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# A review study on *Jaal* and it's Modern Correlation

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## ABSTRACT

The *Rachana Sharir* is branch of *Ayurveda* in which human anatomy is explained according to *Ayurved Samhita*. The knowledge of human anatomy is very much important for treatment of disease and other surgical procedures. *Paribhasha Sharir* is concept of *Ayurveda* in which different anatomical structure are explained in *Ayurvedic* term. It's one of the important contributions of *Ayurveda* in the medical field. It needs to be correlated with modern anatomy which further can be used in surgery purpose and also help in acupuncture or acupressure therapy. It will be the sort of proof that the structure present in modern anatomy were far ago explained in *Ayurvedic Samhita*. In *Paribhasha Sharir* a structure called *Jaal* or plexus is explained which means a binding structure which hold *Maans* (muscular plexus), *Sira* (vascular plexus), *Snayu* (ligamentum plexus) and *Asthi* (bony plexus) in one place and forming the network or *Jaal* like structure, there are 4 structure present in bilateral *Miniband Sandhi* i.e., wrist and *Gulfa Sandhi* i.e., ankle joint. In each joint there is involvement of four anatomical structure namely *Maans, Sira, Snayu, Asthi*. It can be correlated with human anatomical structure namely network of muscle tendons, palmer or planter arches, retinaculum, juncture of carpel and tarsal bones respectively.

**Key words:** *Jaal, Rachana Sharir, Paribhasha Sharir, Maans, Sira, Snayu, Asthi, Manibandh Sandhi, Gulfa Sandhi, plexus.*

## INTRODUCTION

The word *Shariri* is referred as the body. In *Sushrut Sharir Sthan* whole anatomical structures were well explained than any other *Samhita* and as said शारीरि सुश्रुतः श्रेष्ठ.[1] *Sushrut Sharir Sthan* is preferred for knowing the human anatomy in *Ayurvedic* aspect. In this *Sthan* each organ called *Pratyang* is well explained, its furthermore divisions into different structure which is given in 5th chapter of *Sharir Sthan* called *Sharirsankhya Vyakaran.*[2] In this chapter different terminology according to *Ayurveda* is given with detailed anatomy called *Paribhasha Sharir*. If the exact meaning of the given *Ayurvedic* terminology is known then that terminology can be compared with modern anatomy. So, in my review study I am going to compare one of these structures called *Jaal* with modern anatomy. In *Sushrut Sharir Sthan* 5th chapter the *Jaal* is well explained where, the network of *Maansa, Sira, Snayu* and *Asthi* is present and it binds the whole structure together, the structures are present at *Manibandh Sandhi* of upper limb and at *Gulf Sandhi* of lower limb.[3] Each structure contents four components [*Maans, Sira, Snayu, Asthi*] called *Jaal* therefore, they are 16 in numbers.[4]

If we compare it with modern anatomy, we found the same structures namely, muscle, palmer and planter aponeurosis, retinaculum, carpel and tarsal bones are present in both limbs, forming the network called *Jaal*. Therefore, the *Jaal* terminology given in the *Paribhasha Sharir* is well identified in this way.

## MATERIALS AND METHODS

In this review study the *Ayurvedic Samhita* mainly *Bruhatraayi Samhita* are referred. There are some

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articles related to *Paribhasha Sharir* are studied.[5] Sanskrit words are identified with the help of *Sankrit* dictionary. For proper meaning of *Ayurvedic* terminology, a *Ghanekar* commentator of *Sushrut Sharir Sthan* is read. For modern anatomy Cunningham dissection book is referred. *Ayurvedic* as well as modern text are well studied, compared and identified correlation between the given terms.

