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A critical analysis of *Kala Shaareera* with special reference to *Maamsadhara Kala*

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ABSTRACT

Background: *Kala Shaareera* is one of the unique concepts mentioned by *Ayurveda*. *Kala* is a limiting membrane that separates *Dhatu* from its *Ashaya* and it is arranged just like the annular rings of a tree. Among seven *Kala*, *Maamsadhara Kala* is the first one, which does *Dharana* of *Maamsa*. *Kala* plays an important role in producing various *Visha Vegas* by spreading the *Visha* from one *Dhatu* to another. **Objectives:** To study the literature on *Kala Shaareera* w.s.r. to *Maamsadhara Kala* and to critically analyze the concept of *Kala Shaareera* w.s.r. to *Maamsadhara Kala* by comparing it with contemporary science by doing cadaveric study. Hence the present work a critical analysis of *Kala Shaareera* w.s.r. to *Maamsadhara Kala* was taken for study. **Methods:** Literature regarding *Kala* w.s.r. to *Maamsadhara Kala* is collected from *Bruhatrayees*, *Laghutrayees* and other classical books including journals, presented papers, previous work done. And the information is critically analyzed. Anatomical structures related to *Maamsadhara Kala* are confirmed by dissecting four cadavers. **Results:** As per the literary review and cadaveric study, the deep fascia and its certain modifications are considered as *Maamsadhara Kala*. **Conclusion:** *Maamsadhara Kala* is the 1st *Kala* of the body. The deep fascia, epimysium, endomysium, perimysium, intermuscular septa, interosseous membrane along with deep fascia, rectus sheath and palmar and plantar aponeurosis along with its septa are the structures related to *Maamsadhara Kala* in our body.

Key words: Deep fascia, Deep fascia modifications, *Kala*, *Maamsadhara Kala*.

INTRODUCTION

Kala Shaareera is one of the unique concepts mentioned by *Ayurveda*. *Kala* is a limiting membrane that separates *Dhatu* from its *Ashaya* and they are arranged just like the annular rings of a tree.

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Kala can be understood as limiting membrane, *Shodasa Vikara*, *Angapratyanga*, *Chatushpada Guna*, time and even performing arts. As per anatomical point of view, *Kala* as limiting membrane can be taken into consideration based on *Dharana* property.

Kala are 7 in number. They are *Maamsadhara*, *Raktadhara*, *Medodhara*, *Sleshmadhara*, *Pureeshadhara*, *Pittadhara* and *Sukladhara Kala*, and are named and arranged based on the *Dharana Krama* in our body. *Maamsadhara Kala* is the 1st *Kala* which does the *Dharana* of *Mamsa* and through which *Sira*, *Snaayu*, *Dhamanee*, and *Srotas* are spreading like *Bisa Mrunaala* in *Pankodaka*.

Kala plays an important role in producing various *Visha Vegas* by spreading the *Visha* from one *Dhatu* to another. Hence in this study, an effort is made to understand the concept of *Kala Shaareera* with special reference to *Maamsadhara Kala* with the help of conceptual study and cadaver dissection.

MATERIALS AND METHODS

Source of Data

- Literature regarding *Kala* w.s.r to *Maamsadhara Kala* were collected from *Bruhatrayees*, *Laghutrayees* and other classical books including journals, presented papers, previous work done.
- Anatomical structures related to *Maamsadhara Kala* were studied by dissecting four cadavers in the dissection hall of our college.

Method of collection of data

Literatures regarding *Kala Shaareera* w.s.r. to *Maamsadhara Kala* were collected from various books, journals, previous work done and it will be analyzed scientifically.

Assessment criteria

Anatomical structures related to *Maamsadhara* were studied with the help of classical, contemporary literature and cadaver dissection.

OBSERVATIONS AND RESULTS

The study is carried out by collecting all the literature regarding *Kala Shaareera* as well as *Maamsadhara Kala*, and the structures based on literature were identified by cadaveric dissection.

While doing cadaveric dissection of four bodies at *Shareera Rachana* department dissection hall, of our college, we have come across the deep fascia and it's certain modifications in relation to *Maamsadhara Kala*. The cadaver dissection is done layer by layer as per Cunningham's Manual of practical, to observe and study the structures thoroughly.



