PHYSIOLOGICAL UNDERSTANDING OF
ASTHI DHATU AND ASTHIVaha SROTAS

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ABSTRACT

Introduction: Shareera is composed of Dosha, Dhatu and Mala: Dhatus are the entities which support our body and helps in performing proper physiological functions. Asthi is one among the Saptap Dhatu, which mainly involves in Shareera Dharana function. Asthi Dhatu is located in its Srotas as well as in the whole body. Moolasthana of Asthivaha Srotas is Meda and Jaghana.

Aims and Objectives: To understand the Asthi Dhatu and Asthivaha Srotas and its possible physiological interpretations.

Materials and Method: Literature searches were conducted using classical text in Ayurveda, contemporary books, articles and many others.

Discussion and conclusion: Asthi Dhatu plays a vital role in maintaining the physical integrity of the body. The possible interpretation of the Moolasthana of Asthivaha Srotas can be understood as fat or bone marrow adipose tissue and pelvic bone.
Key words: Asthi, Asthi Dhatu, Asthivaha Srotas

INTRODUCTION

Asthi is one among the Saptadhatus which mainly involves in Shareera Dharana function. Asthi is defined as “Asyate Iti Asthi", it is some hard substance which present inside the soft mass i.e., Mamsa and it doesn’t decompose as fast. It helps in providing a structural framework to the Shareera. Humans stand by the inner strength of Asthi, just as trees do with the support of Sara's inner strength.

UTPATTI

Asthi Dhatu is formed by Meda Dhatu in the sequence of Dhatu Nirmana. Meda Dhatu becomes Khara with the combination of Prithvi and Vayu Mahabhoota and its own Dhatwagni. That Khara part is called as Asthi. The Sthayi Bhaga will nourishes the Asthi, and Poshaka Bhaga flows through the Asthivaha Srotas and nourishes both Upadhatu (Danta) and the subsequent Dhatu (Majja).

LOCATION OF ASTHI DHATU

Asthi Dhatu is located in its Srotas as well as in the whole body.

PANCHA MAHABHOOTA PREDOMINANCE

According to Charaka Acharya, Prithvi, Agni, and Vayu are predominant in Asthi Dhatu, but Sushruta Acharya considers that Prithvi and Vayu Mahabhuta are predominant.

GUNA AND KARMA

Asthi Dhatu is having the qualities such as Guru, Khara, Kathina, Sthula, Sthira and Murtima. It mainly does the function of Deha Dharana and Majja Pushhti. Asthi Dhatu provides structure to the body and supports the body by performing various functions like, protection of soft tissues and vital organs of the body(Protective function), supports the body and brings out various movements of the body by their attachment to the muscles and tendons(Mechanical function), plays an important role in the metabolism of calcium and phosphate in the body(Metabolic function), also red bone marrow in the bones is the site of production of blood cells(Hematopoietic function). Prasada Bhaga of Asthi Dhatu with the action of Majja Dhatwagni will help in the formation of Majja Dhatu.

PARINAMA KALA

Acharya Charaka states that, Asthi Dhatu is formed on sixth day from the Ahara Rasa. However, Sushruta opines that, Asthi Dhatu is formed in a time span of twenty days. In modern science it is mentioned that Osteogenesis begins between the sixth and seventh weeks of embryonic development and continues until about age twenty-five.
TYPES OF ASTHI

There are five types of Asthi in human body.

Table No.1: Types of Asthi

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Ayurveda Type</th>
<th>Modern Type</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kapala</td>
<td>Flat Bones</td>
<td>Janu (knee), Jaghana (pelvic), Amsa (shoulder), Ganda (cheek), Talu (palate), Shankha (temples), Shira (skull)</td>
</tr>
<tr>
<td>2</td>
<td>Ruchaka</td>
<td>Teeths</td>
<td>Danta (teeth)</td>
</tr>
<tr>
<td>3</td>
<td>Taruna</td>
<td>Cartilage</td>
<td>Ghrana (nose), Karna (ear), Griva (neck), Akshikosha (orbit of the eye)</td>
</tr>
<tr>
<td>4</td>
<td>Valaya</td>
<td>Ribs</td>
<td>Parshuka (ribs), Prushta Kasheruka (vertebrae)</td>
</tr>
<tr>
<td>5</td>
<td>Nalaka</td>
<td>Long Bones</td>
<td>All other long bones</td>
</tr>
</tbody>
</table>

NUMBER OF ASTHI

Table No.2: Number of Asthi according to different Acharyas

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Opinion of</th>
<th>Number of Bones</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charaka Samhita</td>
<td>360</td>
</tr>
<tr>
<td>2</td>
<td>Sushruta Samhita</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>Astanga Samgraha</td>
<td>348</td>
</tr>
<tr>
<td>4</td>
<td>Modern Science</td>
<td>206</td>
</tr>
</tbody>
</table>

