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# ROLE OF PURISHADHARA KALA CALCIUM & BILIRUBIN METABOLISM

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## ABSTRACT

In Ayurveda, (*Kala)* has been defined as the internal limiting layer in the (*DhatwAshayas*.) It can be considered as a membrane or a layer which separates two entities in the body. Seven *Kalas* are mentioned in this science, of which( *Purishadhara Kala* )is the fifth one. It is situated around spleen liver and large intestine(*Yakrut, Aantra, Unduka* and *PakwAshaya*. )It is also called as the (*Maladhara Kala*) *Acharya Dalhana* has stated that, the ( *Purishdhara Kala* is *Asthidhara) Kala.*

As per modern science, the smooth muscle layer of the intestine, contain calcium- sodium ion channels in large number. These channels function mainly as the initiators of smooth muscle contractions in the intestine. This layer can be considered as one of the internal layer of (*Purishadhara Kala).* The extra cellular fluid is the source of calcium for these ion channels.

*Acharya Sushruta* has explained the seven stages of poison ( i.e *Visha Vegas*.) and this poison takes the (*Ashraya* in these *Kalas* )for exhibiting the symptoms of poisoning.

By this we can correlate( *Purishadhara Kala* to *Asthidhara Kala*, )and also the role of calcium ion channels in the pakwashaya . It explains the( *Ashraya-Ashrayee Sambandha* of *Vata Dosha* )and (*Asthi Dhatu* )in the intestine *(PakwAshaya).*

***Key words*:** *Asthidhara Kala*, Ca-Na ion channels of intestine, *PakwAshaya, Purishadhara Kala, Vish- Vega*

## INTRODUCTION

*Acharya Sushruta* has described (*Sapta Kala* in *Sharir Sthana*[(2)],) an evidence of study of microscopic level. There are seven *Kala*, situated between (*Dhatus* and *Ashaya.)* They define the limits between particular system and their limiting memberene with other systems ( *Dhatu* and *Ashaya*.) They are extensively constituted with (*Snayu*, ) impregnated in( *Jarayu* )and encased in( *Shleshma. )* Study of *Kala* is important in study of human physiology along with the anatomy. Anatomically it separates diferent systems ( *Dhatu* and *Ashaya*,) where as physiologically it does the( *Dharan* )of its respective (*Dhatu*.) When either of the two functions is disturbed, pathology occurs and, so for the treatment purpose, study of *Kala* is important.

The function of large intestin is mainly the formation, holding and proper excreion of stool (*Purishdhara Kala* is *Dharan* of *Purish)* for appropriate time. In the intestine the smooth muscle layer consist of Ca- Na ion channels, for gastrointestinal movements. (*Dharan* of *Puris)*for appropriate time in the intestine depends upon its motor function. Also the Myenteric or Auerbach‘s plexus (nervous control) situated between the longitudinal and circular muscle layer is responsible for the GI movements.

This context involves the study of fifth *Kala*, the (*Purishdhara Kala*,) as mentioned by *Acharya Sushruta*.

Correlation of the interpretation- (*–Kala Purishadhara Saa Eva Asthidhara*‖)by *Acharya Dalhana*, to modern concept of calcium- sodium ion channels in the intestinal layer. Also the *Ashraya- (Ashrayee Sambandha* of *Asthi Dhatu)* with (*Vata Dosha* in the *PakwAshaya )* with respect to modern science has been studied in detail.

## AIMS AND OBJECTIVES

*1)* To study *Kala,*

2) To correlate *Asthidhara Kala* with Ca-Na ion channel containing layer of the intestine.

3) To study the ( *Ashraya- Ashrayee Sambandh* of *Asthi Dhatu* and *Vata Dosha,* )w.s.r to these channels**.**

## MATERIALS AND METHODS

1) Literatures of Ayurveda, *bhrutrayee* and *laghutryee*.

2) Modern texts of physiology

3) Research papers and articles from Journals.

## REVIEW OF LITERATURE

***Kala***

*Kala* is the limiting membrane between different systems (*Dhatu* and *Ashaya.* ) Or it can be understood as limiting membrane between two entities of the body[3].

While describing *Kala*, it is said that as the duramen of cores of a piece of wood or stem becomes exposed to view by cutting into it, so the *Dhatus* of the body may be seen by removing the successive layers. These *Kalas* are extensively supplied with *Snayus* bathed in *Jarayu* and encased in *Shleshma*[4]. In that sutra, the words ( *Pratichhanna, Santata, Vestita)* have been used. Though they are different from each other, they indicate the same meaning i.e. *Nirmiti* (production). (*Snayu, Jarayu* and *Shleshma)* are the three basic principles in the formation of *Kala*.