Fig. 1: Perimysium



Fig. 2: Muscle fasciculi, neurovascular bundle

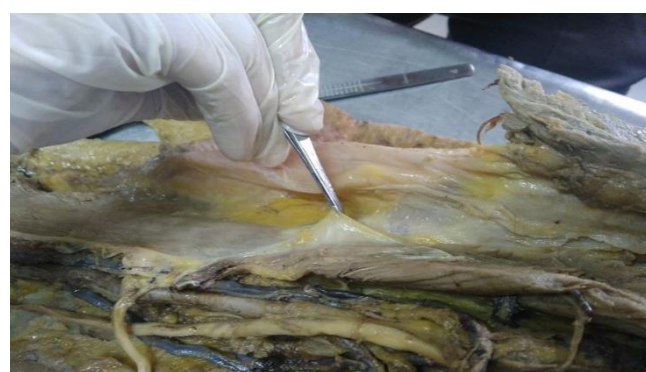


Fig. 3: Epimysium



Fig. 4: Deep fascia around a muscle



Fig. 5: Deep fascia between muscles



Fig. 6: Medial intermuscular septa between anterior and posterior compartment of arm



Fig. 7: Lateral intermuscular septum of leg



Fig. 8: Lateral intermuscular septum of leg, Interosseous membrane of leg



Fig. 9: Palmar aponeurosis



Fig. 10: Plantar aponeurosis



Fig. 11: Rectus Sheath

DISCUSSION

Kala is such a concept, which needs a broad spectrum of understanding with the little amount of description from our classics. The word “*Kala*” itself carries different meanings. As a word; *Kala*, is used to denote the *Maryada* between a *Dhatu* and its *Ashaya*, *Sira Chibukadi Anga Pratyanga*, 16 *Vikara*, *Sukha Dukhadi Guna*, the qualities of *Chikitsa Chatushpada*, a measurement of time and even a performing art or talent.^[1] In the *Shareera Rachana* perspective- *Kala* means the *Maryada* or the limiting membrane between a *Dhatu* and its *Ashaya*, which is formed by the *Paaka* of *Kleda/ Anna Kleda* by *Dehoshma*.^[2]

Dalhana commented on *Susruta Samhita* that, *Dhatu* is the one which does the *Dharana* of our body, and they are 7 in number. But while explaining *Kala* acharya clarifies that not only *Sapta Dhatus*, the *Tridosha*, and *Trimala* are also to be taken into consideration saying that in their normalcy they also do *Dharana* of body. *Ashaya* is the *Avasthana Pradesha*, which supports *Dhatu*.^[3]

Astanga Samgraha^[4] says that, after the formation of *Dhatu* the *Sesha Alpa Rasa* (the minute portion which is remaining), undergoes *Paaka* to form *Kala*. *Indu tika* gives further explanation as *Dhatu* is *Raktadi Dhatu*, and *Ashaya* - the *Srothas* through which they are moving in our body. *Kala* stays exactly between these two. *Srotas*, *Sira*, *Dhamani*, *Rasavahani*, *Nadi*, *Panthana*, *Ayana*, *Marga*, *Sareera Chidra*, *Samvruta*, *Sthaana*, *Ashaya*, *Niketa*, *Dhatu Avakasa* etc. words are used synonymously in body. Hence the *Srotas* means *Ashaya* of *Dhatu* only.

The *Swaroopa*^[5] of something help to identify a structure. Usually in classics so many similes are used for proper identification. *Kala* is also explained in the same way. *Acharya* accepted that, in general, *Kala* appears like the annual rings of a tree. That means, as a tree ages in every year a new layer of wood appears outside. As a result, the tree attains bulk. But we can clearly make out this growth because of ring like appearance. Therefore, we can assume that the *Swaroopa* of *Kala* is very well compared to annual rings, because it gives a clear-cut demarcation between the wood. But in our body, it is not solid like in tree- it is *Snaayu*, *Jarayu* or *Kapha/ Sleshma* form.

Dalhana commented on the ayurvedic suturing material that *Snaayu* is thread/ cord/ fiber like plant material used for making bow string. *Sharangadhara* opines that in our body *Snaayu* are for connecting purpose between *Maamsa*, *Asthi* and *Medas*. *Susruta* says 4 types of *Snaayu* - *Pratanavati* (aponeurosis), *Vrutta* (round), *Sthoola* (thick tendons) and *Sushira* (with opening). *Jaraayu/ Apra* - is a thin membranous layer covers and protects a fetus inside womb just like skin of body is *Jarayu*. *Kapha/ Sleshma* - among 3 *Dosha*, *Kapha* is the one which does *Aalingana/* binding of structures. Hence it is assumed that the *Kala* can be fiber, thick, and strong like *Snaayu*, does covering of structure like *Jarayu*, moist and protective like *Kapha* in our body. *Gananath sen* compares *Swaroopa* of *Kala* with thin silk cloth, wax and clay. These comparisons are also giving the same idea of its *Swaroopa* said by *Susruta* and *Vrddha Vagbhata*.

