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# CONCEPTUAL STUDY OF SHLESHMA- DHARA KALA WITH SPECIAL REFRENCE TO ASTHI-SANDHI SHARIR

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## ABSTRACT

***Introdction****-Acharya Sushruta,* the pioneer of *Sharir,* extensively described the anatomical structures and their functions in relation to life stages in *Sushruta Samhita*, particularly in Sharir Sthana. Among these, the concept of *Kalas*—membranous structures positioned between *Dhatu* (Tissues) and *Ashaya* (Organs)—holds significant importance. In *Ayurveda, Kalas* are classified into three types: *Snayu* (Fibrous), Jarayu (Serous), and *Shleshma* (Mucous), corresponding to modern connective and epithelial tissue membranes. *Shleshma-dhara Kala* is located in all *Sandhis* (Joints), facilitating smooth movement through lubrication, skin to synovial membranes in modern science. **Aim-**to study concept of *shleshma- dhara kala* with special refrence to *asthi-sandhi sharir.* **Method-** A literature review of Ayurvedic texts and modern anatomical references was conducted to establish the anatomical and physiological relevance of *Shleshma-dhara Kala.* Clinical significance is evident in joint-related pathologies such as *Aamavata* (Rheumatoid arthritis) and *Sandhigata Vata* (Osteoarthritis), where synovial fluid alterations affect joint mobility. **Result-**This study focuses on *Shleshma-dhara Kala*, described as the fourth Kala by *Acharya Sushruta*, and its correlation with synovial membranes in modern anatomy. Cadaveric observations of large synovial joints confirmed the presence of lubricated articular surfaces, indicative of synovial membranes secreting synovial fluid. **Conclusion-** The study concludes that *Shleshma-dhara Kala* shares functional and structural similarities with synovial membranes. This comparative analysis bridges *Ayurvedic* concepts with

contemporary anatomical knowledge, reinforcing the scientific foundation of *Ayurveda* in understanding bodily structures.

**KEYWORDS-** *Kalas*, connective tissue, synovial membranes, *Shleshma-dhara*, Synovial fluid.

## INTRODUCTION

*Acharya Sushruta* the pioneer in the field of *Sharir* has gone through evaluating the anatomical structures in relation to all the stages of life along with the evolution of the Universe, under different chapters in his *Sharir Sthan*.

That's why the *Sushruta Sharir Sthana* is considered as *Shresta* (Paramount) among all the *Sharir Sthanas*.[1]

nks'k/kkrqeyewya fg "kjhjaA ¼lq-lw-15@3½

The modern times saw a period of renaissance for the concepts of philosophy and the *Ayurvedic* medicine, especially *Sharir*. Among its fundamental concept, the study of *Kala Kala* is considered an anatomical and physiological entity situated between Dhatu (Tissues) and *Ashaya* (Organ spaces). However, its precise structural and functional aspects remain a subject of interpretation.

The word *Kala* is described by *Acharya Sushruta* as it is situated between the *Dhatu* and *Ashaya*.[2] This description regarding *Kala* is widely spread in the *Sharir Sthanas* of *Acharya Sushruta*.[3] and *Acharya Vagbhata*.[4] But the specified anatomical situation and its physiological aspect have not clearly indicated the meaning of *Kala*. Before mentioning the *Kalas, Acharyas* have explained about *Twak* i.e, Skin, made up of epithelial and connective tissues which is an outermost membrane of the body. After *Twak*, he mentioned about *Kala* which might be a membrane but not mentioned about the thickness of the *Kala*. But the word *Kala* has a meaning as which is a part of the body with a similar to 1/64 parts of thickness of the moon.[5] The *kalas* are clinically applicable in the field of *Ayurveda* in our classical texts the concepts of *Kalas* are related only to *Visha Vigyan* and their explanation is not seen to any other part of the body.[6] *Shleshma-dhara Kala* is fourth *Kala* according to *Acharya Sushruta*[7] and *Acharya Vagbhata*[8] whereas ninth *Kala* according to the *Brihatchareeram*[9] As mentioned before, this *Kala* is not described by *Acharya Sharangdhar*, but instead of that he explained *Yakrit-Pleeha dhara Kala. Shleshma-dhara Kala* is fourth *Kala*.[10]