But at a time all of them are not necessarily required for the formation of *Kala. Kala* may be formed from emboynic mesoderm ,ecctoderm,endoderm ( *Snayu, Jaraya* and *Shleshma* )individually or sometimes it may be formed by their combinations. Hence these three are called root cause in the formation of *Kala*. These three structures i.e. *Snayu, Jarayu* and *Shleshma* can be compared with fibre, serous layer and mucous respectively. From above discussion, the nature of *Kala* becomes clear[5].

*Acharya Vagbhata* has described the formation of *Kala*. He said, *Kala* is formed by the action of respective *Agni* on particuler embroyonic layer ( *Kleda* of *Dhatwashaya*[6].) Functions of *Kala*- Anatomically it separates different systems (*Dhatu* and *Ashaya- "Dhatwashayantarmaryada)"*. Physiologically it does funtions of the paricuar systems (*Dharan* of that *Dhatu* )for appropriate time- (*–Dhara*‖**)**

***Purishdhara Kala* and *Asthidhara Kala*.**

*(Purishdhara Kala*_is the fifth *Kala* described by *Acharyas* in Ayurved. *Acharya Sushruta* said that, (*Malavibhajan* ) seperations of nutrients and formation of mala occurs within the gastro intestinal system ( *Kostha)* which contains large intestine (*Pakwashaya.)* This *Kala* is present in the *Aantra* which is near and around the liver (*Yakrut* ) and in the *Kostha*. *Unduk)* is that place or the organ where *Malavibhajan* begins As defined earlier, function of *Kala* is to separate ( *Dhatu* and *Ashaya,*) in *Pakwashaya* )separation of stool and urine also take place because large intesine absorbs water (*Dhatus (Purish* and *Mootra)* from its

*Ashaya (Pakwashaya)* occur because of this (*Maladhara Kala.)* From above statements of *Sushruta*, it can be understood as (*Maladhara)* or the (*Purishdhara Kala)* is situated in large intestine (*Pakwashaya)*, which begins from ( *Unduk* in the *Koshta.)*

*(Asthidhara Kala)* is not included under the (*Sapta Kala)* of the *Acharyas*, but *Acharya Dalhana* had considered this *Asthidhara‖ Kala* to be same as *Purishdhara Kala*.

Here a question arises, that why (*Dalhana* has considered ( *Purishdhara Kala* as *Asthidhara Kala)*? Why he has not considered *Asthidhara Kala* as a separate *Kala* from (*Purishdhara Kala)*? An attempt is made to try to solve these questions as,

- *(Asthi Dhatu)* is the fifth amongst seven *Dhatus*. As per *Acharya Sushruta, Visha Vega* are seven because, they take the *Ashraya* of these seven *Kala* for appropriate period and exhibits the symptoms accordingly[8]
- In the fifth *Vish Vega*, there is (*Parwabheda*,) so when the poison is in its fifth stage, i.e., when it is in the( *Purishdhara Kala* ) it exhibits symptoms related with (*Asthi Dhatu*.)
- In Ayurveda, *Basti* is given via rectal route, so this way *Basti* nourishes the (*Asthivaha Strotas* ) and thereby treats (*Vataj Vikaras* including *Asthi Dhatu Kshaya*.)
- In Ayurved, *Acharyas Kashyap* has explained about the disease ‗(*Fakka')* in children. In this disease the child is unable to stand even after completing a year. (*Karshya* ) is the main symptom seen in this disease.
- In modern science Rickets is the disease where there is decreased absorption of calcium and phosphorus from the intestine, leading to bending and softening of the long bones.
- Large intestine contains large number of Ca-Na ion channels, which take up calcium from the extra cellular fluid.

From above all discussions, the term (*Asthidhara Kala)* appropriately suits to (*Purishdhara) Kala.*

**Calcium- Sodium ion channels of the large intestine**

According to modern view, if we see the nature of *Maha Srotas* i.e. gastrointestinal tract, it is found to be made up of four layers -Mucous layer, Sub mucous layer, Muscular layer and Serous or fibrous layer.

