



A COMPREHENSIVE REVIEW ARTICLE ON CONCEPT OF JAAL AND ITS MODERN ASPECT

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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.

KEYWORDS: 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. 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. Each structure contents four components [Maans, Sira, Snayu, Asthi] called Jaal therefore, they are 16 in numbers.

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 articles related to Paribhasha Sharir are studied. Sanskrit words are identified with the help of Sanskrit 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 Vagbhata has given number only while Acharya Charaka didn't mention anything about Jaal, according to Sushrut,

मांससिरास्नाय्वास्थि जालानि प्रत्येकं चत्वारि चत्वारि, तानि मणिबन्ध गुल्फसंश्रितानि परस्पर निबद्धानि परस्पर संश्लिष्टानि परस्परगवाक्षितानि चेति, यैर्गवाक्षितमिदं शरीरम् ॥ सु. शा. ५/१२

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 Vagbhata Samhita.^[7] While explaining the properties of Jaal Acharya Sushrut said,

1. Network of Tendons of Digital Muscle in Wrist

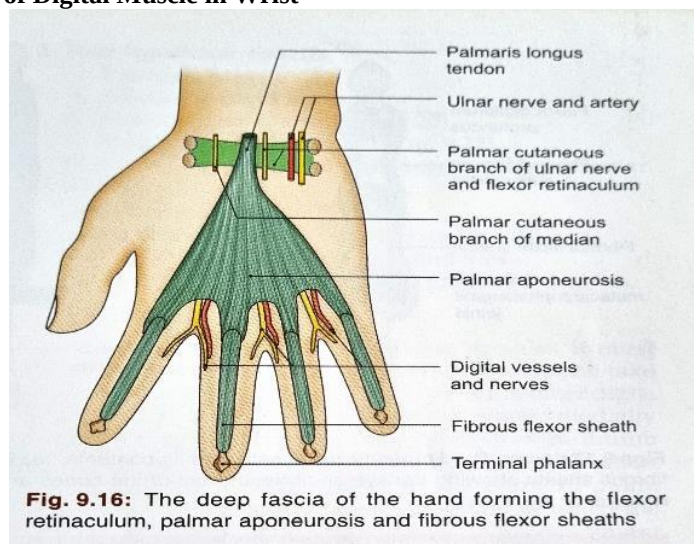


Fig. 9.16: The deep fascia of the hand forming the flexor retinaculum, palmar aponeurosis and fibrous flexor sheaths

It includes the tendon of Extensor group of muscles and flexor group of muscles as given in table and shown in

1. **परस्पर निबद्धानि** - 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 Sharangdhara Samhita.

DISCUSSION

There are some unidentified Ayurvedic terminology present in Samhita. Which deeply explained by our Acharya 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 carpal 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 carpal bone

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	
Extensor pollicis brevis tendon	
Extensor carpi radialis longus tendon	

2. Palmer Arches of Blood Vessels The arch represents the anastomosis of ulnar and radial arteries

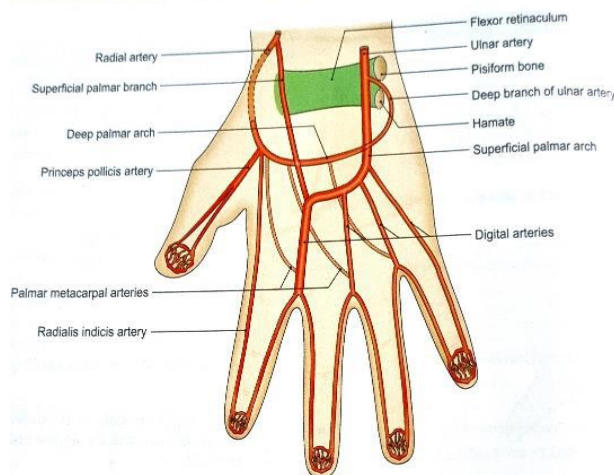


Fig. 9.32: The superficial and deep palmar arches

- 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 palmar branches of ulnar artery both together form deep palmar arch.

