

## INTERSECTING STRUCTURES, VITAL CONSEQUENCES: ANATOMIC SURGICAL EXPLORATION OF ĀNI MARMA - A REVIEW STUDY

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### ABSTRACT

*Marma* are vital anatomical points described in *Ayurveda* whose injury results in specific structural and functional impairments. *Acharya Sushruta* emphasized the importance of anatomical regions of the body, while treating the traumas occurring in war and established the knowledge of these vulnerable structures in *Sushruta Sharira Sthana*. Among them, *Āni Marma* which is located in the *Uru Pradesh* (thigh) and play a crucial role in locomotion. Classical texts describe *Āni Marma* as a *Snayu Marma*, injury to which results in *Shopha Ati Vruddhi* (excessive swelling) and *Stabdha Saktita* (stiffness and loss of movement). The present article attempts to correlate *Āni Marma* with the quadriceps tendon based on anatomical location, structural composition, and clinical manifestations. Such correlation aids in understanding *Marma* from a contemporary anatomical and surgical perspective.

**KEYWORDS:** *Ani, Lakshana, Marma, Snayu, Viddha.*

### INTRODUCTION

In *Ayurveda Marmas* are described as vital points where *Mamsa, Sira, Snayu, Asthi,* and *Sandhi* intersect, and injury to

these points leads to serious consequences.<sup>[1]</sup> A total of 107 *Marma*.<sup>[2]</sup> is described, classified based on location *Urdhwajatrugata*, *Madhya Sharira*, *Shakha*;<sup>[3]</sup> based on structure *Mamsa Marma*, *Sira Marma*, *Snayu Marma*, *Asthi Marma*, *Sandhi Marma*,<sup>[4]</sup> and based on prognosis *Sadhyapranahara*, *Kaalantarapranahara*, *Vishalyaghna*, *Vaikalyakara*, *Rujakara*.<sup>[5]</sup> The knowledge about *Marma* is important to a surgeon during surgical and Para surgical *Shashtra*, *Kshara* and *Agni karma* procedures are to be avoided at these *Marma* sites as injury to these vicinity results in deformity or death of the person. So, one should have proper knowledge about location of *marma*, underlying structures while doing the procedures. The present study attempts to expound *Āni Marma* with the quadriceps tendon based on anatomical location, structural composition, and clinical manifestations. For understanding *Marma* from a contemporary anatomical and surgical perspective.

## AIM

- ◆ To analyse *Āni Marma* described by different *Acharya* with key focus on trauma to corresponding structures of the thigh region.

## OBJECTIVES

- i. To study *Adhoshakhagata Āni Marma* and to determine the location and structural entities as *Snayu Marma*.
- ii. To understand the clinical importance of *Āni Marma* by its classical *Viddha Lakshana* in light of contemporary anatomy.

## MATERIALS AND METHODS

This study is a conceptual and literary review with an insight into the traumatic impact described in classical *Ayurvedic* texts as per the opinion of various *Acharyas* and on modern literature. A comparative analytical approach was adopted based on anatomical and structural dominance along with qualitative parameters and clinical manifestations of injury.

## Ayurvedic Literature

### Concept of *Marma*

The term *Marma* means *Prana*, *Jiva* or life. According to *Dalhana* these are vulnerable points over the human body surface on which any kind of trauma or injury, may lead to death or symptoms like death. *Acharya Sushruta* has described 107 *Marma* and their anatomical classification.

*Acharya Sushruta* classification of the *Marma* based on their *Sthana* (location) are *Shakha* (44 in number), *Madhya Sharira* (26 in number), *Urdhwajatrugata* (37 in number).<sup>[3]</sup> He also classified the *Marma* based on their *Rachana* (Structure) into five and these are *Mamsa Marma* (11 in number), *Sira Marma* (41 in number), *Snayu Marma* (27 in number), *Asthi Marma* (08 in number), *Sandhi Marma* (20 in number).<sup>[4]</sup> *Acharya Sushruta* has also classified *Marma* based on their *Parinaama* (Prognosis) into five. These are *Sadhyapranahara Marma* (19 in number), *Kaalantarapranahara Marma* (33 in number), *Vishalyaghna Marma* (3 in number), *Vaikalyakara Marma* (44 in number) and *Rujakara marma* (8 in number).<sup>[5]</sup> *Acharya Vagbhata* classification of the *Marma* based on their *Rachana* (Structure) into six types. These are *Mamsa Marma* (11), *Sira Marma* (41), *Snayu Marma* (27), *Asthi Marma* (8), *Sandhi Marma* (20) and *Dhamani Marma* (9). He had also mentioned about *Dhamani Marma*.<sup>[6]</sup>

### Meaning

#### 1. In *Medini Kosa*: - आणिः — अक्षाग्रकीलकः, सीमा

- Axle-pin / peg – a pin that holds a wheel to the axle
- Boundary / limit

2. In *Upanishads* - There is no clear, standard usage of आणी in *Upanishads*. However, use of analogies like wheel, hub, spoke are found in *Katha* and *Svetashvatara Upanishad*.