**Aim**

To study concept of *shleshma- dhara kala* with special refrence to *asthi-sandhi sharir*

**Objectives**

1. To establish association between *Shleshma-dhara Kala* and *Asthi-Sandhi Sharir*.
2. To authenticate the inter-relationship between *Dhatu and Ashaya* in the light of Modern Science.
3. Understanding the relation of *Kala* with Membrane of the human body

## MATERIAL AND METHODS

- This study was conducted by compiling and analyzes the literature available in *Ayurveda* regarding *Kala* available in *Ayurvedic* Classics.
- To collect, compile and analyze the literature available in Modern Science resembling *Kala*.
- To do comparative study of *Shleshama-dhara Kala* with lining of capsular ligaments of Synovial joints.

## REVIEW OF LITERATURE

**Shleshma-dhara kala**

*Kalas* as *Acharya Sushruta* has used one word in relation to this *Kala* is "*Pranabhritam"* i.e. means which even controls the *Prana.*[11] The location of this *Kala,* as seen before, it is in *Sarvasandhis*[12] which has to be considered it as the junction of any two structures.

By this quotation *Acharya Sushruta* have explained only the bony joints but there are joints also related to *Peshi, Snayu, Sira* in the body which have not mentioned in this context.

According to *Gananath Sen*, these *Kalas* are compared to membranous structures of the human body. *Kala* is explained in *Sushruta Samhita*, *Sharir Sthana* 4th chapter named *Garbha Vyakarana Sharir* by the verses:

dyk% [kYofi lIr lEHkofUr /kkRok”k;kUrj e;kZnkAA ¼lq- “kk- 4@5½

As it has been explained *Kalas* are formed from the *Kleda* which is present between the *Dhatu* and *Ashaya*. Between every structure there is a membrane which helps in differentiating between the two structures. In between two structures there will always be some sort of fluid present which can be called as *Kleda.* That *Kleda* due to its respective

*Dhatvagni*, it is converted into a membrane form, helps to differentiate between two structures.[13]

Luk;qfHk”p izfrPNéku~ lUrrka”p tjk;q.kkA

“ys’e.kk osf’Vrka”pkfi dykHkxkaLrq rku~ fonq%AA ¼lq- “kk- 4@7 ½

*Kalas* are contemplated with such parts of the body which are interspersed with fibrous tissue like *Snayu (Fibrous membrane)*, spread as thin membranous structure like *Jarayu* (Serous membrane) and as if smeared by *Shleshma* (Mucous membrane) similar structures in the body are called as *Kala* by the well versed people.

**These *Kalas* have been correlated to three structures of our body as**

1. *Snayu*
2. *Jarayu*
3. *Shleshma Vestitam.*

1. ***Snayu:*** These are the structures of our body which have a specific function in the body located in some parts of the body. They have been explained as four types, having a main role to abide the weight of the person said as- Luk;qfHkcZgqfHkcZ)kLrsu Hkkjlgk ujk% AA

So these *Kalas* should definitely have this quality they also abide the weight of the particularly this quality can be associated to *Mamsa-dhara* and *Raktha-dhara Kalas.*

Dr. Ghanekar comments that the *Snayu- Kala* has its origination form the tendons e.g. the fibrous membranes and hence appears to be like the tendon.[15]

Whereas, as Dr. Thatte implies that, these *Kalas* are considered here which cover the tendons. He mentions the specific term, ‘*Snayubhishca Pratichanna*’*[16]*

All the opinions through seem to account differently mean the same.

2. ***Jarayu:*** It is the structure related to the foetal membranes. These membranes protect the foetus from the internal as well as external damages which can affect the foetus. Some of the *Kala* possess the function of selective permeability or selective absorption, commonly seen in the epithelial tissue membranes. Particularly this quality can be related to *Purisha-dhara* and *Pitta-dhara Kalas.*

Dr. Ghanekar opines that these are created for the placenta and are similar to the placental membranes.[17] Dr. Thatte says that these *Kalas* derive their name because they are similar to those covering the placenta.[18]

3. ***Shleshma:*** Here the surface of a structure looks like it is been smeared by *Shleshma.* Means this may have main role to have a smooth surface for easy moving over the vicinity structures also in the interior of the vessels where it provides a smooth layer appears as a polished floor for the free flow of the blood, which is known as endothelium. Particularly this quality is seen in *Shleshma-dhara* and *Medho-dhara Kalas,* where on contemporary science these can be related to Peritoneum, Pericardium, Meninges, Synovial membranes, Loose areolar connective tissues etc.

