



UNDERSTANDING OSTEOPENIA IN AYURVEDA - A COMPREHENSIVE CONCEPTUAL ANALYSIS

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ABSTRACT

Osteopenia signifies a condition where the Bone Mineral Density (BMD) falls below a normal range, serving as a precursor to Osteoporosis, leading to increased risk of fractures. Presently, it is a growing global health concern as it often develops without any noticeable symptoms and is influenced by several causative factors like poor nutrition, physical inactivity, and hormonal imbalance, with ageing being a key factor. *Vata Dosha*, being a main contributing factor is aggravated by two leading causes – *Dhatukshaya* and *Margavarana*. As *Asthikshaya* is primarily due to *Dhatukshaya*, the objective treatment aims to restore the normalcy of the depleted *Dhatu* through *Shamana*, *Shodhana* and *Rasayana Chikitsa*. Prevention of this condition at the earlier stages through appropriate lifestyle modifications and regular monitoring of BMD can aid in minimizing further progression. This article aims to understand the perspective of Osteopenia in Ayurveda, including its aetiology, symptomatology, pathophysiology and therapeutic approach.

Keywords: Osteopenia, *Asthikshaya*, *Dhatu*, *Vata Vyadhi*

INTRODUCTION

In Skeletal radiology, increased radiolucency within the bone structures frequently suggests a diminution in the osseous mineral density. This may indicate a pathological condition with demineralization of the bone tissue, most appropriately termed as Osteopenia. In this condition, the bone mass decreases but is not up to the diagnostic criteria to be considered Osteoporotic. [1] The World Health Organization (WHO) has defined Osteopenia as a BMD T-Score between -1 to -2.5. Studies revealed that females have a four-fold higher overall prevalence of Osteopenia as compared to males. Worldwide, Asia has reported the lowest BMD t-scores by region. [2] An epidemiological survey on the prevalence of Osteoporosis in India shows that the overall incidence of Osteopenia and Osteoporosis was 49.9% and 18.3%, respectively. [3]

Diseases manifest from the inequity between the *Dosha* (humor), *Agni* (digestive fire), *Dhatu* (tissue elements) and *Mala* (metabolic wastes) which may bring forth either *Vridhhi* (increase) or *Kshaya* (decrease) state. [4] *Kshaya* implies degeneration, decline or diminution. With the progression of age, the function of all the *Dhatu* decreases gradually, making it vulnerable to various systemic disorders. In *Charaka Samhita*, *Asthikshaya* has been described under the concept of 18 types of *Kshaya* and is predominantly characterised by symptoms like *Asthi shoola* (pain over the bones), *Sandhi shoola* (pain over the joints), *Rukshata* (dryness), *Sandhi Shaitilya* (looseness of joints), *Shrama* (fatigue) along with *Kesha*, *Nakha prapatana* (breakage of the hair follicle and nails). [5]

Proper analysis and understanding of the ailment using the Ayurvedic approach can efficiently implement suitable measures to remediate the disease.

Materials and Methods: For this article, literary review on references of Osteopenia, Osteoporosis, *Asthikshaya* and *Vata Vyadhi* has been collected from medical textbooks, Ayurveda literature and published journals.

NIDANA/ETIOLOGY-

The general causes of Osteopenia include the following factors [6] -

- Dietary deficiency – Calcium, Vitamin D
- Vascular cause – Anaemia
- Drug induced – Long-term steroid use, Anticonvulsants, Heparin, Immunosuppressants
- Hormonal change – Menopause
- Toxic cause – Alcoholism, Smoking
- Endocrine cause – Cushing Syndrome, Hyperthyroidism, Hyperparathyroidism, Type I Diabetes Mellitus
- Chronic systemic illness – Chronic liver disease
- Congenital – Osteogenesis imperfecta
- Trauma
- Idiopathic

The *Nidana* of *Asthikshaya* is not quoted independently. However, it can be understood through the following concepts highlighted under the heading of *Samanya kshaya nidana* (general causative factors) and *Asthivaha srotodushiti nidana* (specific causative factors) [7],[8]

