



A CRITICAL AND CONSOLIDATE STUDY OF MEDODHARA KALA W.S.R. TO MAJJA DHATU

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ABSTRACT

Kala is one of the unique concepts explained in the classics of *Ayurveda*. *Maharshi Sushruta* defined *Kala* as *Dhatvashyantar Maryada*, i.e., it is a Membranous structure that lines between *Dhatus* and their *Ashayas*. *Medodhara Kala* is one of seven kalas. *Medodhara Kala* is the 3rd *Kala* in *Asthis* about *Majja Dhatu*. Based on *Kala*'s origin, definition, structure, and functional point of view, the *Medodhara Kala* is correlated with endosteum.

Keywords: *Kala*, *Medodhara Kala*, *Sthula Asthi*, endosteum, *Anu Asthi*, bone marrow

INTRODUCTION

Ayurveda is a science of life with a holistic approach to health and personalized medicine. It is one of the oldest medical systems, comprising thousands of medical concepts and hypotheses. Its primary empha-

sis is on the prevention of disease and maintenance of health. *Maharshi Sushruta*, the pioneer in the field of *Sharira*, has evaluated the anatomical structures of all the stages of life, along with the evaluation of the

universe, under different chapters in *Sharira Sthana*. That's why *Sushruta Sharira Sthana* is considered *Srestha* among all the *Sharira Sthanas*.

According to Ayurveda, *Dosha, Dhatu, Mala, Asthi, Sandhi, Kosthargas, Kala, Sira, Dhamani, Srotas, Marma*, etc., are the various structures present in the body. *Maharshi Sushruta* defined *Kala* as *Dhatwasayantara Maryada*, i.e., it is a Membranous structure that lines between *Dhatu*s and their *Ashayas*.^[1] *Medodhara Kala* is one of seven kalas. *Medodhara Kala* is not given elaborately by any Acharyas of *Ayurveda*. So, it must be studied with the help of advanced modern science literature.

The *Kala's* are clinically applicable in the field of *Ayurveda*. There is a factual need for a comprehensive literary study of *Kala's* anatomical and physiological aspects; from the available *Ayurvedic* and modern pieces of literature, such analysis can work as a base for a better understanding of the science. To update *Ayurvedic* Science, as we are in the most advanced and sophisticated era where medical science keeps on doing enormous research, it becomes our vital work to adopt modern science to enhance *Ayurvedic* Anatomical fundamental science so that it not only strengthens *Ayurvedic* fundamentals but also helps to understand the concepts by the students of the medical field, scholars, practitioners, etc., where they might practically implement these theories like *Medodhara Kala*.

By analyzing comparatively with other sciences, such a study helps significantly in the rational understanding of hidden concepts mentioned in *Ayurveda*. Hence, such an attempt is made to fulfill the objectives of this present study.

OBJECTIVES OF THE STUDY

- To explain *Medodhara Kala* described by *Maharshi Sushruta* present in *Asthi*.
- To elaborate on the concept of *Majja Dhatu* present in *Sthula Asthi*.

METHODOLOGY OF THE STUDY

Literature research is done through *Brihatrayes* and *Laghutrayes*, as well as modern anatomy and physiology textbooks and websites, as well as published articles.

LITERATURE REVIEW

Medodhara Kala

The third *Kala* is *Medodhara Kala*. The description of this *Kala* is undoubtedly notifying about the main sites of fat and its distribution in the body, which is universal for both sexes. This *Kala* has been explained as follows: -

