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Conceptual Study of Pittadhara Kala in Correlation with Cell Membrane

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Abstract: ***Pittadhara Kala is 6th Kala among seven Kalas in Human body[1]. It is a pathway or channel of food. It is responsible for duration of life, health, valour, ojas, strength of Bhutagni and dhatwagni[2].All these things will be achieved in human body only when function of Agni is normal. Agni is associated with Pittadhara Kala. It is observed that the same functions are carried out by cell membrane also. Here in this article, it is tried to establish Anatomical, Physiological and Pathological correlation between Pittadhara Kala and cell membrane.***

Keywords: Kala, Ashaya, Amashaya, Pakwashaya, Pittadhara Kala

1. Introduction

There are many concepts in Ayurved, which are not explained in detail. Concept of *kala* is one of them. *Kala* are defined as a structure between *Dhatu* and *ashaya*[3]. These *Kala*s are not only mere anatomical structures but also they perform some specific functions and possess specific properties.

Kala are described by Acharya *sushrut* in *Sharirsthan*. Kalas are 7 in number. *Pittadhara Kala* is 6th out of these seven. There is *Ashraya* and *Ashrayee* relation between *Pittadhara kala* and *Agni*. If Physiology of *Pittadhara Kala* is maintained normal, then only function of *Agni* will be conducted properly. All the diseases are caused due to impaired functions of *Agni*[4].

Hence to maintain normal functions of *Pittadhara Kala*, it is essential to understand wide range of functions of *Pittadhara Kala* in the body.

Aims and Objectives

1) To reveal the intent of Acharya Sushrut behind the *pittadhara kala*.
2) To establish meaning of *Amashaya* and *Pakwashaya*.
3) To establish relation between *Pittadhara kala* and Cell Membrane.

2. Materials and Methods

Material from this article is collected from classic texts of Ayurved. Information is also collected from authentic research journals and websites.

3. Discussion

Ashaya

The word "*Ashaya*" is derived from *Dhatu "Shee"* with *"Ach" Pratyaya*[5]. Meaning of the word is Home.

Ashaya is the cavity in which *Dosh*, *Dhatu* and *malas* stay and move freely to perform their normal functions[6]. From this statement it can be said that –

1) *Ashaya* is an anatomical structure having definite outline.
2) A closed structure containing some functional elements like *Dosh*, *Dhatu* and *Mala* in it.

There are Similarities between *Ashaya* and a cell in human body. It is elaborated in following table.

Table 1

Ashaya	*Cell*
1) *Ashaya* is an anatomical structure bounded with definite outline.	1) Cell is an anatomical structure having definite boundary of cell membrane.
2) It is a closed structure containing some functional elements like *Dosh*, *Dhatu* and *Mala* in it.	2) Cell is a closed structure containing functional elements like Nucleus, golgi complex, lysosomes and other cell organelles.

Cell can be correlated with *Ashaya* and it can be considered as one of the *ashayas* in our body.

According to Acharya Sushrut, *Kala* is called as a separating structure between *Dhatu* and *Ashaya*[7]. There is extra cellular fluid which surrounds body cell. This fluid can be correlated with *Rasa Dhatu* in Ayurved.

Cell can be correlated with *Ashaya*; extra cellular fluid can be correlated with *Rasa Dhatu*. So the membranous structure separating these *Ashaya* and *dhatu* is cell membrane. It may be called as *Kala.*

Amashaya:-

The word *Amashaya* is derived from *Dhatu* "*Aa* + *Am*". Meaning of the *Dhatu* is Undigested, unriped Or Uncooked[8].

Amashaya means the place for undigested food. Commonly it is said that *Amashaya* is the place in the alimentary canal where ingested food comes first and then process of digestion starts. The meaning of the word *Amashaya* is generally considered restricted to the place in Alimentary canal. But the process of Digestion is conducted at cellular level also.

The nutrients in the extra cellular fluid are transported into intra cellular fluid through cell membrane. They are digested by the action of enzymes present in Lysosomes. Lysosomes

are the structures formed from Golgi complex. They contain 60 kinds of powerful digestive enzymes that can break down a wide variety of molecules of nutrients entered inside the intra cellular fluid[9].

Lysosomes contain many digestive and Hydrolytic enzymes, out of which certain enzymes break down large protein and lipid molecules of LDL into amino acids fatty acids and cholesterol[10]. Lysosomal enzymes are synthesized in Endoplasmic Reticulum and are transported to Golgi complex. Here Lysosomes are formed containing these digestive enzymes. Some lysosomal enzymes are as follows–

Table 2: Lysosomal Enzymes

Proteins digesting enzymes	1. Collagenase
	2. Cathepsins
	3. Other Proteases

Table 3: Lysosomal Enzymes

Carbohydrates digesting enzymes	1. β(Beta) Glucosidase
	2. Hexosaminidase
	3. ∝ (Alpha) Mannosidase
	4. ∝ (Alpha) Fucosidase
	5. Sialidase

Table 4: Lysosomal Enzymes

Lipids digesting Enzymes	1. Sphingomyelinase
	2. Esterases

Pakwashaya

The word *Pakwa* is derived from *Dhatu "Pach + Kta*", which means completely digested[11]. Meaning indicates that *Pakwashaya* is the place which holds the *pakwa* food i.e. the products formed after digestion (Post digestive products).

