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CRITICAL INTERPRETATION OF ASTHI KSHAYA AND OESTEOPOROSIS W.S.R ASTHI DHATWAGNI

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ABSTRACT

Ayurveda is an ancient science of life deals with the preventive as well as curative aspect. It is not possible to understand an abnormality without knowing the normality of the concern object. Equilibrium of *Dhatu* is health and disequilibrium cause disease. Function of *Asthi Dhatu* is 'Dharanam shrestham karma. Acc.to Shusruta, 'Astthoni dehdharanam majja pusthiam cha. Asthi gives shape of the body and protect the vital organs. any qualitative, quantitative changes in *Asthi* lead to disease. According to the principle of *Ashryaashryee bhav*, Asthi dhatu is seat of *Vata Dosha*, and reciprocal to each other. Increase of vata dosha is the key factor responsible for *Asthi Kshya*. In Ayurveda both *Vridhi and Kshya* are mentioned as the pathological states of dhatus. *Asthi Kshya* is a condition explained in ayurveda, concept of Asthi kshaya has explained under 18 types of Kshaya by Acharya Charak. Dhatvagni is important factor for dhatu creation, maintenance and growth of dhatus. Within physiological limit if kayagni is strong, dhatvagni become strong. If dhatvagni is strong it will utilize the substrate of aahar rasa and if not satisfied begins to destroy the dhatus itself which leads to dhatukshyaya. Hence both vridhhi and kshyaya of dhatus are mainly due to Hypo and hyper status of dhatvagni, respectively. In Western Medicine, there is a

condition known as osteoporosis which means ‘Porous Bones’ or the brittleness of the bones due to increased porosity from loss of mineral substance, causing reduction in the bone tissue and leading to increased risk of Fractures.

Keywords- Asthi Dhatu, Ashryaashree Bhav, Vata dosha, Asthi Kshya, Osteoporosis

INTRODUCTION

Ayurveda explains Human body as a homeostasis’ of *Dosha, Dhatu, And Mala*. *Dosha Dhatu Mala Mulam hi shariram¹* This can be substantiated by acharya Sushruta’s definition of health. Equilibrium of dosha [sharirik and mansik] psycho-biological rhythm, dhatu [body tissue-digestion and metabolism], *mala kriya* [excretory function] and well-being of Soul, Senses and Mental function.

The function of *Dhatu* is *Dharan* [maintain the body structure and protect the body organs]. Among the *Dhatu*, *Asthi Dhatu* is responsible for maintain the structural frame of the body. It gives shape to the body and protects the vital organs. *Asthi Kshaya* is explained in 18 types of *Kshaya* by Acharya charak². It can be compared to osteoporosis in contemporary era. Two conditions mentioned in ayurveda may be discussed in this regard. *Asthi kshaya* and *Asthi Soushirya*. *Asthi Kshaya* is decrease in the bone tissue & *Asthi Soushirya* means porosity of the bones. Hemadri has mentioned on the word *Soushirya* as ‘*Sarandhratvam*’ which means with pores³. This condition is explained in the context of *Majja Kshaya*. The vitiating

factor of *Majjavaha Srotas*, such as intake of *Abhishyandi* and incompetent diet vitiates *Vata* due to *Margavarodha* (obstruction).

EPIDEMIOLOGY

Osteoporosis or porous bone is a Worldwide problem categorized by low bone mass density & structural deterioration of bone tissue, leading to bone fragility and increase fractures. Men along with women are affected by osteoporosis but females are higher risk. This risk even increases at the time of menopause, which is the period of hormonal imbalance.

World-wide Osteoporosis causes more than 8.9 million fractures Annully⁴. Osteoporosis affects 200 million women world-wide.

INTERPRETATION OF ASTHI KSHAYA

The term *Asthi* is derived from the root *As’+ Kthin’* meaning ‘To stay’ or in the sense of ‘Stability’⁵. The meaning of *Asthi* is ‘*asyate kshipyateyat, asyate iti asthi*’. *Mamsa bhyantarasthah- sharirastha sapta dhatvantargata dhatuvisheshaha*⁶ That which is present in its own state for a long period is called *Asthi*. Sushruta mentions

that *twacha*, *mamsa* etc. gets demolished soon after death, but Asthi persists in its own state for a long period.