## Literature Review

The *Jaal* is well explained in *Sushrut Sharir Sthan* whereas *Acharya Vaghbhat* has given number only while *Aachrya Charak* didn't mentioned anything about *Jaal*, according to *Sushrut,*

मांससिरास्नाय्वास्थि जालानि प्रत्येकं चत्वारि चत्वारि, तानि मणिबन्ध गुल्फसंश्रितानि परस्पर निबध्दानि परस्पर संश्लिष्टानि परस्परगवाक्षितानि चैति, यैर्गवाक्षितमिदं शरीरम् ।। सु. शा. ५/१२[6]

It is structure made by the juncture of *Maans, Sira, Snayu* and *Asthi* which forming a network like structure and collectively form the wrist and ankle joint. They are present in wrist and ankle joint so 4 in numbers but each *Jaal* having another 4 structures so they are total 16 in numbers same number is given in *Vagbhat Samhita.*[7] While explaining the properties of *Jaal Aacharya Sushrut* said,

1. **परस्पर निबध्दानि** - means they are strongly bounded to each other so can't get dislocate easily.
2. **परस्पर संश्लिष्टानि** - means strongly connected with each other so can't get separated easily.
3. **परस्परगवाक्षितानि** - means all given structures forming a network which are arranged in window pattern.

These are the properties because of which they form a stronger joint like wrist and ankle joint, which allows different movements of joint which is combined action of this structure. The same explanation about *Jaal* is given in *Sharangdhar Samhita.*[8]

## Discussion

There are some unidentified *Ayurvedic* terminology present in *Samhita*. Which deeply explained by our *Aachrya* but its correlation to modern anatomy is not done yet. One of such terminologies called *Jaal* is tried to identify in this review article.

### Modern Anatomy

### Wrist joint

It is mainly formed by articulation of radius to the carpel bone of the hand. But the structure around it is

1. Network of tendons of digital muscle tendons
2. Palmer arches of blood vessels
3. Retinaculum
4. Juncture of carpel bone

**1. Network of Tendons of Digital Muscle in Wrist**[9]

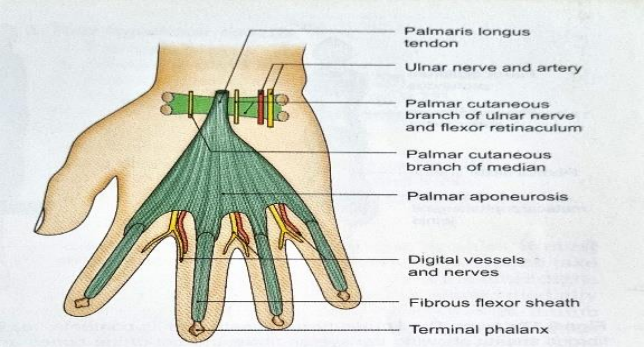


**Fig. 9.16:** The deep fascia of the hand forming the flexor retinaculum, palmar aponeurosis and fibrous flexor sheaths

It includes the tendon of Extensor group of muscles and flexor group of muscles as given in table and shown in picture which can be correlate with the network of *Maans*.

| Extensor group of muscles tendons | Flexor group of muscles tendons |
|---|---|
| Extensor carpi ulnaris tendon | The flexor pollicis longus |
| Extensor digiti minimi tendon | The four flexor digitorum superficialis |
| Extensor digitorum tendons | The four flexor digitorum profundus |
| Extensor indicis tendon | The tendon of flexor carpi ulnaris |
| Extensor pollicis longus tendon | |
| Extensor carpi radialis brevis tendon | |
| Abductor pollicis longus tendon | |

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| | |
|---|---|
| Extensor pollicis brevis tendon | |
| Extensor carpi radialis longus tendon | |