Whereas, Dr. Ghanekar in his commentary state that these originate from the mucous membrane and appear like a thin layer of mucous membrane covering the surface of the various tracts[19] and Dr. Thatte says these are membranes which look to be as if covered by mucous.[20] Dr. Varier mentioned four kinds of *Kalas* which are in accordance with their modern comparison in[21]

1. *Prayahstaneva*: The epithelial membranes.
2. *Snayava:* The fibrous membranes.
3. *Shlaishmika:* The mucous membranes.
4. *Mamsaja:* The muscular layer of the membranes.

**Clinical Significance of Shleshma-Dhara Kala**

*Shleshma-Dhara Kala* plays a crucial role in ensuring smooth movements within the body. It is associated with various serous membranes like the peritoneum, pleura, pericardium, and meninges, which facilitate organ mobility and function.[22]

- Peritoneal diseases (e.g., peritonitis) affect intestinal movements, leading to severe complications.
- Pleural and pericardial conditions (e.g., pleural effusion, pericarditis) impair lung and heart function, potentially becoming fatal.
- Meningeal involvement (e.g., meningitis) disrupts brain function, leading to severe neurological issues.

After death, rigor mortis causes stiffness, preventing movement. This may explain why Acharya *Sushruta* referred to *Shleshma-Dhara Kala* as *"Pranabhritam",* emphasizing its presence in living beings and its role in maintaining bodily motion.

**In relation with *dhatu* and *ashaya***

Main functions of *Dhatu* are described in *Ayurveda* texts as:

***Prinana, Jivana, Lepa, Sneha Dharana, Purana, Garbhotpadana (A.H.SU.11/4)***

Looking into the *Dhatus* relation to *Kalas, Acharya Sushruta* did not mentioned about some of the *Dhatu's Kala* like *Rasa-dhara Kala*, *Asthi-dhara Kala* and *Majja-dhara Kala*. Among these three, the last two are also not been well thoughtout by *Acharya Sushruta* while illuminating about the concepts of *Srotas* too, because he has explained in very detail about *Asthi Bhagna* and its treatment in other parts of the *Samhita* and presence of *Majja* inside. The injury to *Asthi* itself will surely affect the *Majja*. Instead of these Three he has added *Shleshma-dhara Kala*, *Purisha-dhara Kala* and *Pitta-dhara Kala.* Among the *Ashaya* only few of them are related to *Kala*. The *Vata Ashaya* and *Mootra Ashaya* do not have relation to any *Kalas.* The remaining five *Ashayas* have a relation with one of the *Kala.* The main functions of *Kalas* are to hold the substances in their position i.e. *Dharana*. Whereas *Vata* is a substance which cannot be griped by any structure for the reason that it is an *Amurta Dravya.* So *Vata* can not have any *Kala* for *Dharana* purpose. But whereas *Shleshma* and *Pitta* are the *Murta Dravyas* which can be clutch by a layer so they have a separate *Kala* for these two.

*Amashya* and *Pakwashaya* in reality, they are not associated unswervingly to any *Kala,* but they have been associated to two *Kalas* i.e. *Purisha-dhara* and *Pitta-dhara Kala*. Between *Amashaya* and *Pakwashaya, Pitha-dhara Kala* is present and *Purisha-dhara* Kala is present at the level of *Pakwashaya,* where *Malavibhajana* take place. Whereas, *Rakta Ashaya* is related to *Rakta-dhara Kala* directly. The organs liver and spleen have been related to this *Kala* along with the vascular structures of the body.

**Synovial fluid (Modern correlation)**

Synovial fluid is an ultra filtrate of blood plasma that is concentrated by virtue of its filtration through the synovial membrane.[23]

- Provides lubrication, shock absorption, and nutrient transport.
- Contains phagocytic cells to remove debris and microbes.

