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PHYSIOLOGICAL IMPORTANCE OF SAPTADHARA KALA

Vidhya Prabhakaran[1*], Vaidehi V Raole[2], Sunil P Nikhate[3]

[1]PG scholar, Dept. of KriyaShareer, PIA, Parul University, Vadodara, Gujarat, India
[2]Professor & Guide, Dept. of KriyaShareer, PIA, Parul University, Vadodara, Gujarat, India
[3]Reader, HOD, Dept. of KriyaShareer, PIA, Parul University, Vadodara, Gujarat, India

Email: vidhya.prabhakaran002@gmail.com

ABSTRACT

Kala is one of the important topics described mainly in Sushrutha Samhita. There are many basic principles of *Ayurveda* like *Tridosha*, *Panchamahabhuta*, *Dravyaguna* etc, used by the *Ayurvedic* physician for maintenance and management of diseases but till date there is no such any clinical significance of *Kalasharir* is established. *Kala* means layers or membrane of body. They provide support and protection to the organs. The word *Kala* stands for property or a quality. *Kala* is explained as an interface between *dhatu* and *ashaya* that provides a barrier between the two. A few attempts have been made by the modern *ayurvedic* researchers and experts to equate *kala* with any structure, especially *pittadharakala* and *purishadharakala*. However, some of them have considered only one feature of *pittadharakala* and that is of digestion; *Kala* is one such subject, which is too concise to decipher and then apply its knowledge in clinical fields. Very few articles are available in this regards. Some modern *ayurvedic* scholars have given their opinion about these *kalas*. For example duodenum, pyloric orifice, small intestine or its mucosa, stomach and duodenum with their inner linings, etc. have been put forth as an equivalent of *Pittadharakala*... If the *Kala* performs its normal functions then it will holds body physiology but any abnormality occur it will lead to some disease. So an attempt has been made here to understand *kala* with application of modern anatomy and physiology.

Keywords: Absorption, Digestion Epithelial tissue *Kala*, Membrane

INTRODUCTION

Kala is the fine structure that separates the *Dhatu* from their *Ashaya* (Receptacles). (Su.su.4/5)[1]

Like the *Sara* of wood is visible on its cross section, similarly *Kala* is visible on dissection of *Dhatu*, *Mamsa* etc., covering of *Snayu*, proper encasing by *Jarayu* and coverings by *Shleshma* are *kala*. Kala is *Aantarmaryada* (boundary) between *dhatu* and *Ashaya*. *Kala* provides an interface between *Dhatu* and *Ashaya* and also supports the relevant *Dhatu*.

AIM

To Study the physiological importance of *Kalashareer*

OBJECTIVES

To find out the importance of *Kala* with conceptual materials from *Ayurveda.*

MATERIALS AND METHODS

The materials were collected from the *Ayurvedic* literatures and research journals.

KALA

According to Sushruta *Kala* is the structure which separates *Dhatu* from *Ashaya*. (Su.sha.4)[2]

According to Sharangadhara, the *Kleda* or moisture or liquid portion present in between *Dhatu* and *Ashaya* is processed by the heat of the body and converts it in to *Kala* (Sha.pra.5)[3]

According to Vagbhata the moisture that remains inside the spaces in the *Dhatu* (tissues) get cooked by the heat present in them, forms in to structures similar to those found in the wood and became covered with *Snayu*, *Sleshma*, and *Jarayu* is called *kala* because it is formed from very little quantity of rasa, and essence of *Dhatu*.(ash.sang.sha.5/19)[4]

Mamsadarakala

It is stated to separate and support the *MamsaDhatu* in which latter are to be found in *Sira,Dhamani, Snayu* and *Srotas.*

The *Kala* is explained with a simile. The stalk of the lotus flower sinks deep in to the mud and it branches to spread all around in the surrounding area. In the same pattern the *Sira*, *Dhamani*, *Snayu* and *Srotas* by taking support of the *Kala* and nourish the *Mamsa*. It form the protective shield covering. (Su.sha.4/8) [5]

***Mamsadarakala* is explained as first *kala* ?**

Chronological order of *Dhatu* formation is *Rasa, Rakta, Mamsa* etc. and the narration of *Dhatu* in specific order is for nourishment not for holding or supporting. (Dalhana)

Physiological importance -

Mamsa is a main media to receive nutrients from the artery system of blood and remove the metabolic waste products through venous system which is main characteristic feature for living being.[6] So, according to modern point of view we can consider *Mamsadarakala* as epithelial tissue and it lined the cavity of tissue, internal organs. The major function of epithelial tissue includes protection, secretion, absorption and filtration. Epithelial tissue in the intestine absorbs nutrients during digestion. Epithelial tissue in gland secretes hormones, enzymes and other substance. Epithelial tissues in the kidneys excrete wastes and in the sweat gland excrete perspiration.