3. In *Puranic Literature* – The word आणी is not commonly used as a term but similar meanings are conveyed like कीलक (peg) and बंधन (binding element).

4. In *Vedic Literature* – There are no direct occurrences of the word आणी as a term are rare in *Samhitas* like *Rigveda*, *Yajurveda*, etc; but related terms like कीलक (peg), अक्ष (axle), चक्र (wheel) are been used metaphorically.

5. In *Classical literature* – In *Sushruta Samhita*, 6<sup>th</sup> chapter of *Sharir Sthana*; आणी word refers to a specific *Marma* point.<sup>[7]</sup>

## Definition

In *Sushruta Samhita*, *Āni Marma* is considered one among the *Snayu Marma*. Other *Marmas* like *Vitapa*, *Kakshadara*, *Kurcha*, *Kurchasira*, *Basti*, *Kshipra*, *Amsa*, *Amsaphalaka*, *Vidhura* and *Utkshepa* also comes under this category.<sup>[8]</sup>

## LOCATION

- i. In *Sushruta Samhita*, *Acharya Sushruta* illustrates as; *Āni Marma* is located 3 *Angula* above *Jaanu Marma* in both lower limbs. When injured it causes excessive oedema and stiffness of lower extremities. In *Dalhana* commentary, it is located on both the upper and lower extremities 3 *Angula* above the *Kurpara* and *Jaanu* respectively. It is a type of *Snayu Marma*, having *Ardha Angula Pramana* and is *Vaikalyakara* in nature.<sup>[6]</sup>
- ii. In *Ashtanga Hridaya*, *Acharya Vagbhata* also mentioned that *Āni Marma* is located 3 *Angula* above the *Jaanu Marma* and when injured will cause *Urusthambha* and *Shopha* on lower extremities. In *Arunadatta* commentary, the *Āni Marma* is located 3 *Angula* above the *Jaanu Sandhi*. Any injury pertaining to this area will result in *Urusthambha* and *Shopha*.<sup>[9]</sup>
- iii. In *Ashtanga Sangraha*, *Āni Marma* is located 3 *Angula* above *Jaanu* on both lower extremities and any injury over these vital area causes excessive oedema and stiffness of lower extremities. In *Indu* commentary, the *Āni Marma* can be found over the *Uru* region just 3 *Angula* above the *Jaanu Marma* and is situated in both sides of *Urdwa* and *Adhoshakha*.<sup>[10]</sup>

## Viddha Lakshana<sup>[11]</sup>

Injury over these *Marma* (vital areas) causes *Shopha Abhivruddhi* (excessive oedema) and *Stabdha Saktita* (stiffness of lower extremities) as it is located 3 *Angula* above *Jaanu* on both lower extremities.

**Table 1: Classical Description of *Āni Marma* According to Different *Acharyas*.**

<i>Acharyas</i>	<i>Location</i>	<i>Numbers</i>	<i>Pramaana</i>	<i>Type (Parinaama &amp; Rachana)</i>	<i>Viddha Lakshana</i>
<i>Susrutha</i>	3 <i>Angula</i> above <i>Jaanu Marma</i>	4	1/2 <i>Anguli</i>	<i>Vaikalyakara Marma &amp; Snayu Marma</i>	<i>Shopha Abhivruddhi, Stabdha Saktita</i>
<i>Ash. Hridaya</i>	3 <i>Angula</i> above <i>Jaanu Marma</i>	4	1/2 <i>Anguli</i>	<i>Snayu Marma</i>	<i>Urusthambha and Shopha</i>

Ash. Sangraha	3 Angula above Jaanu Marma	4	1/2 Anguli	Vaikalyakara Marma & Snayu Marma	Shopha Abhivruddhi, Stabdha Saktita
Charaka	-	-	-	-	-

### **Jaanu Marma**

#### **Location**

**जङ्घोर्वोः सन्धाने जानु...**<sup>[12]</sup> In *Sushruta Samhita*, Jaanu Marma is located at the junction of Jangha and Uru. **जानूपरिष्ठाच्च द्वात्रिंशदङ्गुलम्...**<sup>[13]</sup> as mentioned in above *Slokha* the region extending 32 Angula above the knee; as the circumference is taken the measurement of Jangha and Uru are similar.