Hence, it is called as the *sara of sharir*⁷. The definition of *kshaya* is '*kshiyate anena iti kshya*', *kriya kshayakarawat tu kshaya ityucyatebudhaihi*, *kshaya vyadhi visheshaha*⁸. That which decreases is called as *kshaya* or *kriya*, which cause the decrease either Qualitative or Quantitatively is known as *kshaya* and it is a *Vyadhi Visheshha*.

PANCHBHOUTIK CONSTITUTION OF ASTHI DHATU

Prithvi and *Vayu Mahabhoot* are predominant in *Asthi Dhatu*. *Kathinata* [hardness], *Sthiratva* [stability], *Chirasthayitva* [durability], *Gurutva* [heaviness] and *Ghanatva* [compactness] are the *Guna* contributed by *Prathvi Mahabhoot* to *Asthi Dhatu*. *Vayu* produces sinuses [cavities] in bones with support of *Akash mahabhoot*.

According to Dalhana⁹, *Asthidhara Kala* and *Purishdhara Kala* are the same Functional similarities between these two can be understood that, both are the places of *Vata Dosha*.

ASTHIVAHA SROTAS¹⁰

Mulasthanas of *Asthi Vaha Srotas* are principal organs like *Medodhatu* and *Jaghana* or *Groin Region*. *Commetator* Explains that *Asthi Dhatu* is found in fluid

form and therefore word [asthivahanam] or conveyer of *Asthi Dhatu* is used for its *Srotas*. As we know that *Srotas* is *suvh* space in living body, where absorption and conversion of nutriment required for the entity takes place.

PHYSIOLOGY OF BONE FORMATION

Bone and teeth contain the mineral hydroxyapatite [calcium phosphate with some OH groups] associated with a cartilage [protein] matrix.

Collagen molecules and ground substance is primarily formed by osteoblast through complicated sequence of biochemical reactions.

FUNCTION OF ASTHI DHATU¹¹

- 1-*Dehadharanam* function of *Asthi dhatu* includes, *Samrakshana Avalamban* and *Nibandhan*.
- 2-*Majjakrita*- *Asthi Dhatu* controls quantity of *Majja Dhatu*. Hence *Majja Poshana* is the function of *Asthi Dhatu*.
- 3-*Mala Poshana*- To keep *Nakha*, *Loma Kesha* etc *Mala* of *Asthi dhatu* in *Prakrutavastha* and their nourishment is also the function of *Asthi dhatu*.

MANIFESTATIONS OF ASTHI VRIDHI AND KSHYA¹²

Due to increase in asthi dhatu bone are deposited on Bones. commentator dalhana adds increase in hair, nails also.

Due to wanning Asthidhatu falling of head and body hair, nails, beard, and teeth observed. Along with these manifestations looseness in joints & pain in bones are precipitated. Dalhana adds that entire body becomes dry along with nails and teeth.

FEATURES OF ASTHI SARA PURUSHA¹³

Asthisara Purusha has large and stout- heal ankle, knee, forearm, scapula, chin, head and joint of finger, bone, nail and teeth. Such person is very enthusiastic, active, bear strain, have excellent and durable bodies and live for long.

PHYSIOLOGY OF BONE¹⁴: bone or osseous tissue is a specialized rigid connective tissue that form the skeleton. It consists of special type of cell and tough intercellular matrix [protein fiber called collagen fibers] of ground substance. And it is strengthened by the deposition of mineral salts like calcium phosphate and calcium carbonate.

Bone has three major types of cells: 1- osteoblasts, 2- osteocytes, 3- osteoclasts.

BONE REMODELING: bone Remodelling is a dynamic lifelong process in which old bone is resorbed and new bone is formed. Usually, it takes place in groups of bone cells called the basic multicellular

units [BMU]. The entire process of remodeling extends for about 100 days in compact bone and about 200 days in spongy bone.