## 2. Palmer Arches of Blood Vessels [10]

The arch represents the anastomosis of ulnar and radial arteries

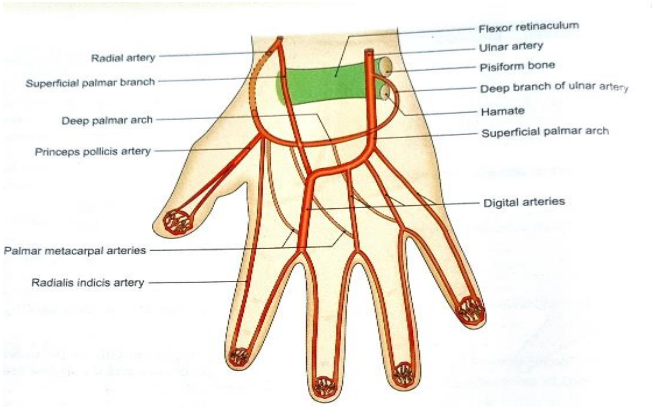


**Fig. 9.32:** The superficial and deep palmar arches

- Superficial Palmer Arch - which formed by branches of ulnar artery beyond flexor retinaculum. it gives three common digital branches and one proper digital branch which supply the medial 3 and half fingers.
- Deep Palmer Arch - which is formed mainly by terminal and is completed medially at the base of 5th metacarpal bone by the deep palmer branches of ulnar artery both together form deep palmer arch.

## 3. Retinaculum[11]

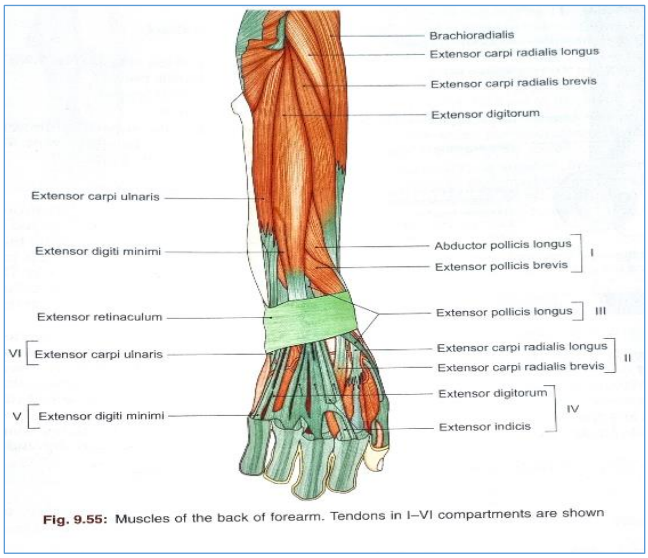


**Fig. 9.55:** Muscles of the back of forearm. Tendons in I–VI compartments are shown

It is of two types,

Extensor retinaculum - it is thick strip of deep fascia which holds the extensor tendons in place. It sends down a septum which attaches to the longitudinal ridge on the posterior surface of the lower end of radius. Retinaculum forms a septum which divides the space deep to the retinaculum into numbers of tunnels or compartments for separate tendons or groups of tendons and their sheaths.

Flexor retinaculum - this is dense fibrous band which bridges the anterior concavity of carpus and converts it into carpel tunnel from where flexor tendons of fingers and thumbs and tendons of flexor carpi radialis passes. As both retinaculum shows the same property of forming tunnel and this exactly given in properties of *Jaal* that they form windows or tunnels like structure. This structure can be corelate with the network of *Snayu*.

## 4. Juncture of carpel bone [12]

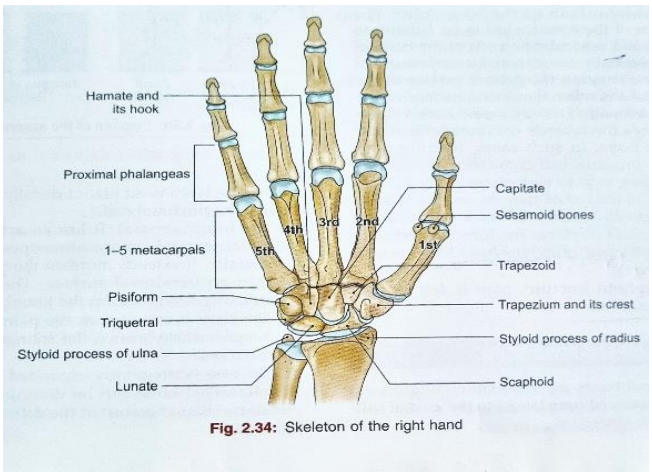


**Fig. 2.34:** Skeleton of the right hand

The carpel bones are total 8 in numbers which arranged in distal and proximal row. Distal row includes the trapezium, trapezoid, capitate, hamate bones. The proximal row of carpal bones (from radial to ulnar) includes the scaphoid, lunate, triquetrum and pisiform bones. It can be compared with the network of *Asthi*. These are the anatomical structure present in *Maniband Sandhi* that is wrist joint.