***Dhatu poshan nyaya* (Tissue nourishment law)**[24]

- *Kedari Kulya Nyaya* explains tissue nourishment like irrigation, where *Ahara Rasa* nourishes *Dhatus* via specific channels.
- *Rasa Dhatu* is nourished first, followed by *Mamsa Dhatu*, as it is farther from the source.

**Shoulder Joint- Ball and Socket joint**

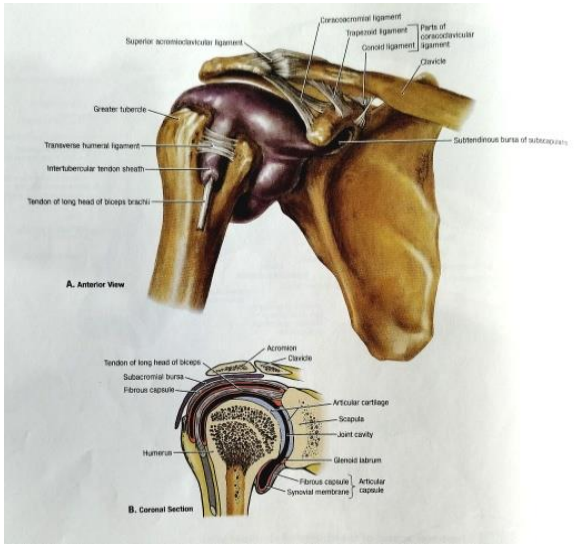



**Figure 1: Shoulder Joint- Ball and Socket Joint.**

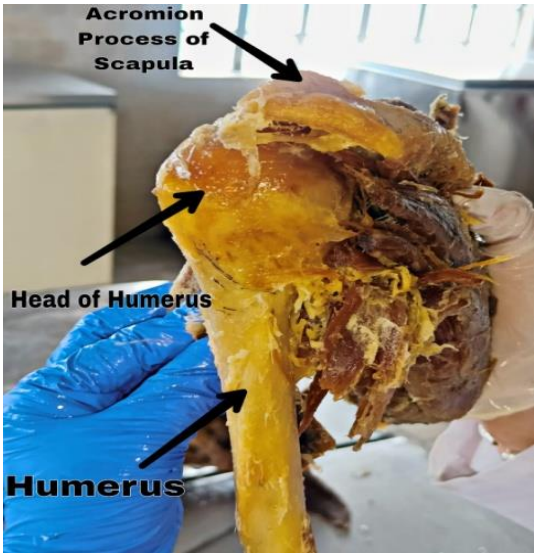



