 Assessment criteria

Observation and identification of *Rujakar marmas* were done, considering their structural anatomy through cadaveric

dissection. To specify the area of particular *Rujakar marma*, *Swangula pramana* (Individual finger unit) measurement was taken as the standard measurement criteria.

Ulnar side of both the open palm is joined and measured the width of both palms at meta carpo-phalangeal joints (base of fingers) with the help of vernier caliper. The obtained measurement i.e. 14.32 cm is divided by 8 (as this width is average for 8 fingers). The achieved 1.79 cm measurement is called as individual finger unit i.e also called as One *Angula pramana* (*Swangula pramana*).^[19]

3.5. Procedure

Dissection of *Rujakar marmas* were done on cadaver by using dissection kit with help of Cunningham's Manual of Practical Anatomy text and B.D Chaurasia's Human Anatomy text for understanding the structural anatomy of *marmas*. On the basis of Ayurvedic literature related to the *Rujakar marma*, the point was identified on cadaver and circular area of given *Pramana* (dimension) was drawn taking *marma* point as centre. Neat & detailed dissection was done with the help of dissection kit & dissection guides. With the help of superficial & deep dissection, the structures present at that site were identified. After accessing the *angula pramana* on all sites of *Rujakar marma*, circular incision is made on skin flap. By retaining the skin flap on respective *marma*, cut medially leaving the lateral margin intact. With the help of literary & observational study, the location & anatomical structure of *Rujakar marmas* were exacted and image photographed.

4. OBSERVATION & DISCUSSION

Manibandha Marma (Fig: 1 &2)

The *Manibandha marma* is the place of *Manibandha sandhi*. The exact location of *Manibandha marma* is mentioned as junction between *prakoshta* and *pani* and may be taken as the wrist joint as per modern references.^[20] These are two in number (left and right hand), situated at the wrist joint. It is two inches in extent and

structurally it is a *Sandhi marma*. Anatomically this area consists of the wrist joint, inferior Radio Ulnar joint and Radio Carpal Joint.

i. Mamsa: The text Sushruta samhita advocates 10 *peshis* (muscle) are present in the region of *Manibandha sandhi*.^[21] We won't get any detailed reference regarding the *peshis* present in the *Manibandha sandhi* in *Samhitas*. While dissecting the wrist region, the following muscles were observed in and around the wrist joint. This muscle helps in the movement of wrist joint. These are Flexor carpi radialis, Flexor carpi ulnaris, Extensor carpi radialis longus, Extensor carpi radialis brevis, Long flexure and Extensor

ii. Sira/Dhamani: Identified Sira/Dhamani can be correlated to anatomical structures as Radial artery, Ulnar Artery.

iii. Snayu: *Snayu* binds the joints together and helps in performing various functions. Ancient text has mentioned a total of 70 *snayus* in each extremity. *Manibandha sandhi* is *prathanavathi* variety as it is present in *urdhwa shaakha* (upper limb). *Sushruta* has explained that ten *snayu*'s are present in *Manibandha sandhi*.^[22] The ligaments which are present at the wrist joint may be considered as *snayu*. Following ligaments are traced on dissection of the wrist joint.

Fibrous capsule, Anterior: Palmar radiocarpal ligament & Palmar ulnocarpal ligament, Posterior: Dorsal radiocarpal ligament, Medial: Ulnar collateral ligament, Lateral: Radial collateral ligament, Carpal tunnel: Median nerve, Tendon of flexor digitorum profundus Tendon of flexor digitorum superficialis.

iv. Asthi: Ten number of *Asthis* present in the *Manibandha sandhi*.^[23] In the region of wrist, the inferior surface of the lower end of radius, articular disc of inferior radioulnar joint, scaphoid, lunate and triquetral bones articulates with each other to form the wrist joint.

v. Sandhi: Apart from the above structures, it also involves the wrist joint (radiocarpal

joint) as well as the distal radioulnar and intercarpal joints.



