**Ayurvedic perspective of osteoporosis – in old age and geriatrics**
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**ABSTRACT:**
In the beginning, that is from the 1960's, when a link between menopause and osteoporosis was first identified; estrogen treatment was the standard for preventing bone loss, however there was no fracture data, even though it was thought to be effective. This continued until the Women's Health Initiative (WHI) study in 2001 that published data on 6 years of treatment with hormone therapy that showed an increase in heart attacks and breast cancer. Even though the risks were small, 1 per 1500 users annually, patients were worried and there was a large drop off in estrogen use. In later analyses the WHI study showed that estrogen reduced fractures and actually prevented heart attacks in the 50-60 year age group. Estrogen alone appeared to be safer to use than estrogen + the progestin medroxyprogesterone acetate and actually reduced breast cancer.

**Keywords:** Osteoporosis, estrogen, fracture, breast cancer, geriatrics

**INTRODUCTION:**
In Ayurveda asthishunyata may be taken as the osteoporosis seem to be more common in the female having symptoms like wise as in asthi- majja kshaya. Osteoporosis is a condition that weakens bones, making them fragile and more likely to break. It develops slowly over several years and is often only diagnosed when a minor fall or sudden impact causes a bone fracture. The most common injuries in people with osteoporosis are: wrist fractures, hip fractures.

**OSTEOPOROSIS**
In Ayurveda acharyas explain the dhatus are the main elements of the body which control (dharan) our body, basically they explain 7(seven) dhatus of the body which balance body, accordingly to their karma.

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 dhatvantarga dhatuvishshaha’. Asthi nirmetee:-

"पृथिव्यम्मिनलादीनां सम्धातः स्वोष्यम् कृतः ||३०||
खरत्वां कृतः अस्थि
करोति तत्र "सौष्ठियम्मस्मि" मध्ये समीरणः ||३१||"
That which presents in its own state for a long time is called asthi. Sushruta mentions that twacha, mamsa etc. tissues get 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: 'Kriya kshayakaratwat tu Kshaya ityucyatebhadhi';

"क्षिपते अनेन इति क्षयः
"क्षयः व्याधिः विशेषः"

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 vishesha. So, the combined meaning of asthi kshaya is decrease in bone tissue. Asthi Dhatu Guna and Karma Asthi is guru (heavy), khara (rough), kathina (hard), sthula (bulkiness), sthira (stable) and murtimad. Its function is deha dharana (provides structural framework to the body), Majja pushti (nutrition to the bone marrow) andit is the seat of vata. The etiological factors for asthi kshaya are not mentioned separately in the texts. However, Charaka has explained the samanya nidana (general etiological factors) which lead to the kshaya of 18 types which include mostly the vataprapak nidan like excessive exercise and intake of dry vegetables, irregular dietary habits which includes excessive fasting, dieting and limited foods, excess of food also, excess of worry, grief, fear, hunger, waking at nights, letting out excess of blood, dosha, dhatumalaand time factor (adana kala and vridhavastha). Majja dhatu which is present inside the asthi dhatu provides nutrition to asthi. The factors responsible for the vitiation of asthivaha and majjavaha srotas are also responsible for asthi kshaya. The dietary factor such as intake of abhishyandi and incompetent foods of majjavaha sroto dushti nprovocates vata due to obstruction leads to vitiation of vata. Vitiation of asthivaha srotas directly leads to aggravation of vata, resulting in asthi kshaya.

"रसासृकमासमेदो
स्थिमज्जाशुक्राथण
tu Kshaya ityucyatebudhai";

"थप्रणिां थजविां लेपः
स्नेहो निरण पुरणां
गिशो उत्पादश्च
tu Kshaya ityucyatebudhai"

As according to above reference osteo means bones which concluded as asthi dhatu of our body which do dharna karma of body.

As per pathology we can conclude majja dhatu is also play an important role in maintaining density and toughness to make bone strong. We can conclude it as as a bone marrow which remain inside the bone always to provide nutrition to the bone.

