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Basic Concept of *Kala* -A Review

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ABSTRACT

Introduction

Kala is an anatomical structure describe in classical ayurvedic text which is one of the most difficult topics to understand scientifically. Sushrut was the first to describe *Kala Sharir* under *Sharir Sankhya Vyakarana Adhyay* 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 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*. 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 *Vrahatrayi* & *Laghutrayi*.

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

Discussion:



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The term *kala* is discussed at great length with the help of similes, embryogenesis given by commentator Indu on *Ashtangasangraha* (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



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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*. *Vagbhat* 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 *Sushrutadid* 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 Monnier 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

कलाः खल्वपि हि सप्त भवन्ति
धात्वाशयान्तर मर्यादाः
यथा हि सार काष्ठेषु छिद्यमानेषु दृश्यते ॥
तथाहि घातुमांसेषु छिद्यमानेषु दृश्यत ॥
स्नायुभिश्च प्रतिच्छन्नान् सन्ततांश्च
जरायुणा ॥
श्लेष्मणा वेष्टितांश्चापि कलाभागांस्तु तान्
विदुः ॥ (सु. शा. 4/5-7)

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*.

दधति इति धातवो रसरक्तमांसादयः,
कफपित्तपुरीषाणि अपि प्राकृतानि स्वकर्मणा
दधति इति धातवः, तेषां आशया



अवस्थानप्रदेशा धात्वाशयाः, तेषां अन्तरेषु मर्यादाः सीमाभूता इति अर्थः॥ तासां अन्तःस्थितत्वेन अप्रत्यक्षाणां अस्तित्वं प्रति उपमानं प्रमाणं निर्दिशन् आह-भवत इत्यादि। एतेन कला स अधिष्ठान पृथग्धातु उपलम्भ कार्येण अव्यक्तं एव कलानां अस्तित्वं साधितं भवेत्। तासां उपष्टम्भकं निर्दिशन् आह-स्नायुर्भिः इत्यादि। सन्तान् सम्यक् प्रकारेण व्याप्तान्। जरायु उल्बाकारो येन वेष्टिताः प्राणिनो जायन्ते; कलावेष्टको अपि तद्वत् एव। (सु. शा. 4/5-7 पर डल्हण)

Dalhana's commentary explains this in some detail. *Rasa*, *rakta* etc. hold (support) the body and hence they are called *dhatu*. Similarly, *kapha*, *pitta* and *purisha* also support body when they are in their normal status, so they are also called *dhatu*. The sites of their location are called *ashayas*. Boundary between these *dhatu* 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.

तासां प्रथमा मांसधरा, यस्यां मांसे सिरास्नायुधमनीस्रोतसां प्रताना भवन्ति॥ यथा बिसमृणालानि विवर्धन्ते समन्ततः॥ भूमौ पंकोदकस्थानानि तथा मांसे सिरादयः॥ (सु. शा. 4/8-9) यस्यां कलायामधिष्ठिते मांसे सिरादीनां प्रताना विस्तारा भवन्ति॥

----यथा बिसमृणालानीत्यादि। तथा मांसे इत्यादि। तथा प्रथमकलायां मांसस्थाः सिरादयो भवन्ति। ननु, रसानन्तरं रक्तं, ततो मांसं, तत् कथं प्रागेव मांसधरा पठिता, ततो रक्तधरेति? उच्यते, पोषणे क्रमोऽयं नतु धारणे; अत एव यस्यामित्याधारत्वेन कला निर्दिष्टा॥ (सु. शा. 4/8-9पर डल्हण)

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).

द्वितीया रक्तधरा नाम मांसस्याभ्यन्तरतः; तस्यां शोणितं विशेषतश्च सिरासु यकृत्प्लीहनोश्च भवति॥

वृक्षाद्यथाभिप्रहतात् क्षीरिणः क्षीरिमावहेत्। मांसादेवं क्षतात् क्षिप्रं शोणितं संप्रसिच्यते॥ (सु. शा. 4/10-11)

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*.