Fig: 1: Anterior Feature of Wrist

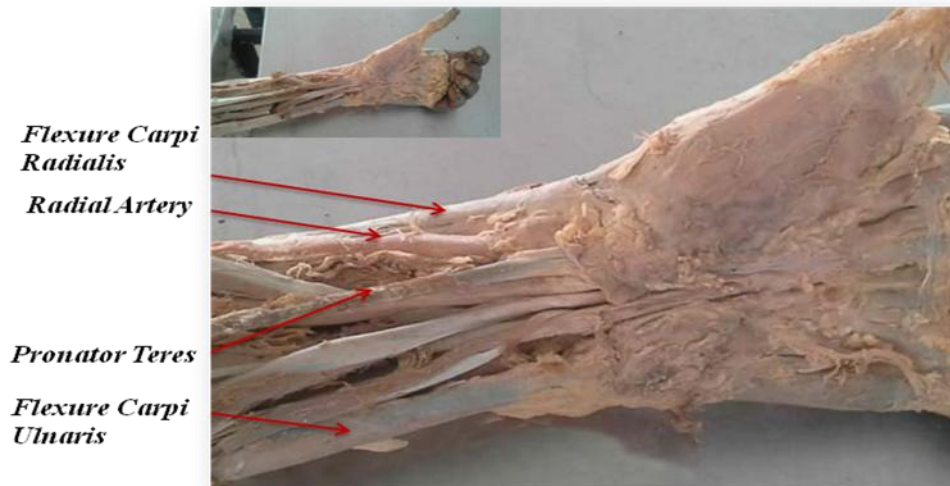


Fig: 2: Posterior Feature of Wrist



Fig: 3: Anterior Feature of Ankle joint (Talocrural joint)

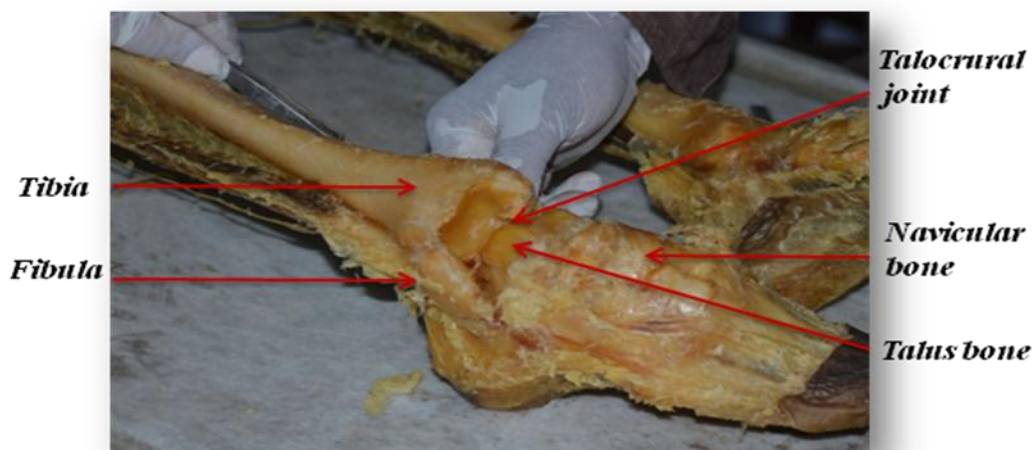


Fig: 4: Anterior Feature of Ankle joint (Talocrural joint)

vi. Marmabhighata

Injury to *Manibandha marma* will lead to *kunthata* [24] i.e restricted movement of hand and these *lakshanas* may be due to: 1. Injury to radial and ulnar collateral ligaments may lead to severe pain and restricted movement (*kuntatha*). 2. Fractures of the wrist joint involving the lower end of the radius (Colle's fracture and Smith's fracture) are very common. Fracture of the Scaphoid is also very common.