As in Ayurveda -

- sthana of majja
  "अस्थानां मज्जानी......."
- karma of majja

"मज्जा प्रीति सेहं बलं श्रुक पुष्थि पुरणं अस्थानां
च"

There are two types of dhatu, i.e. sthaya and poshaka dhatu. Asthi or bone can be considered as sthaya dhatu and not the whole Asthi dhatu. But in this condition, the decrease is not so remarkable as compared to Osteoporosis. Majja is the
next Dhatu of Asthi. Acharya Chakrapani commenting on Charaka vimana sthana 5/8 mentions that Asthi dhatu is also in liquid form called as poshaka Asthi which flows through the Asthivaha srotas and nourishes the sthaya Asthi dhatu.

According to recent advances, the osseous tissue can be taken as the sthaya 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.

The etiological factors can be classified as Aharaja (dietary), Viharaja (lifestyle), Manasika (mental) and Anya (others). Acharya Charaka explained the general etiological factors i.e. samanya nidana which leads to the kshaya of all 18 types. Asthi kshaya is a condition in which there is decrease in the Asthi dhatu or Bone tissue leading to undesirable effects. It can be compared with Osteoporosis in which there is decrease in the Bone Mineral Density (BMD) causing increased risk of fractures.

The signs and symptoms of Asthi kshaya i.e. Asthi-sandhi shula, kesha, roma, nakha, danta vikara/pata and daurbalya are same as the updated signs and symptoms of osteoporosis mentioned in contemporary science.

Asthi kshaya is more suitable condition than Asthi saushirya to be correlated to osteoporosis. Asthi kshaya is ‘decrease in the bone tissue’ and Asthi saushirya means ‘porous bones’.

Hemadri has commented on the word ‘Saushirya’ as ‘Sarandhratvam’ which means ‘with pores’, this condition is explained in the context of Majja kshaya. Osteoporosis means the decrease in the bone tissue and not the bone marrow.

Another condition termed as Osteopenia is a pre stage or Purvarupavastha of Osteoporosis in which there is decrease in the Bone Mineral Density too.

In the process of kshaya, Majja kshaya occurs when there is no proper supply of nutrients from Asthi dhatu. Thus Majja kshaya may occur after Asthi kshaya as per the basic principles of anuloma kshaya.

Since there is decrease of bone tissue in both the conditions i.e. Osteopenia and Osteoporosis, they may be commonly compared with Asthi kshaya.

As by this it shows majja is the main dhatu help to rejuvenate nutrient to the bone by remaining inside them. As the age permits the quality and the quantitative changes our in majja leads to the degradation of the bone which leads to fracture and many other pathology. Mainly female are more prone to this disease, whose pathology never resemble before by symptoms, it mainly found after fracture of bone mainly neck of femur or vise versa through various test like X-Ray or MRI.

In majja kshaya we get symptoms as “अस्थानो मज्जानी सौष्ठविं भ्रमस्तिंमिः।(अ.हू.)
शरीरभ्य अस्थिधी दुर्बलानीलपनिः।
प्रततं वातरोगाणि अत्यशुक्रता पर्वभेदो 
अस्थिशुन्यता॥(सू)

As due to majja kshya, it leads to the asthi saushirya (loss of bone density), bhram (vertigo), timir darshan (blurred vision). According to sushruta, it leads to asthi shirnata –weakening of bones, asthi durbalata, asthi laghuta, vaatroga, alpashukrata, parvabhedo, asthi shunyata(osteoporosis). As mention above majja kshaya leads to the vaatroga means it may leads to the vaat vruddhi it relates with asthi as it leads to asthi kshaya.

Asthikshaya lakshana:

“अस्थितोद सदिगं दन्तकेशानखादिषु”
As majja kshaya persist asthi leads to get deficit in their properties and asthikshaya lakshana will leads to happen in future which shows symptoms as asthi thod–sadanam (bone & joints-pain) kasha. lom kshamashru- patan, dvijan-(hair fall, hair split ends) kshram(fatigue), sandhi Shaithilya(joints weakening).

