

Analytical Review of Asthikshaya (Osteoporosis)

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Abstract: According to the Principle of Ashraya - Ashrayee Bhava by Acharya Vagbhata, when Vata increases, Asthi Dhatu decreases because Vata and Asthi are inversely proportional to each other. In starting stage Asthi Kshaya can be taken as Lakshana, but when it gets Sthana Samraya in Asthi Dhatu, its progress can be taken as Vyadhi. The clinical features of Asthi Kshaya are Asthishula, Rukshata, Asthitoda, Sandhi Shaithilya, Keshaya, Loma, Nakha, Danta vikara & Paatana, Sadana and Shrama. Asthi Kshaya is a condition where there is decrease in the bone tissue and Asthi Soushirya means Porosity of bone. Hemadri has commented on the word Soushirya as 'Sarandhratvam' which means with pores.

Keywords: asthikshaya, soushirya, vata, ashray-ashrayi bhavas, osteoporosis.

1. Introduction

Ayurveda the "Science of Life" is a time tested treasure of knowledge which explains human body as a congenial homeostasis of dosha, dhatu and mala.

"Doshdhatumaloolam hi shariram"

(Su.Su. 15/3)

*Samadosha Samagnischa Samdhatumalakriyah
Prasannatmendriyamanah swastha ityabhidhiyate*

(Su. Su. 15/48)

This can be substantiated by sushruta's definition of health that is equilibrium of dosha (Psycho-biological rhythm), agni (digestion and metabolism), dhatu (body tissues), malakriya (excretory function) and well-being of soul, senses and mental faculty.

Human body is made up of Pancha-mahabhutas. The state of equilibrium of Dosha, Dhatus, Malas is health and its disturbance is known as disease. This disequilibrium may either be Vriddhi or Kshaya. According to Ayurveda, Balyavastha is a period of Dhatu nirman or anabolic phase; Yuvavastha maintains Samavastha (equilibrium) of different Dhatus; but in old age all Dhatus decrease gradually as catabolism speeds up.

Asthikshaya is a condition described by Acharya Charak under 18 types Kshaya. Asthi & Vata are inversely proportional to each other regarding Vriddhi and Kshaya. Vriddhvata leads to Kshaya of Asthi.

The symptoms of Asthikshaya are similar to Osteoporosis, in which there is a decrease in bone mass leading to increased bone fragility and susceptibility to fractures. By 2050, the global osteoporosis sufferers will reach 6 million (including both males and females), 3/4 of who will reside in developing countries. Fractures of vertebral bodies, ribs, proximal femur, humerus, distal radius with minimal trauma are the most common complications. Advanced age, female sex, sex hormone deficiency, a diet having low calcium, protein and vitamin-D, smoking, alcoholism, prolonged corticosteroid therapy, low Body Mass Index (BMI) are some of the risk factors of Osteoporosis. But it is seen that people consuming nutritious diet are also suffering from the disease. If the symptoms are present before menopause, they grow rapidly after menopause. Osteoporosis is disorder which can be occurs because of disturbance in ashyagni.

Osteoporosis is a major worldwide problem in the present era. Recent data in healthy Indian population, 20-30% of males and 30-50% of female above the age of 50 years are found to be osteoporotic. It is a silent and progressive disorder. Awareness of osteoporosis especially in postmenopausal woman has led to screening, because it is one of the important factor to develop osteoporosis. The environmental factor such as poor nutrition and low calcium intake, a sedentary life style and exposure of medications including steroids also play a role.

The etiological factors for asthikshaya are not mentioned separately in the ayurvedic texts. However, one should assess the etiological factors for asthikshaya on the principle of Ashray-ashrayi Bhavas. Here an effort is made to study the etiopathogenesis of Asthikshaya.

