PHYSIOLOGICAL IMPORTANCE OF SAPTADHARA KALA

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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 kala. 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 Aantiarmyada (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
cloth 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 Kalas that which is Saraktaand 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 insulting layer that prevents cutaneous heat loss and it stores energy for longer periods of fasting.

**Shleshadharakala**

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 Shlesha present in the Santhi or joints facilitates for their proper and smooth motion and functioning. Shleshadharakala 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 Shlesha. Physiological importance is to absorb shock and reduce friction during movement.

**Purishdharakala**

The 5th kala 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 Koshtha, 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 Purishdharaka 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 Sheph. (Su.sha.3/20-22) According to Ayurved, Shukradhara Kala is Sarvashariryapaee (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 Sarvashariryapaee. In modern science structurally Shukradhara Kala can be correlated with seminiferous epithelium lined in seminiferous tubules.

**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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