Table no. 1 Nidana of Samanya Kshaya and Asthivaha Srotodushiti

Aharaja Nidana	Viharaja Nidana	Manasika Nidana
Anashana (fasting)	Ativyayama (excessive physical exercise)	Ati Chinta (excessive worrying)
Alpasana (intake of less quantity of food)	Vata Atapa Sevana (exposure to dust and sunlight)	Bhaya (fear)
Ruksha, Sheeta Annapaana Sevana (intake of dry, cold food and liquid items)	Kaala – time factor (Adana Kaala, VridhHAVASTHA)	Soka (grief)
Vatala Ahara Sevana (excessive consumption of Vata aggravating food)	Asthi vighatana (repeated trauma)	Ati Samkshobha (excessive irritation)

SAMPRAPTI/PATHOPHYSIOLOGY –

Osteopenia results from an uncoupling of Osteoclast Osteoblast activity, leading to a reduction in the bone mass. Osteoclasts are cells that degrade the bone to initiate normal bone remodeling and mediate bone loss in pathological conditions by increasing their resorptive activity. Osteoblasts are responsible for the synthesis and mineralization of bone during the initial bone formation and are later involved in bone remodeling. Peak bone density is typically achieved in males and females by the late second or third decade of life. Later, the natural ageing process favours bone resorption over bone formation as the bone remodeling cycle continues, progressively reducing the bone mass and predisposing to conditions such as Osteopenia.^[2]

CONCEPT OF DHATU PAKA -

The nourishment of all the *Dhatu* is dependent on the *Ahara Rasa*. *Dhatu Poshana* (nourishment) takes place sequentially from *Rasa* to *Sukra Dhatu*. When *Agni* gets hampered, *Ahara* does not digest properly, leading to *Ama* and poor nutrient absorption. This in turn, results in *Uttarothhara Dhatu Poshana Abhava* from *Rasa* to *Asthi Dhatu*, leading to *Asthi Dhatu Kshaya*.^[9]

CONCEPT OF ASHRAYA-ASHRAYEE SAM-BANDHA -

The principle of *Ashraya-Ashrayi Bhava* also explains the interdependence between *Dhatu* (*Ashraya*) and *Dosha* (*Ashrayi*). In *Asthikshaya*, *Asthi* serves as the *Ashraya* for *Vata Dosha*. Therefore, when *Vata Dosha* gets aggravated, *Asthi Dhatu* decreases in function and vice versa.^[10]

POORVAROOPA/PREMONITORY SYMPTOMS –

As *Asthikshaya* is caused due to aggravated *Vata*, its prodromal symptoms are in *Avyakta avastha* (unmanifested stage). Here, *Avyakta lakshana* can be considered as *Ishat/Alpa Vyakta* (minimal clinical signs and symptoms), as stated by *Chakrapani*.^[11]

ROOPA/CLINICAL FEATURES –

The symptoms of Osteopenia usually go unnoticed unless it further progresses to the Osteoporotic stage with a high risk of fractures and complications. However, loss of bone mass results in loss of strength; therefore, minimal trauma is adequate to induce a fracture.

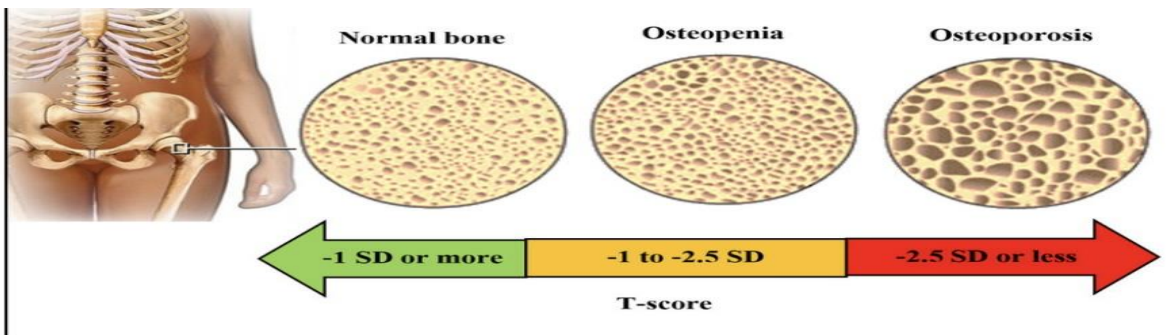


Fig 1: Stages depicting reduction in bone density^[12]