2. Review of Literature

A. Asthi Dhatu

The function of dhatu is dharana of the Sharira. Asthi is blessed with the function of Sharira dharana, which gives shape to the body and protects the vital organs. Man without Asthi would have been an amorphous bolus of soft tissues. Hence Asthi dhatu can precisely be termed as the edifice bars, on the systematic framework of which man stands tall and handsome

Asthi dhatu is the fifth dhatu among all seven dhatus. According to ayurveda the origin of asthi dhatu is pitraj

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bhavatmaka. In the process of dhatu poshana, part of medo dhatu reaches in next Strotas that is asthivaha Strotas, it takes part in production of asthi dhatu. Asthi dhatwagni acts on part of ahara rasa as well as nutrients which are coming from medovaha Strotas, and then produces asthi dhatu. There are two types of dhatu, i.e., sthayi dhatu and poshaka dhatu. Asthi or bone can be considered as sthayi dhatu, not the whole asthi dhatu. According to Chakrapani commentary on Charaka vimana sthana that, Asthi dhatu is also in liquid.

According to recent advances, the osseous tissue can be taken as the Sthayi Asthi Dhatu and the nutrients that are responsible for the nourishment of the bone tissue such as calcium, phosphorus, magnesium etc can be considered as the Poshaka Asthi Dhatu.

B. Panchmahabhautika Composition of Asthi

According to Chakrapani, there is an excess of Earth and Vayu Mahabhuta in Asthi Dhatu and according to Dalhan, along with Prithvi and Vayu Mahabhuta, Tej Mahabhuta is also predominant in Asthi Dhatu. It is only in the presence of Tej that Mead Dhatu Kharta is attained and becomes bone form.

C. Asthi Dhatu Guna and Karma

Asthi is a Pitruja Avayava (paternal tissue). Guru (heavy), Khara (rough) Kathina (hard), Sthula (bulkiness), Sthira (stable) and Murtiman are the Gunas of Asthi Dhatu. Its function is Dehadharana (supports the body and gives perfect shape to the body), Majjapushti (acts as reservoir of Majjadhatu) and it is the seat of vata.

D. Asthi Dhatu Nirman/Asthyagni

After bhutagni paka has completed dhatupaka takes place. Dhatwagni denotes for agni present in body dhatu. Final stage of digestion is completed by dhatwagni. The seven kinds of dhatwagni corresponding to the seven dhatu are

1. Rasagni
2. Raktagni
3. Mamsagni
4. Medogni
5. Asthyagni
6. Majjagni
7. Shukragni

According to acharya Arundatta & Hemadri: Bhutagni travel through anna rasa to dhatu and after that they are called as dhatwagni.

Acharya Vagbhata has described that agni in dhatu are present as pachakansha.

In Digestion & Metabolism in ayurveda written by C. Dwarkanath (Section 2, P.N.109, 112, 116) Each of the seven agnis is responsible for bringing about the transformation of appropriate nutrient substances present in a potential form in the ahararasa, into the corresponding poshaka or asthayi dhatu-precursor dhatu. So to say before the same is built up as part of the concerned poshaka of Sthayi dhatu.

In seven dhatwagni, asthyagni participate in the synthesis of compounds, predominantly vayavya cum parthiva. By the action of asthyagni on medo dhatu two parts are formed. First one Poshaka asthi dhatu (Prasada Bhaga) & second kasha,

smamshru, loma, nakh (Kitta bhaga).

In sharir kriya vigyana written by Dr. Sunil Verma & Dr. J.R. Yadav (Ch. No.24, P.N.271) On the basis of function and composition many of the endocrine secretions (hormones), endoenzymes (like proteases), vitamins can be grouped under dhatwagni. The endoenzymes are made up of protein and contain Cu, Fe, Zn, Mn, S, P and are rich in agni and vayu mahabhoot. Vayu mahabhoot act as stimulant for all the reactions in the body.

Pachakansha and heat present in asthidhatu is called asthyagni it can be correlated with alkaline phosphatase (shynthesized in liver and present in pancreas and spleen), calcitonin, parathormone. For bone calcification vit. D, vit. C, vit. A, parathormone and sex hormone are necessary. Vit. D and sex hormone are derived/synthesized from cholesterol, which is a substance of meda category. This supports the concept of Ayurveda that formation of bone tissues takes place from medo dhatu by the action of asthyagni.

