

A COMPREHENSIVE STUDY OF *ASTHIKSHAYA* WITH SPECIAL REFERENCE TO OSTEOPENIA

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ABSTRACT

Objective: To study and conceptualize the concept of *Asthikshaya* in *Ayurveda*. **Data Sources:** *Charaka Samhita* with *Chakrapani* commentary, *Sushrut Samhita* with *Dalhan* commentary and *Ashtang Hridaya* with *Sarvangsundra* commentary, all accessed from NIIMH website. Principles of anatomy & physiology by Tortora as a source of contemporary data. **Review Methods:** Literary review mainly focussed on description of *Asthi Dhatu* and its relation with *Vata Dosha* by *Ashrayashrayi Sambhandha*. Etiological factors of *Asthikshaya* along with symptoms and *Samprapti* are correlated with osteopenia. **Results:** *Asthikshaya* is a condition in which there is a progressive decrease in

the *Asthi Dhatu* (Bone tissue). *Asthikshaya* is not described as a separate entity in *Samhitas* but *Acharya Charaka* has explained it under 18 types of *Kshaya*. It is a slowly progressive bone metabolic disorder. **Conclusion:** Osteopenia is considered as a silent disease which if remain untreated may lead to osteoporosis; a major cause of fractures. *Asthikshaya* is a *Vata Vyadhi* without any prodromal symptoms like osteopenia. Hence, *Asthikshaya* (Osteopenia) can be considered as a prodromal phase of osteoporosis.

KEYWORDS: *Asthikshaya*, *Ashrayashrayi Sambhandha*, Osteopenia.

INTRODUCTION

Ayurveda is the world's oldest system of medicine and its origin can be traced in *Rigveda* and *Atharvaveda*. *Ayurveda* involve a scientific tradition of peaceful living. The gross physiology of *Ayurveda* is based on achieving, maintaining and promoting positive health. Human body

is a beam of equilibrium of *Dosha, Dhātu and Mala*.^[1] A *Dhātu* is that entity which supports and provides nourishment to the body. *Asthi* is the fifth among metamorphic chain of *Dhātu* which protects the vital organs and gives shape to the body. *Asthi* is one of the *Gambhir Dhātu* and it comes under the *Madhyam Rog Marga*.^[2] The existence of human body without *Asthi* would have been like a formless bolus of tissues. Generally, bones are considered as *Asthi Dhātu*. *Asthikshaya* is not described as a separate entity in *Samhitas* but *Acharya Charak* has explained it under 18 types of *Kshaya*.^[3] *Asthikshaya* is a condition in which there is a progressive decrease in the *Asthi Dhātu* (Bone tissue).

It can be correlated with osteopenia in which there is a decrease in bone mineral density which encompasses a wide range of fracture risk. World Health Organization defined osteopenia in June 1992^[4] ^[5] as a BMD level between -1.0 to -2.5 SD below that of a 'young normal' adult (T-score between -1.0 and -2.5, whereas osteoporosis as a T-score at -2.5 or lower). World Health Organisation (WHO) has established the definition based on BMD measurement at the spine, hip or forearm by Dual-Energy X-Ray Absorptiometry (DEXA) devices.^[6]

Objective

To study and conceptualize the concept of *Asthikshaya* in *Ayurveda*.

MATERIAL AND METHODS

Various *Ayurvedic Samhitas* including *Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridayam*, *Ashtanga Samgraha* and their commentaries were kept in centre for this review. Relevant materials were searched and collected from other sources like modern textbooks, websites, various databases like PubMed, google scholar, journals and other research articles. After thoroughly going through all the sources, a critical review was done over the same which is tried to be elaborated through this manuscript.

Etymology

According to *वाचस्पत्यम्*: the word '*अस्थि*' is derived from the root '*अस + स्थिन्*' meaning 'to throw' or 'to stay' or in the sense of Stability.^[7] It denotes a bone or the kernel of a fruit.^[8] According to modern science bone is defined as the hard connective tissue of the skeleton of a vertebrate.^[9]

Definition^[10]

अस्यते क्षिप्यते यत्शरीरस्थसप्तधात्वन्तर्गत धातुविशेषः ॥ इति भाषा

Asthi is a body tissue which stays for a longer time (*Asyate*) and which takes part in movements (*Kshipyate*) with muscles. It is found inside the coating of *Mamsa*. Muscles are attached strongly to the bones by means of veins and ligaments and thus are kept in position and do not fall off.^[11] He compared the bone with hardcore inside the trunk of a tree to support it, in the same way body is supported by bones and is kept erect.^[12] And since these bones form the pith (*Sara*) of the human body, they are not destroyed even after the destruction and falling off the attached flesh, skin etc. of the body.^[13]