Process of bone remodeling: **1- bone resorption-** destruction of bone matrix and removal of calcium [osteoclastic activity], **2-bone formation-** development and mineralization of new matrix [osteoblastic activity]

COMMON ETIOLOGICAL FACTORS FOR ASTHI KSHAYA

The Etiological factors for *asthi kshaya* are not mentioned separately in the Samhitas. but one should assess the Etiological factors for asthi kshaya on the principal of *Ashrayashrayi Bhavas¹⁵*. Asthi is the main seat of *Vata*. *Vagbhata* describe that increase or decrease of *Asthi* and *vata* are inversely proportional to each other. The factors which cause increase of *vata* will cause decrease of *Asthi*.

Charaka has explained the *Samanya Nidanas* which Cause to the *Asthi Kshaya* of 18 types¹⁶. The Etiological factors can be classified as *Aharaja* [dietary], *Viharaj* [lifestyle], *Mansika* [mental] and *Anyaj* [others].

Aaharaj Nidanas: *Vata* prkopaka, ruksha, laghu ahara increase the Rukshata of *Vata* dosha. The Snehatwa of Medas and Majja dries up due to Ruksha Guna of the *Vata* dosha leading to the improper nourishment

of the asthi dhatu causing asthi kshaya. This vriddhi of vata dosha leads to the asthi dhatu kshaya because of Ashraya-Ashrayi Bhava.

Viharaj Nidanas: Balavad- Vighraha and Bhar-vahan are some of the causes for Urah Kshata resulting in *Abhighat janya Vata vriddhi*. This in turn leads to asthi dhatu kshaya. Excessive indulgence in *Vyayama, Adhyayana, Pradhaavana, Langhana, Plavana & Pratarana* [swimming] leads to vriddhi of Chala Guna of vata dosha. This vriddhi of Vata dosha leads to Asthi Dhatu kshaya. Dharan of Adharaniya vegas causes obstruction in the normal vata Gati(Margavarodha) and leads to vata prakopa. This Prakopit vata causes Asthi dhatu kshaya.

Maansika nidaan: which cause vata Prakopa Chinta, Krodha, Bhaya, Shok are explained. These result in improper nourishment of the dhatus and obstruction in the asthi dhatu poshak components causing Asthi kshaya.

Hormonal Abnormalities- Oestrogen deficiency woman. This is usually the result of menopause in women, although there are other conditions in younger women that can also lower Oestrogen levels. This is one of the reasons why osteoporosis is more frequent in women. Hyperthyroidism, high levels of parathyroid hormone [primary

hyperparathyroidism], excess cortisol production [Cushing's syndrome], low level of testosterone in men[hypogonadism], inflammatory arthritis, medications such as steroids, anti-epileptic drugs.

COMMON ETIOLOGICAL FACTORS FOR OSTEOPOROSIS

Osteoporosis may be seen as a consequence from the involutional losses related with aging and in women, additional losses related to natural Menopause. This condition is called as the '**Primary Osteoporosis**'. Osteoporosis that is caused or aggravated by other disorders or Medication exposures is referred to as '**Secondary Osteoporosis**'¹⁷.

MORPHOLOGIC FEATURES OF OSTEOPOROSIS¹⁸

Except disuse or immobilisation osteoporosis which is localised to the affected limb, other forms of osteoporosis have systemic skeletal distribution. Histologically, Osteoporosis may be active or inactive type.

Active osteoporosis is characterised by increased bone resorption and formation i.e., *Accelerated turnover*. There is increased resorptive surface as well as increased quantity of osteoid with increased osteoblastic surfaces. The width of osteoid seams is normal.

Inactive osteoporosis has the features of minimal bone formation and reduced resorptive activity i.e., *reduced turnover*. Histological changes of inactive osteoporosis include decreased number of osteoclasts with decreased resorptive surfaces, and normal or reduced amount of osteoid with decreased osteoblastic surface. The width of osteoid seams is usually reduced or may be normal.