Pain in the bones and joints is the main symptom of Asthi kshaya which can be correlated to Asthi toda, Asthi Bheda, ruja and shoola stated in Ayurvedic text. Normally when dhatu is affected, its upadhata and mala are also affected; hence dental deformity/fall, falling of scalp hair, body hair, moustache and nail deformity are seen in Asthi kshaya. Teeth are considered as upadhatus of Asthi by Acharya Sharangdhara.

• Treatment of asthi –majja –shukra kshaya

In nails, this disulphide bond is needed to bind keratin which gives them strength, which is compromised is osteoporosis. For bones, the protein collagen needs disulphide bonds to stick together, lowered levels of which makes bones susceptible to fractures.

Recent studies of Osteoporosis have shown that deformity in the nail i.e brittle nails and teeth are definite indicative of risk of Osteoporosis.

It was found that levels of disulphide bond - needed to bind one protein molecule to another - were lower in people with osteoporosis.

In Osteoporosis, the first clue that the fingernail could play a role in diagnosing the disease came when a doctor noticed that hip osteoporosis patients had floppy nails (flimsy, soft & thin).

Current evidence including several prospective studies supports an association of osteoporosis with the onset and progression of periodontal disease in humans which can be correlated to the danta vikara and danta pata lakshana of Asthi Kshaya in Ayurveda.
In asthi kshaya treatment acharya told about the panchakarma like basti as the main karma and the ksheer sarpi and tikta dravya is mainly used as drug of choice. As ksheer and sarpi is said to be as jivniyam in agrya sangrah which promotes rejuvenating effect in body which increase the body ability to be in normal and strong enough for long term. As sneha guna ksheer and ghrit helps to reduce vayu from the asthi and increase their density. There are lots of controversies as tikta rasa increases vaat vitality in body as shown in samhita, but some researches shown that the gamitva of tikta ras dravya are more then any other ras which increase the efficacy of ksheer and ghrit towards bone. Here tikta rasa act as a mediator to promote action as ksheer and ghrut on bones.

Similarly in majja and shukra kshaya swadu and tikta aushad and aahara are used for the treatment. As by the siddhanta of samanya viparya, saman guna leads to increase in the saman guna of the dhatu which are interrelated with dosha and dhatu by ashrya ashrayi bhava. Madhu and tikta rasa helps also in majja kshaya as of asthi, because majja are form from the asthi which act as a precursor of majja.

Shamana:

Guduchi
Study was carried out on ethanolic stem extract of Tinospora cordifolia (TC) (10, 50, 100mg/kg b.wt.) subcutaneously for 4 weeks on ovariectomized rats. Study reveals that ovariectomized rats treated with TC (10 mg/kg b.wt.) showed estrogen like effects in bone as the bone loss in tibia was slower than ovariectomized control and thus has the potential for being used as antiosteoporotic agent. Samanga[45] – In vitro study was done on four medicinal plants for evaluation of antiresorptive activity in the treatment of bone loss disease. All the four drug decoction inhibited osteoclastogenesis similarly to standard alendronate at the highest doses, but Hemidesmus indicus was found effective at lower concentrations also.

Shatavari-
Study was carried out on aqueous and methanolic extracts of Asparagus racemosus root in ovariectomized rats to evaluate the antioestrogenic activity. Study showed significant effecton mineralization,
ossification and osteoclastic activity suppression in histopathological examination. It showed significant results in biochemical parameters, also reduced serum alkaline phosphatase activity, serum calcium significantly and also inhibited the ovariectomized induced excessive loss of calcium in urine.

Studies of ashwagandha[48], vacha[49], dadima[50], madhuyashti[51, 52], vidarikanda[53], parushak [54], padmabeeja[55] also shows anti-osteoporotic properties.

**Use of Rasayanas:**

“रसायनानां सवेशामुपयोगः प्रशस्यते ||२४९||”च.चि

Use of rasayana is always mentioned in texts always helpful in jara vyadhi nashanam so its always prescribed by acharyas in daily basis.