Table no. 2 Lakshana as opined in different Samhita-

Sl. No.	Lakshanas	CHARAKA SAMHITA ^[13]	SUSHRUTA SAMHITA ^[14]	ASTANGA HRUDAYA ^[15]	ASTANGA SANGRAHA ^[16]	HARITA SAMHITA ^[17]
1.	Ruja	-	-	-	-	+
2.	Asthi shoola	+	+	-	-	-
3.	Asthi bheda	+	-	-	+	-
4.	Asthi toda	-	+	+	+	-
5.	Kesha Vikara, Paatana	+	-	+	+	-
6.	Smashru Vikara, Paatana	+	-	-	-	-
7.	Danta Vikara, Paatana	+	+	+	+	-
8.	Loma Vikara, Paatana	+	-	+	+	-
9.	Nakha Vikara, Paatana	+	+	+	+	-
10.	Shrama	+	-	-	-	-
11.	Sandhi Shaitilya	+	-	-	+	-
12.	Rukshata	-	+	-	+	-
13.	Parushya	-	-	-	+	-
14.	Asthibadda	-	-	-	+	-
15.	Mamsabhilasha	-	-	-	+	-
16.	Anga Bhanga	-	-	-	-	+
17.	Ati Manda Chesta	-	-	-	-	+
18.	Medo kshaya	+	-	-	-	+
19.	Bala kshaya	-	+	+	+	-
20.	Viryasya mandya	-	-	-	-	+
21.	Vikampana	-	-	-	-	+
22.	Vamana	-	-	-	-	+
23.	Vishangata	-	-	-	-	+
24.	Sosha	-	-	-	-	+
25.	Kathorata	-	-	-	-	+
26.	Shophita	-	-	-	-	+

PROGNOSIS/SAADHYASADHYATA –

Asthi is a *gambheera Dhatu* which is deeply situated. The diseases of *gambheera sthana dhathu* are said to be *Yapya/Kasta Sadhya* (manageable). ^[18] However, this condition becomes *Asadhya* (untreatable) in the *Vridha avastha* or the senile age group. Also, it is likely to become *Asadhya* in the end stage of *Kriya Kala*, i.e the *Bhedavastha*, unless proper treatment is planned in the initial stages.

INVESTIGATIONS ^[19] –

1. Bone Densitometry: DEXA SCAN (Dual X-Ray Absorptiometry) is an X-ray-based bone scan, the gold standard in quantifying bone mass.
2. Biochemistry: Serum Ca⁺, Phosphate, Vitamin D
3. Serum Osteocalcin

Table no. 3 Assessment of BMD according to WHO ^[20] –

BMD T-Score	Diagnosis
+1 to -1	Normal bone density
-1.0 to -2.5	Low bone density Or Osteopenia
-2.5 or more	Osteoporosis

ASTHIKSHAYA CHIKITSA -

The primary aim of treatment is to prevent the further progression of Osteopenia into Osteoporosis. Nutrition plays a crucial role and it is vital to consume sufficient Calcium and Vitamin D through diet and supplements. Additionally, lifestyle changes, such as refraining from smoking and limiting alcohol intake are essential for maintaining optimum bone health.

PHARMACOLOGICAL INTERVENTION –

Bisphosphonates are the most commonly prescribed drug for low bone density and are classified into two categories: nitrogen-containing compounds (Alendronate, Risedronate) and simple non-nitrogen-containing compounds (Etidronate, Tiludronate). The former, being the first drug of choice, reduces the chances of fractures by 40-70 % by inhibiting Osteoclast resorption and inducing Osteoclast apoptosis ^[21].