SAMPRAPTI

In Ayurveda classic, all the Etiological factors explained under Vata Vyadhi an attempt has been made here to formulate and explain the Pathogenesis of Asthi Kshaya. The etiological factors responsible for the vitiation of Medovaha, Asthivaha, Majjavaha and Purishavaha Srotas play a major role in the pathogenesis of Asthi kshaya. Proper functioning of Jatharagni, Dhatwagni & Bhutagni are Important for this function. Samprapti of asthi kshaya explained as Samanya and Vishesh Samprapti. **Samanya Samprapti:** increase in vata leads to decrease in Asthi dhatu. Margavarana and dhatu kshaya are the causative factors for Aggravation of vata¹⁹. Charaka has maintained that due to the obstruction in the path of Vata especially *Vyan vayu*, it Aggravates and cause dryness in Rasadi dhatu²⁰. Obstruction of Normal Gati of Vata [vyana vayu] occurs due to Margavarana. By this the Ahara Rasa

vikshepa [rasa samvahana] dhatu vyuhana and agni samorana functions of vyana vata are affected. As a result of this, the Ahara Rasa containing the poshakamsas will not be able to reach the dhatus and nourish the sthaya dhatus as lead to dhatu kshaya. It can be said that dhatu kshaya karaka and *margavarana karaka nidaan sevena* causing the prakupita vata to fill the riktaat in asthivaha srotas which are devoid of snehadi gunas and cause asthi kshaya.

Vishesh Samprapti: It may be surprising that asthi kshaya may also be seen in patient of Sthaulya. Asthi is the very next tissue to Meda and Meda nourish the Asthi dhatu, hence there should be increase of asthi in the persons of increased Meda. Charak and chakrapani both have clarified that, Snigdha, Guru etc. Ahara taken by the person suffering from obesity is directed towards the nourishment of Meda dhatu only. And predecessor and subsequent tissue nourishment will not possible²¹. Medovah srotas is vitiated due to its provoking factors. This leads to medo dhatwagni mandyata, which cause Meda Vridhhi. Due to hypo functioning of Meda Dhatwagni, instead of Sthayi Meda dhatu, Ama meda is formed. Excessive accumulation of such ama Meda causes obstruction in the channels nourishing the subsequent tissue [asthi] leading to asthi kshaya. In later stages decrease of Majja,

Shukra, and Oja may also be seen as complications.

Vitiation of Jatharagni leads to improper digestion of the food, resulting the production of Ama Rasa, leading to improper nourishment of the asthi resulting in asthi kshaya.

Asthi dhatwagni also has anabolic and catabolic function. Charak opines that the *sharirika Roga* [somatic disease] and *Manasika Roga* [Psychic disease] have inter-relationship. Acharya Chkrapani clarifies that: this relationship may be four ways, 1-*Shariranam Sharirena*, 2-*Shariranam Manasena*, 3-*Manasanam Manasena*, 4-*Manasanam Shariranam*²². Charka say that²³, if person is afflicted by worry, fear, grief and anger. These Psychological factors have direct influence on functioning of agni and also result in

aggravation of vata lead to Asthi Kshaya. Asthi Dhatu is the Fifth among the metamorphic chain of dhatu. Therefore, it is a deep seated dhatu. It is said in classic that deep tissue seated disorders are *Yapya*²⁴ in the initial stages and become *Pratyakhyeya* in the later stages, as the condition worsens

Changes in the Calcium Ion activity in the extracellular fluid affects multiple biological processes²⁵. If for any reason, the serum level of calcium falls below its normal value, the body can react in three specific ways. 1-it may increase intestinal absorption. 2- it may decrease urinary excretion, or 3- it may increase the release of calcium from bone. The factors responsible for monitoring these activities are given in table.

Agent	Effect on serum levels	kidney	GIT	Bone
PTH	↑ca, ↓P	Direct action phosphate [phosphaturia] ↓ resorption of ca	---	Direct action ↑ mobilisation of ca from bone
VITAMIN-D	↑ ca, ↓P	---	Direct action ↑ absorption of ca & P from gut	Direct action ↑ mobilisation of ca from bone
CALCITONIN	↑ca, ↓P	↓ urinary excretion of ca	---	↓ mobilisation of ca from bone