रसा: पयासिः भोज्यानि स्वाद्भन्तलवणानि च ||
बृहणं यच स्त्री सर्व प्रशस्तं वातरोथगणाम्।
च.चि.28/105

Regular use of milk and rasala, use of madhur amla lava dravya in food are always bruhiya which nourishes body and also one of the best for treatment of vaatroga.

**Osteoporosis**

Osteoporosis is a systemic skeletal disease characterized by the low bone mass and micro-architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture.

**Causes of osteoporosis:**

Losing bone is a normal part of the ageing process, but some people lose bone density much faster than normal. This can lead to osteoporosis and an increased risk of fractures.

Women also lose bone rapidly in the first few years after the menopause (when monthly periods stop and the ovaries stop producing an egg). Women are more at risk of osteoporosis than men, particularly if the menopause begins early (before the age of 45).

Many other factors can also increase the risk of developing osteoporosis, including:

- long-term use of high-dose oral corticosteroids
- other medical conditions – such as inflammatory conditions, hormone-related conditions, or malabsorption problems
- a family history of osteoporosis – particularly history of a hip fracture in a parent
- long-term use of certain medications which can affect bone strength or hormone levels
- having a low body mass index (BMI)
- heavy drinking and smoking
- Read more about the causes of osteoporosis.
Diagnosing osteoporosis:
Risk assessment tools
If your doctor suspects you have osteoporosis, they can make an assessment using an online programme, such as FRAX or Q-Fracture. These tools help to predict a person’s risk of fracture between the ages of 40 and 90. The algorithms used give a 10-year probability of hip fracture and a 10-year probability of a major fracture in the spine, hip, shoulder or forearm.

DEXA scan
They may also refer you for a DEXA (DXA) scan to measure your bone mineral density. It’s a short, painless procedure that takes about 5 minutes, depending on the part of the body being scanned. Your bone mineral density can be compared to the bone mineral density of a healthy young adult and someone who’s the same age and sex as you. The difference is calculated as a standard deviation (SD) and is called a T score.

Standard deviation is a measure of variability based on an average or expected value. A T score of:
- above -1 SD is normal
- between -1 and -2.5 SD is defined as decreased bone mineral density compared with peak bone mass
- below -2.5 is defined as osteoporosis

Preventing osteoporosis
If you’re at risk of developing osteoporosis, you should take steps to help keep your bones healthy. This may include:
- taking regular exercise
- healthy eating – including foods rich in calcium and vitamin D
- taking a daily supplement containing 10 micrograms of vitamin D
- making lifestyle changes – such as giving up smoking and reducing your alcohol consumption

How is osteoporosis related to menopause?
There is a direct relationship between the lack of estrogen after menopause and the development of osteoporosis. After menopause, bone resorption (breakdown) overtakes the building of new bone. Early menopause (before age 45) and any long phases in which the woman has low hormone levels and no or infrequent menstrual periods can cause loss of bone mass.

At menopause estrogen deficiency impairs the normal cycle by increasing osteoclastic resorption activity without a corresponding increase in osteoblastic activity and the amount of bone resorbed therefore is greater than the amount deposited leading to a net loss of bone. This process was originally described as ‘uncoupling’. The cellular changes that occur in estrogen deficiency are now quite well understood. There is an increased production of Tumor necrosis factor (TNFα) and cells of the stromal / osteoblastic lineage become more sensitive to IL-1, IL-1 and TNF stimulate stromal cells / preosteoblasts to release several cytokines- IL-6, macrophage colony stimulating factor (M-CSF), IL-11, granulocyte macrophage colony-stimulating factor (GM-CSF), transforming growth factor (TGF). The final cytokine in the osteoclastogenesis cascade is RANK ligand (receptor activator of nuclear factor B ligand) which is produced from osteoblasts and binds to its receptor RANK on osteoclasts (1, 2). RANKL has a natural antagonist osteoprotegerin (OPG) that is a soluble receptor that is secreted by the stromal osteoblast lineage cells (3). OPG is stimulated by estrogen (3). In retrospect we now realize that the uncoupling factor secreted by the osteoblasts is RANKL. These factors increase bone resorption by increasing the pool size of pre-osteoclasts in bone marrow (1) and are down regulated by estrogen. The important action of estrogen is to increase OPG secretion (3) and decrease M-CSF (1) and RANK (4).
Who should have a bone mineral density test?