### Ankle joint

It is a strong synovial hinge joint between the inferior aspect of medial malleolus of tibia and the lateral

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malleolus of the tibia and trochlea of talus. Supporting structure of ankle joint contains,

1. Network of Tendons of Muscle Tendons
2. Planter Arches of Blood Vessels
3. Retinaculum
4. Juncture of Tarsal Bone

### 1. Network of Muscle Tendons of Ankle Joint[13]

It includes the tendons of muscles given in table given below; it can be correlate with network of *Maans*.

#### At back of the Ankle

1. Plantaris tendons - spindle shaped tendons that attaches the plantaris muscle to the heel bone.
2. Achilles tendons - attaches calf muscle [Gastrocnemius and Soleus], to heel bone.

#### At inner Ankle

1. Posterior tibial tendon - attaches the muscle to multiple bones along the medial arch of the foot but primarily the navicular bone.
2. Flexor hallucis longus tendon - attaches from Flexor hallucis longus onto the planter surface of the 1st hallux.

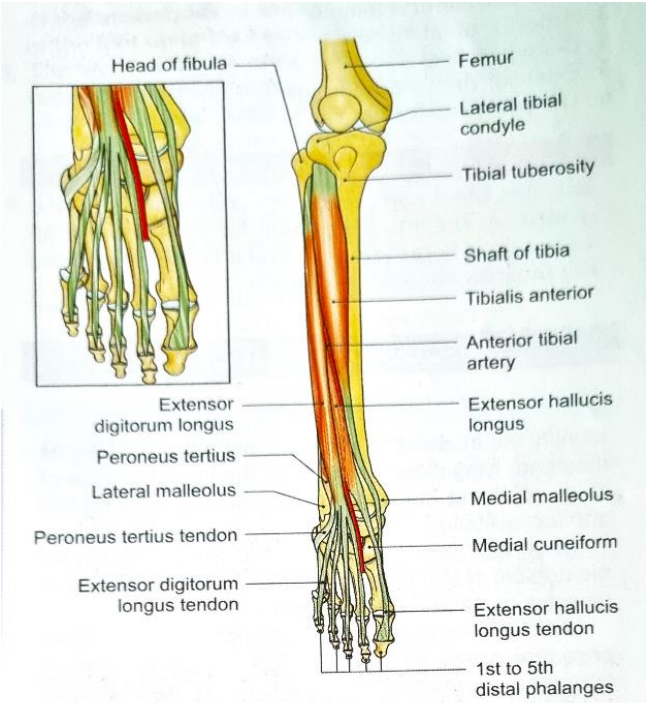


**Fig. 8.5:** Muscles of front of leg and dorsum of foot (inset)

#### At outer Ankle

1. Peroneal longus tendon - attaches the Peroneal longus to lateral base of the 1st metatarsal and medial cuneiform.
2. Peroneal brevis tendon - attaches the Peroneal brevis to the styloid process at distal end of the 5th metatarsal.

#### At font of the Ankle

1. Peroneal Tertius tendon - attaches the Peroneal Tertius muscle to the dorsal surface of the 5th metatarsal.
2. Extensor Digitorum Longus Tendon - attaches the Extensor Digitorum Longus muscle, extends down and under the superior and inferior extensor retinaculum, splits into 4 segments and attaches to the 2-5th digits.
3. Tibialis Anterior tendon - attaches the Tibialis Anterior muscle to the undersurface of the first cuneiform bone, and the base of the first metatarsal bone.