Samprapti Ghatak²⁶

▪ Nidana: Vata Prakopaka Nidana, ▪ Dosh: Vata, ▪ Dushya : Asthi Dhatu, Upadhatu and Malas of Asthidhatu, ▪ Srotas : Asthivaha. ▪ Srotodushti: Sanga, Vimarga gamana, Atipravritti, ▪ Agni: Jataragni and

Dhatvagni Mandyata, ▪ Doshagati : Marma Asthi Sandhi ▪ Rogamarga : Madhyama ▪ Udbhavasthana : Pakvashaya , ▪ Adhithana : Asthi/ Sandhi/ Kेशha/ Danta/ Nakha

Diagnosis- Various bio-chemical makers are available for the diagnosis of

osteoporosis. The Radiological assessment is very much helpful for the diagnosis. X-Ray of proximal femur [AP view] was taken to assess **Singh's Index** [grading osteoporosis on the trabecular pattern of the proximal end of the femur]²⁷.

PROCEDURE OF B.M.D – For a DEXA scan, the patient has to lie on their back on table. The machine will scan the bone and measure the amount of radiation they absorb. The DEXA technique scan the hip and lower Spine. Takes about 20 min. to perform.

INTERPRETATION OF B.M.D²⁸- The result of a bone density test is compressed either as a T or Z score.

T -scores characterize numbers that compare the state of your bones with those of an average young person with healthy bones.

Z-score instead characterize numbers that compare the condition of your bones with those of an average person your age. and generally used in case of severe osteoporosis.

Normal	Bone density is within 1 SD (+1 or -1) of young adult mean.
Low bone mass	Bone density is b/w 1 & 2.5 SD below the young adult mean (-1 to -2.5SD).
Osteoporosis	Bone density is 2.5 SD or more below the young adult mean (-2.5 SD or lower).
Severe osteoporosis	Bone density is more than 2.5 SD below the young adult mean, and there have been one or more osteoporotic fractures.

CHIKITSA: Large intestine is the site of vata dosha. When there is pathology in the large intestine (gas, constipation etc.), the pathology is transferred to the bones which become more porous and air filled. Such is the case of osteoporosis. Line of Treatment of *Asthi Kshaya* includes: 1) Nidana Parivarjana (Avoidance of etiological factors), 2) Shodhana (Biopurification), 3) Shamana (Palliative treatment), 4) Rasayana (Rejuvenation) and 5) Pathyapathya (Proper diet).

1. **Nidana Parivarjana:** Prevent the indulgence of the causative factors is prime importance in Ayurveda. The person suffering from *Asthi kshaya* must avoid the excessive indulgence in etiological factors responsible for aggravation of Vata, vitiation of *Medovaha, Asthivaha, Majjavaha & Purishavaha srotas* and also the psychic factors.
2. **Shodhan chikitsa:** It is indicated in bahu doshavastha of a disease. There is direct mention of chikitsa

sutra in Ashtanga Sangraha²⁹ and in Ashtanga Hridaya for Asthi kshaya³⁰. Charaka has stated the similar line of treatment for *Asthi pradoshaja vikara. panchakarma*, especially *Basti* which contains kshira, tikta and ghrita dravya. Here a question may arise in the minds that, tikta dravyas in the treatment of Asthi kshaya, which itself is caused by increased Vata. This may worsen the condition. But *Arunadatta* in his *Sarvanga Sundara teeka* on *Ashtanga Hridaya (11/31)* says that, drugs having snigdha and shoshana properties produce kharatwa in Asthi dhatu and increases Asthi dhatu, because Asthi is also having khara property as its foremost character. We cannot find a single drug which has both snigdha and shoshana properties. Therefore, combination of kshira, ghrita and tikta dravya is indicated. Here snigdha property is contributed by kshira and ghrita and shoshana property by tikta drugs, because *shoshana* is the main property of tikta drugs³¹. Asthi which possess the khara guna is nourished by the combination of *kshira, ghrita* and *tikta dravya*, which also produce khara guna

when combined. This again works on the samanya siddhanta. Hence use of basti prepared with tikta dravya along with kshira and ghrita in the treatment of Asthi kshaya.