**Figure 2: Shoulder Joint- Ball and Socket Joint.**

**Elbow Joint – Hinge Joint**

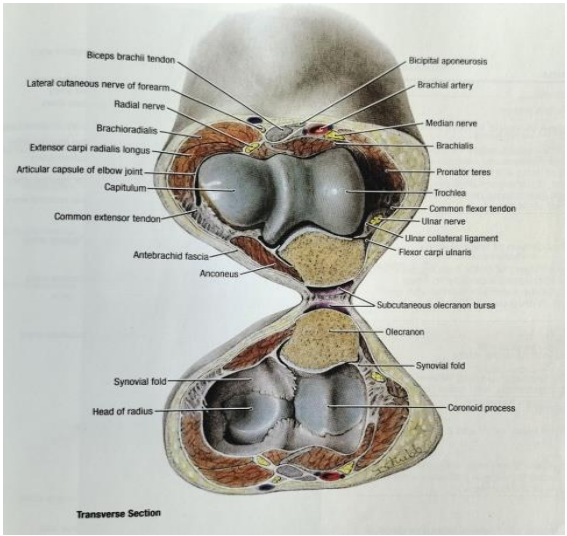



**Figure 3: Elbow Joint – Hinge Joint.**

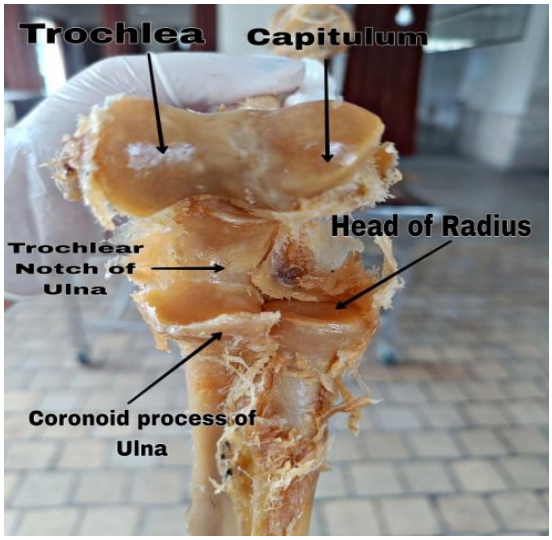



**Figure 4: Elbow Joint – Hinge Joint.**

**Wrist Joint- Condyloid Joint**

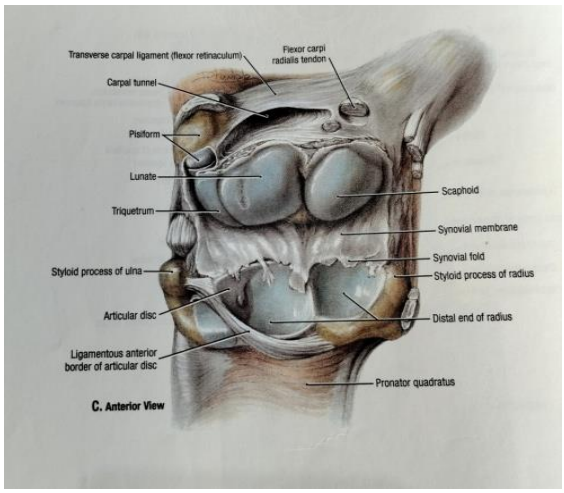
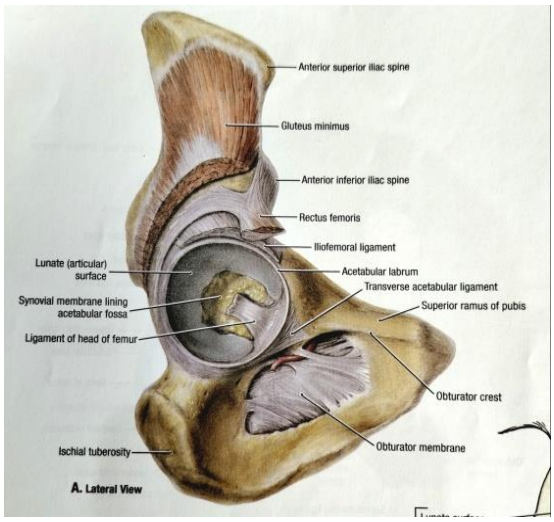



**Figure 5: Wrist Joint- Condyloid Joint.**


**Figure 6: Wrist Joint- Condyloid Joint.**

**Hip Joint- Ball And Socket Joint**



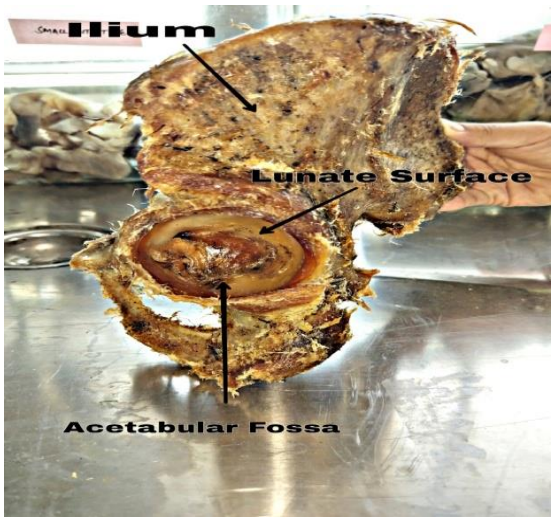
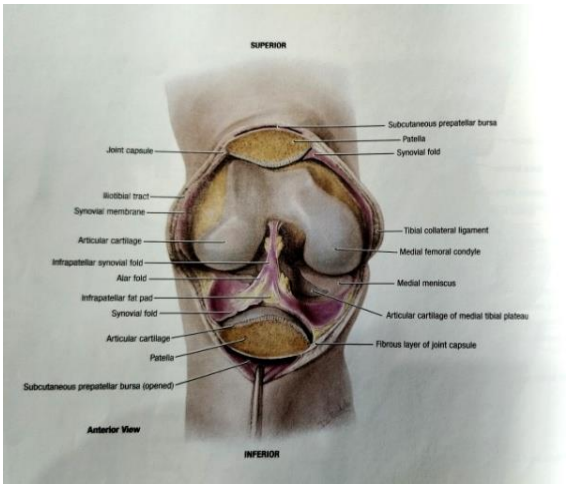