UPADHATU AND MALA

Table No.3: Upadhatu and Mala of Asthi Dhatu according to different Acharyas

<table>
<thead>
<tr>
<th>Acharya</th>
<th>Upadhatu</th>
<th>Sushruta</th>
<th>Sharangadhar</th>
<th>Bhavaprakash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Charaka</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sushruta</td>
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<tr>
<td></td>
<td>Sharangadhar</td>
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<tr>
<td></td>
<td>Bhavaprakash</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPA DHATU</td>
<td>-</td>
<td>-</td>
<td>Danta</td>
<td>-</td>
</tr>
<tr>
<td>MALA</td>
<td>Kesha, Loma</td>
<td>Nakha, Roma</td>
<td>Nakha</td>
<td>Nakha, Loma</td>
</tr>
</tbody>
</table>

ASTHI VRIDDHI LAKSHANA

Acharya Sushruta and Vagbhata have mentioned that, Asthi Vridhdi causes overgrowth of bones and extra teeth. Commentator Dalhana adds excess growth of hair.
**ASTHI KSHAYA LAKSHANA**

As stated by Acharya Charaka, due to Kshaya of Asthi Dhatu falling of scalp hair and body hair, nail, beard and teeth is observed. These symptoms are accompanied by an increase in joint looseness\(^2\). According to Sushruta Samhita, Asthi Kshaya is characterized by extreme bone pain, brittle nails and teeth, and dryness. Dalhana adds, the entire body becomes dry, including the nails and teeth\(^2\). Given the link between Vata and Asthi Dhatu, this makes sense. The same kind of Lakshanas are explained by Ashtanga Hridaya\(^2\).

**ASTHIDHARA KALA**

Acharya Sushruta has not mentioned about Asthidhara Kala. But Acharya Dalhana opines that Purishadhara Kala is same as Asthidhara Kala. It can be explained through various examples like: Asthi Dhatu is fifth amongst Sapta Dhatus. According to Acharya Sushruta, Visha Vegas are seven because they take the Ashraya in the Sapta Kala and exhibits Vishavegantara Lakshanas accordingly. In the fifth Visha Vega, when the Visha is in fifth Kala i.e., Purishadhara Kala, there is Parvabheda which is related with Asthi\(^2\). Both Pakwashaya and Asthi are important sites of Vata Dosha. Basti Karma which is considered as Ardha Chikitsa is given through rectal route, so in this way Basti nourishes the Asthivaha Srotas and thereby treats Vataja Vikaras and Asthi Dhatu Kshaya. In Asthi Pradoshaja Vikara like Asthi Kshaya, Asthi Vidradhi, Katishoola, Sandhi Vata etc. Panchatikta Ksheera Basti is advised\(^2\).

**ASHRAYA-ASHRAYI BHAVA**

Ashraya is Adheya, or the ground for support, and Ashraya is Adhara, or support. Dosha and Dushyas are having Ashraya Ashrayi Sambandha, they stay together. Asthi is Ashraya to Vata Dosha. Because of its Laghu Guna, Vata keeps the bone light. The reflection of the Vriddhi of Dushya is the Vriddhi of Dosha. This law only applies to the signs of Kapha and Pitta. Asthi is a part of Vata: if Vata rises, Asthi falls and vice versa\(^2\). Brimhana Chikitsa is indicated for Vata Vriddhi. Decreased state of Asthi Dhatu is to be treated with Basti using Ksheera, Ghrita and Tikta Rasa Dravyas\(^2\).

**ASTHI SARA PURUSHA**

Acharya Charaka explains that Asthi Sara Purusha has large and stout-heel (Parshni), ankle (Gulpha), knee joint (Jamu), forearm (Aratni), scapula (Jatru), chin (Chibuka), head (Shira), joints of finger (Parva), bone (Asthi), nail (Nakha) and teeth (Danta). Such persons are very enthusiastic, active, bear strain, have excellent and durable bodies and live for long\(^2\). Sushruta Acharya states that Asthi Sara individual has huge head, shoulder, tooth, chin, nail, and bones\(^2\).

**ASTHIVAAAA SROTAS**

Srotas are the Channels meant to carry Dhatus during the process of transformation from one Dhatu to another Dhatu\(^1\). Asthivaha Srotas helps to transport the materials needed to make the bone tissue in the body. It has been only explained by Acharya Charaka.
**MOOLASTHANA:**

Table No.4: Moolasthana of Asthivaha Srotas according to different Acharyas

<table>
<thead>
<tr>
<th>CHARAKA SAMHITA</th>
<th>SUSHRUTA SAMHITA</th>
<th>ASTANGA SAMGRAHA</th>
<th>ASTANGA HRIDAYA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDA AND JAGHANA</td>
<td>-</td>
<td>MEDA AND JAGHANA</td>
<td>MEDA AND JAGHANA</td>
</tr>
</tbody>
</table>

**ASTHIVAVA SROTODUSHTI KARANA**

The Asthivaha Srotodushti is caused by, Vyayama (indulgence in excessive exercise), Ati Sankshobha (excessive irritation), Asthi Vighattana (bones being crushed and subjected to repeated trauma), Vatala Ahara (excessive consumption of Vata aggravating food).