3. Retinaculum

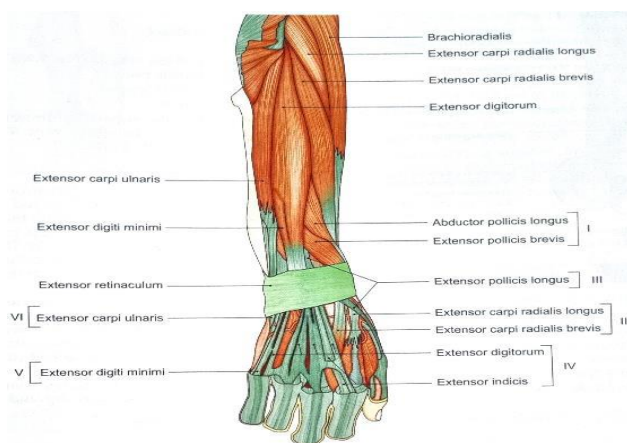


Fig. 9.55: Muscles of the back of forearm. Tendons in I–VI compartments are shown

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 carpal 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 correlate with the network of Snayu.

4. Juncture of carpal bone

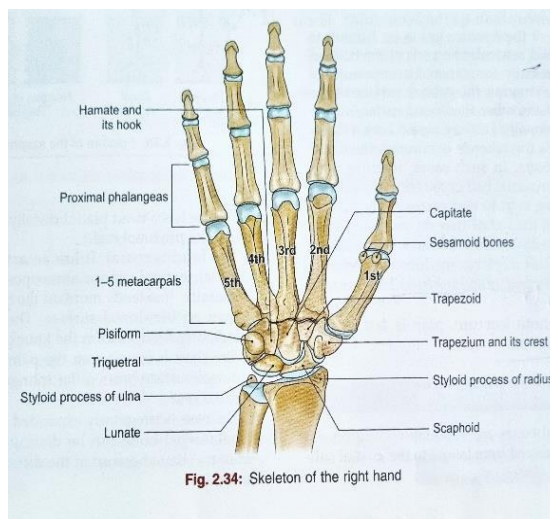


Fig. 2.34: Skeleton of the right hand

The carpal 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 structures 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 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

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 plantar surface of the 1st hallux.

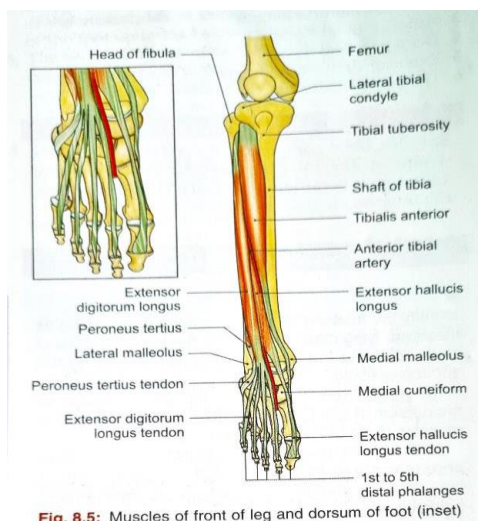


Fig. 8.5: Muscles of front of leg and dorsum of foot (inset)

At outer Ankle

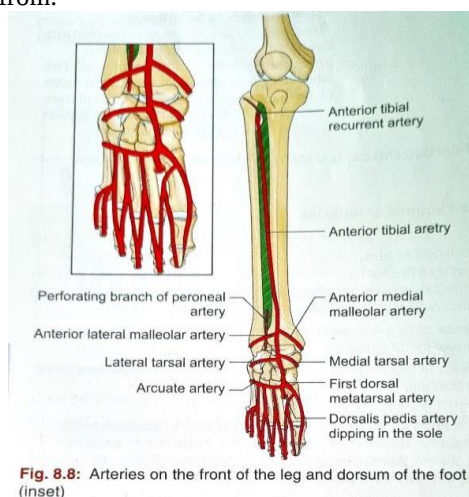
1. Peroneal longus tendon -attaches the Peroneal longus to lateral base of the 1stmetatarsal and medial cuneiform.
2. Peroneal brevis tendon -attaches the Peroneal brevis to the styloid process at distal end of the 5th metatarsal.

At font of the Ankle

1. Peroneal Tertius tendon -attaches the Peroneal Tertius muscle to the dorsal surface of the 5th metatarsal.

2. Planter Arch

It is acirculatory anastomosisformed from:



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.

