

Clinical evaluation of the role of Tikta Ksheera Basti and Ajasthi Bhasma in the management of Asthi Kshaya vis-à-vis Osteoporosis

SANJAY KADLIMATTI* P. G. SUBBANAGOUDA**

Ayurveda Mahavidyalaya, Heggeri Ext., Hubli-24.

ABSTRACT : Ayurveda explains health as an equilibrium of the Dhatus "*Dhatu Samyam Arogata*". Among the Dhatus, Asthi is blessed with the function of Shareera Dharana. Any derangement in Asthi results in disease. Asthi Kshaya is a condition in which there is Kshaya of the Asthi Dhatu. Asthi Kshaya may be compared to Osteoporosis, in which there is a decrease in bone mass leading to bone fragility and fractures. According to the principle of Ashrayaashrayee Bhava, when Vata increases Asthi decreases because, both are inversely proportional to each other. Classics mention the use of Basti prepared with Tikta Dravya, Ksheera and Ghrita for the treatment of Asthi Kshaya. To assess the efficacy of Tikta Ksheera Basti and Ajasthi Bhasma in the management of Osteoporosis, present study was undertaken on 40 patients of Osteoporosis. Patients diagnosed Osteoporotic by Bone Mineral Density test, were randomly divided into two groups, A and B consisting of 20 patients each. Patients of Group-A were administered Tikta Ksheera Basti in Kala Basti schedule (16 days) followed by Ajasthi Bhasma - 500 mg orally B.D. with milk as Anupana for 3 months. Patients of Group-B were given only Ajasthi Bhasma - 500 mg orally B.D. with milk as Anupana for 3 months. The combined therapy of Basti and Ajasthi Bhasma showed encouraging results in the subjective and objective parameters of Osteoporosis. The study shows that the Tikta Ksheera Basti and Ajasthi Bhasma are very effective in the management of Osteoporosis.

Key words : Asthi Kshaya, Osteoporosis, Ksheera Basti, Ajasthi Bhasma, Singh's index, Bone Mineral Density.

INTRODUCTION

'AYURVEDA' attributes its prime importance to maintenance of health in healthy individuals and alleviation of diseases in ailing populace. It explains human body as a congenial homeostasis of Dosha, Dhatu and Mala¹. Moreover, the equilibrium of the Dhatu is termed as health². Among the Dhatus, Asthi is blessed with the function of Shareera Dharana. It is this Asthi which gives shape to the body and protects the vital organs. Any derangement in the Asthi Dhatu leads to the different kinds of diseases. Chakrapani says this derangement may either be Kshaya or Vriddhi³.

Asthi Kshaya is a condition in which there will be Kshaya (diminution) of Asthi Dhatu (bone tissue). Asthi Kshaya may be compared to Osteoporosis, in which there is a decrease in bone mass leading to increased bone fragility and susceptibility to fractures. Osteoporosis is a commonest condition affecting the older population. According to the principle of Ashraya Ashrayee Bhava,⁴ when Vata increases Asthi decreases because, Vata and Asthi are inversely proportional to each other. Hence the

etiological factors of Vata Vriddhi are the etiological factors for Asthi Kshaya. Apart from these, the etiological factors for the vitiation of Medavaha, Asthivaha, Majjavaha and Purishavaha Srotas can also be taken as the causative factors for Asthi Kshaya. The Samprapti of Asthi Kshaya involves a very complex mechanism. By the result of above mentioned pathogenetic factors the provoked Vata, either by Dhatukshaya or by Margavarana, enters the Rikta Asthivaha Srotas and leads to Asthi Kshaya. The clinical features of Asthi Kshaya are Asthishula, Toda, Sandhi Shaithilya, Kesha, Loma, Nakha, Danta Vikara and Paata, Dourbalya, Rukshata etc.⁵ Charaka and Vagbhata mention the use of Basti prepared with the Tikta Dravya, Ksheera and Ghrita as the treatment⁶ of Asthi Kshaya along with the use of Swayoni Dravyas (similar substance). Sushruta also mentions the use of similar substances in case of diminished Dhatus⁷.

In the contemporary science Osteoporosis is defined as "a progressive systemic skeletal disease characterized by low bone mass and micro architectural deterioration of bone tissue with a consequent increase in bone fragility and susceptibility to fracture"⁸.

