



AN ANATOMICAL REVIEW OF STRUCTURES ASSOCIATED WITH “RAK-TADHARA KALA”

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ABSTRACT

According to ancient *Ayurvedic* literatures the word ‘Kala’ has been used in an anatomical sense i.e., moist layer or membrane. *Kala* is a thin moist layer or glistening structure which provides covering to different organs of the body. This covers different types of *Koshthanga* (viscera), *Asaya* (cavities), *Sira* (vessels), *Peshi* (muscles), etc in the human body. These ‘Kalas’ are the boundary between *Asaya* (cavity) & *Dhatu* (product in that cavity). These *Kalas* are seven in number. The anatomy & physiology of ‘Kala’ gives us information about the importance of ‘Kala’ in the human body. Every seven ‘Kala’ plays important role in their specific sites. In which the second *Kala* is “*Raktadhara Kala*”. According to ayurveda “*Raktadhara Kala*” presents inside the muscle & holds the ‘*Rakta dhatu*’ and presents especially in *Sira*(vessels), *Yakrut* (liver) & *Pleeha* (spleen). They all [*Sira*, *Yakrut*, *Pleeha*] are important structures of the blood vascular system. ‘*Hridaya*’ is also one of the important structures of the blood vascular system because it not only holds the blood but also pumps the blood throughout the human body, yet it is not mentioned as a specific site of “*Raktadhara Kala*”. So for a proper understanding of “*Raktadhara Kala*,” it is necessary to know which structures are responsible for “*Raktadhara Kala*”. In this study, we can easily understand all anatomical structures associated with “*Raktadhara Kala*”.

Keywords: Kala, Raktadhara Kala, Sira, Yakrut, Pleeha, Raktashaya, Hridaya.

INTRODUCTION

The knowledge of *Sharir* is based on knowledge of medical science (in both Ayurveda & modern science). According to Ayurveda *Sharir Sthan* is one of the most important parts, in which *Sharir Rachana* & *Sharir Kriya* is described. *Shushrut Sahita's* "Garbhavyakaran chapter" of *Sharir Sthan*, has described *Kala*. *Kala* is a thin membranous layer that separates the underlying 'Dhatu' from its 'Ashaya' (cavity). The specific *Kalas* are located in specific sites. There are 7 types of *Kala*⁽¹⁾, in which the 2nd one being "Raktadhara Kala" which presents inside the muscle & contains *Shonita* (blood), especially within *Sira*, *yakrut* & *pleeha*.⁽²⁾ So for proper understanding, it is essential to be explained "Raktadhara Kala" in a proper way and correlate it with modern medical science, and explained which anatomical structures are associated with "Raktadhara Kala".

Aim and Objectives

- To study the "Raktadhara Kala" from various Ayurvedic Samhitas.
- To study anatomical structures associated with "Raktadhara Kala" as per modern medical science.

Material & Method

Sushruta Samhita and various *Ayurvedic Samhitas* from *Brihatrayi* & *Laghutrayi* along with their commentaries by different authors were referred for the study. The matter available on the internet and in published journals was also studied. References from modern medical sciences were also utilized to correlate the concepts.

Observation

Ayurvedic literature has been studied in detail to explore the "Raktadhara Kala" (It's a membranous covering that separates blood from its surroundings). *Maharshi Sushrut* has described "Raktadhara Kala" is the 2nd *Kala* that remains deep to *Mamsadhara Kala*, and *Sira*, *Yakrut*, & *Pleeha* are the special locations of "Raktadhara Kala". To understand *Maharshi Sushrut* has given an example that when we

take an incision of a tree, which produces white milky discharge oozes out and in the same way when we take an incision of muscle blood oozes out.⁽³⁾ *Acharya Vagbhat* has mentioned that "Raktadhara Kala" is the second *kala* and it is present inside the flesh, within which holds *Shonita* (blood) and especially located in the *Sira*, *Pleeha*, and *Yakrut*.⁽⁴⁾ *Acharya Bhavaprakash* & *Sharangadhar* have also mentioned that "Raktadhara Kala" is the second *Kala*.⁽⁵⁾ According to *P.S. varier* in "Brihachhariram" the second *kala* is "Raktadhara Kala" and it is present in the 'Raktashaya' and an internal layer of 'Hridya' and the walls of macro & micro blood vessels.⁽⁶⁾ According to previous published journals inner layer of blood vessels & sinusoids of the Liver and spleen correlated with "Raktadhara Kala".⁽⁷⁾ So according to modern medical science we can correlate "Raktadhara Kala" with the internal layer of vessels, internal layer of heart, sinusoids of liver and sinusoids of the spleen because they all structures holds blood under circulation.