Basic element of bone calcium and phosphorous gets many properties after bhutagnipaka and later gets combines to form the bone by the action of asthyagni.

E. Asthi Kshaya

The word Asthikshaya is composed of two words Asthi and Kshaya. The word Asthi is derived from the root 'As' + 'Kthin' meaning "To Stay" or in the sense of "Stability". The definitions of asthi are 'asyate kshipyateyat'; 'asyate iti asthi'; 'mamsabhyantarasthah-sharirastha sapta dhatvantargata dhatu visheshaha'. That which is present in its own state for a long time is called asthi. Sushruta mentions that twacha, mamsa etc. tissues gets destroyed soon (after death), but asthi persists in its own state for a long time. Hence, it is called as the sara of the Sharira.

Similarly, the definitions of Kshaya are 'Kshiyate anena iti Kshaya'; 'Kriya kshayakarawat tu Kshaya ityucyatebudhaihi'; 'Kshaya vyadhi visheshaha'. That which decreases is called as Kshaya or the kriya which causes the decrease either qualitatively or quantitatively is known as Kshaya and it is a vyadhi visheshaha. So, the combined meaning of asthi kshaya is decrease in bone tissue.

Asthi saushirya is another condition explained in Majja dhatu kshaya. Saushirya is Sarandhratvam means porous bones. Asthi kshaya is the first stage of the disease, which is mainly characterized by different kinds of pain and deformities of Upadhatu and Malas of Asthi. Dantha, Nakha, Kesha etc. As the disease progresses, as per the principles of Anulomakshaya, it will affect Majja dhatu and manifest as Asthisoushirya, so Asthi saushirya is increase in porosity of bones which may lead to Bhagna afterwards.

F. Lakshana of Asthikshaya

Asthikshaya (decrease in bone tissue) is a condition explained in Ayurveda under the heading of ashtadashkshaya. Lakshana of asthikshaya stated by Charak.

*Keshalomanakhshamshrudvijaprapatanam shramah.
Gayamasthikshaye Lingam Sandhisathilyamev Cha*

(Ch. Su. 17/69)

Sushruta gives lakshana of asthikshaya,

Asthyakshaye asthishulamdantanakhabhangoroukshyam ch.
(Su. Su. 15/13)

Vagbhata also describes the lakshana of asthikshaya.

Dantanakromkeshashatanaraukshyaparushyasandhisathily
aasthidodaasthibdhamaansbhilashahairasthi.

(As.Sa.Su.19/10)

Table 1
Symptoms of Asthikshaya According to Different Samhita

Symptoms	Ch. Sa.	Su. Sa.	As. Sa.	As. Hr.	Bh. Pr.	Ha. Sa.
Kesha vikara	+	-	+	+	-	-
Loma vikara	+	-	+	+	-	-
Nakha vikara	+	+	+	+	+	-
Smashru vikara	+	-	-	+	-	-
Danta vikara	+	+	+	+	+	-
Shrama	+	-	-	-	-	-
Asthi Toda	-	-	+	+	-	-
Ruja	-	-	-	-	-	+
Asthi Shula	-	+	-	-	+	-
Ruja	-	-	-	-	-	+
Sandhishathilya	+	-	+	-	-	-
Rukshata	-	+	+	-	+	-
Parushya	-	-	+	-	-	-
AsthiBaddha Mamsabhilasha	-	-	+	-	-	-
Angabhanga	-	-	-	-	-	+
Atimandacheshta	-	-	-	-	-	+
Medakshaya	+	-	-	-	-	+
Viryasyamandya	-	-	-	-	-	+
Vikampana	-	-	-	-	-	+
Vamana	-	-	-	-	-	+
Visangnata	-	-	-	-	-	+
Shosha	-	-	-	-	-	+
Kathorata	-	-	-	-	-	+
Shopha	-	-	-	-	-	+

G. Strotas Involved in Asthikshaya

1) Asthivaha Strotas

Strotas are the channels of circulation that carry the nutrients of dhatus. According to chakrapani poshak asthi flows in asthivaha Strotas in the form of asthayi asthi dhatu, and provides nutrients to sthayi asthi dhatu (bone). When asthivaha Strotas dushti happens the flow of poshak asthi dhatu will also be affected. This produces asthikshaya.