Epidemiology : Osteoporosis is a global dilemma that is expected to increase in significance with the growing elderly population. It affects both sexes and all races albeit to different degrees. The lifetime risk for

* M.D. (Ayu), Ph.D. Scholar, Dept. of Kayachikitsa, I.P.G.T. & R.A., Jamnagar.
Email : drsanjay_charaka@yahoo.in

** Professor and Head, Dept. of Post Graduate Studies in Kayachikitsa, Ayurveda Mahavidyalaya, Hubli, Karnataka

an Osteoporotic fracture is 30-40% in women and 13-15% in men. Women are at high risk compared to men and the risk even increases at menopause, which is a physiological transition period of hormonal imbalance. In the U.S., as many as 8 million women and 2 million men suffer from osteoporosis and an additional 18 million have bone mass levels that put them at increased risk of osteoporosis⁹. In United Kingdom 200,000 fractures occur each year due to osteoporosis at an annual cost of £ 940 million¹⁰. The problem of osteoporosis in *INDIA* remained neglected for a long time for two important reasons: 1. The average life expectancy in our country at independence was 47 years, and 2. Osteoporosis, till recently was considered as an inevitable consequence of aging with no treatment available. With increasing numbers of elderly in India, osteoporosis is emerging as an important public health problem¹¹.

The etiological factors of Osteoporosis are increasing age, sex hormone deficiency, Caucasian race, low body mass index (BMI), malnutrition (low Calcium diet), smoking, alcohol, prolonged corticosteroid therapy etc.¹² The treatment is mainly aimed at preventing further bone loss, maintaining the bone mass, prevention of fractures, calcium and vitamin-D supplementation, hormone replacement therapy (HRT), and the use of certain drugs like Bisphosphanates, Selective Estrogen Receptor Modulators (SERMs) and anabolic steroids etc.¹³ Use of HRT, Bisphosphanates, SERMs and anabolic steroids are not devoid of adverse effects. So, it is need of the hour to carry researches for finding efficient, economic, natural and safer formulations to manage Osteoporosis. Ayurveda has got many time tested formulations for this condition.

Aims & Objectives :

The following were the aims and objectives of the study:

1. To study Asthi Kshaya vis-à-vis Osteoporosis in the light of Ayurveda and Modern Science.
2. To study the efficacy of Tikta Ksheera Basti and Ajasthi Bhasma in Osteoporosis.
3. To evaluate the efficacy of Basti and Shamana Chikitsa in lifestyle improvement of Post Menopausal women and Osteoporotic men.

MATERIALS & METHODS

Source of Data : Patients attending the OPD & IPD of the Department of Post Graduate Studies in Kayachikitsa, Ayurveda Mahavidyalaya Hospital, Hubli were selected for the study.

Inclusion criteria :

1. Patients presenting with the classical features of Asthi Kshaya vis-à-vis Osteoporosis.
2. Post-Menopausal women and Osteoporotic men were taken for the study.
3. Patients were selected between the age group of 40-60 years.
4. Patients of Osteoporosis diagnosed by B.M.D test (t-score < -2.5).

Exclusion criteria :

1. Patients below the age of 40 years and above the age of 60 years.
2. Patients suffering from pathological Osteoporosis and neoplasms of the bone.
3. Patients suffering from Diabetes Mellitus, Hyper-parathyroidism, Paget's disease, Thyrotoxicosis, Cushing's syndrome, Endocrinal disorders and other serious systemic diseases were excluded.

Grouping : *Group-'A'* : Tikta Ksheera Basti in Kala Basti schedule (16 days) after Ama Pachana, followed by Ajasthi Bhasma capsules - 500 mg B.D. with Godugdha as Anupana for 3 months.

Group-'B' : Only Shamanoushadhi i.e. Ajasthi Bhasma capsules - 500 mg B.D. with Godugdha as Anupana for 3 months after Ama Pachana.

Plan of treatment :

1. Ama Pachana: Panchakola Churna - 3gm b.d with warm water for 3-5 days.
2. Snehana (Abhyanga): Ksheera Bala Taila - All over the body.
3. Swedana: Nadi Sweda - All over the body
4. Basti: Tikta Ksheera Basti - in Kala Basti schedule (16 days).

Anuvasana Basti :

-Pancha Tiktaka Guggulu Ghrita	1 Prasrita (80ml).
-Saindhava Lavana	1 Aksha (10gms).
-Shatapushpa Churna	1 Aksha (10gms).

Asthapana Basti :

-Makshika	1 Prasrita (80ml).
-Saindhava Lavana	1 Aksha (10gms).
-Pancha Tiktaka Guggulu Ghrita	2 Prasrita (160ml).
-Puto Yavani Kalka	1 Prasrita (80gms).
-Godugdha	4 Prasrita (320ml).