Fundamental Constitution & Properties

Fundamental constitution of *Asthi Dhatu* shows predominance of *Partiva Mahabhuta* and physical properties of *Prithvi Mahabhuta* are guru (Heavy), *Khara* (Rough), *Kathina* (Hard), *Manda* (Slow), *Sthira* (Stable), *Vishada* (Clear/Non slimy), *Sandra* (Dense), *Sthula* (Gross), *Gandha* (Smell) dominance, *Shabda* (sound), *Sparsha* (touch), *Rupa* (vision) and *Rasa* (taste).^[14] And *Acharya Charaka* has also explained physical properties of *Asthi Dhatu* as *Guru* (Heavy), *Khara* (Rough), *Kathina* (Hard), *Sthula* (Gross), *Sthira* (Stable) and *Murtiman* (with a definite physical form).^[15]

According to modern histology of bone or osseous tissue contains extracellular matrix which is composed of 15% of water, 30% of collagen fibres and 55% of crystallized mineral salts. The most abundant mineral salt is calcium phosphate $[Ca_3(PO_4)_2]$. It combines with another mineral salt, calcium hydroxide $[Ca(OH)_2]$ to form hydroxyapatite $[Ca_{10}(PO_4)_6(OH)_2]$. These crystals then combine with calcium carbonates and ions like magnesium, fluoride, potassium and sulphate. Then, these mineral salts are deposited in the framework formed by collagen fibres of the extracellular matrix to make the tissue hard. This process is called ossification.^[16] So, calcification depends upon the presence of collagen fibres. Mineral salts (*Prithvi & Agni*) first begin to crystallize in the microscopic space (*Aakash and Vayu*) between collagen fibres.

Therefore, the overall composition can be presented predominance wise as-

Prithvi + Vayu + Agni + Akasa + Apa

Asthivaha Srotas

Srotas are the body channels through which nutrients are transported from the place of production to the place of need. The channel for transportation and transformation of *Asthi Dhatu* as mentioned by *Acharya Charaka* are predecessor *Meda Dhatu* and *Jaghana* (Pelvic Girdle).^[17] The process of digestion and assimilation of food is completed in three phases. During third phase of *Dhatwagni*, *Asthi Dhatu* gets its nutrition from *Medo Dhatu* as a part of the complementary cycle of *Dhatu* formation.^[18] On the other hand, pelvic bones are considered as the largest and most thick bones having maximum surface area. Therefore, as a reservoir for calcium, phosphorus and other ions, it plays the most important role in ion exchange. Thus, the *Mula* of *Asthivaha srotas* can be justified as *Meda* and *Jaghan* (Pelvic bones).

Ashrayashrayi Bhava

On the basis of constitution of *Asthi Dhatu* it can be considered that *Prithvi* is most abundant *Mahabhuta* of *Asthi Dhatu*. And increase in *Vayu Mahabhuta* may lead to decrease in *Asthi Dhatu*. So, *Asthi* is the main seat of *Vata Dosha*. *Acharya Vagbhata* has explained that *Asthi Dhatu* and *Vata* are inversely proportional to each other i.e., when *Vata* increases, *Asthi* decreases and vice-versa.^[19]

Etiological Factors

There is no separate description of *Asthi Kshaya Nidana* in *Ayurvedic* texts but on the basis of *Ashrayashrayi Bhava* it can be said that the factors which increases *Vata* are *Nidana* of *Asthi Kshaya*. *Acharya Charaka* had explained general etiological factors for *Kshaya*.^[20]

***Vata* vitiating factors^[21]**

1. Excess intake of food which is dry, light to digest and cold.
2. Over administration of *Shodhan Karam* like *Vaman*, *Virechan*, *Asthapan* and *Shirovirechan*.
3. Suppression of urges.
4. Excessive physical workout.
5. Fasting and any kind of physical trauma.
6. Over indulgence in sexual activities.
7. Fear and sorrow.
8. Excessive blood-letting.
9. Improper sleep at night.

10. Odd postures of body.

In addition to this, all *Dhatus* are formed in a metamorphic chain, so, vitiation of *Medovaha*, *Asthivaha* and *Majjavaha Srotas* may also lead to *Asthikshaya*.

Table No. 1: Factors causing *Srotas Dushti*.