3. **Shamana chikitsa:** Acc. to shushruta, Swayoni dravya similar to the respective dhatu, is to be used for the treatment of the respective dhatu kshaya. *Tatra Swayoni Vardhana Dravya Prayogaha Pratikarah*³². This is based on the *samanya siddhanta*. This samanya is of three types: 1) **dravya samanya**, 2) **guna samanya** and 3) **karma samanya**. Among these, dravya samanya is considered the best for the treatment of dhatu kshaya. In case of dhatu, samanya is described as; **Dhatavaha punaha shariraha samana gunaihi samana guna bhuyishthairva api ahara vikaraihi abhyasyamanaihi vriddhim prapnuvanti** |. Dalhana commenting on Sushruta samhita sutra sthana -same thing i.e., "*Asthi Taruna Sangnakena Asthnam*". The use of *Taruna Asthi* increases Asthi dhatu. i.e., *Bhasma* also increase The Asthi dhatu.
4. **Rasayana chikitsa:** Rasayana chikitsa basically denotes to the nourishment and rejuvenation of

tissue³³. Many Rasayana preparations are useful in Asthi kshaya: e.g., Chathurtha Triphala Rasayana, Dwitiya Brahma Rasayana, Chyavanaprasha Rasayana and Shilajatu Rasayana with milk.

5. **Pathyapathya**³⁴: The healthy dietetics and lifestyle to be followed in Asthi Kshaya. Madhura, amla, lavana rasa, guru, snigdha, ushna gunas Ahara which are vata dosha shamaka and asthimajja poshaka should be included more in ahara, intake of milk, chees and other dairy foods, green leafy vegetables, and gried fruits help to improve calcium level in body.

DISCUSSION:

Acc. To Acharya Dalhana, the Asthidhara Kala as Purishdhara Kala, those causative factors responsible for vitiation of Purishvaha Srotas are also responsible for Asthikshaya.

The Etiological factors responsible for the vitiation of Medovaha, Asthivaha, Majjavaha and Purishavaha Srotas play a major role in the pathogenesis of Asthi kshaya. Pain in the bones and joint is the main symptoms of asthi kshaya. Generally, when dhatu is affected its upadhatu and mala is also affected, hence dental, hair and nail deformity are seen in Asthi Kshaya. It

is also because of aggravation of vata dosha. As we know Asthi and Vata both are *Ashraya- Ashrayee sambandha* and both are reciprocal to each other. Therefore, anything which causes vata aggravation will bring degenerative changes in Asthi.

Ayurveda and modern science consider old age one of the causative factors of Osteoporosis. In old age *vata* become increase and dhatus becomes kshina along with *indriya*, *bala*, and *virya* etc. Tarpana (gratification)& Yapana(sustain) function of Ahararasa is also hampered in old age. Proper nourishing procedure of dhatu is very essential in maintaining the Qualitative and Quantitative normalcy of dhatu.

Radiological assessment is very much helpful for the diagnosis. The first step in the management of osteoporosis, attaining the good bone mass at the adolescents prevents the risk of osteoporosis. Ashthiangi is having chief role in maintenance of bone mass density.

Calcitonin, parathormone and vit-D₃ can be included as Asthi dhatvagni. In hyper parathyroidism, osteoporosis i.e., Asthikshaya is evident.

The chikitsa must be scheduled to bring normalization of Aggravated Dosha to remove *Avarana* by **shrota-shodhan** and to normalize as well as increase the poshana of Asthi Dhatu.

In old age it is better to prevent osteoporotic changes right from early age by following dincharya and ritucharya.

CONCLUSION:

Ahararasa and Meda dhatu are very important for nourishment of Asthi dhatu as per different theory of biotransformation. Proper working of Asthivaha strotas and asthiagni makes healthy bone. Hormone like Calcitonin, parathormone and vit-D₃ is having positive effect on bone health and their vitiation lead to osteopoesis .i.e. Asthikshata. Examination of Asthivsha strotas, sign & symptoms of asthikshaya & vrudhhi can be used as diagnostic tool for assessment of asthi dhatu. Finally, we should have to take care of Asthi dhatu by following dincharya and ritucharya as it important for dharana (sustainability; firmness) of living body.

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