**ASTHI PRADOSHAJAVIKARAS**

Asth Pradoshaja Vikaras are, Adhyasthi (bone overgrowth), Atidanta (extra teeth), Dantabhedha (crack in the tooth), Asthibheda (splitting pain in the bone), Danta Shula (pain in the tooth), Asthisthula (pain in the bone), Asthi Toda (pricking pain in the bones), Vivarnata (discoloration of the body), Kesha Dosha (disorders of hair), Loma Dosha (disorders of body hair) Shmaska Dosha (deformities of moustache) and Kunakha (infection of nailbed).

**ASTHI AS THE MOOLASTHANA OF MAJJAVAHA SROTAS**

Asth is considered to be one among the Moolasthanas of Majjavaha Srotas. During the formation of Asthi, Vayu Mahabhuta makes space in the Asthi Dhatu, later these spaces get occupied by the Meda Dhatu, is referred to as Majj.

**DISCUSSION**

**STHAYI AND ASTHAYI ASTHI Dhatu**

Sthayi Bhaga of a Dhatu will nourish itself whereas Asthayi Bhaga has the ability to transport and nourish the next Dhatu and Upadhatu. In case of Asthi Dhatu, the Sthayi Dhatu can be considered as the Osseus tissue which is the specialized rigid connective tissue that forms the skeleton. The Asthayi Asthi Dhatu can be considered as the bone minerals or bone salts such as Calcium, Magnesium, Phosphorous etc. which helps to strengthen the bone.
MEDA AS MOOLASTHANA

According to Dhatuposhana Nyaya, the origin of Asthi Dhatu takes place on account of the specific action of Asthi Dhatwagni and Asthi Poshakamsa which is formed during the time of Medo Dhatu Utpatti. Here Meda can be understood as the fat or bone marrow adipose tissue.

Both bone and adipose tissue are having the same origin i.e., Mesenchymal stem cells. BMAT (bone marrow adipose tissue) is a heterogeneous tissue, found mostly in the medullary canal of the long bones (tibia, femur and humerus), in the vertebrae and iliac crest. This adipose tissue is also known as marrow adipose tissue (MAT) or yellow adipose tissue. Functionally, marrow adipocytes secrete adipokines, such as adiponectin, and cytokines, such as RANK-ligand and stem cell factor. These mediators can influence bone remodelling by promoting bone resorption. In addition, marrow adipocytes can secrete free fatty acids, acting as an energy supply for bone.

Fats are an essential part of a balanced diet. Saturated fatty acids (SFAs) improve bone health by enhancing osteoclast survival and promotes calcium absorption or excretion. Omega-3-long-chain polyunsaturated fatty acids (W-3 LCPUFA) mediate bone metabolism via lipid oxidation, calcium absorption and prostaglandin synthesis. It helps in promoting the functions of bone marrow mesenchymal stem cells and osteoblasts.

Fat facilitates fat soluble vitamins. Vitamin D is one among the fat-soluble vitamins which is essential for the calcium absorption. As a result, as indicated by all of these facts, they are crucial for maintaining bone health.

PANCHATIKTA KSHEERA BASTI AND BONE HEALTH: THE ROLE OF FAT

Acharya Charaka has advised Panchatikta Ksheera Basti for the Asthi Pradoshaja Vikaras. Basti is the best treatment for pacifying Vata Dosha. As Vata is having Ashraya- Ashrayi Bhava with Asthi, Basti will help to control Vata Dosha as well as nourishing Asthi Dhatu. Studies shows that fatty acids might serve as potential therapeutic and nutritional agents in managing metabolic bone disorders. All the ingredients of this Basti like, Guduchi (Tinospora cordiofolia), Nimba (Azadirachta indica), Vasa (Adhathoda vasica), Kantakari (Solanum xanthocarpum), Patola (Luffa acutangula), Ksheera (Milk), Goghrita (Ghee), Madhu (Honey) contain fatty acids which might improve absorption as well as bone health.

JAGHANA AS MOOLASTHANA

The Pelvic region is intimately associated with Pakwashaya, the source of Vata. Applied through Guda Marga, Basti Chikitsa acts on Pakwashaya and is the principal treatment for Vataja Vikara. Any issue with Jaghana causes a disruption in the living body's upright posture. This is the area where Asthivaha Srotas vitiation is most commonly seen in old age.

Pelvic bone forms the central axis of the skeletal framework of our body. Its primary role is to support the weight of the upper body while sitting and to transfer this weight to the lower limbs while standing. It
serves as an attachment point for trunk and lower limb muscles, and also protects the internal pelvic organs. Thus, pelvic bone plays a vital part in skeletal system.

CONCLUSION

All the Dhatus have its own importance in sustaining the life of an individual. Asthi Dhatu plays a vital role in maintaining the physical integrity of the body. It is present all over the body, and is superior in Deha Dharana, despite the fact that it is the primary function of all Dhatus. Sthayi Bhaga of Asthi Dhatu can be correlated to the osseus tissue whereas Asthayi Bhaga can be correlated as the bone minerals like calcium, phosphorous, magnesium etc. As the Moolasthana of Asthivaha Srotas, Meda can be understood as the fat or bone marrow adipose tissue, while the pelvic bone can be understood as Jaghana.

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