The number ^[6] of *Kala* is 7. Namely *Maamsadhara Kala*, *Raktadhara Kala*, *Medodhara Kala*, *Sleshmadhara Kala*, *Pureeshadhara Kala*, *Pittadhara Kala* and *Sukradhara Kala*. *Dalhana* clearly says that the order and naming are given based on *Dharana* not based on *Poshana*. *Acharyas* stated that when cutting *Maamsadi*, there will be oozing of *Dhatu*, from this we can assume that, the *Kala* is said from outside to inside.

As per order of *Dhatu*, *Rasa* & *Rakta* should come 1st. instead *Acharya* started with *Maamsa Dhara Kala*. Why because while explaining layer by layer of *Shareera*, *Acharya* 1st explained *Twak* and then *Kala*. The 7th layer of *Twak* is *Maamsadhara Twak*, followed with 1st *Kala* - *Maamsadhara Kala* which does *Dharana* of *Maamsa*.

The *Maamsadhara Kala*^[7] is the 1st *Kala* through which *Sira*, *Snaayu*, *Dhamanee*, *Srotas* etc. are passing through just like *Bisa mrunaala* in *Pankodaka*. It also does *Dharana* of *Maamsa (Dhatu)*. With more clarity here the *Maamsa* indicates both *Maamsadhara Kala* *Maamsa Dhatu* and *Peshi*.

While discussing about this *Kala* we can take the consideration of muscle tissue. That structure which gives a covering for the muscle fiber, a bundle of fibers and a muscle itself can be compared here. The endomysium, epimysium, perimysium and separating a group of muscles etc. can be correlated here. Along with that all possible structures of deep fascia modifications which supports muscle also to be taken into consideration.

The *Raktadhara Kala*^[8] is situated beneath 1st *Kala* in *Sira*, *Yakrit* and *Pleeha*. With the simile of latex plants, *Acharya* says that by cutting *Maamsa*, there will be oozing of *Rakta*. If we consider *Rakta* as blood, then the endothelial lining of blood vessels, spleen and liver can be compared with *Raktadhara Kala*.

The *Medodhara Kala*^[9] is 3rd *Kala* which is located in in *Udara*, *Anu Asti* and *Maha Asti*. The term *Udara* can be taken as abdomen region or even the *Udara* of *Anu Asti*. If so, the shaft of small bones contains *Sarakta Meda*. In long bones the same is *Majja*. In *Siras*, the *Kapala* protected brain mater is called as *Mastaka*

majja. Meda is the *Dhatu* which is *Sandra*, *Sarpitulya*, *Snehadhatu* and is located in *Udara* and below *Twak*. The *Snigdha* part of *Maamsa* is called as *Vasa*. And is located inside *Maamsa*.

As per Gananath sen, *Majja* is the *Sneha* in the middle of *Asti*. It is of 2 types, *Peeta* and *Rakta*. Inside *Nalakasti* (long bones) it is *Peeta*, and rest of the bones it is *Rakta Majja*.

So as a matter of discussion - dura matter, peritoneal folds, and endosteum of bones, can be co related to this *Kala*.

4th *Kala* - *Sleshmadhara Kala*^[10] is located in *Sandhi*, its function is lubrication, and nourishment of *Sandhi*. *Susruta* clearly mentioned that *Sandhi* doesn't mean only *Asti Sandhi*, it is also the *Samyogasthaana* of *Peshi*, *Snaayu* and even *Sira*. Even under *Asti Sandhi - Chala Sandhi* should only to be considered based on simile. With that perspective the synovial membrane lined fibrous capsule of synovial joints, bursa, and flexor sheath are to be considered for *Sleshmadhara Kala*.

Sharangadhara^[11] *Acharya* opines that 4th *Kala* is *Yakrit-Pleeha Dhara Kala*. In some opinions of this commentary, *Sleshmadhara Kala* is said to be located between *Yakrit and Pleeha*. In the modern perspective the omental bursa/ lesser sac located between liver and spleen may be considered here.

The *Pureeshadhara Kala*^[12] is located inside *Antah koshta*, *Pakwashaya* specially in *Unduka*. It is also termed as *Maladhara Kala* and *Aantradhara Kala*. All names indicate its location as well as function. When the food enters the *Aamashaya*, itself the *Saara Kitta Vibhajana* starts. The *Saara* will be absorbed and the *Kitta* will be separated to *Mootra* and *Pureesha*. This *Kitta Vibhajana* happens with the help of *Pureeshadhara Kala*.