तृतीया मेदोधरा; मेदो हि सर्वभूतानामुदरस्थमण्वस्थिषु च, महत्सु च मज्जा भवति॥

स्थूलास्थिषु विशेषेण मज्जा त्वभ्यन्तराश्रितः॥



अथेतरेषु सर्वेषु सरक्तं मेद उच्यते ॥
शुद्धमांसस्य यः स्नेहः सा वसा
परीकिर्तिता ॥ (सु. शा. 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 श्लेष्मधरा सर्वसन्धिषु प्राणभूतां भवति ।

स्नेहाभ्यक्ते यथा ह्यक्षे चक्रं साधु प्रवर्तते ।
सन्धयः साधु वर्तन्ते संश्लिष्टाः श्लेष्मणा
तथा ॥ (सु. शा. 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 पुरीषधरा नाम; याऽन्तःकोष्ठे मलमभिविभजते पक्वाशयस्था ॥

यकृतसमन्तात् कोष्ठं च तथाऽन्त्राणि समाश्रिता ॥

उण्डु(न्दु)कस्थं विभजते मलं मलधरा कला ॥ (सु. शा. 4/16-17)

पंचमीत्यादि । अन्तःकोष्ठ इति ----- ।
चरके च पुरीषाधारशब्देनोण्डुकः प्रतिपादितः,
अत एव पुरीषधरा इति नामास्याः । मलं विभजते मूत्रपुरीषरूपतया विभागं करोति ।
गयी तु, विभजते तस्मात् कोष्ठात् पृथक्करोतीति व्याख्याति ॥ (सु. शा. 4/16-17 पर डल्हण)

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

षष्ठी पित्तधरा; या
चतुर्विधमन्नपानमामाशयात् प्रच्युतं
पक्वाशयोपस्थितं धारयति । (सु. शा. 4/18)

पित्तमत्रान्तरग्निसंज्ञकम् । आमाशयात् प्रच्युतं कफाशयात् भ्रष्टं, पक्वाशयोपस्थितं पक्वाशयगमनायोपस्थितं पित्तस्थानं संप्राप्तं, धारयति 'पाकार्थ' इति शेषः । तथा च संग्रहः--'षष्ठी पित्तधरा नाम पक्वमाशयमध्यस्था । सा

ह्यन्तरग्नेरधिष्ठानतयाऽऽमाशयात् पक्वाशयोन्मुखमन्नं बलेन विधार्य पित्ततेजसा शोषयति पचति' (अ.सं. शा.अ. 5) इति ॥ (सु. शा. 4/18 पर डल्हण)

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 *kaphashaya* by Dalhana. *Pittadhara 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*.

सप्तमी शुक्रधरा, या सर्वप्राणिनां सर्वशरीरव्यापिनी ॥

यथा पयसि सर्पिस्तु गूढश्चेक्षौ रसो यथा ॥
शरीरेषु तथा शुक्रं नृणां विद्यादिभषण्वरः ॥
द्वयंगुले दक्षिणे पार्श्वे बस्तिद्वारस्य चाप्यधः ।

मूत्रस्रोतःपथाच्छुक्रं पुरुषस्य प्रवर्तते ॥ (सु. शा. 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

धात्वन्तरेषु याःसप्त कलाः संपरिकीर्तिताः ।
तास्वेकैकामतिक्रम्य वेगं प्रकुरुते विषम् ॥
(सु. क. 4/40)

Since *Dhatu*s 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

यस्तु धात्वाशयान्तरेषु क्लेदोऽवतिष्ठते स
यथा स्वमूष्मभिर्विपक्वः
स्नायुश्लेष्मजरायुच्छन्नः काष्ठ इव सारो
धातुसारशेषो रसशेषोल्पत्वात् कलासंज्ञः ॥
(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 धात्वाशयान्तरमर्यादाः सप्त कलाः तासां
प्रथमा मांसधरा नाम । यस्यां मांसे
सिरास्नायुधमनीस्रोतसां भूमामिव पंकोदकेन
बिसमृणालानां प्रतानानि भवन्ति ॥ (अ.सं.
शा. 5/31)

तथाहि-प्रथमा रसविशेषजाऽपि मांसधरा ।
यस्यां भूम्यामिवाधिष्ठाय मांसे कर्दमसदृशे
सिरादीनां प्रतानानि मृणालप्रख्यानि
भवन्ति ॥ (अ.सं. शा. 5/31 पर
इन्दुविरचित शशिलेखा व्याख्या)

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 रक्तधरा नाम
मांसस्याभ्यन्तरतस्तस्यां शोणितं विशेषतश्च
सिराप्लीहयकृत्यु भवति । मांसाश्च क्षतात्
क्षतजं वृक्षादिव क्षीरिणः क्षीरं प्रवर्तते । (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 मेदोधरा नाम । मेदो हि
तस्यामुदरेऽण्वस्थिषु च सरक्तं भवति ।
तदेव च शिरसि कपालप्रतिच्छन्नं
मस्तिष्काख्यं मस्तुलुंगाख्यं च स्थूलास्थिषु
च मज्जा ॥ (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*.



