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 Paribhaha 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 शारीर 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 Gulfa 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
articles related to Paribhasa Sharir are studied. 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, 

मांससिस्त्राह्याभ्यायां

जालानन

प्रत्येकां

चत्वारर

चत्वारर

तानन

मणिबन्ध

गुल्फसांश्रश्रतानन

परस्पर

ननबध्दानन

परस्पर

सांस्िष्टानन

परस्परगवाक्षितानन

चैनत,

यैगगवाक्षितसमदां

शरीरम्

सु. शा. ५/१२[६]

It is structure made by the junction 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.[७] While explaining the properties of Jaal Aacharya Sushrut said,

1. परस्पर निवाद्यानन - means they are strongly bounded to each other so can’t get dislocate easily.
2. परस्पर सांंस्िष्टानन - means strongly connected with each other so can’t get separated easily.
3. परस्परगवाक्षितानन - 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.[८]

**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[९]**

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.

<table>
<thead>
<tr>
<th>Extensor group of muscles tendons</th>
<th>Flexor group of muscles tendons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensor carpi ulnaris tendon</td>
<td>The flexor pollicis longus</td>
</tr>
<tr>
<td>Extensor digiti minimi tendon</td>
<td>The four flexor digitorum superficialis</td>
</tr>
<tr>
<td>Extensor digitorum tendons</td>
<td>The four flexor digitorum profundus</td>
</tr>
<tr>
<td>Extensor indicis tendon</td>
<td>The tendon of flexor carpi ulnaris</td>
</tr>
<tr>
<td>Extensor pollicis longus tendon</td>
<td></td>
</tr>
<tr>
<td>Extensor carpi radialis brevis tendon</td>
<td></td>
</tr>
<tr>
<td>Abductor pollicis longus tendon</td>
<td></td>
</tr>
</tbody>
</table>
2. Palmer Arches of Blood Vessels \cite{10}

The arch represents the anastomosis of ulnar and radial arteries.

- **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 \cite{11}

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 correlate with the network of Snayu.

4. Juncture of carpel bone \cite{12}

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 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
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.

**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:

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[^13]: Steinberg, 1991
[^14]: 1991

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

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

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.

REFERENCES


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