When we study based on functions, this layer is compared with epithelial lining of terminal part of small intestine, caecum, ascending colon, and part of transverse colon. Where the formation of *Mala* happens by separating from *Kitta*, which in turn the

formation of stool, after absorption of water and nutrients.

Pittadhara Kala^[13] is located in between *Aamaashaya* and *Pakwashaya* or inside *Pachyamaanasaya*. It is also said that *Pitta* or *Agni* does its function for proper digestion, absorption and formation of *Mala*.

Astanga Hrudaya clearly mentions that *Pittadhara Kala* is located in *Garahani*. From the further explanations we can assess that this is the part after *Aamaashaya* and before *Pakwashaya*.

While closely observing this *Kala*, we may compare the epithelial layer *Garahani* - duodenum and some parts of jejunum. The bile, pancreatic juice and gastrointestinal secretions acts as *Pitta* and *Agni* and helps in proper digestion and absorption of food and water.

The 7th *Kala* is *Sukradhara Kala*,^[14] the location is *Sarva Shaareera* as per *Susruta* and in *Mootra Maarga* as per *Vrdhha Vagbhata*. In ayurvedic perspective *Sukra Dhatu* is *Sarva Shareera Vyapi*, and its ejaculation happens in sexual activity. The function of *Sukra* is *Garbhotpatana*.

The *Saarva Daihika Sukra Dhatu* does the *Dhairya*, *Chyavana* etc. functions of the body. This we may co relate with testosterone hormone. And correlation of any structure to *Sukradhara Kala* is impossible.

The *Mootra Marga Asrita Sukra Dhara Kala*, we may compare with the epithelial lining of male urethra through which the semen is ejaculated out.

Discussion on Kala and Visha Vega^[16-18]

Acharya Susruta and *Vrdhha Vagbhata* - after giving description of *Kala* in *Shaareera Sthana*, explained their application in *Kalpa Sthana* and *Uttara Tantra* respectively under the concept of *Visha*. *Pittadhara* and *Sleshmadhara Kala* are mentioned under *Grahani* and *Sandhi* contexts. While explaining *Visha Vega* – the time taken by *Visha* to move from one *Dhatu* to another, *acharya* says that *Visha* crosses each *Kala* and enters *Dhatu* to spread further till it reaches *Kalakalpa* (death). Under all types of *Sarpa Visha* and

even other animal poisons, there are totally 7 Vega, because of 7 Dhatu and 7 Kala.

In *Sarpa Visha* the onset and severity of the signs and symptoms in a victim depends on so many factors like species of snake, nature, number and depth of bite, extend of anger or fear motivated the snake to bite, amount of venom injected, age and size of the victim etc. After the bite, the poison remains in the site for 100 *Matra Kaala*. Then it starts its spread.

When the *Visha* moves from *Rasa* to *Rakta* by crossing *Kala* between them, shows symptoms in *Rakta*, to produce *Prathama Vega*. Likewise, the *Kala* between *Rakta* - *Maamsa*, *Maamsa* - *Meda*, *Meda* - *Kapha*, *Kapha* - *Pureesha*, *Pureesha* - *Pitta* and *Pitta* - *Sukra*; will be crossed by *Visha* to produce consecutive *Vega* in each stage. While explaining *Visha Vega*, *Susruta* says that in 4th *Vega*, *Visha* moves to *Koshta* from *Meda* and affects its *Sthanika Dosha* - *Kapha*, then moves to *Asthi* to affect *Praana Agni* to produce 5th *Vega*, moves to *Grahani*, which is the *Sthana* of *Pittadhara Kala* to produce *Majja Gata Lakshnas*, then finally reaches *Sukra*, and influences *Vyaana Vata* and spreads throughout body. In a nutshell, this is how the *Visha* moves from *Shaakha* to *Koshta* to produce *Visha Vega*.

Because of the properties of *Visha* it is very difficult to observe this movement of crossing *Kala*. that's why classics had given only symptoms of various stages of *Visha Vega*.

Dalhana opines that there is no objection in considering *Pureeshadhara Kala* with *Asthidhara Kala* in 5th *Vega* and *Pittadhara* as *Majjadhara Kala* in 6th *Vega*. But he didn't give any reason for such concept.