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*.

चतुर्थी श्लेष्मधरा नाम । तत्स्थेन हि श्लेष्मणा श्लेषिताः सर्वसन्धयो दृढा भवन्ति सोपांगा सोभ्यंगा (इवाक्षा- इति पाठभेद) ॥ (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 पुरीषधरा नाम । सा ह्यन्नामपक्वाशयाश्रिता कोष्ठान्तरुण्डुकस्थं मलं विभजति । (अ.सं. शा. 5/35)

उण्डुकं पुरीषाधारः ॥ (अ.सं. शा. 5/35 पर इन्दुविरचित 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 *purishadhara* by Indu.

षष्ठी पित्तधरा नाम पक्वमाशयमध्यस्था । सा ह्यन्तरग्नेरधिष्ठानतयाऽऽमाशयात् पक्वाशयोन्मुखमन्नं बलेन विधार्य पित्ततेजसा शोषयति पचति पक्वं च मुञ्चति दोषाधिष्ठिता तु दौर्बल्यादाममेवाततोऽसावन्नस्य ग्रहणात् पुनर्ग्रहणीसंज्ञा । बलं च तस्याः पित्तमेवाग्न्यभिधानमतः

साऽग्निस्तब्धोबुंहितैकयोगक्षेमा शरीरं वर्तयति । (अ.सं. शा. 5/36)

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 द्वयंगुले दक्षिणे पार्श्वे बस्तिद्वारस्याधो मूत्रमार्गमाश्रिता सकलशरीरव्यापिनी शुक्रं प्रवर्तयति ॥ (अ. सं. शा. 5/37)

सप्तमी बस्तिद्वारस्य द्वयंगुलमतिक्रम्य दक्षिणे पार्श्वे मूत्रमार्गमाश्रित्य वर्तते ॥ (अ. सं. शा. 5/37 पर इन्दुविरचित शशिलेखा व्याख्या)

Seventh *kala* is *shukradhara kala* 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.

धात्वन्तरेषु याः सप्त कलाः पूर्वं प्रकीर्तिताः ।

अतीत्य तासामेकैकां वेगं प्रकुरुते विषम् ॥ (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

धात्वाशयान्तरक्लेदो विपक्वः स्वंस्वमूष्मणा ॥

श्लेष्मरन्नायवपराच्छन्नः कलाख्यः काष्ठसारवत् । ताः सप्त ---- । (अ.ह. शा. 3/9)

धातूनां—रसादीनां, आशयाः—आधाराः जलाशयवत्तेषामन्तराण्यन्तरालानि, तेषु

धात्वाशयान्तरेषु क्लेदो धात्वाशयान्तरक्लेदः । स विपक्वः कलाख्य उच्यते—कलासंज्ञां लभते । केन विपक्वः ?