### 2. Planter Arch[14]

It is a circulatory anastomosis formed from:

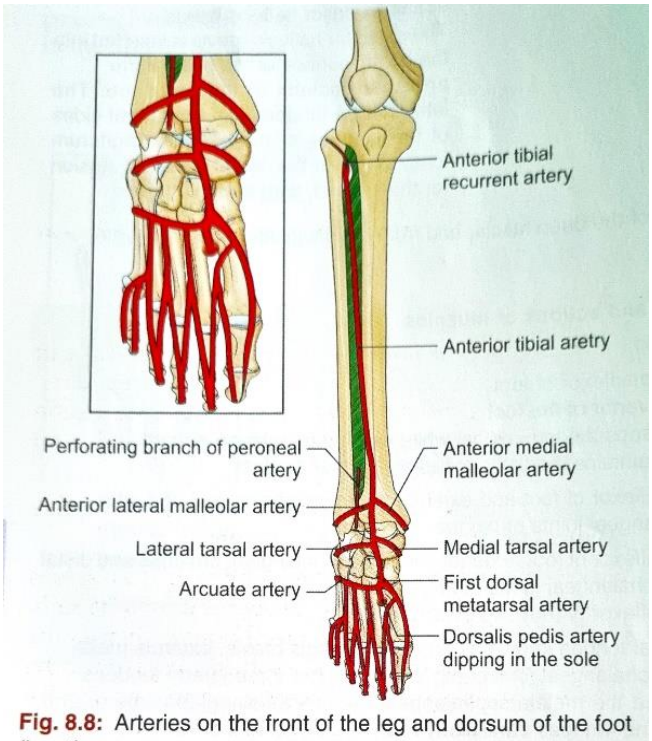


**Fig. 8.8:** Arteries on the front of the leg and dorsum of the foot (inset)

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Deep plantar artery, Lateral plantar artery. The plantar arch supplies the whole foot. The plantar arch runs from the 5th metatarsal and extends up to 1st metatarsal. The arch is formed when the laterally by plantar artery which turns medially to the interval between the bases of the first and second metatarsal bones, then it unites with the deep plantar branch of the dorsalis pedis artery, thus completing the planter arch. It can compare with network of *Sira*.

### 3. Retinaculum of Ankle joint[15]

Ankle joint bind by fibrous structure of retinaculum which three types these retinacula leave some space between them called tunnel from, which tendons of muscle are passes. Which given in following table,

### Type of Retinaculum in Foot

There are 3 types of retinaculum present in ankle joint,

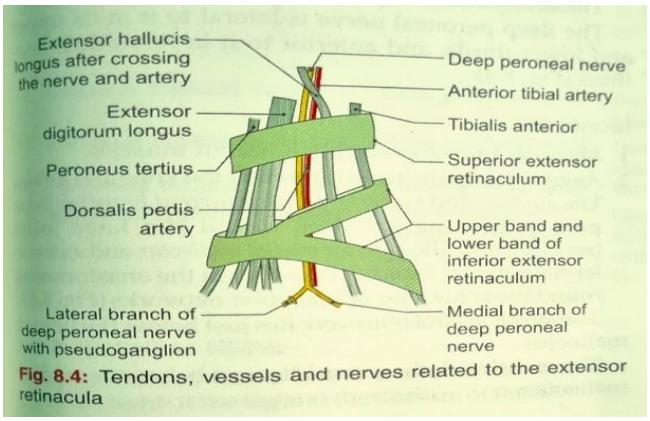


**Fig. 8.4:** Tendons, vessels and nerves related to the extensor retinacula

### 1. Extensor Retinaculum

Two types of extensor retinaculum present depend on their positions,

- Superior Extensor Retinaculum - medially it attaches to the lower part of anterior border of tibia, laterally to the lower part of the anterior border of fibula.
- Inferior Extensor Retinaculum - this is 'Y' shaped band of deep fascia, situated in front of ankle joint and over the posterior part of the dorsum of the foot.
- Structure passing under retinaculum

1. Tibialis anterior.
2. Extensor hallucis longus.
3. Anterior tibial vessels.
4. Deep peroneal nerve
5. Extensor digitorum longus.
6. The peroneus tertius.

