ABSTRACT

Introduction

*Kala* is an anatomical structure described in classical ayurvedic text which is one of the most difficult topics to understand scientifically. Sushrut was the first to describe *Kala Sharira* under *Sushrut Sandhya Vyakaranayadhyay of Shushruta Samhita*. He has explained seven types of *Kalas* along with their short, but very significant definition. *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 regard. 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*. This has the potential to create confusion in the mind of young researchers and practitioners of *Ayurveda*. So an attempt has been made here to understand *kala* with application of modern anatomy and physiology. *Kala* is considered to be a barrier between *dhatu* and its *ashaya*. There are seven *kala*.

Aims and Objectives:

- To reveal the intent of *Sushruta* behind the derivation of *Kala Sharira*.
- To study seven *kalas* in detailed description from various *ayurvedic* text book

Materials and Methods:

Ayurvedic literature: Texts under *Vrahamayi&Laghutrati*.

Other allied literature like Vedas, Upanishads, Puranas, Periodicals & manuscripts available if any.

Discussion:
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.

**Conclusion:**
After thorough study of *kala* it is decided that it should be a tissue membrane as it separates each *dhatu* from its *ashaya*.

**KEYWORDS**
*Kala, Tissue membrane, Pittadhara kala*
INTRODUCTION

Sushruta was the first to describe kala. He has explained kala as a barrier or interface between dhatu and its ashaya by giving examples of pith of wood, snayu and jarayu (amniotic membrane). With very brief, but very important description of this basic criterion he gave one criterion for a separate for each dhatu. The nomenclature is different for each dhatu and not in the usual order of Dhatus. Vagbhata has then added the embryological development of kala. This is also very brief. So the questions arise as to why Sushruta has not given detailed description; or why Vagbhata, despite being able to explain the embryological origin of kala, did not add further to the existing knowledge of kala. Sushruta was a surgeon, so probably for him kala did not carry much importance in surgical anatomy. Probably he consistently observed kala during dissection or surgery and he noted down these observations. The subject of anatomy was still developing and that of kala was still unknown and he was inventing this subject. Probably Sushruta did not want to deviate from his focus of surgery and gross anatomy so he did not delve much in this subject.

ETYMOLOGY OF KALA

The word Kala has been used in various meanings in Sanskrit, Vedic and Ayurvedic literature e.g. art, skill, ingenuity, a small part of anything, division of time, interest on a capital etc. All these meanings of kala with their references (in Monniar Williams) are out of the scope of the present topic related to anatomy so they are not discussed here. Etymology of kala in relation to sharira is not available.

KALA IN SHUSHRUT SAMHITA

Like the saara (pith) of wood is visible on its cross section (or longitudinal section); similarly, kala is visible on dissection of dhatu, mamsa etc. Coverings of snayu, proper encasing (of the fetus) by jarayu and coverings by shleshma are kalas. Kala is antara maryada (boundary) between dhatu and ashaya; in other words, it provides an interface (barrier) between dhatu and ashaya. Its existence is inferred by its function; that is of supporting the relevant dhatu.
Dalhana’s commentary explains this in some detail. Rasa, rakta etc. hold (support) the body and hence they are called dhatus. Similarly, kapha, pitta and purisha also support body when they are in their normal status, so they are also called dhatus. The sites of their location are called ashayas. Boundary between these dhatus and their ashayas are called kalas. Since they are located within the body their existence is explained by simile. The kala with its location supports different dhatu so their existence is proven though it is invisible (in an intact body). For example, snayu etc. support (the body). Encasing by kala is similar to amnion covering the fetus.

First kala is mamsadhara. Branches of sira, snayu and dhamani spread in mamsa located in this kala like lotus stem branches spread in soil below the water. The chronological order of dhatu formation is rasa, rakta, mamsa, etc.; then why is mamsadhara described first followed by raktadhara? The narration of dhatu in specific order is for their nourishment, not for holding or supporting. (Dalhana).

Second kala is raktadhara. It is located inside mamsa. Blood in its blood vessels is formed in yakrit and pliha. Latex oozes on cutting a lactiferous tree; similarly, blood oozes from injured mamsa.

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Parmar et al.  
Int J Ayu Pharm Chem 2018 Vol. 8 Issue 3  
[e ISSN 2350-0204]
अयोध्य दश योगधारा कला वर्गीय शास्त्रीय साहित्यीय उपप्रकाश
शुद्धमांसगती योगधारा कला का नाम रखता है। यह साहि
साहित्यीय साहित्य विियत है। (श्रापुत्र 4/12-13)

Third kala is known as medodhara. Meda is found in every person’s abdomen and
small bones while in larger bones majja is formed in the central part. Meda in small
bones is called sarakta meda.