स्वंस्वमूष्मणा,—आत्मीयेनात्मीयेन वह्निना । यथा—रसधात्वाशयान्तरस्थः क्लेदो

रसधातूष्मणा विपक्वः कलैका भवति । यावच्छुक्रधात्वाशयान्तरस्थः शुक्रधातूष्मणा

विपक्वः सप्तमी कला भवति । कीदृशो विपक्वः ? श्लेष्मणा रन्नाय्वाऽपरया

च—जराय्वाख्यया, छन्नः—छादितः । “वा दान्तशान्त” इत्यादौ छदेर्ण्यन्तात् छन्नशब्दो

निपातितः । किंवात् ? काष्ठसारवत् । यथा काष्ठस्य सारः, तथाऽयं

धातुसारशेषोऽल्पत्वात्कलासंज्ञः । धात्वाशयान्तरमर्यादाः सप्त कलाः ।

तत्र—“आद्या मांसधरा यस्यां धमन्यः स्नायव्यः सिराः । स्रोतांसि च प्ररोहन्ति

प्रतानैर्व्यापभिः कला ॥१॥ । द्वितीयाऽसृग्धराऽस्यां तु

मांसान्तः शोणितं स्थितम् । विशेषतः सिराप्त्नीहयकृत्यु क्षतजं क्षतात् ॥२॥

मांसात्प्रवर्तते क्षीरं क्षीरिवृक्षादिव क्षतात् । मेदोधरा तृतीयाऽत्र मेदोऽस्थनामुदरे

स्थितम् ॥३॥ भवत्यणुषु मज्जाऽन्तः

स्थूलास्थिष्वथ मूर्द्धनि ।

मस्तुलुङ्गकपालान्तश्चतुर्थी तु

कफाश्रया ॥४॥ तत्स्थः कफो द्रढयति

सन्धीनस्थानं शरीरजान् । पञ्चम्यासां

विडाधारा साऽऽमपक्वाशयाश्रया ॥५॥

उन्दुकस्थं विभजते मलं, पित्तधरा पुनः ।

षष्ठी पक्वाशयान्तस्था

वहन्यधिष्ठानभावतः ॥६॥ पक्वाशयोन्मुखं

कृत्वा बलात्पित्तस्य तेजसा । शोषयन्ती

पचत्यन्नं तदेव च विमुञ्चति ॥७॥

दोषदुष्टाऽथ दौर्बल्यादाममेव निरस्यति ।

लभते ग्रहणीसंज्ञामस्याश्वाग्निबलं

बलम् ॥८॥ शरीरं

धारयत्यग्निबलोपष्टम्भबृंहिता । अन्त्या कला

शुक्रधरा मूत्रमार्गमुपाश्रिता ॥९॥ द्वयङ्गुले

दक्षिणे पार्श्वे बस्तिद्वारस्य चाप्यधः । शरीरं

व्याप्य सकलं सा शुक्रं वर्तयत्यपि ॥१०॥”

इति । (अ.ह. शा. 3/9 पर अरुणदत्त)

The definition of *kala* given Vagbhat in

Ashtanghridaya 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 *rasadhātu* matures the *kleda* located

between *rasadhātu* 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*,

snayu, *sira* and *srotamsi* spread in these

like tendrils.



Asrigdhara kala: Blood within *mamsa*, *sira*, *yakrit* and *pliha* 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 through out the whole body.

DESCRIPTION OF KALA IN BHAVAPRAKASHA

स्नायुभिश्च प्रतिच्छन्नां सन्ततांश्च
जरायुणा ।

श्लेष्मणा वेष्टितांश्चापि कलाभागांस्तु तान्
विदुः ॥

धात्वाशयान्तरे धातोर्यः क्लेदस्त्वधितिष्ठति ।
देहोष्मणाभिपक्वश्च सा कलेत्यभिधीयते
(भा.प्र. पू. 3/216—217)

Bhavamishra's opinion about *kala* is almost same as that of Sushruta and Vagbhat; only difference is the specificity made about *kleda* and *ushma*. He has deviated from his predecessors by specifically stating that the *kleda* involved is of *dhatu* (located in *ashaya*) and its maturation to the form of *kala* is achieved by the action of body heat.

REVIEW OF RESEARCHER

Only few views are available about structure of *kalas*, they are-

Prof. D.G. Thatte has explained that the anatomical description of seven *kalas* is mostly of inner linings of the body cavities and not about outer serous, parietal or visceral covering having *mamsadharakala*. Some are endothelial linings whereas some are facial sheaths between a particular tissue like *mamsadhatu*. Many of these *kala* give origin to muscle tissue like cremasteric fascia to cremasteric muscle or thoracolumbar fascia to muscles of posterior abdominal wall².

Acharya Sudarshana Shastri has stated that as per description found in Sushrut Samhita formation of all *kalas* originally occurred from three primordial structures viz, *snayupratichhannakala*



(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 *dhatu* 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 *Ashtangsamgraha* (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 *kalait* seems that it may be a tissue membrane as it separates each *dhatu* from its *ashaya*. It can 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 start hematopoiesis.



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