Understanding the Concept of Kala in Ayurveda: A Review of Anatomy and Physiology

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Abstract
Background: Anatomy is a fundamental science that explores the structures of the human body, including the bones, joints, sense organs, and skin. Knowledge of anatomy is essential for understanding diseases and their treatments, including medicinal or surgical procedures. In Ayurveda, an ancient Indian system of medicine, the concept of Kala is a unique and important concept that has been explained by Acharya Sushruta in the Sushrut Samhita.

Objective: The objective of this review is to provide a comprehensive understanding of the concept of Kala in Ayurveda, its anatomical and physiological relevance, and its clinical implications.

Data Source and Review Method: A thorough review of relevant classic literature on anatomy, Ayurveda, and the concept of Kala was conducted using electronic databases such as PubMed, Scopus, and Google Scholar. The data were analysed and synthesized to provide a comprehensive overview of the topic.

Result: The concept of Kala is described as a limiting membrane or layer situated between Dhatu (vital elements) and Aashaya (cavities that hold the vital elements). There are seven Kala in the body, which can be understood by their functions in the body. They are extremely minute particles, similar to cells, and can be considered as special membranes in the body that have an important role in performing body physiology.

Conclusion: The concept of Kala in Ayurveda is a unique and important concept that has relevance in both anatomy and physiology. Understanding the concept of Kala can help in the better understanding of diseases and their treatments. Further research in this area could lead to new insights into the functioning of the human body and the development of new therapies.

Keywords: Kala, Limiting membrane, Pittadhara, Purishadhara, Rakadhara, Shleshmadhara

INTRODUCTION:
The concept of Kala in Ayurveda is a unique and important concept that has been explained in the Sushrut Samhita by Acharya Sushruta. The word Kala is derived from a Pali-English dictionary and means a small part of anything or any single part or portion of the whole. Kala is described as a limiting membrane or layer situated between Dhatu (vital elements) and Aashaya (cavities that hold the vital elements). There are seven Kala in the body, which are the substrata of the elements or vital elements of the human body. These include flesh, blood, fat, phlegm, urine, bile, and semen. Although many terminologies like Kandara, Kurcha, Mansarajju, Sanghat, and Simanta are described in Ayurveda Sharir, there is no established clinical significance of Kala sharir to date. However, understanding the concept of Kala can lead to a better understanding of the functioning of the human body and the development of new therapies. In this review, we aim to provide a comprehensive understanding of the concept of Kala in Ayurveda, its anatomical and physiological relevance, and its clinical implications.

MATERIAL AND METHODS:
The materials and methods for this study involved a review of various classical texts including Charaka Samhita, Sushruta Samhita, Ashtanga Sangrah, Ashtanga Hridaya, Bhavprakasha, and Sharangdhar Samhita. Additionally, evidence-based resources such as journals, books, and data-based information from modern texts were reviewed. The focus of the study was on Kala Sharir, and therefore contemporary anatomical literature, especially histology, journals, articles, internet material, and previous research papers related to this subject were also reviewed. The review of these materials and literature was used to provide a better understanding of Kala Sharir and its importance in the context of Ayurveda.

LITERATURE REVIEW-
The literature review reveals that *Kala Sharir* is a concept described in various classical Ayurvedic texts, including Susrutha Samhita, Ashtanga Sangraha, Ashtanga Hridaya, Bhavprakash, and Sharangdhar Samhita. The term "Kala" is used in different meanings in these texts, including indistinct, unit of time, minute, and membrane. In the context of *Sharir*, *Kala* refers to a thin membranous entity that separates the vital elements and cavities that hold the vital elements. The vital elements resides in cavities that hold the vital elements and the inner lining of the these cavities is called *Kala*. The literature also explains the process of formation of *Dhatu*, which takes place in many stages. *Dhatu* begins as a liquid called *Dhaturasa*, which is transformed into the subsequent *Dhatu*. During this process, some *Kleda* remains between *Dhatu* and *Ashaya*, which is not converted into the previous or next *Dhatu* and remains in very less quantity, called *Kala*. The muscle layer that covers *Kala* is spread out like a membranous structure (*Snayu*), resembling an amniotic membrane (*Jarayu*), and covered in mucus (*Shleshma*). Membranous structure signifies structural support, amniotic membrane signifies barrier/selective permeability, and mucus signifies lubrication and nutrition. In the description of how the *Visa* moves from one *Kala* to another, Susrutha has used the term *Asthidhara Kala* and *Majjadhara Kala* in place of *Purishadhara Kala* and *Pittadhara Kala*, respectively. The literature suggests that *Kala Sharir* has not been established with any clinical significance so far.