The manifestations of the pain, rigidity and deformity in the area after injury are suggestive of the involvement of the anatomical structures like nerves, blood vessels and bones situated in the wrist joint.

Gulpha marma (Fig: 3 & 4)

Gulpha sandhi is located in between *pada* and *jangha*. [25] The ankle joint present at the junction of leg and foot can be understood as the same. Anatomically it is a *Kora* variety and is *Chestavanta* (movable). [26] In hinge joints, the convex surface of the one bone fits in to the concave surface of another bone. As the name implies, hinge joints produce an opening and closing motion like that of a hinged door. So *Gulpha sandhi* may be considered as a hinge variety of synovial joint.

The *Gulpha marma* is the place of *Gulpha sandhi*. The *Gulpha marma* is 2 *anguli pramana* and is a variety of *Rujakara*

marma. [27] The location of *marma* is very important to understand the structures involved during its trauma. There is less explanation regarding the exact location of the *marma* other than its *pramana* mentioned as two *angula*. The area occupied by the *marma* is explained in terms of own finger's breadth (*swanguli*). [28]

So we may consider 2 *angula pramana* equally as length, breadth or as diameter both towards the anterior and posterior aspect of ankle joint (*Gulpha sandhi*). While dissecting the ankle region, the following anatomical structures were observed in and around the ankle joint.

The above findings are sorted in accordance to *marma vastu* as follows.

i. *Mamsa - Peshi* is the structure which covers the *Sira, Snayu, Asthi, Parva* and *Sandhi* and thus providing *dehabala*. Extensor retinaculum, Extensor digitorum longus, Extensor hallucis longus, Tibialis anterior, Peroneal retinaculum on lateral side, Peroneus tertius, Flexure retinaculum, Flexure hallucis longus & Tibialis posterior are traced as muscles.

ii. *Sira/Dhamani* - Identified *Siras* and *dhamanis* related to *Gulpha sandhi* can be correlated to veins and arteries related to Ankle region are superficial peroneal nerve, deep peroneal nerve, anterior tibial artery,

Greater saphenous vein, Small saphenous vein, Posterior tibial artery, Posterior tibial nerve & Sural nerve.

iii. Snayu - Snayu binds the joints together and allows all possible movements. Ligaments have a great role in giving support and stability to the joints which helps them to carry out their function easily. Almost all of Ayurvedic texts have mentioned that there are 150 Snayu present in each extremity. Among them 30 are present in the ankle. Prathmanvathi type of Snayu is mostly seen in the Sandhi. [22]

It can be understood that this type of Snayu is present in the region of Gulpha. So the ligaments those are present in the Gulpha sandhi may be considered as Snayu. According to modern concept of Ankle, the ankle/foot complex is structurally analogous to the wrist-hand complex of the upper extremity but has a number of distinct differences to optimize its primary role to bear weight.

The complementing structures of the foot allow it to sustain large weight bearing stresses under a variety of surfaces and activities that maximize stability and mobility. The ankle/foot complex must meet the stability demands of; providing a stable base of support for the body in a variety of weight-bearing postures without excessive muscular activity and energy expenditure. The articular surfaces are lower end of the tibia and fibula and talus. This mortise is well guarded by ligaments which hold the joint firmly. It is also supported by the surrounding structure which helps to make the joint more stable.

Under this section the following structures are traced on dissection of the Ankle joint: Extensor digitorum longus tendon, Flexor digitorum longus tendon, Tibialis anterior tendon Extensor hallucis tendon. Tibialis posterior tendon, Peroneus longus tendon & Peroneus brevis tendon

iv. Asthi - The bones taking part in the articulation are: Lower end of Tibia and Fibula superiorly Superior surface of the body of the Talus inferiorly

V. Sandhi - Ankle joint proper & Distal tibio fibular articulation

Kurchashira marma (Upper limb)

The etymology of the word suggests that, it is named so because it is head part of brush like structure. This marma is present below and on both sides of the Manibandha marma and Gulpha marma. Both the marmas are one angula in pramana and are snayu marma of Rujakara variety. [27]

Assuming from the shape of the marma, it has to be understood that the flexor and extensor tendons coming under the flexor and extensor retinaculum respectively has to be taken into account. Here the kurcha or brush like appearance is made up by the confluence of various tendons and nerves.

