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A Review On *'Kalaa Sharir'*: Bridging Ayurved Concepts Along With Its Possible Relevance In Contemporary Modern Science

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Abstract: A thorough understanding of various terminologies mentioned in Ayurveda is essential for their effective application in clinical practice and research. *Kalaa sharir* is a significant aspect of *sharir* necessitating a detailed study and exploration of the concept to uncover its significance. '*Kalaa'* refers to the distinct layers, sheath or membranes that envelop and protect various internal structures of the body. These are not only structurally significant but also hold considerable functional importance. The seven types of *kalaa* i.e. *Mamsadhara, Raktadhara, Medodhara, Shleshmadhara, Purishadhara, Pittadhara Shukradhara Kalaa* described in Ayurvedic texts represent specific anatomical and physiological structure and functions. There appears to be a possible correlation between the classical descriptions of *kalaa* in Ayurveda and modern anatomical structures. Also *Kalaa* is closely associated with *Dhatu*, its origin, and *Dosha* interactions, forming a strong foundational basis for understanding the applied aspects of *Kalaa* in clinical practice. So, this article aims to present a comprehensive review of the concept of *Kalaa Sharir*, its relation with various components of body and hence to simplify its clinical applicability.

***Index Terms - Kalaa, dhatu,* layers, membrane, sheath**

I. INTRODUCTION

Human body is formed by a well-coordinated and constantly evolving network of components. Ayurveda presents the concept of *Sharir* (body) as comprising multiple entities such as *Doshas* (biological humours), *Dhatus* (tissues), *Malas* (waste products), *Agni* (digestive/metabolic fire), *Srotas* (channels), *Kala* (membranes), and *Ashayas* (cavities). Each of these components possesses distinct characteristics and plays a vital role in maintaining physiological balance. They are intricately interconnected and function in harmony to support normal bodily functions and sustain overall health.

Kalaa is one such fundamental concept in Ayurved. The term *Kalaa* (often spelled *Kalaa* or *Kalā*) indeed refers to fine layers, membranes, or sheaths that surround or support bodily structures. Various physiological functions such as formation, transportation, maintenance, and excretion are supported and regulated by the *Kalaa*. These layers are believed to play a crucial role in maintaining systemic balance, offering not only physical protection but also contributing to energetic and psychological well-being.

According to Ayurveda, the human body is a complex system composed of interconnected layers, with each *Kalaa* serving a specific function that helps to support individual's physical, mental, and spiritual health.

AIM:

To explore the concept of *Kalaa* as described in Ayurveda and assess its possible relevance with structures identified in anatomy.

OBJECTIVES:

1. To gain a comprehensive understanding of the concept of *Kalaa* through an in-depth review of Ayurvedic classical texts.

2. To explore and analyse the possible correlation between the Ayurvedic concept of *Kalaa* and anatomical structures described in modern medical sciences.

MATERIALS AND METHODS:

A comprehensive review was conducted of classical Ayurvedic literature, including the *Sushruta Samhita*, *Charaka Samhita*, *Ashtanga Sangraha*, and *Ashtanga Hridaya*, along with their traditional commentaries. In addition, relevant content from texts such as the *Sharangdhar Samhita*, *Kashyapa Samhita*, *Bhavaprakasha*, and *Bhela Samhita* was also studied. Contemporary research papers and scholarly articles related to the topic were further examined to support the study.

REVIEW OF LITERATURE:

In Ayurvedic classics, *Kalaa* is defined as the *'Dhatu-aashaya antara maryada'*, referring to the structural boundary that separates a *Dhatu* (tissue) from its *Aashaya* (cavity or location). According to Ayurveda, there are seven such *Kalaas* present within the human body.[1] The structure of *Kalaa* is further illustrated through a classical analogy: just as the pith becomes visible when a piece of wood is cut, similarly, when tissues like *Mamsa* (muscles tissue) are cut, the *Kalaa* becomes visible.[2] The portions of the body which are covered by *Snayus* (ligaments and tendons), enveloped by *Jarayu* (membrane) and smeared with *Kapha* (mucous) are called *Kalaas.* [3] These components may be interpreted as corresponding to the fibrous, serous, and mucous layers in modern anatomical terminology.[4]"

Formation of *kalaa*:

Various classical references regarding the formation of *Kalaa* are found across the Ayurvedic *Samhitas*. According to *Sharangadhara*, the *Kleda*—the moisture or liquid present between the *Dhatu* (tissue) and its *Ashaya* (cavity)—is processed by the body's internal heat and transformed into *Kalaa.*[5] *Vagbhata* further elaborates that this *Kleda*, present in between the dhatu and its aashaya, when subjected to the inherent heat of the body, undergoes a transformation similar to that observed in trees, where internal fluids solidify into structural forms. The resulting structure becomes enveloped by *Snayu* (tendinous sheath), *Shleshma* (mucous or Kapha), and *Jarayu* (serous or chorionic membrane). This formation is termed *Kalaa* because it originates from a minimal amount of *Rasa*—the essence of the *Dhatus*—which oozes out in a manner analogous to the sap released when fresh wood is cut.[6]

Listed below are the seven *Kalaas* found within the human body:

1. The first among the seven *Kalaas* is the *Mamsadhara Kala*, located within the *Mamsa Dhatu* (muscle tissue). It provides a supportive medium through which *Siras* (veins), *Snayus* (fibrous tissues/ligaments), and *Dhamanis* (arteries) can branch and spread throughout the muscle.[7]
   An analogy from classical texts likens this arrangement to the *Bisa* (lotus rhizome) and *Mrunala* (lotus stalk), which grow continuously through muddy water in the soil—just as the vascular and connective tissue components are spread and proliferate within the muscular tissue.[8]
2. The second *Kala* is the *Raktadhara Kala*, which is situated within the *Mamsa Dhatu* (muscle tissue) and serves as the site where *Shonita* (blood) resides, particularly within the *Siras* (veins) related with the *Yakrit* (liver) and *Pliha* (spleen).[9]
   An analogy from classical texts compares this to the flow of milky sap from certain trees when their bark is cut or injured—similarly, when muscle tissue is incised, blood flows out rapidly from within. [10]
3. The third *Kala* is the *Medodhara Kala*. *Meda* is primarily found in the abdominal region and within the smaller bones of living beings. In contrast, the larger bones predominantly contain *Majja* (bone marrow). Specifically, long bones are filled with *Majja*, while smaller, flat, and curved bones contain

Sarakta Medas—a form of red-tinged marrow. Additionally, the pure fat located within the muscles is referred to as *Vasa* (muscle fat).[11]

4. The fourth *Kala* is the *Shleshmadhara Kala*, which is located in all the joints of the body and plays a vital role in supporting their function. As stated in *Sushruta Sharira* just as a wheel turns smoothly when its axle is well-lubricated with oil or grease, similarly, the body's joints function effectively when lubricated by *Shleshma* (synovial-like Kapha), ensuring ease of movement and flexibility.[12]
5. The fifth *Kala* is known as *Purishadhara Kala*, located within the *Pakvashaya* (large intestine). Its primary function is to separate *Mala* (waste matter, particularly feces) from the digested food. This *Maladhara Kala*, situated along the gastrointestinal tract—beginning from the *Yakrit* (liver) and extending through the intestines—facilitates the separation of fecal matter specifically at the *Unduka* (caecum).[13] As per *Dalhan*, *purishdhara kalaa* is the *asthidhara kalaa.*[14]
6. The sixth *Kala* is known as *Pittadhara Kala*—the membrane responsible for holding and regulating *Pitta*, It plays a crucial role in supporting and retaining the four types of ingested food—*Ashita* (swallowed), *Khadita* (chewed), *Peeta* (drunk), and *Leedha* (licked)—as they move from the *Aamashaya* (stomach) toward the *Pakvashaya* (large intestine).[15] *Pittadhara kalaa* which was described as the sixth *kalaa* situated between *aamashaya (stomach) and pakvashaya (large intestines)* is known as *grahani.*[16] that houses the digestive fire (*Agni*), which is responsible for the transformation and absorption of nutrients.[17] This region is also identified as the site of absorption—due to its role in assimilating digested food. When the function of this digestive fire is impaired, e specially under the influence of disturbed *Vata* and other *Doshas*, it can lead to the formation of *Aama* (undigested or toxic material).[18]As per *Dalhan*, *pittadhara kalaa* is the *majjadhara kalaa.*[19]
7. The seventh *Kala* is known as *Shukradhara Kala*, which is said to permeate the entire body of all living beings. Its presence is subtle and pervasive, much like ghee hidden within milk or the essence of jaggery within sugarcane juice—imperceptible to the eye, yet inherently present. Similarly, *Shukra* (reproductive fluid/semen) exists throughout the body in an unmanifest form and becomes evident only under specific conditions.[20]