Here meaning of *pakwa* food is not taken as digested food; because from the digestive stuff that comes into *Pakwashaya*, the useful nutrients are already absorbed. Hence it can be stated that *Pakwashaya* is the place which holds *Pakwa mala* or processed and properly formed stools.

As stated above, the digestion of nutrients takes place in the cell due to lysosomal enzymes. During this process of digestion, some waste products are formed in the cell. They are transported out of the cell through cell membrane via[12] –

1) Passive transport system
2) Active transport system
3) Exocytosis

4. Result

From above discussion it can be stated that –

1) As the cell is bounded by a membrane; and it contains some functional elements, the cell cavity can be considered as "*Ashaya*".
2) As the process of Digestion takes place inside the cell cavity, the cavity can be considered as "*Amashaya*".
3) As the waste products formed in the cell during digestion are transported and collected into extra cellular fluid, the place outside the cell can be considered as *Pakwashaya*.
4) According to Acharya Vagbhat, *Pittadhara Kala* lies between *Amashaya* and *Pakwashaya*[13]. So the cell membrane - which lies between *Amashaya* (cell cavity) and *Pakwashaya* (extra cellular space) can be considered as *Pittadhara Kala*.

5. Conclusion

Function of *Pittadhara kala* in alimentary canal is related with digestion and transportation. The main responsible factor for these functions is *Agni*.

Functions conducted at the level of Alimentary canal around *Pittadhara kala*-

1) Digestion – It means transformation or conversion of food or nutrients into acceptable form for body or cell.
2) Transportation – Digestive enzymes are transported into the lumen of intestines for the digestion of food; and nutrients are transported (absorbed) out of the lumen of intestines.

These functions are commonly said to be conducted in alimentary canal and *Pittadhara Kala* plays an important role for the conduction of these functions. But it is observed that these functions are conducted at cellular level also.

Functions conducted at cellular level around cell membrane –

1) Digestion – The nutrients which are transported through cell membrane are further digested by Lysosomal enzymes.
2) Transportation – Nutrients from extra cellular fluid are transported into the cell and wastes from intra cellular fluid are transported outside the cell through cell membrane.

The same functions are carried out in the alimentary canal and the cell. So there is significant correlation seen between *Pittadhara Kala* and cell membrane. Hence *Pittadhara Kala* should not be considered restricted only in Alimentary canal.

Pittadhara Kala is a seat of *Agni* which digests food in *Annavaha Srotasa*. In the pathological conditions related with *Pittadhara Kala*, *Agni* becomes vitiated and digestion of food is not conducted properly. Due to improper secretion of digestive juices, "*Aam*" is created which is absorbed in the body through alimentary canal. *Aam* is partially digested or undigested food.

Aam can be produced during digestion process at cellular level also. It may happen due to disturbances in the formation of Lysosomal enzymes. This deformation of enzymes may be caused due to insufficient electrolytes and ions needed for formation of molecules of enzymes. Reasons for the insufficiency of electrolytes and ions are as follows –

1) Electrolyte imbalance in body fluids
2) Impaired transportation of ions through membranes.
3) Disturbed acid – base balance of body fluids. (Disturbed pH of body fluids)
4) Decreased permeability of cell membrane.
5) Disturbed Homeostasis.

Due to deformed Lysosomal enzymes, nutrients entered in the intra cellular fluid cannot be digested properly. They remain partially digested or undigested and can be called as

Aam. Thus *Aam* may be formed not only in Alimentary canal (*Annavaha Srotasa*), but also at cellular level due to disturbed *Agni*. Thus following similarities between *Pittadhara Kala* and Cell membrane can be noted.

Table 5

Pittadhara Kala	**Cell Membrane**
1. Lies between *Dhatu* (Tissue of intestines) and *Ashaya* (Lumen of intestine).	1. Lies between *Rasa dhatu* (Extra cellular fluid) and *Ashaya* (Lumen of Cell)
2. Lies between *Amashaya* and *Pakwashaya*	2. Lies between Intra cellular cavity (*Amashaya*) and Extra cellular space (*Pakwashaya*)
3. Holds ingested food for further digestion process.	3. Holds nutrients for further action of enzymes.
4. In area of *Pittadhara kala*, intestinal digestive enzymes are in action for digestion of food.	4. In area of cell membrane, Lysosomal enzymes are in action for digestion of nutrients.
5. Holds *Agni (Jatharagni*) which is basic element for digestion.	5. Holds *Agni (dhatwagni*) which is responsible for digestion at cellular level.
6. If physiology of *Pittadhara Kala* is disturbed, *Agni* is vitiated and *Aam* is formed.	6. If physiology of cell membrane is disturbed, transportation of materials through membrane becomes abnormal. This causes deformity in lysosomal enzymes and *Aam* is formed.

Hence it can be concluded that Pittadhara Kala can be considered widely as the Cell membrane all over the body.

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