- *Maharshi Sushruta* mentioned that the name of the third *Kala* is *Medodhara Kala*, where *Medos* (fat) is present in the abdomen and *Anu Asthis* (small bones) of all human beings. In contrast, *Sthula Asthis* (long bones) contains *Majja* (bone marrow). *Majja* (marrow) is mainly situated inside the *Sthula Asthis* (long bones), while in all remaining bones, there is fat mixed with blood (*Sarakta Medo*, appears red). *Vasa* (muscle fat) is the unctuous portion of *Sudha* (pure) *Mamsa*.^[2]
- According to *Acharya Vagbhata*, the third *Kala* is called *Medodhara Kala*. It holds fat (adipose tissue). Fat tissue is found primarily in the abdomen, and that in the small bones is mixed with blood (appears red); the same inside the head covered by the bones of the skull is known as *Mastiska* and *Mastulunga*, that present in the gross bones is *Majja* (marrow).^[3]
- According to *Damodar Sharma Gaur* *Medodhara Kala* is the peritoneum containing extra-peritoneal fat (omentum), a fatty layer of superficial fascia, the lining of medullary canals, and marrow spaces of the bones, Meninges supporting cheesy brain matter.^[4]
- Dr. B.G Ghanekar has quoted that, in the human body, there is always a tendency for accumulation of fat. When the *Sharira* becomes *Sthula*, this fat accumulation will be more significant. In *Sthula Sharira*, everybody has an excess fat accumulation, but it is found more in *Sphik, Sthana*, and *Udara Pradesh*. All over the body, its accumulation is located below the skin, i.e., in subcutaneous tissue. In *Udaragruha*, it is present in the *omentum*, a part of the peritoneum.^[5]
- Dr. D.G. Thatte has quoted on this *Kala* that the fat is abundant, especially in the abdominal wall, buttocks, and *Sthana Pradesh* (pectoral Region).

It is also deposited in *Udaravarana Kala* (peritoneum), especially in *Vapavahana* (omentum). *Sushruta* has differentiated *Medo*, *Majja*, and *Vasa*. *Majja* is of two types: (1) *Pita Majja* (Yellow bone marrow) and (2) *Rakta Majja* (Red bone marrow). The *Majja*, found in large bones, is of yellow type. Therefore, it should be named yellow marrow. The red marrow is found in small bones. Thus, *Sarakta Medo* (mixed with blood) should be called Red bone marrow. The remaining *Medo* is found in *Vapavahana* (omentum) and subcutaneous tissues.^[6]

Utpatti of Majja Dhatu

- According to *Charaka Samhita*, *Vayu* causes porosity in the interior of bones, and this porous space gets filled up with the *Snehansha* of *Medos* (fat). This *snehansha* is, after that, called *Majja* (bone marrow).^[7]
- According to *Charaka Samhita*, the principle of *Majja Dhatu* formation is quite similar to modern Anatomy. In the embryonic stage, the endochondral ossification process takes place to form bones. The mesenchymal cell includes a layer of chondroblast cells, starting primary areolae by the alkaline phosphatase enzyme. A periosteal bud develops in the primary areolae, creating large cavities called secondary areolae. The bone matrix (osteoid) deposits here and hardens, forming bone. The periosteal collar in the bone starts to get thicker and thicker. The part of the bone and the matrix are removed, and big cavities are created inside the bones. Trabeculae formed as a result of endochondral ossification are also removed. The cavities formed inside bones are known as marrow cavities. Later, fat and bone cells gather inside these cavities and form the marrow tissue.

DISCUSSION

Medodhara Kala is the third *Kala* as per *Maharshi Sushruta* and *Acharya Vagbhata*. As *Kala* is the structure limiting *Dhatu* and *Ashaya*, *Medodhara Kala* is a membranous structure between *Medo Dhatu* and its *Ashaya Asthi*.

In this context, *Majja Dhatu Medodhara Kala* is correlated with endosteum under the criteria of-

- Origin of *Kala*
- Definition of *Kala*
- Structure of *Kala*
- Functional point of view

In the fifth chapter of *Sharira Sthana*, “*Sharirasankhya Vyakarana Sharira*” (*Su.Sha-5/4*), *Maharshi Sushruta* mentioned the list of *Anga Pratyangas*. According to him, *Kala* is a *Pratyanga* that will develop in the micro form during intrauterine life. Here, the *Medodhara Kala* is correlated with the endosteum based on the origin point of view because the endosteal cells in the endosteum are reminiscent of the embryonic stage, undifferentiated mesenchyme, which, under the appropriate regulatory influence, can modulate and transform into cells with hematopoietic potential, stromal cells, and osteoprogenitor cells.