- All post-menopausal women who suffer a fracture that is suspicious for osteoporosis.
- All post-menopausal women under age 65 who have one or more additional risk factors.
- All post-menopausal women age 65 and over, regardless of additional risk factors.

Should I consider hormone therapy for osteoporosis?

Hormone therapy (HT) is believed to be useful in preventing or decreasing the increased rate of bone loss that leads to osteoporosis. Hormone therapy is generally recommended for postmenopausal women who have:

- An early menopause
- A low bone mass, as measured by a bone density test and menopausal symptoms
- Several other risk factors for osteoporosis, such as: a petite, thin frame; family history of osteoporosis, or a medical problem associated with osteoporosis

While all of the risks associated with HT are not yet known, studies have shown that some types of HT may increase your risk of developing:

- Breast cancer
- Gallbladder disease
- Blood clots
- High blood pressure (in some women)

If you are using HT to prevent osteoporosis, be sure to talk to your doctor so that you can weigh the benefits of HT against your personal risk for heart attack, stroke, blood clots, and breast cancer. If needed, your doctor can prescribe different treatments to prevent osteoporosis and fractures.

Finally, it’s important to note that women who have had their uterus removed by hysterectomy are prescribed estrogen alone, not the combination of hormones found in HT. Estrogen therapy alone has been shown to have less risk than combination hormone therapy. Your doctor can provide you more information about how your health history fits in with the risks and benefits of hormone therapy.

DISCUSSION:

Acharya Chakrapani commenting on Charaka viman sthana 5/8 mentions that Asthi dhatu is also in liquid form called as poshaka Asthi which flows through the Asthivaha srotas and nourishes the sthayi Asthi dhatu.

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.

The etiological factors can be classified as:
- Aharaja (dietary), Viharaja (lifestyle), Manasika (mental) and Anya (others).

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the bone tissue’ and Asthi saushirya means ‘porous bones’.

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In the process of kshaya, Majja kshaya occurs when there is no proper supply of nutrients from Asthi dhatu. Thus Majja kshaya may occur after Asthi kshaya as per the basic principles of anuloma kshaya. Since there is decrease of bone tissue in both the conditions i.e. Osteopenia and Osteoporosis, they may be commonly compared with Asthi kshaya.

Kala (time) is the age factor. Old age is the time of aggravation of Vata.

Sushruta says that the Anna Rasa can not nourish the old aged persons due to senile degeneration;

स एवान्नरसो वृद्धानां (जरा) परिक्षणे सारितहाद्विप्रीणां भवति।सू.सू १४/५९

The symptoms of ageing like loss of vigor, functioning of sense organs, courage etc. are related to degenerative changes in the body tissues.

Asthikshaya may also be seen in patients of sthauitya (obesity).

Asthikshaya in persons with increased Meda is surprising, because Asthi is the very next tissue to Meda and Meda nourishes the Asthi, so there should be increase of Asthi in persons of increased Meda.

In Ayurveda, the context of Menopause is depicted as “Jara Pakva Avastha” of body and Rajonivrutti.

According to Acharya Sushruta and various other references, 50 years is mentioned as the age of Rajonivrutti.

Menopause is linked with Vata dosha dominated stage of life. In this stage symptoms of menopausal phase like insomnia, anxiety, urinary symptoms, osteoporotic changes are due to dominance of Vata dosha. Rajonivrutti janya lakshan is a group of symptoms produced by degenerative process of body tissue.

Degenerative changes are explained in Ayurveda as Dhatukshaya lakshana and Asthi kshaya occurs when there is Asthi dhatu kshaya.