The nature of (*Maha Srota)s* i.e. Gastro.Intestinal. tract according to modern view and the nature of *Purishdhara Kala* described by *Sushruta* both are similar, Hence (*Purishdhara) Kala* can be attributed with gastro-intestinal tract.

Smooth muscles in the GI are situated in the muscular layer (longitudinal and circular muscle layer) and also few in the deeper layer of the mucosa. The contractile process in smooth muscle is activated by calcium ion.

- Regulation of Contraction by Calcium Ions

Combination of Calcium Ions with Calmodulin—Activation of Myosin Kinase and Phosphorylation of the Myosin Head. Calmodulin does this by activating the myosin cross-bridges.

- **Importance of Calcium channels** in generating the smooth muscle action potential[11]

The smooth muscle cell membrane has far more voltage-gated calcium channels than does skeletal muscle but few voltage-

gated sodium channels.Therefore, sodium participates little in the generation of the action potential in most smooth muscle. Instead, flow of calcium ions to the interior of the fiber is mainly responsible for the action potential. Calcium Pump is required to cause smooth muscle relaxation.

- **Source of Calcium Ions** that cause contraction
  (1) through the Cell Membrane and
  (2) the Sarcoplasmic Reticulum
  (3) the extracellular fluid

  Almost all the calcium ions that cause contraction enter the smooth muscle cell from **the extracellular fluid** at the time of the action potential or other stimulus.

**Corelation of *Purishdhara Kala* with calcium- sodium ion channels containing layer of the intestine**

The *Purishdhara Kala* is sitiated in the in large intistine(*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**.

These channels are much slower to open and close than are the rapid sodium channels of large nerve fibers. The movement of large amounts of calcium ions to the interior of the muscle fiber during the action potential plays a special role in causing the intestinal muscle fibers to contract.

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*.

**Correlation of functions of *Kala* with modern science**

1. It separates the two *Dhatus (Purish* and *Mootra),* from the *Ashaya (Pakwashaya)*

Absorption in the colon- Most of the water and electrolytes in this chyme are absorbed in the colon, Most of the absorption in the large intestine occurs in the proximal one half of the colon, giving this portion the name absorbing colon

Bilirubin metabolism[12]- Conjugated bilirubin is metabolised by colonic bacteria to form stercobilinogen, which may be further oxidised to stercobilin. Both stercobilinogen and stercobilin are then excreted in the stool.

A small amount of **stercobilinogen** (4mg/day) is absorbed from bowel, passes through liver and is excreted in the urine, where it is known as **urobilinogen** or following further oxidation, urobilin

2. *Purish Dharan* for appropriate time and then is expelled out of the *Pakwashaya.*

The principal functions of the colon are- absorption of water and electrolytes from the chyme to form solid feces and, storage of fecal matter until it can be expelled. The distal colon functions principally for storage of feces until a propitious time for feces excretion and is therefore called the storage colon[11].

***(Ashraya-Ashrayee Sambandha* of *Asthi Dhatu* and *Vata Dosha* )with respect to calcium- sodium ion channels of the intestine.**

*Acharya Vagbhata* has explained the (*Ashraya- Ashrayee Sambandh)* of (*Dhatu* and *Dosha),* in which he say that, *Vata Dosha* situated in( *Asthi Dhatu*, *Pitta* in *Sweda)* and *Rakta,* and *Kapha* in rest of

the( *Dhatus)* with *(Mala and Mootra*. )Inter relationship of (*Dhatu* and *Doshas* ) – When there is an increase in (*Doshas*,) changes leads to increase in *Dhatus*, but about *Asthi* and *Vayu*, there is an inverse relation between them. Because ( *Dosha* and *Dhatu)s* are increased by *Tarpana*. Although *Tarpan* have property of *Kapha Vardhan* but it act as (*Vata Nashak*. Thus vice versa; *Langhana)* does *Kapha Kshaya* but instantly increases *Vata*.

**Hypercalcemia Depresses Nervous System and Muscle Activity-** When the level of calcium in the body fluids rises above normal, the nervous system becomes depressed and reflex activities of the central nervous system are sluggish. Also, increased calcium ion concentration decreases the QT interval of the heart and causes lack of appetite and constipation, probably because of depressed contractility of the_muscle walls of the gastrointestinal tract. These depressive effects begin to appear when the blood level of calcium rises above about 12 mg/dl, and they can become marked as the calcium level rises above 15 mg/dl[(11)].