TREATMENT IN AYURVEDA –

Nidana parivarjana (avoiding the causative factors) is the first and foremost line of treatment to be adopted to prevent the further progression of the disease. *Vatopakrama* serves as the prime line of therapy in all *Vataja* disorders ^[22]. It includes rejuvenating modalities that are particularly efficacious for the management of *Asthikshaya*, like *Snehana* (oleation) in the form of *Snehapana* with specific *Ghritha Yoga* such as *Guggulu Tiktaka Ghritha*, *Mahatiktaka Ghritha*, *Panchatiktaka Ghritha* which provides *Brimhana* effect to the *Asthi dhatu*. *Abhyanga* (massage) with specific *Taila Yoga* such as *Gandha Taila*, *Ashwa-*

gandha Bala Lakshadi Taila, and *Ksheerabala Taila* also does *Vata shamaka*, thereby reducing *Rukshata* and nourishing the deeper *Dhatu*. *Swedana Karma* (sudation) with *Shastika Shali Pinda Sweda* is also helpful in alleviating the symptoms of *Asthikshaya* as *Shastika Shali*, *Balamoola*, and *Ksheera* possess *Snigdha guna* (unctuous property) and has the potential to nourish and rejuvenate the depleted *Dhatu* ^[23]. *Panchakarma* therapy, especially *Basti karma* (enema) in the form of *Tikta ksheera basti*, is the main line of *Chikitsa* for all *Asthivaha sroto vikara* ^[24]. For the treatment of all *Dhatu kshaya*, the concept of “*Swayoni Dravya Upayoga*” was mentioned, which explains the usage of drugs having *Samanya guna* (similar quality) to the depleted *Dhatu* ^[25]. In addition to the above, *Rasayana Chikitsa*, the supreme line of treatment in *Jara Chikitsa* (Geriatric care) is vital in treating the condition.

Pathya Apathya ^[26] –

Pathya - *Shali*, *Mamsa rasa*, *Ksheera*, *Sarpi*, *Godhuma*, *Rasona*, *Patola*, *Shigru*, *Balamulaka*, *Dhatri*, *Vajra Valli*, *Laksha*
Apathya – *Kshara*, *Amla*, *Katu*, *Lavana*, *Ruksha ahara*, *Ativyayama*, *Ayasa*

DISCUSSION

Bones serve as a reservoir for essential minerals, particularly Calcium and Phosphorus, which are vital for various physiological processes. In Osteopenia, patients will usually have weaker bones, making them

vulnerable to fractures and a few patients may develop Osteoporosis when left untreated. The root cause of all diseases is *Mandagni* [27]. One of the fundamental lines of treatment in *Asthi kshaya* includes rectifying the *Agni* through proper implementation of *Pachana-Deepana dravya*, which will promote digestive capacity and overall health. *Samprapti Vighatana Chikitsa* is one among the prime lines of treatment for any disease to be followed. So, the treatment of *Asthi kshaya* should be planned considering the *Nidana* of *Vata prakopa*, *Dhatukshaya* and *Margavarana*. As *Asthi kshaya* is the consequence of the later, the core treatment should be focused on bringing back the normalcy of the depleted *Dhatu*.

Vatopakrama describes the various treatment modalities that can be followed in all *Vataja*-related disorders. *Snehana*, being one of the most practiced lines of therapy, is applicable in either way as *Bahya Sneha* in the form of *Abhyanga* and *Abhyantara Sneha* in the form of *Snehapana*. Proper implementation of *Snehana karma* brings *Vatanulomana* (downward movement of *Vata*), *Deeptagni* (increase in digestive power), *Mardava* (softness to the skin) and *Snigdhatva* (unctuousness) to the whole body [28]. *Swedana karma*, particularly *Shastika Shali Pinda Sweda*, can be practical in *Asthi kshaya* as the key ingredients here include *Shastika Shali*, *Balamoola kwatha* and *Ksheera*, which possess *Snigdha guna*, which is opposite to *Ruksha* and *Khara guna* of *Vata dosha* and *Asthi dhatu*. *Swedana karma* can effectively alleviate pain over the bony areas and joints, reduce *Stambha* (stiffness), and detoxify the toxins through the microchannels of the skin thereby improving the circulation of blood flow [29].