5. *Shamanoushadhi* : Cap. Ajasthi Bhasma - 500 mg B.D. with milk for 3 months.

Ajasthi Bhasma was prepared by giving Gajaputa to the pieces of Ajasthi. After the first puta, Kumari swarasa bhavana was given to the obtained powder and again the puta was given. Finally the bhavana of rose water was given to overcome the odour of the Ajasthi Bhasma.

A special proforma was designed which included all the important and relevant data related to Osteoporosis. Standard scorings were adopted for the subjective as well as objective parameters for the assessment of clinical condition of patients before and after treatment.

Investigations : The following laboratory investigations were carried out;

Blood : Hb %, TC, DC, ESR, RBS, Serum Alkaline phosphatase, phosphorus and calcium.

Urine : Sugar, Albumin and Microscopic examinations.

X-Ray : X-ray of proximal femur (both), AP view was taken to assess Singh's index (grading Osteoporosis on the trabecular pattern of the proximal end of the femur).

BMD : To measure Bone Mineral Density (BMD) before and after treatment, standard Ultrasound Bone Densitometer was used which was provided by "The Himalaya Drug Company, Bangalore".

Follow up : Patients were followed up for three months after the completion of treatment.

Parameters of the study :

Subjective parameters :

Shula (Pain) :

- Grade 0 - No pain
- Grade 1 - Mild pain
- Grade 2 - Discomforting pain
- Grade 3 - Distressing pain
- Grade 4 - Horrible

Sparshasahyata (Tenderness) :

- Grade 0 - No Tenderness
- Grade 1 - Mild tenderness without any sudden response on pressure
- Grade 2 - Wincing of face on pressure
- Grade 3 - Wincing of face and withdrawal of the affected part on pressure
- Grade 4 - Resist touch due to tenderness

Dourbalya (General debility) :

- Grade 0 - No Dourbalya
- Grade 1 - Not able to perform strainous activity
- Grade 2 - Not able to perform moderate activity
- Grade 3 - Cannot perform moderate activity but, can perform mild activity without any difficulty
- Grade 4 - Even mild activities cannot be performed

Objective parameters :

Singh's Index (Singh-Maini Index):

- Grade 6 - All the normal trabecular groups are visible and the upper end of the Femur seems to be completely occupied by cancellous bone.
- Grade 5 - The structure of principal tensile and principal compressive trabeculae are accentuated. Ward's triangle appears prominent.
- Grade 4 - Principal tensile trabeculae are markedly reduced but can still be traced from the lateral cortex to the upper part of the femoral neck.
- Grade 3 - There is a break in the continuity of the principal tensile trabeculae opposite the greater trochanter. This grade indicates definite Osteoporosis.
- Grade 2 - Only the principal compressive trabeculae stand out prominently; the others have been more or less completely resorbed.
- Grade 1 - Even the principal compressive trabeculae are markedly reduced in number and are no longer prominent¹⁴.

Bone Mineral Density (T-Score): WHO Criteria for assessing osteoporosis¹⁵ :

Normal - 't' score greater than -1; Osteopenia - 't' score between -1 to -2.5; Osteoporosis - 't' score less than or equal to -2.5 and severe osteoporosis - 't' score less than -2.5 with fracture.

Overall effect of therapy: Marked improvement->75% to 100% improvement, Good improvement->50% to <75% improvement, Moderate improvement->25% to <50% improvement and Poor improvement-<than 25% improvement.

OBSERVATIONS

The following were the observations of the study. Total 40 patients, 20 in each group A and B were registered. Maximum number of patients i.e. 32 (80%) were in the age group of 50-60 years, 31 (77.50%) were females and all had attained menopause, 34 (85%) were

Hindus, all the 40 were married. Maximum number of patients; had primary education (50%), belonged to middle class (35%), were housewives (72.25%), had sedentary lifestyle (75%), were from urban habitat (75%), had the chronicity of 2-4 years (30%), had vishamagni (55%), had krura koshta (42.50%), were vegetarians (67.50%), had the habit of drinking tea (82.50%), had disturbed sleep (57.50%),

Maximum number of patients; were of Vata-pittaja prakriti (70%), had Madhyama Sara (65%),

Madhyama Samhanana (85%), Madhyama Pramana (90%), Madhyama Satmya (60%), Madhyama Satwa (50%). Madhyama Abhyavaharana Shakti (65%), Madhyama Jarana Shakti: (50%), Madhyama Vyayama Shakti (45%), Madhyama Vaya (90%). The commonest Nidanas observed were Katu Rasa Pradhana, Ruksha, Sheeta and Laghu Guna Pradhana Ahara Sevana, Vishamashana, Ratri Jagarana, Chinta and Krodha. The Laxanas observed were Asthi Shula, Sandhi Shula, Sparshasahyata, Dourbalya, Sandhi Shaithilya, Keshha, Danta Vikara/Pata, Rukshata etc.