Thus, it is seen that what our *Acharyas* have said is correct. The depressed contractility of the muscle walls of the gastrointestinal tract can be considered as *Vata Kshaya*, where as the increased calcium level can be considered as increased *Asthi Dhatu.* Thus (*Ashraya-Ashrayee Sambandha* of *Asthi Dhatu* and *Vata Dosha)* is correct, with respect to modern science.

## OBSERVATIONS AND DISCUSSIONS

- *Kala* is the limiting membrane between (*Dhatu* and *Ashaya. Snayu, Jarayu* and *Shleshma )* are the three basic principles in the formation of *Kala*.
- *Maladhara* or the *Purishdhara Kala* is situated in the *Pakwashaya*, which begins from *Unduk* in *the Kostha*. It does the function of *Mala Vibhajan*,
- Function of the *Purishdhara Kala* can be compared with-
  - i) Absorptive function of the colon
  - ii) Bilirubin metabolism.
- The calcium- sodium ion channels, necessary for the motor functioning of the intestine, present in the intestinal layer can be correlated to the *Asthidhara Kala* of the *Pakwashaya*.
- *Ashraya-Ashrayee Sambandha* of *Asthi Dhatu* and *Vata Dosha* in the *Pakwashaya* can be correlated with respect to calcium- sodium ion channels of the intestine as, Hypercalcemia Depresses Nervous System and Muscle Activity.

## CONCLUSION

- In the fifth (*Vish Vega*,) the poison in the body exhibits ( *Parwabheda*,) which is the symptom related to *Asthi Dhatu*.
- Calcium- sodium ion channels which are necessary for the motor functioning of the intestine, does *Dharan* of *Asthi Dhatu* for appropriate time**.**
- Functions of (*Maladhara Kala* can be compared with- Absorptive function of the colon and Bilirubin metabolism.
- *(Ashraya-Ashrayee Sambandha* of *Asthi Dhatu)* and (*Vata Dosha in the Pakwashaya)* is equivalent to hypercalcemia depressing the nervous system and muscle activity.
- *(Asthidhara Kala*,) is equivalent to the calcium- sodium ion channels containing layer of the colon

## REFERENCES


1. Sushruta, Sushruta Samhita, Commentary by Dalahana, Chaukhamba Prakashan, Varanasi, revised edition 2012, p.540, Kalpasthana 4, shloka 40.
2. Sushruta, Sushruta Samhita, Ambikadutta Shastri, Chaukhamba Prakashan, Varanasi, revised edition, 2012, p. 38. Sharirasthana 4, shloka 6,7.
3. Sushruta,SushrutaSamhita,Dr.Anantram Sharma, Chaukhamba Publication, Varanasi, revised edition, 2009, p. 48. Sharirasthana 4, shloka 5.
4. Sushruta,SushrutaSamhita,Dr.Anantram Sharma,Chaukhamba Publication, Varanasi, revised edition, 2009, p. 48. Sharirasthana 4, shloka 6.
5. Nilkanth G. Thakare, Mukund P. Erande, Structural and descriptive study of Pittadhara Kala Ayurlog: National Journal of Research in Ayurved Science-2013; 1(3): 1-9, http://www.ayurlog.com
6. Vagbhata, AstangaHrudaya, Dr Ganesh Garde, Anmol Prakashan, Pune, revised edition, 2008, p.133. Sharirasthana 3, shloka 9.
7. Sushruta, Sushruta Samhita, Dr.AnantramSharma, Chaukhamba Publication, Varanasi, revised edition, 2009, p.50. Sharirasthana 4, shloka 16,17.
8. Sushruta, Sushruta Samhita, Dr.AnantramSharma, Chaukhamba Prakashan, Varanasi, revised edition, 2009, p. 546, Kalpasthana 4, shloka 45.
9. Sushruta,SushrutaSamhita,Dr.Anantram Sharma, Chaukhamba Prakashan, Varanasi, revised edition, 2009, p. 545, Kalpasthana 4, shloka 44.
10. Vagbhata, Astanga Hrudaya, Dr Ganesh Garde, , Anmol Prakashan, Pune, revised edition 2008, p. 53. Sutra sthana 11, shloka 26.
11. Guyton And Hall, Textbook of Medical Physiology, Elsevier Limited, 11th edition 2006, Gastrointestinal Physiology p.772, 95, 97, 817, 980.
12. Davidson's Principles and Practice of Medicine, Elsevier Limited, 19th edition, 2004, Liver and biliary tract diseases, p. 843.



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