   During sexual activity, when the mind is joyful and engaged, *Shukra* is released through the urinary tract. Classical texts describe its point of emergence as approximately two *Angula* (around 4 cm) below the opening of the urinary bladder, on the right side. This *Shukra*, though discharged from a localized area, is believed to originate from its subtle form spread throughout the entire body.[21]

DISCUSSION:

As per definition given by Acharya Sushrut, *kalaa* is a boundary between *dhatu* (tissues) and *Ashaya* (cavity). Any layer that acts as a boundary between a tissue and an adjacent cavity—whether the cavity lies within or outside the tissue—may be identified as a Kalaa. If we go for detail analysis of types of *kalaa* given by Sushrut, we can say these are nothing but different types of layers, separating the structures present in the body which can be classified under the seven types of *kalaa* explained by *Sushrut.* Based on this structural form, *Mamsadhara kalaa* can be interpreted as the intermuscular septa, which separate individual muscles while creating pathways for the passage of blood vessels and nerves. Additionally, the deep fascia that envelops the muscles may also be considered a part of *Mamsadhara kalaa.*

In the context of *Raktadhara Kalaa*, Sushruta mentions its presence within the muscle tissue, as well as specifically in structures like blood vessels, the liver, and the spleen. Muscle tissue is richly vascularized, containing an extensive network of blood vessels, which justifies the mention of *Raktadhara Kalaa* in this region. Based on this, the walls of blood vessels—particularly the endothelial lining—can be considered as a structural representation of *Raktadhara Kalaa.* Furthermore, Sushruta includes the liver and spleen under *Raktadhara Kalaa*. Modern anatomical and physiological understanding supports this view, as both organs play vital roles in hematopoiesis, especially erythropoiesis during fetal life and under certain pathological conditions in adults. Histologically, both the liver and spleen exhibit layered tissue arrangements, which may correlate with the concept of '*Kalaa*' or membranous layers. Hence, Sushruta's inclusion of these organs under *Raktadhara Kalaa* is a reflection of their significant role in blood formation and storage, as well as their structural characteristics.

The fat-laden layer of the peritoneum can be correlated with *Medodhara Kalaa*, as it represents a membranous structure embedded with adipose tissue. Furthermore, Sushruta's reference to fat around bones aligns with the modern understanding of bone marrow composition. Both red bone marrow (hematopoietic in function) and yellow bone marrow (rich in adipocytes) can be considered under the domain of *Medodhara*

Kalaa due to their fatty content and structural relevance. In muscle tissue, fat is stored in two primary forms: intramyocellular triacylglycerol (IMTG), which is present within muscle cells, and intermuscular adipose tissue (IMAT), found between muscle fibers. These fat deposits contribute to energy metabolism and can be associated with the *Medodhara Kalaa* described by Sushruta. Thus, *Medodhara Kalaa* encompasses various fat-storing structures throughout the body, including visceral fat, bone marrow fat, and intramuscular fat, all of which are functionally and structurally significant.

Being located at the joints; *Shleshmadhara Kalaa*, plays a crucial role in providing lubrication to facilitate smooth movement. This description closely corresponds to the structure and function of the synovial membrane in modern anatomy. The synovial membrane lines the inner surface of joint capsules and is responsible for secreting synovial fluid, which reduces friction between articulating surfaces and nourishes the cartilage. Given its anatomical position and lubricating function, the synovial membrane can be considered a structural correlate of *Shleshmadhara Kalaa*. This interpretation highlights Sushruta's advanced understanding of joint physiology and the importance of specialized tissues in maintaining joint health and mobility.

Purishadhara Kalaa, plays a role in the formation of fecal matter, as located in the large intestine. Based on this, the mucous membrane of the colon can be considered a structural correlate of *Purishadhara Kalaa*. Although *Sushruta* does not explicitly describe *Asthidhara Kalaa*, commentator *Dalhana* suggests that *Purishadhara Kalaa* itself should be regarded as *Asthidhara Kalaa*. To understand this correlation, we refer to Ayurvedic principles. There exists an *ashraya-ashrayi* relationship between *asthi dhatu* (bone tissue) and *vata dosha*, with *vata* residing in *asthi*. Additionally, Ayurvedic texts identify the *pakvashaya* (large intestine) as the main site of *vata dosha*. Therefore, there is an indirect yet significant link between *pakvashaya* and *asthi* dhatu, supporting the idea that *Purishadhara Kalaa* (located in the *pakvashaya*) can be viewed as *Asthidhara Kalaa*. Modern science also suggests a connection between the intestine and bone health. Gut microbiota influence bone metabolism by modulating the immune system, affecting osteoblast and osteoclast activity, altering growth factor levels, and impacting nutrient absorption. These findings support the traditional concept of an intrinsic link between intestinal and skeletal health.