चतुर्थी भेदमात्र वर्गीय शास्त्रीय प्राँतांतिक भवति।
भेदमात्रकला यथा ह्यंक कथावर्तित। सबध्य: कथावर्तित सर्पविष्णु: भेदमात्रकला
व्यक्तिः। (श्रापुत्र 4/14-15)

Fourth kala known as shleshmadhara kala
is located in all joints of a person. Properly
lubricated wheel’s axis function properly;
similarly, with properly adhered shleshma
(kala)the joints work properly.

पंचमी पुरीयधारा नाम: यास्तःकोष्ठेष| मलमलितभिवसेजः पक्वाश्यवस्था।
यकृतसरमलात् कोष्ठेष च तथाक्षिकाणि
समाखिता।।
उष्ण(ज्वला)कसम्बं विभजते मल भलधरा
कला।। (श्रापुत्र 4/16-17)

पंचमीयादिय। अन्तःकोष्ठ इतिः अन्तःकोष्ठ 
चरके च पुरीयधारासेनेमुमुकः प्रतिपादितः।
अतः एव पुरीयधारा इतिः नामायाः।। मलं
विभजते मृत्युपुरीशुपथया विभागम् करोतिः।
गयी तु, विभजते तरःनात् कोष्ठेष पृथक्करोतितिः
व्याख्यायित।।(श्रापुत्र 4/16-17 पर दल्चण)

Fifth kala is located inside the koshtha and
is called purishadhara kala. It divides the
waste products in the GIT in urine and
excreta.

पर्वतीय पित्रधारा; यव चतुर्विधमलधारामहामस्थानीतः
प्रत्युत् पक्वाश्याप्रत्येकाः धार्यति। (श्रापुत्र 4/18)

पितामहकालांनिर्विवाहितकाल। आमाशयात्
प्रस्फुतं कपालमस्थान्त प्रश्चेपं, पक्वाश्यापरिष्ठतं
पक्वाश्यामांसापरिष्ठतं पितामहां संप्राप्तं,
धार्यति च घातायेः। तथा च संबंधः।“पर्वतीय
पित्रधारा नाम पक्वाश्यामस्थानी।
सा ज्वलनावद्विज्ञानतःस्मांमस्थानी
पक्वाश्यामुखमत्र वलेन विधायर
पितामहारसेजः शीघ्रत्ववायु पक्षति।” (असं. श्रापुत्र 5)
इतिः। (श्रापुत्र 4/18 पर दल्चण)

Sixth kala is pittadhara, which retains the
consumed food (of four types) for further
digestion, which oozes from amashaya and
is heading towards pakwashaya. Pitta is
antar agni. Amashaya is explained as
kapasha by Dalhana. Pittadharaka kala
is explained as the site of pitta and it holds
the food there by its strength (bala) for its
further digestion, and then desiccates it by
the action of teja of pitta.

स्तन्त्री मुक्तधारा, च सर्वप्राणिनां
सर्वशरीरवस्थितः।
यथा प्रयत्नं सर्वप्राणं गुरूद्वेशैः रसो यथा।।
शरीरेऽयथा तथा शुक्रं वृहं विस्तारं विश्लेष्यवर्तं।।
झुवंगुले दक्षिणेऽपस्म्य विस्त्तारं च बल्लाश्च चाप्तं।।
मुज्जोशतःपक्वाश्यां पूर्वक्षयं प्रवर्तितं।। (श्रापुत्र 4/21-22)

Shukradhara kala is the seventh dhatu
spread throughout whole body. As ghee is
obscure in milk and juice is obscure in
sugar cane so is *shukra* obscure in whole body. With example of milk relatively large amount of *shukra* (semen) is ejaculated with little sexual efforts while small amount of semen is ejaculated with huge sexual efforts in men.

**Kala in Kalpasthana**

दात्वज्ञानें या:सप्त कला: संपारिकृतिता:।

तात्स्वेकःकामकतिकव वेंग प्रकुष्ठे विषम्।।

(सु. क. 4/40)

Since *Dhatus* and the *Kalas* are seven, clinical features of *visha* (poisoning due to bite of snake) *vegas* occur when *visha* crosses these barriers in chronological and so *vishavegas* are also seven in number.