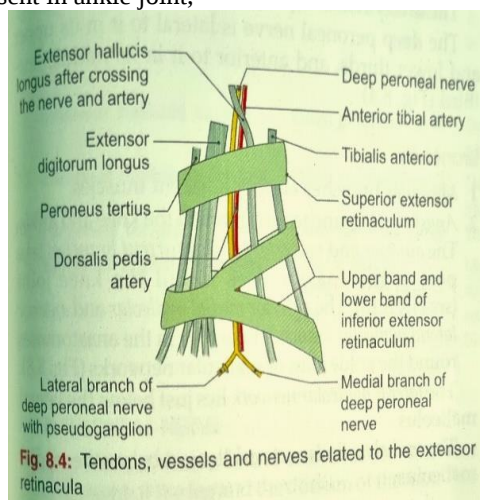
2. Extensor Digitorum Longus Tendon -attaches the Extensor Digitorum Longus muscle, extends down and under the superior and inferior extensor retinaculum, splits into 4 segments and attaches to the 2-5th digits.
3. Tibialis Anterior tendon -attaches the Tibialis Anterior muscle to the undersurface of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

3. Retinaculum of Ankle joint

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,



1. Extensor Retinaculum

Two types of extensor retinaculum present depend on their positions,

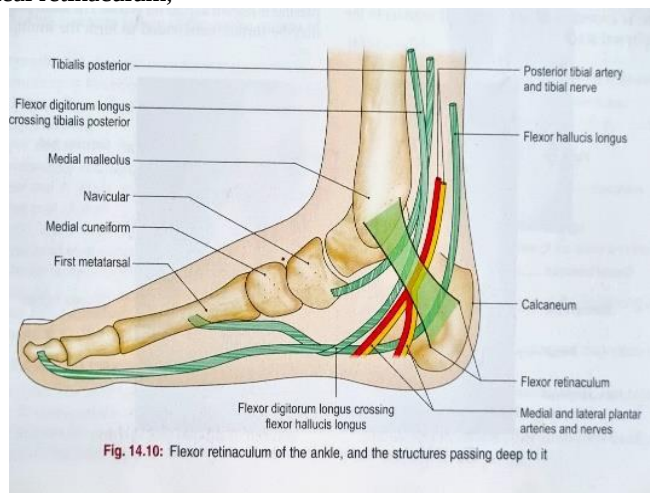
- Superior Extensor Retinaculum - medially it attaches to the lower part of anterior border of tibia, laterally to the lower part of the anterior border of fibula.
- Inferior Extensor Retinaculum - this is 'Y' shaped band of deep fascia, situated in front of ankle joint and over the posterior part of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

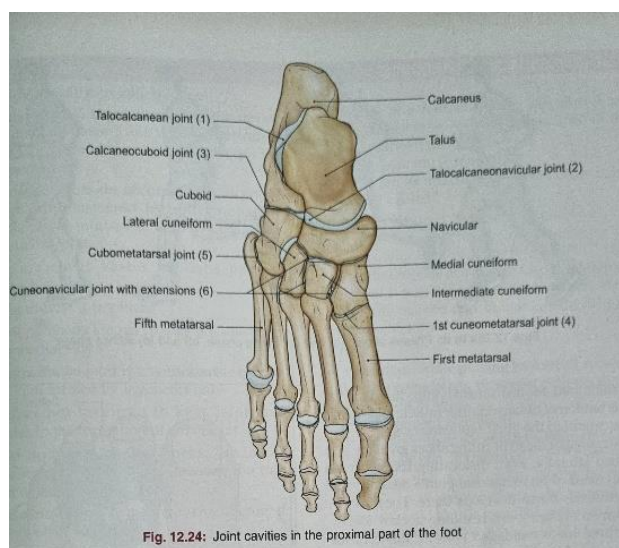


- Superior Peroneal Retinaculum - thickened band of deep fascia situated just behind the lateral malleolus, it attaches anteriorly to the posterior margin of lateral malleolus and posteriorly to the lateral surface of the calcaneum and to the superficial transverse fascial septum of leg.
- Inferior Peroneal 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



3. Juncture of tarsal bone

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 correlate 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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