The involvement of the mind cannot be ruled out in the pathogenesis of disease, because body and mind are closely related and Asthi kshaya is not an exception to this rule.

विकाराणां शारीरमानसानां परस्परं संसर्गमाह-     ते च विकारा इत्यादि।
अत्र च परस्परशान्द्रेन शारीराणां शारिरिण,     मानसानां मानसेन,
शारीराणां मानसेन,     मानसानां शारिरिण चानुवंशज्ञेयः।|८||
आयुवेददीपिका व्याख्या (व्यक्तिदृष्टिः कृत),
विमानस्थानमः ६ (रोगावलीकिर्मम)

Acharya Charaka opines that the sharirika roga and manasika roga have an inter-relationship.

Acharya Chakrapani clarifies that this relationship may be in four ways;

i) Shariranam Sharirena,
ii) Manasanam Manasena
iii) Shariranam Manasena and
iv) Manasanam Sharirena.

Psychic factors explained in Vata vyadhi such as worry, fear, grief and anger leads to both dhatu kshayajanya and margavaranajanya Vata prakopa.

कामादिभिर्मिनिस उपयुक्तः प्रभावदेववांशस्पष्टिः
एवमशृध्यात्ममयुचितेन ज्ञात मनसं उपयोगित
श्वादमुदर्स्कं भवति।
आयुवेददीपिका व्याख्या (वक्रपाथणदत्त ३,)
विमानस्थानमः ६ (रोगावलीकिर्मम)

Chakrapani, Vimana sthana, 2/8.
These factors produce ama resulting in obstruction.

Acharya Charaka says that although food is taken in proper quantity and is wholesome, still it is improperly digested if a person is suffering from worry, fear, grief and anger etc.

Hence these psychological factors have direct influence on functioning of agni and also results in vitiation of Vata leading to Asthi kshaya. As discussed Asthi kshaya is a disease caused by the increased Vata.

The purva rupa are in unmanifested (avyakta) stage and here avyakta can be taken as ishat or alpa vyakta or asampurna lakshana, so to say mildness in the symptoms, as clarified by Chakrapani.

In the initial stage of the disease, mild symptoms of Asthi kshaya like dull aching in the bones, joints, and mildness of other symptoms etc. can be considered as the purva rupa of Asthi kshaya.

Osteoporosis is totally asymptomatic in the initial stage, because low bone mass itself doesn’t cause any symptoms and it is called as the “silent thief” which can be correlated to Alpa vyakta or ayakta lakshana in Ayurveda.

Sampraptivighatana (breaking of pathogenesis) is the prime line for the treatment of any disease in ayurveda. So, treatment of asthikshaya should be done considering both the facts for vata prakopa that is margavaran and dhatu kshayam.(6) In margavaran, strotoshodhak treatment should be given which clears the channels and nourishes the next dhatu. Drugs or medicinal plants given above are mostly having katu, tikta rasa snigdha guna. tikta rasa is having strotoshodhak property which acts on margavaran. But tikta rasa is vata propaka. So, it should not be used in asthikshaya as vataprakopa increase the asthikshaya. It can be explained like this; asvaghbhat have mentioned that asthikshaya treatment with tiktaksheer sadhita basti. Arundatta commenting on it explains dravya which have snigdha, soshana and khara property are used in asthikshaya. khara is the main property of asthi. Dravya which have both snigdha and shoshan properties are not available that’s why this principle was explained. Use of ksheera (snigdha), ghrita with tikta rasa (shoshan) produces khara properties which helps in asthivridhi. In the same way, drugs given can be given single or in combination with other drugs.In dhatu kshaya (asthikshaya) includes vatashamak (asthi is the seat of vata), tarpak and brihman treatment. Vata is having properties laghu, ruksha, sheeta, khara, sukshma, chala, vishada, medicinal plants described are mostly vatashamak due to predominance of guru, snigdha guna, madhura vipaka and ushna virya. Hence, it can be used directly in dhatukshaya condition.

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