Basti karma is considered *Ardha Chikitsa* (half treatment) in all *Vata Vyadhi* [30]. To treat all *Asthivaha sroto vikara*, *Basti* using *Tikta rasatmaka dravyas* along with *Ksheera* and *Sarpi* should be utilised. *Tikta rasa*, by virtue, has *Ruksha guna* (dry) and *Sheeta virya* (cold potency), which will bring forth more *Kharatva* (dryness) to the *Asthi Dhatu* and aggravate the symptoms. However, in a commentary by *Arunadatta*, it is stated that drugs having both *Snigdha* as well as *Soshana guna* increase the func-

tion of *Asthi Dhatu* and as in nature, there are no known drugs that possess both the qualities, the concept of *Tikta ksheera Basti* was hence explained [31]. This combination of *Basti* is proven to increase bone mass density and nourish, rejuvenate, and repair the degeneration of bones and cartilage.

In the senile age group, the functions of all *Dhatu*, *Indriya* (sense organs) as well as *Bala* (strength) become *Hiyamana* (minimal), which makes it even more challenging to undergo *Shodhana Karma* [32]. Palliative measures in the form of *Shamana Chikitsa*, like *Guggulu Kalpana* and *Rasayana Chikitsa* are highly favorable. *Guggulu* (*Commiphora mukul*) is the best-known drug for its *Vedana Sthapana* property. Specific *Guggulu Kalpana* mentioned for *Asthi Bhagna Chikitsa*, such as *Lakshadi Guggulu*, *Abha Guggulu*, *Yogaraja Guggulu*, and *Mahayogaraja Guggulu* will aid in strengthening the bones, thereby reducing the risk of fractures. *Rasayana* is “*Jara vyadhi nashana*”; it prevents senility and promotes the life span [33]. Through the timely implementation of *Rasayana Chikitsa*, one can fortify one's vitality and safeguard against all ailments. Single *Rasayana* drugs such as *Asthishrunkhala* (*Cissus quadrangularis*), *Guduchi* (*Tinospora cordifolia*), *Ashwagandha* (*Withania somnifera*), *Tila* (*Sesamum indicum*) and *Shatavari* (*Asparagus racemosus*) are proven to have a significant effect in the management of *Asthi kshaya* [34]. Other considerable *Rasayana aushadhi* include *Laksha Rasayana*, *Balamoola Rasayana*, *Shilajatu Lauha Rasayana*, *Lashuna Rasayana* and *Guggulu Rasayana*. *Swayoni Dravya*, for example, *Sudha Varga dravya*, possessing similar properties with the pertinent *Dhatu* such as *Godanti*, *Pravala*, *Mukta*, *Shankha* and *Pishti*, is also proven to be rich in Calcium and contributes to promoting bone mineralisation and density, hence restoring the overall health of the bone [35].

CONCLUSION

Ageing is an inevitable phenomenon which increases vulnerability to various musculoskeletal disorders. Specific lifestyle alterations, including faulty dietary habits, lack of physical activities and exposure to

stress also exacerbate several musculoskeletal-related disorders and Osteopenia is one among them. As *Ashtikshaya* is a preventable disease, before the condition further progresses into *Bheda Avastha*, where the condition may even present with severe complications, early diagnosis with proper intervention in treatment and lifestyle adhering to the principles of *Dinacharya* and *Ritucharya* along with suitable *Pathya* and *Apathya* can contribute to mitigating the condition at the earliest. Therefore, a clear understanding of *Nidana Panchaka* and its *Chikitsa* is necessary.

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