Three layers of connective tissue which extended from deep fascia protect and give strength to the skeletal muscle. They are Epimyseum, Perimysium, and Endomysium, they may extend beyond the muscle fiber to form tendons i.e. deep fascia in the histological level it can be taken as endomysium.[7]

Endomysium is the deepest and smallest component of muscle connective tissue. This thin layer helps provide an appropriate chemical environment for the exchange of calcium, sodium, potassium which is essential for the excitation and subsequent contraction of a muscle fiber.

The endomysium contain capillaries bring body nutrients and oxygen to the fiber and the endomysium also contain nerve cells.

Raktadharakala

Raktadharakala supports *Rakta* in the vessels present in *Mamsa* and in special, the *Siras* of such organs as the *Yakrit* and *Pleeha*. Simile of lactiferous tree is given which oozes latex on making acts on the tree trunk.(su.sha.4/10) [8]

Clinical correlation of *Yakrit* and *Raktadharakala*

Yakrit is formed by *Raktadhatu* at the time of foetal development. *Raktadharakala* mainly holds *Dharana* of *Raktadhatu*. At the incidence of any injury bleeding is seen normally which later stops naturally. This process is called coagulation. This coagulation depends on various factors called as coagulation factors. Most of the coagulation factors are related to liver. Hence any liver disease may hamper this coagulation process. According to *Ayurveda Yakrit Vikara* will land up in to *Raktadhatu Dushti* and *Raktakala Dushti*. This proves relation between *Yakrit* and *Raktadharakala*.[9]

In modern we can correlate *Raktadharakala* in to endothelial lining in the blood vessels and sinusoids of liver and spleen and the entire haemopoetic system[10]

Physiologically endothelium helps blood flow properly by producing that prevent blood from

clotting and platelets from clumping together. It mainly involving cardio vascular regulation. Macromolecular transport regulation and for immune response and for Angiogenesis (creation of new blood vessels) ,Lymphangiogenesis (creation of new lymphatic vessels) and for blood pressure regulation.

Medodarakala

While describing this *Kala* Sushruta has made an interesting and far reaching suggestion that the *Medas* that fills up the shaft of long bones is known as *Majja* and that which is present in the *Anuasthi* (Small bones) is to be treated as *Sarakta Meda* ie. blood cum fat .Commentator Indu defines the third *Kala*as that which is *Sarakta*and occurs in abdomen and small bones getting located there the *Meda* attains the form of *Masthulunga* or *Majja*. (Su.sha.4/22) [11]

In modern, functionally the adipose tissue and fatty layers of the abdomen should be considered as *Medodarakala*.

Adipose tissue is type of connective tissue that is composed of mainly of adipocytes. It provides structural support protective pad of major organs. It serves as an insulating layer that prevents cutaneous heat loss and it stores energy for longer periods of fasting.

Shleshmadharakala

Membrane which hold mucus or secrete mucus. It is present in all bony joints. Simile as properly lubricated parts of frictional area of a wheel helps for good smooth and quality movement the *Shleshma* present in the *Santhi* or joints facilitates for their proper and smooth motion and functioning. *Shleshmadharakala* provides lubrication for the bony joints and enable them to overcome the shock and repeated movement. (Su.sha.4/14-15) [12]

According to modern view

Functionally this *Kala* can be compared to the synovial membranes covering the inner surface of the joints. The synovial fluid secreted by this membrane can be considered as *Shleshma*. Physiological importance is to absorb shock and reduce friction during movement.