But when we are closely searching through classics, in *Vata Roga*, *Acharya* mentioned *Basti* as the prime treatment which is administered through *Pakwaashaya*. The *Vata Dosha* and *Asti* is having *Asraya Asrayi Sambanda*. Also, in 5th *Vega*, the symptoms are related to *Asthi* and *Prans Vata*. Hence, we can assume that there is a relation between *Pureeshadhara Kala* - *Asthi Dhara Kala* with a common factor *Vata Dosha*.

Pittadhara Kala is located in *Pakwaamashaya Madyaga*. It is also the site of *Pitta*. The treatment modality of *Pitta* is *Virechana*. In *Pakshaghata*, it is said that *Virechana* is the best treatment. If we are analyzing closely, *Pakshaghata* is a disorder based on brain, which is *Mastaka majja*. And in 6th *Vega*, the symptoms are related to *Grahani*, *Pitta* as well as *Majja*. Hence, we may consider the fact of *Asthidhara Kala* and *Majjadhara Kala* under the concepts of *Pureeshadhara Kala* and *Pittadhara Kala* respectively.

In modern point of view^[19] poison contains – protein, enzymes (hydrolases, phospholipase A2, L- amino acid oxidase and peptidases), non-enzymatic polypeptide toxin, and nontoxic proteins, nonprotein ingredients (carbohydrates, metals – in the form of glycoprotein metalloprotein enzymes), lipids, free amino acids, nucleotides and biogenic amines.

Hyaluronidase is a factor said to promote the spread of venom through tissues. Though contemporary science given all the details of poisons, the exact mechanism of spread of *Visha* through *Kala* is very difficult to correlate and explain.

CONCLUSION

Kala is the *Maryada*/ limiting membrane between a *Dhatu* and its *Ashaya*. Here *Dhatu* means *Rasadi Sapta Dhatu*, *Tri Mala*, and *Tri Dosha* which does *Dharana* of the body in their normalcy and *Ashaya* refers to the *Avasthana Pradesha* of above said *Dhatu*. *Kala* is formed by the *Paaka* of *Kledaamsa* located between *Dhatu* and *Ashaya*, by *Swa Ushma* and they appear like the *Saara* of *Kashta* (annual rings of a of tree).

The *Swaroopa* of *Kala* is like *Snaayu*, *Jarayu*, or *Sleshma*. Based on the appearance and location they can be understood as fibrous membrane, thin, clear/ transparent membrane or slimy membranes of the body.

The total number of *Kala* is 7. They are *Maamsadhara*, *Rakta dhara*, *Medodhara*, *Sleshmadhara*, *Pureeshadhara*, *Pittadhara*, and *Sukradhara Kala*. *Shaarangdhara* mentioned *Yakrit Pleehadhara Kala* instead of *Sleshmadhara Kala*. The

order of Kala is based on Dharana Krama not based Poshana krama.

Probable structures of correlation for each Kala can be understood as:

- *Maamsadhara Kala* - deep fascia modifications.
- *Raktadhara Kala* - endothelial lining of blood vessels, liver and spleen.
- *Medodhara Kala* - Dura matter, peritoneal folds, and endosteum of bones.
- *Sleshmadhara Kala* - synovial membrane lined fibrous capsule of synovial joints, bursa, and flexor sheath, omental bursa.
- *Pureeshadhara Kala* - epithelial lining of terminal part of small intestine, caecum, ascending colon, and part of transverse colon.
- *Pittadhara Kala* - epithelial layer duodenum, some parts of jejunum.
- *Sukradhara Kala* - structural correlation of *Sarva Daihika Sukra* is very difficult. *Mootra Margasrita Sukradhara Kala* may be compared with epithelial lining of male urethra.

Maamsadhara Kala is the 1st Kala beneath *Maamsadhara Twak* (7th layer) which does the *Dharana* of *Maamsa*. Just like the *Bisa Mrunaala* in *Pankodaka* (stalks and roots of lotus) spreads through the swampy water, in the same way *Sira*, *Snaayu* and *Srotas* passes through *Maamsa* within or along the *Maamsadhara Kala*. Based on the descriptions of *Kala* in classics, we may compare *Maamsadhara Kala* with deep fascia and it's certain modifications such as epimysium, perimysium, endomysium, intermuscular septa, and interosseous membrane along with deep fascia, rectus sheath, palmar and plantar aponeurosis along with its septa. This structure protects the muscle fiber, fasciculi, muscle, group of muscles, and even a compartment of muscle for their proper action and also carries the neuro vascular bundle through them.

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