**Figure 7: HIP Joint- Ball and Socket Joint. Figure 8: HIP Joint- Ball and Socket Joint.**

**Knee Joint- Hinge Joint**



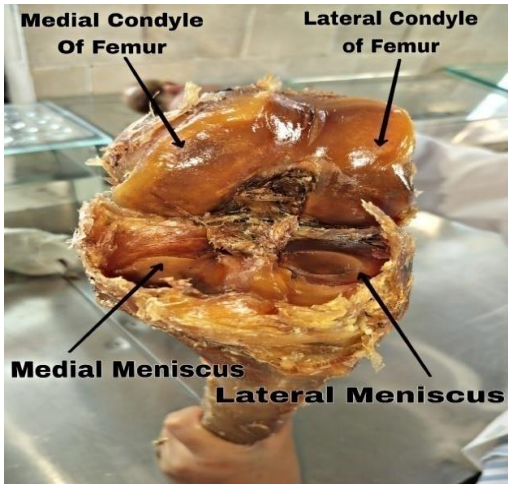




**Figure 9: Knee Joint- Hinge Joint. Figure 10: Knee Joint- Hinge Joint.**

**Ankle Joint- Hinge Joint**

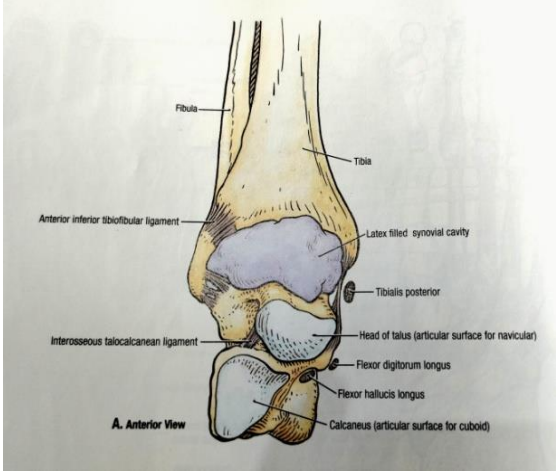



**Figure 10: Ankle Joint- Hinge Joint**

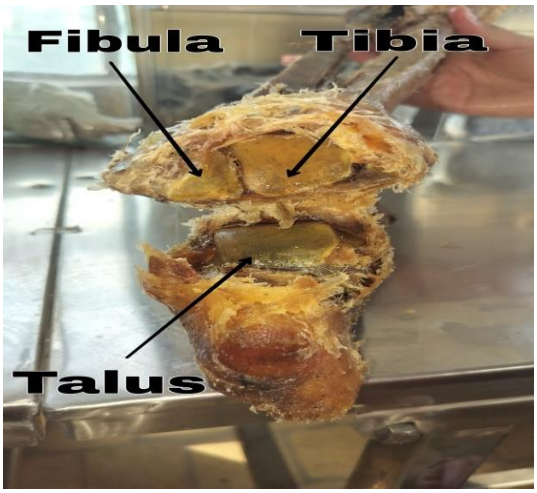



**Figure 11: Ankle Joint- Hinge Joint.**

## OBSERVATION

***Cadeveri*c study of large synovial joints were done in the dissection hall of Rajiv Gandhi Govt. Post. Graduate Ayurvedic Medical College, Paprola (H.P), Department of *Rachana Sharir* and found following facts:**

During dissection, study of large synovial joints we observed following structures :-

1. The muscles surrounding the joints.
2. Ligaments attachments to the joints.
3. After incision of fibrous capsule, articular surfaces of the bones were found lubricated, so it indicates the presence of synovial membrane with synovial fluid are visualized in each synovial joints.
4. Synovial fluid is the ultra filtration of plasma, given by (GRAYS ANATOMY) and this process of filtration can not be observed in cadaver because this phenomena is found only in living cells.[25]