Purishdharakala

The 5thkala is called *Purishdharakala* (the membrane or layers which hold or form stools or feces) . It is in the *Pakwashaya* inside the abdomen. This *Kala* particularly at the level of *Yakrit* and with in *Koshta*, differentiate the mala situated at the site of *Unduka*. The *Purishadharakala* separates the water and nutrients from the digested food and forms the stool or feces. This *Kala* is also called by the name '*Maladharakala'*. (Su.sha.4/16-17) [13]

The *Purishdhara Kala* is satiated in the in large intestine (*Pakwashaya*,) which starts from the *Unduk*, i.e, cecum. In gastrointestinal smooth muscle fibers, the channels responsible for the action potentials allow especially large numbers of calcium ions to enter along with smaller numbers of sodium ions and therefore are called calcium-sodium channels**.** Calcium is a *Parthiv* (earth) *Dravya*. It can be considered as one among the *Asthi Dhatu*. As we have seen there are calcium- sodium ion channels, necessary for the motor functioning of the intestine, these channels does *Dharan* of *Asthi Dhatu* for appropriate time so this layer can be correlated to the *Asthidhara Kala* of the *Pakwashaya*[14]. The fate of vitamin D in the human upper Gastro intestinal lumen during digestion and focuses on the proteins involved in the intestinal membrane and cellular transport of VitaminD across the enterocyte[15]. The concept of vitamin D absorption proves the *Purishadarakala* also can called as *Asthidharakala*.[16]

Pittadhara kala

It is stated to cover that part of the *Koshta* described as the *Grahani*. Its main function is seen to be provide *Pachaka Pitta* which is necessary for the digestion of the food brought to this part of the *Koshta* from the *Adhoamashaya*, on its way to the *Pakwashaya*, the retention of food. In this part for the duration of its digestion and the separation of *Sara* fraction from the *Kitta*. *Grahani* has been identified as the small intestine specially duodenal gland. (Su.sha.4/18) [17]

According to modern much of the food digestion take place the duodenum, digestive enzyme from pancreas

breakdown fats, protein and carbohydrates. This bile helps in the digestion and absorption of fats.

Shukradhara kala

Which support the *Shukradhatu* and present all over the body is stated to be conducted through channel the *Shukravahasrotas* located about 2*Angula* on either side and below the *Mutravahasrotas* for being discharged during sexual act. The origin of *Shukravahasrotas* is stated to be *Vrushana* and *Shepha*. (Su.sha.3/20-22) [18]. According to Ayurved, *Shukradhara Kala* is *Sarvasharirvyapee* (spread in whole body). Because, at the time of fertilization zygote form with the union of male and female *beej* (gametes). In zygote each and every part of the body (*Anga-Pratyanga*) and *Bhav* is present in unmanifest form. When each *Bhav* is present in male and female *beej* then they should be manifest in the zygote. It is possible only when both the *beej* contain all necessary factors or parts of the body in the subtle form. So, we can say that *Shukra* and *ShukradharaKala* is *Sarvasharirvyapee*. In modern science structurally *Shukradhara Kala* can be correlated with seminiferous epithelium lined in seminiferous tubules [19].

DISCUSSION

The outlook of the *Kala* in general the same as those of epithelial tissue. *Raktadharakala* when studied together with the description of the endothelial lining of blood vessel which mainly involving cardiovascular regulation. Medodharakala with the description of adipose tissue understanding that the vast concept behind the *Medodhatu* and it serve as an insulating layer that prevents cutaneous heat loss. *Shleshmadharakala* which hold mucus and facilitate the proper and smooth functioning of joints. *Purishadharakala* or *Maladharakala* with the description of simple columnar epithelium separates the water and other nutrients from the digested food and forms the food. Intestinal absorption of vitamin D from the meal to the enterocytes giving concept of *Purishadharakala* as *Asthidharakala* mentioned by *Accharya*. *Pittadharakala* giving the idea of digestion take place in duodenum and the separation of *Sara* fraction from the *Kitta*. *Shukradhrakala* is the kala which supports the *Shukradhatu* and it is present all over the body.

General description of *kala* is given in only two verses. In fact, only definition is given in one line of the verse and the remaining part is devoted to similes given for the explanation of *kala*. So the term *kala* is discussed at great length with the help of similes, embryogenesis given by commentator Indu on *Ashtangasamgraha* (A.S. Sha. 5/30) and description of *kala* in different ancient texts. A logical conclusion is drawn with all these discussions and then that conclusion is tested whether it can be applicable to all the seven *kalas*.

CONCLUSION

Kalasharira (anatomy & physiology of *kala*) gives us information about the important membrane and layers of the body which support the body elements. According to *Ayurveda* diseases are forming when the tissues are vitiated by the *Doshas*. So understanding the relation of *Dhatu* with their *Kala* is very important to know the pathological condition of *Doshas*. This *Kala* give the early signals of upcoming disease in individual.

Thus a precious knowledge of *Kala* is important for the physician to make a diagnosis at the right time and for giving *Chikitsa* on that condition to maintain health.

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