2) Medovaha Strotas

Medo dhatu is the just previous to asthi dhatu and provides the poshakansh sara to the asthi dhatu. When medovaha Strotas dusti occurs it leads to the lack of poshakansh sara. This results in less nourishment of next dhatu i.e., asthi dhatu, hence asthikshaya originates.

3) Majjavaha Strotas

Majjavaha strotas dushti like virruddha and abhishyandi ahara causes amotpatti. Ama can cause obstruction in way of vata (margavrodh), as well as shortage of nutrients in dhatu poshana process it can result in form of asthikshaya.

4) Purishvaha Strotas

Dalhana said that asthidhara kala is same like purishdhara kala. So according to this consideration whenever dusti of purishvaha Strotas takes place it also leads to the dusti of asthivaha Strotas. This ultimately results in asthikshaya. So above described Strotas is related to the asthikshaya.

H. The Etiological Factors for Asthi Kshaya

The etiological factors for Asthi kshaya are not mentioned separately in the texts. However, one should assess the etiological factors for Asthi kshaya on the Principles of Ashray-ashrayi Bhavas. Accordingly, Asthi is the main seat of Vata.

Vagbhata explains that increase or decrease of Asthi and Vata are inversely proportional to each other i.e., when Vata increases, Asthi decreases and vice-versa. Hence, the factors which cause increase of Vata will cause decrease of Asthi.

Charaka has explained the samanya nidanas which lead to the kshaya of 18 types. The etiological factors can be classified as Aharaja (dietary), Viharaja (lifestyle), Manasika (mental) and Anya (others).

Etiological Factors that Increase Vata

• Dietary

- Excessive intake of;
- Dry vegetables.
- Dry meat.
- Pungent, Bitter, Astringent substances.
- Dry, light, cold, rough, porous substances.
- Alcohol having dry property.
- Improperly cooked food.
- Fasting.
- Dieting & limited food.
- Irregular dietary habits.
- Excess of eating.

• Lifestyle

- Excess of;
- Fighting with stronger
- Exercise.
- Reading.
- Walking
- Running.
- Jumping.
- Swimming.
- Lifting heavy weights.
- Falling from fast moving vehicles.
- Sexual intercourse.
- Night Waking
- Exposure to wind, sun-light.
- Natural urges Suppression.
- Using uneven seats & beds.
- Day sleep.

• Mental

- Excess of;
- Worry.
- Grief.
- Fear.
- Anger.

Table 2
Medovaha Sroto Dushti Hetu

Dietary	Lifestyle	Mental	Others
Intake of fatty food, Varuni (Alcohol) intake.	Lack of exercise, Day sleep.	-----	-----

Table 3
Astshivaha Sroto Dushti Hetu

Dietary	Lifestyle	Mental	Others
Following Diet & lifestyle leading to increase of Vata.	Exercise, crushing of bones	-----	Irritation

Table 4
Majjavaha Sroto Dushti Hetu

Dietary	Lifestyle	Mental	Others
Intake of abhishyandi & virddha-ahara.	-----	-----	Crushing. trauma. Compression.

Table 5
Purishavaha Sroto Dushti Hetu

Dietary	Lifestyle	Mental	Others
Excessive eating, Overeating during indigestion, weak digestion, lean built	Suppression of urge of defecation.	-----	-----

- **Others**

- Trauma.
- Injury to vital organs.
- Improper treatment.
- Letting out excess of blood, dosha, dhatu & mala.
- Overuse of Panchakarma.
- Loss of body tissues.

I. Samprapti

Samprapti of Asthikshaya is not explained in Ayurvedic texts. Vitiating of Vata is the main factor in Samprapti of Asthikshaya. Vitiating of Vata occurs by two ways; Dhatukṣaya and Margarodha. Therefore, the Samprapti can be explained by two ways, one is Dhatukṣhayajanya and another is Margavarodhajanya. Apatarpan i.e., taking Vataprakopak Ahara (diet) and Vihara (living habits) leads to vitiating of Vata due to decrease in Dhatus and the Srotas become Rikta (devoid of unctuousness). Vitiating Vata fills the Rikta Srotas. The walls of Srotas got stretched by the force of Vata leading to weaken them and vitiating Vata over power the weak Srotas to create disease.