**DESCRIPTION OF KALA IN ASHTANG SANGRAHA**

यस्तृ धात्वज्ञानांतरेषु कलेडोविषिष्ट्ये सयाया

स्वमूहमितिविद्यः:

स्नायुमेलाज्ञातायुष्णः काष्ठ इव सारे

धातुसङ्गारे स्त्रसेषोपत्यवात् कलासंबः।।

(अ.सं. शा. 5/30)

*Kleda* (moisture) located between *dhatu* and *ashaya*, gets matured by its own *ushma*, becomes coverings like that of *snayu, shleshma, jarayu* etc. Like *saar* (pith) of wood it is *saar* of *dhatu*; however, small amount of *rasa* is left within it so it is called *kala*.

ता धात्वावशालमन्यादा: सप्त कला:लासां

प्रथमा मांसधरा नाम।

यस्तां मांसे

हिरयासाधुधवतीजिओतां भूमातिव पक्षदेवेन

विस्मृणानां प्रतानालि भवलि।।

(अ.सं. शा. 5/31)

**Tathāhi—प्रथमा रसविषेषजालिष्य मांसधरा।**

यस्तां भूमातिवाद्विजिष्य मांसे कदमसदृशे

सिरादिनां प्रतानालि गुणालप्रश्वालि

भवति।। (अ.सं. शा. 5/31 पर

इन्दुविवेचित शिलेय्का व्यायामः)

Though first *kala* is formed from *rasa* it is still called *mamsadhara kala*. The sprouting (branches) of *sira* (blood vessels) spread in *mamsa* like branches of lotus stem spread in mud.

**द्वितीया तत्क्षारा नाम**

मांसत्वाभ्यत्तदातस्त्वां शोभितं विशेषत्वः

सिरास्नीदयङ्कुशः भवति। मांसाभ्याः

क्षतान्

क्षतजः वृक्षादिभ क्षीण: कीर्तां प्रवर्तति। (अ.

सं. शा. 5/32)

Second *kala* is *raktadhara* located in *mamsa*. The blood (circulating) in it is especially formed from *sira, yakrit* (liver) and *pliha* (spleen). Blood oozes out from mamsa, when it is injured. Simile of lactiferous tree is given, which oozes latex on making cuts on the tree trunk.

**तृतीया नेदोधरा नाम।**

नेदो हि

तस्यामुदरेण्याधिरिष्टु च सरकां भवति।

तदेव च शिरिः क्षपालप्रतिच्छाः

मरिष्टिष्काद्यं मस्टुलुंगाद्यं च

स्तूलाविद्युच्यं च माजाः।।

(अ.सं. शा. 5/33)

*Medodhara* is third *kala*. In *udar* (abdomen) and small bones *meda* in this *medodhara kala* becomes of red color (hematogenous). It produces blood. The same in the head covers the skull (brain) and is called *mastishka* or *mastulunga* while in larger bone it is called *majja*. 

**Parmar et al.**

Int J Ayu Pharm Chem 2018 Vol. 8 Issue 3

[e ISSN 2350-0204] 2018Greentree Group © IJAPC

www.ijapc.com 240
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 *mastulunga* or *majja*.

श्लेष्मधरा नाम। तत्स्थेन हि श्लेष्मणा श्लेषेकि: शर्वसाध्यो द्रूप भवति सोपांगा सोभ्यंगा (झ्यासा- झ्यि पाठ्येत)। (अ.सं. शा. 5/34)

*Shleshmadhara kala* is fourth *kala*. *Shleshma* situated there covers all the joints and makes them strong like lubrication of the axis of a wheel (reduces the friction and keeps it functional for a long time).

पञ्चमी पुरीघधरा नाम। सा ह्यान्यामपवाश्यास्त्रीता कोष्जलक्रुदकर्ष्यं मलं विभाजित। (अ.सं. शा. 5/35)

उपर्युक्त पुरीघधरा। (अ.सं. शा. 5/35 पर इन्द्रुभिर्भित शशिलेखा व्याख्या)

Fifth *kala* is *purishadhara kala*. It is located in intestine, *amashya*, *pakwashaya* and in *unduka*, (an internal body organ), separates waste (excreta).

*Unduka* is defined as *purushadhara* by Indu.