**Marma over the Uru Region.**<sup>[14]</sup> – In *Sushruta Samhita* of *Sharir Sthana*; based on the *Sthana* classification, *Shakha Marma* is 44 in number like-wise one *Shakha* contains 11 *Marma* each. So as the *Uru* region when taken into consideration – *Jaanu*, *Āni*, *Urvi*, *Lohitaksha* and *Vitapa* are the *Marma* present.

#### **Snayu**

A structure which helps in binding the joints and helps the body in weight bearing. Structurally it has been described something similar to a fibrous in nature.

### **IMPORTANCES**

*Snayu* is said to be originated from *Mamsa* on *Khara Paka*.<sup>[15]</sup> *Snayu* is a structure which binds *Mamsa*, *Asthi* and *Medas* of the body.<sup>[17]</sup> *Sushruta* while emphasizing its importance mentioned that any injury to *Snayu* will cause more harm to human body than if caused by *Asthi*, *Sandhi*, *Peshi* and *Sira*.<sup>[18]</sup> In *Sushruta Samhita*, *Snayu* are classified into different types based on their structure and functional significance. *Pratanavati Snayu* (branched/bifurcated in nature), which provides flexibility and allows a greater range of movement. *Vritta Snayu* are rounded structures that contribute to tensile strength, enabling them to withstand pulling forces. *Prithula Snayu* are thick and robust, offering stability to the joints and supporting structures. *Sushira Snayu* (porous in nature), impart elasticity, thereby facilitating resilience and adaptability during movement. The number of *Snayu* mentioned by *Sushruta Samhita Sharir Sthana* is 900.<sup>[19]</sup>

### Modern Literature

The surface anatomy and the structural composition of this *Marma* correspond to the common tendon of quadriceps muscle in lower extremity. In the lower extremity this tendon protects the knee joint from sliding during full flexion. The tone and strength of the muscle are responsible for the stability of the knee joint during various actions.<sup>[20]</sup> From the perspective of modern anatomy, the quadriceps femoris muscle tendon inserts into the superior border of the patella, which subsequently continues as the patellar ligament attaching to the tibial tuberosity. The quadriceps tendon plays a crucial biomechanical role in knee extension and stabilization of the patellofemoral joint.<sup>[21]</sup> Any trauma to this region may compromise the extensor mechanism of the knee, leading to pain, restricted movement, and functional disability, which aligns with the classical *Ayurvedic* description of the consequences of injury to *Āni Marma*.

### Modern Literature of *Āni Marma*

The rupture of the Quadriceps tendon causes compartment syndrome, often acute, a threatening condition caused by high pressure build inside muscle compartments – typically after fractures or severe injuries, which limits blood flow and damages nerves and muscles. Symptoms include severe pain, swelling, numbness, and tightness.<sup>[22]</sup>

### Thigh Region Anatomy

The thigh region extends between the hip and the knee joints. Anatomically it is a part of the lower limb. **Skin** – the superficial and the outermost covering of thigh region. **Superficial Fascia** – a superficial fatty layer and a deep membranous layer, which are continuous with the corresponding layers of the anterior abdominal wall. The membranous layer is loosely attached to the deep fascia of the thigh except near the inguinal ligament, where it is firmly attached along the horizontal line. **Intermuscular Septa** – There are three intermuscular septa in the thigh – lateral, medial and posterior intermuscular septa. The lateral one is strong; the others are thin fascial layers on the front and back of the adductor muscles. All three septa pass to the linea aspera and the corresponding supracondylar line. The order of attachment of the thigh muscles to the linea aspera is that of their position in the thigh. **Muscles of the front of thigh** – The muscles of the anterior compartment of the thigh are the Sartorius, the Quadriceps femoris and the Articularis genu. The Quadriceps femoris is so-called as it consists of four parts – the Rectus Femoris, the Vastus Lateralis, the Vastus Medialis and the Vastus Intermedius. The anterior most muscle of the quadriceps; the rectus femoris is

fusiform and it runs vertically on the front of the thigh superficial to the vasti group of muscles.

### Clinical Manifestation of *Āni Marma* Injury

The probable structures related to *Ani Marma* based on five structural entities in the anterior aspect of the lower extremity are *Mamsa* (Muscular) components: Rectus femoris, Vastus Intermedius, Vastus Lateralis, and Vastus Medialis. *Sira* (Vascular) component is descending branch of lateral circumflex femoral artery. *Snayu* (connective tissue) component is Quadriceps tendon. *Asthi* (Sclerous) component is distal one-third of anterior surface of femur bone.