According to *Maharshi Sushruta*, *Kala* is the structure limiting *Dhatu* and *Ashaya*. Similarly, *Medodhara Kala* is a membranous structure between *Medo Dhatu* and its *Ashaya Asthi*. According to a modern point of view, endosteum is a thin membrane that lines the inner surface of the medullary cavity of compact bones.^[8] The trabeculae of the cancellous bones are also covered by endosteum containing osteoblasts, osteoclasts, and osteoprogenitor cells.^[9] Also, according to the definition point of view, the endosteum perfectly correlates with *Medodhara Kala*.

According to *Ayurveda*, *Kala* is made up of *Snayu* (fibrous), *Jarayu* (serous), and *Sleshma* (mucus). These all are the accessory factors for the formation of *Kala*. But it is optional that all three factors are present in *Kala*. *Snayu*, *Jarayu*, *Sleshma*, or a combination form *Kala*.^[10] *Medodhara Kala*, which is correlated with the endosteum, is a membrane lining the inner surface of the bone marrow cavity. The endosteum consists of a layer of flattened osteoprogenitor cells and type III collagenous fibers (reticular fibers).^[11] As the endosteum comprises fibrous connective tissue, it is more acceptable to correlate *Medodhara Kala* with the endosteum from the structural point of view.

Based on a functional point of view:-

- I. The endosteal cells in adult human bone marrow are part of the undifferentiated mesenchymal cells, which, while providing a membranous lining for the bone surfaces, might also give nutritional support to the underlying osteocytes and help to maintain skeletal and plasma calcium homeostasis.
- II. They could also provide the microenvironment necessary for supporting and controlling hematopoiesis.
- III. In addition, when necessary, they can transform directly into hematopoietic or osteoprogenitor (osteoblasts and osteoclasts) cells under appropriate regulatory influence.^[12]
- IV. The endosteum contains hematopoietic stem cells (HSCs), which are totipotent and produce all types of blood cells.^[13]

Based on the above points, the functions of the endosteum(Medodhara Kala) are similar to the structure and functions of bone marrow(Majja Dhatu).

Hence, it is more appropriate to correlate Medodhara Kala with the endosteum by discussing the above four points.

CONCLUSION

- *Medodhara Kala* residing in *Stula Asthi* is the endosteum, which lines the inner surface of the medullary cavity of all long bones.
- *Medodhara Kala* residing in *Anu Asthi* is endosteum because the trabeculae of the cancellous bones are also covered by endosteum containing osteoblasts, osteoclasts, and osteoprogenitor cells.
- *Medodhara Kala* is correlated with endosteum based on the origin point of view because the endosteal cells in the endosteum are reminiscent of the embryonic stage, undifferentiated mesenchyme, which, under the appropriate regulatory influence can modulate and transform into cells with the potential, stromal cells, and osteoprogenitor cells.
- The endosteum consists of a layer of flattened osteoprogenitor cells and type III collagenous fi-

bers (reticular fibers). So, it is more appropriate to correlate *Medodhara Kala* with endosteum from a structural point of view.

- The function (hemopoiesis) of endosteum (*Medodhara Kala*) is quite similar to the functions of bone marrow (*Majja Dhatu*).
- About *Majja Dhatu*, the *Medodhara Kala* residing in *Sthula Asthi* is endosteum.
- The endosteum is a thin membrane that lines the inner surface of the medullary cavity of compact bones. The trabeculae of the cancellous bones are also covered by endosteum containing osteoblasts, osteoclasts, and osteoprogenitor cells.
- *Majja Dhatu* (bone marrow) is not formed from the *Medodhara Kala* (endosteum), but the function (hemopoiesis) of *Majja Dhatu* and *Medodhara Kala* is quite similar.

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