The structures passing deep to the retinacula are: Median nerve, Flexor digitorum superficialis tendon, Flexor pollicis longus tendon, Flexor digitorum profundus tendon, Flexor carpi radialis tendon lies on the groove of Trapezium between the superficial & deep slips of retinaculum, The nine tendons of the muscles of the extensor compartment in six osteofacial compartments, The tendon of Palmaris longus is inserted into the superficial part of flexor retinaculum, Lunate scaphoid and Capitate bone & Midcarpal joint

Marmabhighata: Any injury to the structures in fracture of Scaphoid and tenosynovitis may lead to deformities such as the swelling of the digits and their movements becomes painful, impairment of the extension/ flexion and abduction of the wrist and thumb, bleeding from the radial artery and pain due to injury to the radial nerve. These symptoms may relate to the **Kurchashira marma** (Lower limb)

Lowerlimb: Deep peroneal nerve, Dorsalis pedis artery, Inferior extensor retinaculum, Peroneal retinacula, Lateral plantar nerve, Medial plantar nerve, Apex of plantar aponeurosis, Plantar surface of calcaneum bone, Talo-calcaneo navicular joint & Spring ligament of talo calcaneo navicular joint.

Marmabhighata: The possible reason for classifying kurchashira as a snayu

marma is the predominance of *snayu* in the region. It is a variety of *Rujakara marma*. Another fact is that an injury at that level will lead to *vaikalyata* (deformity). [29] The reason is that most of the manifestations involving injury to the nerves and vessels are found much below the ankle joint. When the tip of plantar aponeurosis gets infected, it will cause severe pain and tenderness in front of calcaneal region. Due to injury to foot by thorn or hard objects there will be formation of calcaneal spur which is an extremely painful condition. As sole of foot is a pressure prone area, most of the times this sort of injury tend to involve the *Kurchashira marma*.

5. CONCLUSION

Manibandha sandhi is the region in between the *Prapaani* and *Hasta* of *urdhvasakha* (upper limb). *Manibandha marma* is located at the region of *Manibandha sandhi*. Based on the review of the *Rujakara marma* and the underlying anatomical structures, it can be incorporated that *Manibandha marma* is radio-carpal joint as well as distal radioulnar joint and its allied structures presented in *marma vastu*.

Gulpha sandhi is the region in between the *pada* (foot) and *Jangha* (leg) of *adhoshakha* (lower limb). Anatomically *Gulpha* is the ankle region of the leg. *Gulpha marma* is located at the region of *Gulpha sandhi*. Based on anatomical structures and the review of the *Rujakara marma*, *Gulpha marma* is talocrural joint and distal tibiofibular joint as well as its allied structures presented in *marma vastu*.

Kurchashira of *urdhvasakha* (upper limb) is situated below and on one side of the *Manibandha sandhi* (wrist joint). The vessels, nerves and the tendons beneath the flexor and extensor retinaculum give the shape of a head of the brush. The predominance of extensor and flexor tendons passing through the region justifies the classification of this *marma* in the *snayu* variety. Anatomically it includes the

midcarpal joint, intercarpal articulations and allied structures.

Kurchashira of *adhoshakha* (lower limb) is situated below *Gulpha sandhi* (ankle joints) and anatomically it includes the Talo-calcaneo-navicular joint and allied structures. The predominance of extensor and flexor tendons passing through the region and presence of apex part of plantar aponeurosis and various retinacula justifies the classification of *Kurchashira marma* in the *snayu* variety.

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