## DISCUSSION

The concept of Kala in *Ayurveda,* as described by *Acharya Sushruta* and *Acharya Vagbhata,* represents specialized layers between *Dhatus* and *Ashayas,* contributing to bodily functions. Modern science classifies body structures into epithelial, connective, muscular, and nervous tissues, and every system is inherently linked to these. While some *Kalas* may relate more to epithelial membranes and others to connective tissue, a direct one-to-one correlation remains complex. This article explores the structural and functional significance of *Kalas,* bridging *Ayurvedic* wisdom with modern anatomical insights. In the narration of importance of the

*Shleshma-dhara Kala* which resides in the *Sarva Sandhi* and it has also been said as *Pranabhritaam* has been mentioned in this Kala description. *Shleshma-dhara Kala* is present in all the joints of the body in a living being.

When the word *Sarva Sandhi* has been used, all these *Sandhis* have to be involved in *Shleshma-dhara Kala* along with other *Sandhis* like the joint between Lungs and thoracic cage which is divided by Pleura which also has to be involved in this *Kala*. Similarly the junction between the Heart and Lungs is also been divided by a membrane which is known as Pericardium also has to be involved within this *Kala*. Like that all the junctional parts of the body will surely divided by this *Kala* from the vicinity structures. Hence it is seen in pathologies like Rheumatic fever, where heart and joints are affected.

In the joints again the Synovial membrane, bursae in tendons secretes the synovial fluid or *Shleshaka Kapha*, which lubricates the joints facilitating the movements. Thus the *Acharyas* have very categorically illustrated with the example of a cart wheel oil is applied for lubrication as seen before.[26] *Shleshaka-Kapha* secreted by the *Shleshma-dhara Kala* increases which may lead to oedema a condition which can be related to *Aamavata* disease.[27] If the *Rukshata* is increased, it causes a reverse kind of pathology e.g. *Sandhigata Vata.*[28] The treatment primarily in the first case is *Pachana* i.e. conversion of excess of *Kleda* secreted by the *Kala*. In the second case dryness has to be decreased by facilitating increased secretion by the *Kala*.

## CONCLUSION

In the body membranes are formed out of epithelial or connective tissues, so all the *Kalas* will fall under these two cells itself. But it is bit complex to say this particular membrane is related to this particular *Kala* on modern grounds. As *Acharya Charaka* said there are very few things which can be visualized and many things are *Apratyaksham* which cannot be seen by the naked eye.

*Kala* must be regarded as an admixture of the structural and functional components at the root level of the bodily basic elements. It must also be agreed that not all *Kalas* can be interpreted on the same principle as per *Nirukti* and definition of *Kala*.

1. *Kalas* are marginal lines between *Dhatu* and Ashaya, situated interior to the body. These *Kala* are invisible and have been explained by *Upamana.*
2. *Kalas* are formed of three structures:-

1) *Snayu* = fibrous
2) *Jarayu*= Serous
3) *Shleshmana* = Mucous

3. *Kleda* (Moisture) which is present in *Dhatu* and *Ashaya*, by its own *Agni*, help to convert it into *Snayu, Jarayu, Shleshmana* which are membranous structures illustrative as *Kalas*
4. *Shleshma-dhara Kala*, which is the fourth *Kala* according to *Acharya Sushruta*, situated in all joints of body in a living being helps to have smooth and easy movement in the joint
5. *Asthi Sandhi* are described of two types :

1) *Chestavanta* = Movable
2) *Sthir* = Immovable

A) *Shleshmadhara Kala* (synovial membrane) is mainly present in large movable joints.

B) On Cadaveric study, large synovial joints were dissected and after the incision of Articular capsules, the Articular bony parts of the joints were found lubricated, which indicate the presence of Synovial Fluid secreted by cells present in the Synovial Membrane

On the basis of literally study of *Ayurveda* and Modern Science it is found that *Kalas* are formed of same structure as membranous present interior to the body. Thus it can be concluded, that *Shleshma-dhara Kala* is similar to the Synovial Membrane present in the Synovial Joints of the body.

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