### 2. Fibular or Peroneal Retinaculum

There are two types of peroneal retinaculum,

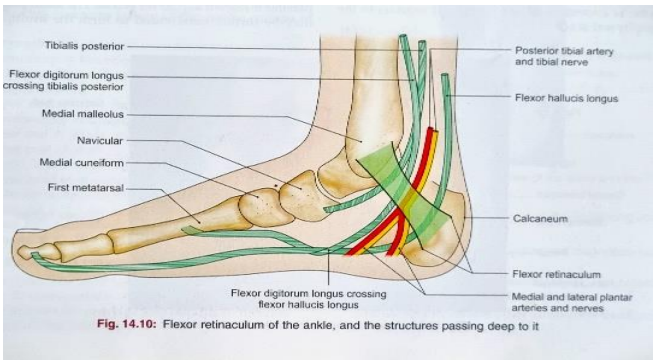


**Fig. 14.10:** Flexor retinaculum of the ankle, and the structures passing deep to it

- Superior Peroneal Retinaculum - thickened band of deep fascia situated just behind the lateral malleolus, it attaches anteriorly to the posterior margin of lateral malleolus and posteriorly to the lateral surface of the calcaneum and to the superficial transverse fascial septum of leg.
- Inferior Peroneal Retinaculum - thickened band of deep fascia situated anteroinferior to the lateral malleolus, superiorly attached to the anterior part of the superior surface of calcaneum, which continue with the inferior extensor retinaculum. Inferiorly, attached to lateral surface of calcaneum.
- Structures passing under retinaculum

1. Peroneus longus
2. Peroneus brevis

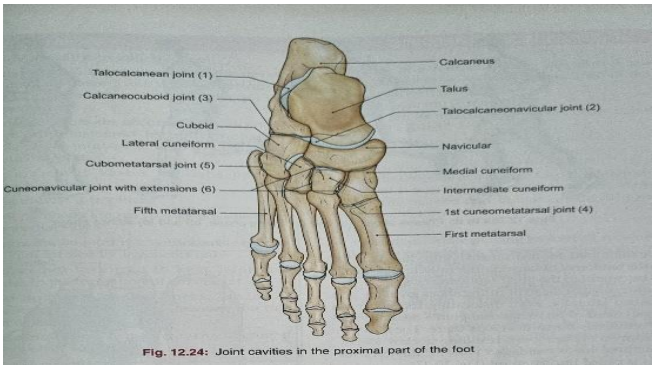


**Fig. 12.24:** Joint cavities in the proximal part of the foot

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### 3. Juncture of tarsal bone [16]

The tarsal bones are 7 in numbers. Which are arranged in three rows. Hind foot includes calcaneus and talus bone which involve in ankle joint along with tibia bone. Mid foot includes cuboid and cuneiform whereas navicular bone present between hindfoot and midfoot as shown in picture. This structure can be corelate with *Asthi* network.

From above detailed anatomical structure of wrist and ankle joint we can say that there is similarity between the *Ayurvedic Jaal* properties and definitions with structure present in these joint.

## RESULT

The unrecognized terminology of *Ayurvedic* terminology called *Jaal* is studied and correlate with modern anatomy.

## CONCLUSION

From above discussion we can say that the terminology called *Jaal* explained in 5th chapter of *Sushrut Sharir Sthan* which is formed by network of *Maans, Sira, Snayu, Asthi* is strongly bounded and forming window or tunnel like structure. Which is present in *Manibandh* i.e., wrist joint and *Gulfa Sandhi* i.e., ankle joint is same as structure in respective joint where *Maans* is Network of muscle tendons which passes through tunnel Like structure formed by retinaculum. Network *Sira* is palmer and planter arch, anastomosis of blood vessels of hand and foot respectively. Network of *Snayu* is a fibrous structure called retinaculum which binds all structure together and protect the joint from dislocation as well as separation, which is also property of *Jaal*. *Asthi* is juncture of carpel and tarsel bones, which is part of wrist and ankle joint. It is concluded that, the terminology *Jaal* is nothing but an anatomical structure present around the given joints.

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