3. Modern View

In Asthikshaya there is diminution of asthi dhatu similar to this, there is a condition known as osteoporosis in western system of medicine which means 'porous bones' or 'the brittleness of bones' It is characterized by reduce bone mineral density micro architectural deterioration of bone tissue and an increased risk of fracture. The prevalence of osteoporosis and osteoporosis-related fractures increases markedly with age, reflecting the age-related decline in bone mass and the increased risk of falling in the elderly. (Davidson's principles & practice of medicine, Ch. No. 25, P.N.1121)

A. Osteoporosis

According to WHO, "Osteoporosis is a progressive malady of skeletal system. Its symptoms include low bone mass and disintegration of micro architectural network of bone tissue. Persons suffering with Osteoporosis have fragile bones and are more prone to fractures."

Osteoporosis is one of the metabolic bone disorders, which

is caused by many factors. It may be seen as a consequence from the involuntal losses associated with aging and, in women, additional losses related to natural menopause. This condition is called as the 'Primary Osteoporosis'. Osteoporosis that is manifested or worsened as a complication of other disorders or side effect of certain medications is termed as 'Secondary Osteoporosis'.

Osteoporosis is a growing public health problem worldwide and is one of the most common bone disorders in India. Bone density is determined by the amount of bone present in the skeletal structure. Osteoporosis develops slowly over several years and often only diagnosed when a minor fall or sudden impact causes a bone fracture. The adult skeleton undergoes a continuous process of remodelling where in bone resorption is coupled with bone formation. When bone resorption exceeds to formation, then Osteoporosis occurs.

B. Risk Factors of Osteoporosis

1. Age: Old age is more affected from osteoporosis
2. Gender: Women get osteoporosis more often than men.
3. Family history
4. Sex hormone: Low oestrogen level in women and low testosterone in men causes osteoporosis.
5. Nutritional factors: Low calcium diet, magnesium and vitamin-D deficiency
6. Genetic factors
7. Life style factors: Smoking or tobacco in any form, alcoholism, lack of exercise (Sedentary life style) etc.
8. History of fracture as an adult.
9. History of fracture in an immediate relative, low body mass index (BMI) <19.
10. Caucasian race (White Americans of Asian origin),
11. Menopause, surgical menopause (radical hysterectomy or oophorectomy in early age),

Some of the causes of secondary Osteoporosis are: Premature menopause, osteogenesis imperfecta, anorexia nervosa/bulimia, androgen insensitivity, Turner's and Klinefelter's syndrome, diabetes mellitus, hyperparathyroidism (10 and 2°), Cushing's syndrome, gastrectomy & celiac disease, malabsorption, rheumatoid arthritis, glucocorticoids etc.

C. Symptoms of Osteoporosis

Symptoms of Osteoporosis include,

1. Pain (due to fractures)
2. Tenderness
3. General debility
4. Muscular weakness
5. Abdominal distension
6. Insomnia
7. Loss of appetite
8. Osteo-arthritis
9. Kyphosis and Scoliosis

D. Diagnosis

Radiological Assessment:

1. X-ray
2. Bone mineral density (BMD) measurements,
3. Quantitative tomography (QCT),
4. MRI & Ultrasound

4. Aim and Objectives

- Review pathophysiological aspect of Asthi-kshaya according ayurvedic literature.
- To understand comparative study of Asthikshaya with osteoporosis and its clinical utility in present time.

5. Material and Methods

- Literary view will be collected from available vedic, ayurvedic and also from contemporary science, journals etc.
- The concept of Asthikshaya is studied from various Ayurvedic Samhitas while the concept Osteoporosis is

studied from modern books, by searching various databases like PubMed, google scholar and other research articles.

6. Conclusion

This paper presented an analytical review of Asthikshaya (Osteoporosis).

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