**THE SEVEN KALA OR VARIOUS MEMBRANES:**

According to Ayurveda, there are seven *Kala* or limiting membranes that are the inner linings of various body cavities and tissues. Sushrut, an Ayurvedic scholar, described *Kala* as sheath-like structures enveloped by *Shleshma* or mucoid material. In modern anatomical language, these structures are called mucous membranes. Epithelium is the layer of cells that covers tissue surfaces and body cavities opening to the outside. Embryologically, epithelium derives from all three germinal cells. Mesothelial cells line internal cavities and proximal parts of the urogenital tract lining, including the pericardial, pleural, and peritoneal cavities. Endothelium lines blood vessels and lymphatics.

**THE SEVEN KALA IDENTIFIED BY SUSRUT ARE:**

1. *Mamsadhara Kala*: This *Kala* contains a network of veins, fibrous tissue, and arteries. It has been compared to the anatomical picture of a lotus stalk present in muddy water.
2. *Raktadhara Kala*: This *Kala* can be compared to the endothelial lining of arteries, veins, and lymphatics. The *Rakta Dhara Kala* allows blood to flow in blood vessels, and all the blood manufacturing and hemopoietic organs like the liver and spleen are the seat of this *Kala*.
3. *Medodhara Kala*: This *Kala* supports the *Meda* or fat. Fat is found in the abdomen or peritoneal sac, and Sushrut has identified two types of *Meda*: *Sarakta Meda* (red bone marrow) found in short bones, and *Peeta Meda* (yellow marrow) found in long bones.
4. *Shleshmadhara Kala*: This *Kala* is present in the synovial membrane and practically all joints. It has been compared to the lubricant in a wheel axis that permits the wheel to move freely. Similarly, *Shleshma* with the *Shleshmadhara Kala* allows all bony joints to move freely on their respective axes. This synovial membrane is lubricated with synovial fluid.
5. *Purishadhara Kala*: The big intestine, rectum, and abdominal cavity all contain this *Kala*, which is used to support faeces. This membrane separates *Kitta* and *Sara Bhag* right from the *Unduk* (caecum) and extends from the liver to the whole large intestine.
6. *Pittadhara Kala*: This *Kala* holds all four types of food intake - *Asit, Khadit* (swallowed), *Peeta* (druk-liquid), and *Leedh* (licked) - that enter the intestine. These are digested and absorbed in due course of time by the action of pitta or digestive enzymes. The *Pittadhara Kala* is located in the *Laghu Antra* (small intestine), which Sushrut has also described as "Grahami."
7. *Shurkadhara Kala*: The last and seventh *Kala* identified by Sushrut is *Shurkadhara Kala*, which is functional all over the body in all living beings. *Shukra* is used for estrogenic and androgenic hormones that circulate in the entire body. They have been compared to sugarcane juice or *Ghee* present in milk. As these items cannot be independently identified in milk, similarly *Shukra* in the form of hormones cannot be isolated from the body, but its action can be observed.

**DISCUSSION:**

The following anatomical structures can be associated with the Seven *Kala*:

The first *Kala*, *Mamsadhara Kala*, is believed to be related to deep fascia and intermuscular septa. This makes sense, as these tissues are responsible for providing support and protection to the muscles and organs in the body. Next, *Raktadhara Kala*, which is said to be connected to the endothelial lining of the blood vessels and sinuses in the liver and spleen. This *Kala* is associated with the regulation and circulation of blood in the body. The third *Kala*, *Medodhara Kala*, is thought to be related to the omentum and deep fascia. These tissues play an important role in storing fat and providing insulation to the body. Moving on to the fourth *Kala*, *Shleshmadhara Kala*, this is said to be associated with
the synovial membrane. This membrane lines the joints and helps to reduce friction and wear and tear. The fifth Kala, Purishdhara Kala, is believed to be connected to the mucous membrane of the colon and rectum. This membrane helps to absorb water and nutrients from the waste material in the body. The sixth Kala, Pittadhara Kala, is associated with the mucous membrane of the small intestine. This membrane is responsible for absorbing nutrients from food and passing them into the bloodstream. Finally, Shukradhara Kala, which is believed to be related to the mucous membrane of the vasculature seminalis, vas deferentia, and other reproductive organs. This Kala is associated with fertility and sexual energy.

Overall, the Seven Kala provide a fascinating insight into the interplay between energy centres in the body and the structures that support and regulate them. While these beliefs may not be scientifically proven, they provide a valuable perspective on the human body and its functions.

CONCLUSION:
In conclusion, the concept of Kala in Ayurveda is an important and unique concept that is described in various classical texts. Understanding the anatomical and physiological relevance of Kala can help in the better understanding of the functioning of the human body and the development of new therapies. Further research in this area could lead to new insights into the functioning of the human body and the development of new therapies.

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