DISCUSSION

'Kala' is a thin membranous & glistening structure that provides covering to different organs & cavities of the body. In it, we can include different types of the membrane (like fibrous, serous & mucous), fasciae, septa, sheaths & capsules which cover the organ externally or internally and separates from one structure to another structure. According to their function & place, they are given different names. The main function of *kala* is holding (*Dharan*) of the fundamental constitution (*Dhatu*) & separates the underlying "Dhatu" from its "Ashaya" (cavity). "Kala" is "Dhatvashayantarmaryadah" So that "Raktadhara Kala" is a membranous lining that separates "Dhatu" (*Rakta Dhatu*) means "Blood" and "Ashaya" [cavities of vessels] and it is clear that "Raktadhara Kala" is present within Blood vessels, capillaries, & vascular organs. According to *Ayurvedic Acharyas*, "Raktadhara Kala" is present in 'Si-

ra, Yakrut & Pleeha' [Sirasuyakrutpleehoshchabhavati]. According to P.S. Varier in 'Brihachhariram,' it is present in 'Raktashaya' and in the internal layer of 'Hridaya' & walls of micro and macro blood vessels. So, the following structures are associated with "Raktadhara Kala": *Sirasu* - *Siras*' are correlated with all vessels like arteries, veins & capillaries. According to modern medical science, we can correlate "Raktadhara kala" with the inner membrane of all blood vessels. Vessels are covered within three different layers: ⁽⁸⁾ [1] Tunica externa/adventitia-outer layer-It consists of a thin layer of fibroelastic tissue. [2] Tunica media -Medial layer - Made up mainly of smooth muscles of smooth muscles arranged circularly. [3] Tunica intima -Internal layer -It is made up of endothelium, and subendothelial connective tissue. The internal layer 'Tunica intima' is the innermost layer of the vessels, so we will consider the 'Tunica intima' layer under "Raktadhara Kala". Tunica intima is lined by a thin single sheet of endothelial cells called the endothelium. This layer is in direct contact with blood which minimizes friction, as blood moves through the lumen of vessels. All blood vessels except capillaries are covered by three layered structures. Capillaries have only a single layer of endothelium. So, we consider the vascular endothelium of Tunica intima under "Raktadhara Kala". *Yakruta*- '*Yakruta*' is correlated with 'Liver'. The fetal liver is hematopoietic in function. The differentiation of the blood cells takes place in several loci in the internal between the liver cells and the wall of the hepatic sinusoids. The blood cells are set free into the sinusoids and thence into the fetal circulation. ⁽⁹⁾ So during hematopoiesis 'Liver sinusoids receive blood and the wall of sinusoids covers blood to their surroundings. According to modern medical science, 'The Liver is one of vascular organ & special type of structure found inside it, called sinusoids. The sinusoids are a special type of capillaries that structurally consists of endothelial cells which hold blood under circulation. The wall of a sinusoid consists only of endothelium supported by a thin layer of connective tissue. ⁽¹⁰⁾ The wall may be in-

complete in places, so that blood may come into direct contact with tissue cells. In the Liver branches of the hepatic artery & portal vein open into the sinusoid. The Sinusoid opens into the central vein. The blood from the hepatic artery mixes with blood from the portal vein in the hepatic sinusoid. ⁽¹¹⁾ That's why we can mention the wall of sinusoids of the Liver under "Raktadhara Kala". *Pleeha*- '*Pleeha*' is correlated with 'Spleen'. During intrauterine life, 'Spleen' plays an important role in erythropoiesis. ⁽¹²⁾ According to modern medical science 'Spleen' is also one of the vascular organs. 'Spleen' also inside has special structures like sinusoids, which consist of endothelial cells, which hold blood under circulation. ⁽¹³⁾ That's why we can consider the wall of sinusoids of the Spleen under "Raktadhara Kala". *Raktashaya*-According to Maharshi Shushrut '*Shonitasya sthanam yakrut pleehaanau*'. ⁽¹⁴⁾ So the *Raktashaya* is located in '*Yakrut*' and '*Pleeha*'. According to P.S. Varier "*Raktashaya*" is located in *Hridaya, Yakrut, Pleeha* & their blood vessels ⁽¹⁵⁾. That's why we can consider 'Raktashaya' under "Raktadhara Kala". *Hridaya*- '*Hridaya*' is correlated with 'Heart'. The heart is covered by three layers-epicardium, myocardium, and endocardium. ⁽¹⁶⁾ Endocardium layer of the 'Heart' is the inner most layer. It corresponds to the 'Tunica intima' of blood vessels. It consists of a layer of endothelium that rests on a thin layer of delicate connective tissue. ⁽¹⁷⁾ That's why we can consider the inner most layer of the Heart under "Raktadhara Kala".

CONCLUSION

In view of the above discussion, we can consider that "Raktadhara Kala" is the inner most layer of all vessels, the heart, and the wall of sinusoids of 'Liver' & 'Spleen' which covers blood (*Rakta Dhatu*) or being in direct contact with blood. *Rakta Dhatu* (blood) exists everywhere in the body and is circulated through vessels. These vessels contain endothelial lining which is directly in touch with *Rakta Dhatu* (blood), this endothelial lining exists beneath *Mamsa Dhatu* (Smooth muscle of Tunica media). So we can consider the endothelial lining of Tunica in-

tima of blood vessels under "Raktadhara Kala". *Yakrut* & *Pleeha* are the origin (*Utpattisthana*) of 'Rakta Dhatu'. Most sinusoids are present in the 'Liver' & 'Spleen' which consist of endothelial cells, which hold blood under circulation. So, we can also mention 'Yakrut' & 'Pleeha' under "Raktadhara Kala". The innermost layer of 'Heart' is also made of endothelial cells & it corresponds to the 'Tunica intima' of blood vessels. So we can consider it under "Raktadhara Kala". In the human body "Raktadhara Kala" plays an important role because "Raktadhara Kala "or "vascular endothelium" not only covers blood but also protects against vascular injury. So, we can correlate vascular endothelium of all 'Vessels', 'Heart', & endothelial lining of the wall of sinusoids presents in 'Liver' & 'Spleen' with "Raktadhara Kala".

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