<i>Medovaha Srotas</i> ^[22]	<i>Asthivaha Srotas</i> ^[23]	<i>Majjavaha Srotas</i> ^[24]
<ul style="list-style-type: none"> • Intake of fat rich diet and <i>Varuni</i> (a type of drink) • Lack of exercise • Day time sleep 	<ul style="list-style-type: none"> • <i>Vata</i> aggravating diet and lifestyle. • Any kind of bone fracture. • Excessive physical exercise. • Irritation. 	<ul style="list-style-type: none"> • Intake of <i>Abhishyandi</i> and incompatible diet. • Crushing trauma and compression.

Symptoms of *Asthikshaya*

According to *Acharya Charaka*^[25]

- Loss of scalp, facial and body hair.
- Looseness of joints.
- Nail disorder.

According to *Acharya Sushruta*^[26]

- Pain in bones.
- Erosion of teeth and nails.
- Roughness.

According to *Acharya Sushruta*^[27]

- Pricking pain in bones.
- Weakness in teeth, hair and nails.

Samprapti

Samprapti of *Asthikshaya* is not explained in *Ayurveda* texts, but on the basis of etiological factors we can say that vitiation of *Vata* plays the main role in *Samprapti* of *Asthikshaya*. According of *Acharya Charaka* vitiation of *Vata* occurs by two ways; *Dhatukshaya* and *Margavrodha*.^[28] Therefore, the *Samprapti* can be explained by two ways, one is *Dhatukshayajanya* and another is *Margavarodhajanya*. Both these lead to aggravation of *Vata* and this gets filled in the vacant *Srotas* and lead to the various generalized and localized disorders. According to *Aashrya-ashrayi Bhava*, we can say that aggravated *Vata* lead to the *Dusti* of *Asthivaha Srotas* and further causes *Asthikshaya*.

DISCUSSION

Life has become extremely difficult in the modern era of improved technology and hectic schedules. As a result, no one pays attention to healthy eating habits and lifestyle habits, culminating in metabolic disorders. One of them is *Asthikshaya*, or Osteopenia. Its prevalence is unaffected by socioeconomic status. People with a higher socioeconomic status may have a more sedentary or stressful life and are also more likely to consume unhealthy diets such as fast food and carbonated beverages, which is a major cause of *Agni Dusti* and can lead to *Srotorodha* or *Margavrodha*. As a result, the transport and transformation of *Poshak Dhatu* to *Asthivaha Srotas* is hampered, potentially resulting to *Asthikshaya*. People with a higher socioeconomic status may have a more sedentary or stressful life and are also more likely to consume unhealthy diets such as fast food and carbonated beverages, which is a major cause of *Agni Dusti* and can lead to *Srotorodha* or *Margavrodha*. As a result, the transport and transformation of *Poshaka Dhatu* to *Asthivaha Srotas* is hampered, potentially resulting to *Asthikshaya*. People with a higher socioeconomic status may have a more sedentary or stressful life and are also more likely to consume unhealthy diets such as fast food and carbonated beverages, which is a major cause of *Agni Dusti* and can lead to *Srotorodha* or *Margavrodha*. As a result, the transport and transformation of *Poshaka Dhatu* to *Asthivaha Srotas* is hampered, potentially resulting to *Asthikshaya*.

Bone remodelling is process of replacement of old bone tissue with new one. It involves the resorption of minerals and collagen fibres by osteoclast, and bone deposition by osteoblasts. If the osteoclastic activity overrun the osteoblastic activity, then it results in bone loss causing osteopenia.^[29] As a result, aggravated *Vata Dosha* causes bone resorption and an increase in osteoclastic activity. With advancing age, *Vata Dosha* increases, and *Dhatukshaya* occurs resulting in *Asthikshaya*.^[30] As people age, some central (haversian) canals may get blocked, resulting in Osteopenia i.e., *Asthikshaya*.

CONCLUSION

Osteopenia is considered as a silent disease because it remains undiagnosed until any fracture occurs. In *Ayurveda* *Asthikshaya* is considered as *Vata Vyadhi* and *Acharya Charaka* has explained that *Vata Vyadhi* has indistinct manifestation in prodromal stage. So, it is clear that *Asthikshaya* is a prodromal stage of osteoporosis which is known as osteopenia. The gold standard for diagnosing the osteoporosis is Bone mineral density test by DEXA-Scan and

bone biomarkers like serum osteocalcin and bone alkaline phosphatase. It should be diagnosed at early stage of osteopenia.

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