In case of *pittadhara kalaa*, Sushruta says, it is present at small intestine and responsible for absorption of digested food material. Here we can include mucous membrane of small intestine in *pittadhara kalaa*. Like *asthidhara kalaa*, *Sushrut* has not explained *majjadhara kalaa* but *Dalhan* says *pittadhara kalaa* has to be considered as an *majjadhara kalaa*. *Majja dhatu* is related with nervous system so we can corelate this concept with enteric nervous system, a "second brain" present in the gut with ~600 million neurons. It controls digestion — movement, secretion, absorption — and works mostly on its own. Uses many neurotransmitters like serotonin and acetylcholine.

In case of *shukradhara kalaa*, Sushruta says, it is present all over the body. As per different texts in ayurveda, *shukra* is correlated with the final product of food material. During the metabolism food material is converted into all the *dhatus* (tissue) in step-by-step manner and finally lead to formation of *shukra dhatu*. This shukra dhatu is present in all over the body of both male and female. If we correlate this in modern science we find, during ejaculation of semen, several physiological changes occur in the body, including increased heart rate and breathing, muscle contractions in the pelvic region, and the release of neurotransmitters like norepinephrine and serotonin. This denotes presence of *shukra* in all over body. Secondly Sushrut says, *shukra* is present 4 cm below the orifice of urinary bladder, so we can include testis (and ovaries in female as it is homologous organ) in the *shukradhara kalaa*, particularly different layers of testis and ovaries can be included in *shukradhara kalaa*.

Seven *Kalaas* mentioned so distinctively with specific locations and functions, shows possible remarkable correlation with modern anatomical and physiological structures as enlisted below:

Sr.No	*Kalaa*	Ayurvedic Description	Possible Anatomical Correlation
1	***Mamsadhara Kalaa***	Located within muscles; supports spread of *sira* (vessels), *snayu* (ligaments), and *dhamani* (arteries).	Intermuscular septa and deep fascia separating muscles, allowing vessels and nerves.
2	***Raktadhara Kalaa***	Present in muscle tissue, vessels, liver, and spleen; site of blood flow and storage.	Endothelial lining of blood vessels; vascular tissue in liver and spleen.
3	***Medodhara Kalaa***	Associated with fat in the abdomen, small bones, and muscle tissue.	Peritoneal fat, red and yellow bone marrow, intramuscular fat (IMTG/IMAT).
4	***Shleshmadhara Kalaa***	Located in joints; lubricates joints for smooth movement.	Synovial membrane lining joints; secretes synovial fluid for lubrication.
5	***Purishadhara Kalaa***	Found in *pakvashaya* (large intestine); separates waste (*mala*) after digestion.	Mucosal lining of colon; linked to bones via gut-bone axis. *Dalhana: = Asthidhara Kalaa.*
6	***Pittadhara Kalaa***	Located between stomach and large intestine; digests and absorbs food via digestive fire (*Agni*).	Mucosa of small intestine; aligns with enteric nervous system (ENS) for digestion.
7	***Shukradhara Kalaa***	Distributed throughout the body; *Shukra* is systemic. Ejected near urinary bladder during ejaculation.	Testes in males, ovaries in females; supports concept of systemic reproductive tissue.

Table No.1: Seven *Kalaas* with possible anatomical correlations

CONCLUSION:

According to Ayurvedic texts, *Kalaa* can be understood as a structural layer that separates tissues from internal cavities. A detailed analysis of the descriptions of various types of *Kalaa* suggests that several anatomical structures in modern science correspond to these layers. These include the cell wall, epithelial linings, fascia, intermuscular septa, mucous and serous membranes, fibrous membranes, synovial membranes, fibrous capsules, and protective coverings such as the pleura, peritoneum, pericardium, meninges of the brain, as well as the walls of blood vessels. Each of these may be correlated with specific *Kalaa* described in Ayurveda, reflecting the depth and precision of classical anatomical understanding.

Also, Disturbances in the *Doshas* can lead to the vitiation of the associated *Dhatus*, which in turn may damage the corresponding *Kalaa* and impair the function of related organs or *Ashayas*. This interdependence is crucial in understanding the pathogenesis of diseases and serves as a foundational principle in Ayurvedic diagnosis and treatment. A clear understanding of *Kalaa* enables the physician to make timely diagnoses, assess prognosis accurately, and formulate an effective treatment plan.

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