षष्ठी पित्रधारा नाम पक्वमाशयमध्यस्य। सा ह्यालार्क्षेदिधिश्चन्त्यास्तसमाशयस्तु पक्वमाशयेऽनुमुक्तमत्र बलेन विधायर्थ पित्रतेजसा शोष्यति पंखि पंखं च मुन्धि दोषाधिष्ठिता दु: दौर्भव्यादामोवेच्यतोदसावस्तयं यहङ्गात् पुनर्याद्यभिनंश्च। वलं च तस्य: पित्रमेवांग्यभिधायमतः

Sixth *kala* is *pittadhara kala*. It is situated between *amashaya* and *pakwashaya*. It is site for *antargni* (*jatharagni*) so it (forcefully) retains food that has been released from *amashaya* and is proceeding towards colon, and digests it with *teja* of *pitta* and then releases the digested food. It is the site of *vata* etc. *doshas*. Its weakness (in holding the chyme for sufficient time) results in release of *ama* (partly digested food) so maintenance of *agni* would hold it (function of *grahani*).

सप्तमी शुक्रधरा नाम द्यंगुले दक्षिणेपाश्च स्त्रियास्त्राध्या भूमिश्चामच्यं तुकलशीरसापिनी शुक्रं प्रवर्तयति। (अ.सं. शा. 5/37)

*Shukradhara kala* is located in right side, below the opening of *basti* and located in urinary passage. It spreads in whole body and ejects *shukra*. Indu explains that it passes beyond the two finger-opening of *basti* and gets located in right side in the passage of urine.

(अ.सं. उ. 40/21)
The toxin of a snake crosses the *kalas* in chronological order from first to seventh and exhibits its toxicity depending on the level it has crossed.

**DESCRIPTION OF KALA IN ASHTANG HRIDAYA**

The definition of *kala* given Vagbhat in *Ashtanghrdaya* is not different from that given by others. Like intermediate spaces within the undersurface of the natural water body, *kala* is *kleda* between *dhatu* and *ashaya*. He has given more clarification about its genesis that *ushma* of *rasadhatu* matures the *kleda* located between *rasadhatu* and its *ashaya* to form the first *kala*. Like this it continues till *ushma* in *shukradhatu* forms seventh *kala*. Since it is leftover of *dhatusaar* and in less amount it is called *kala*.

*Mamsadhara kala*: Branches of dhamani, *snyu*, *sira* and *srotamsi* spread in these like tendrils.
Asrigdhara kala: Blood within mamsa, sira, yakrit and phiha remains confined within this. Injury to these will cause bleeding like oozing of latex on cutting of lactiferous tree.

Medodhara kala: It confines meda within abdomen and small bones. In bigger bones it forms majja.

Kaphadhara kala: It covers brain in the skull. Kapha located within this kala makes joints of bones strong.

Purishadhara kala: It is situated in ama-pakwashaya and supports (holds) waste product. It separates waste product in unduka.

Pittadhara kala: It is located in (directed towards) pakwashaya where the agni is situated. With teja of pitta it desiccates, digests and then leaves the food. if it is vitiated by any dosha it leaves undigested food and gets the name of grahani. Strength of agni is its strength. Favored and nurtured by strength of agni it supports the body.

Shukradhara kala: It abides in urine pathway on the right side two fingers below the bladder opening. It ejaculates shukra, which is spread throughout the whole body.

DESCRIPTION OF KALA IN BHAVAPRAKASHA

As per description found in Sushrutsamhita formation of all kalas originally occurred from three primordial structures viz, snayupraticchhannakala.
(fibrous membrane), jarayusantatakala (serous membrane) and shleshmaveshtitakala (mucus membrane)\(^4\). Sumati S. Khot has explained kala in an article titled “Basic Concept of Kala (Membrane)” in the following manner. Kalas are minute particles present in the body which are concerned with the process of formation of the dhatus and malas. One of the meanings of kala is quality and biologically active quality of one dhatu giving birth to another type is termed as kalaby acharyas. These are membranes with special functions. We can correlate the kalas structurally with fascia, septum, fibrous membrane; mucous membrane or serous membrane but functionally, we can correlate them with cells or formative elements\(^1\&\(^3\).

**DISCUSSION**

Entire research was focussed on the term kala related to anatomy without deviating to other meanings of kala as they do not serve any purpose for the advancement of knowledge of anatomy. 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. An approach is adopted to understand this description in perspective of modern functional anatomy as the macroscopic or microscopic description of kala is missing. 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. The anatomical structures for all the seven kalas have been described from the basic definition of kala and its function.

**CONCLUSION**

After thorough study of kalaitseems that it may be a tissue membrane as it separates each dhatu from its ashaya. Itcan be membrane of epithelial (mucosa) or connective tissue in majority of the kala. However, in raktadharakala stroma may also be considered as raktadharakala as in pathologic condition of myelofibrosis, hematopoietic stem cells in stroma starthematopoiesis.
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