In classical texts, injury to these vital point leads to excessive oedema and stiffness. When these symptoms are correlated with modern anatomy of the lower limb, the thigh region—particularly the anterior compartment—is considered. Thus, injuries in this area, such as rupture of the **Quadriceps Muscle Contusion** is one among many types. Contusion injuries to the quadriceps are common among athletes. Usually, the mechanism of injury is a direct blow to the quadriceps causing significant muscle damage. Contusions cause rupture of the muscle fibers at or directly adjacent to the area of impact, usually leading to hematoma formation within the muscle causing pain and loss of motion.

**Bilateral Traumatic Rupture of the Quadriceps Tendon.**<sup>[23]</sup> Quadriceps muscle tendon rupture is a traumatic injury in which the quadriceps detaches from the patella, disrupting the knee extensor mechanism. The knee mechanism consists of the quadriceps tendon, quadriceps muscle, medial and lateral patellar retinaculum, patella, patellar tendon and tibial tubercle. Insufficiency in any of these structures can compromise the extensor mechanism, limiting daily activities.

## DISCUSSION

*Marma* in *Ayurveda* represents vital anatomical loci where structural and functional elements such as *Mamsa*, *Sira*, *Snayu*, *Asthi*, and *Sandhi* converge. Among these, *Āni Marma* is categorized as a *Snayu Marma* and grouped in *Vaikalyakara Marma*, indicating that its injury predominantly results in deformity rather than death. Overall description excavated from various classical *Samhita* indicates the *Āni Marma* three *Angula* above the *Janu Sandhi*, emphasizing its clinical importance in the lower extremity as the result of *Viddha Lakshana* (injury) like *Sopha Abhivruddhi* (excessive swelling) and *Stabdha Saktita* (stiffness of the

limb) highlight the functional impairment following trauma to this region. The etymology of a word is the beauty of *Sanskrit* language which makes it self-explanatory. The term *Āni*, derived from अण with the suffix इन् denotes a structure similar to an axle-pin or stabilizing peg, suggesting a component responsible for maintaining structural integrity and controlled movement. This lexical interpretation aligns well with the classification of *Āni* as a *Snayu Marma*, as *Snayu* structures (tendons and ligaments) are crucial for joint stability and coordinated motion. Thus, the *Ayurvedic* description inherently suggests a fibrous, stabilizing anatomical entity, which provides a strong basis of identifying the *Āni Marma* with modern anatomical structures of the thigh.

In the modern anatomy, the location described for *Āni Marma* corresponds closely to the anterior compartment of the thigh, particularly the quadriceps femoris tendon and its associated musculature. The quadriceps tendon, formed by the convergence of four muscles—rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius which inserts into the superior border of the patella and plays a vital role in knee extension and patellofemoral stability. This anatomical arrangement supports the *Ayurvedic* concept of a stabilizing structure analogous to a “peg,” reinforcing the validity of correlating *Āni Marma* with the quadriceps tendon complex.

The clinical manifestations of injury described in *Ayurveda* show significant parallels with modern medical observations. Trauma to the quadriceps tendon or surrounding structures can result in pain, swelling, restricted mobility, and functional disability, which closely resemble *Shophā* and *Stabdha Saktita*. Conditions such as quadriceps tendon rupture, muscle contusion, and compartment syndrome further substantiate this correlation. In particular, acute compartment syndrome of the thigh, characterized by increased intracompartmental pressure, leads to severe swelling, stiffness, and neurovascular compromised features that strongly mirror the classical *Viddha Lakshana* of *Āni Marma*.

Furthermore, the structural analysis based on the five *Marma* components—*Mamsa*, *Sira*, *Snayu*, *Asthi*, and *Sandhi* reveals that the region encompasses key anatomical elements including the quadriceps muscles, descending branch of the lateral circumflex femoral artery, quadriceps tendon, and the distal femur. This multidimensional involvement explains the severity of functional impairment following trauma. The predominance of the *Snayu* component justifies its classification as a *Snayu Marma* and underscores the *Ayurvedic*

emphasis on the vulnerability of fibrous stabilizing structures, which, when injured, produce more pronounced disability compared to other tissue injuries.

## CONCLUSION

*Āni Marma* is classified as a *Vaikalyakara Marma* producing deformity, measures approximately  $\frac{1}{2}$  *Anguli* about (1–2 cm) and is located three *Angula* above the *Jaanu*, corresponding to the superior border of the patella. It predominantly consists of *Snayu* (tendinous structures), when injured, produces *Shopha Abhivruddhi* (excessive swelling) and *Stabdha Saktita* (stiffness of the limb). All these observations indicate that the quadriceps femoris tendon closely corresponds to the structure of *Āni Marma*.

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