RESULTS

TABLE NO. 1 : EFFECT OF THERAPY ON THE SUBJECTIVE PARAMETERS IN PATIENTS OF GROUP-A :

Parameter	Mean score		Mean (Diff)	% Relief	SD	SE	t	p	Remarks
	BT	AT							
Pain	2.65	0.3	2.35	88.65%	0.59	0.13	18.08	<0.001	HS
Tenderness	2.40	0.45	1.95	81.25%	0.51	0.11	17.73	<0.001	HS
General debility	2.25	0.40	1.85	82.22%	0.49	0.11	16.89	<0.001	HS

TABLE NO. 2 : EFFECT OF THERAPY ON THE OBJECTIVE PARAMETERS IN PATIENTS OF GROUP-A :

Parameter	Mean score		Mean (Diff)	% Gain	SD	SE	t	p	Remarks
	BT	AT							
X-ray (Singh's index)	2.85	3.75	0.90	31.58	0.91	0.20	4.5	<0.001	HS
BMD (t-score)	-3.74	-1.19	+2.55	68.18	1.42	0.32	7.79	<0.001	HS

TABLE NO. 3 : EFFECT OF THERAPY ON THE SUBJECTIVE PARAMETERS IN PATIENTS OF GROUP-B :

Parameter	Mean score		Mean (Diff)	% Relief	SD	SE	t	p	Remarks
	BT	AT							
Pain	2.55	1.85	0.70	27.45%	0.57	0.13	5.38	<0.001	HS
Tenderness	2.25	1.65	0.60	26.67%	0.75	0.17	3.53	<0.01	HS
General debility	2.15	0.95	1.20	55.81%	0.77	0.17	7.06	<0.001	HS

TABLE NO. 4 : EFFECT OF THERAPY ON THE OBJECTIVE PARAMETERS IN PATIENTS OF GROUP-B :

Parameter	Mean score		Mean (Diff)	% Gain	SD	SE	t	p	Remarks
	BT	AT							
X-ray (Singh's index)	3.35	3.90	0.55	16.42%	0.89	0.20	2.75	<0.02	S
BMD (t-score)	-3.34	-1.14	+2.20	65.87%	1.62	0.36	6.11	<0.001	HS

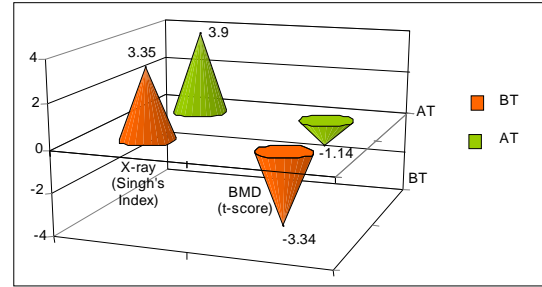
TABLE NO. 5 : TOTAL EFFECT OF THERAPY ON SUBJECTIVE PARAMETERS OF GROUP-A :

Sl. No.	Parameter	Marked improvement	Good improvement	Moderate improvement	Poor improvement
01	Pain	15 (75%)	05 (25%)	00 (00%)	00 (00%)
02	Tenderness	12 (60%)	07 (35%)	01 (05%)	00 (00%)
03	General debility	13 (65%)	06 (30%)	01 (05%)	00 (00%)
04	BMD (t-score)	10 (50%)	-	06 (30%)	04 (20%)

TABLE NO. 6 : APPROXIMATE RASA, GUNA, VIRYA, VIPAKA & DOSHAGNATA OF ASTHAPANA AND ANUVASANA BASTI :

Characteristics		Asthapana	Anuvasana
Rasa	Madhura	64.77%	27.43%
	Tikta	21.59%	60.15%
	Kashaya	6.89%	-
	Katu	5.25%	2.04%
	Lavana	1.50%	10.37%
Guna	Snigdha	67.52%	31.38%
	Ruksha	16.19%	16.62%
	Guru	9.04%	8.60%
	Laghu	4.92%	35.10%
	Tikshna	2.33%	8.0%
Virya	Shita	66.60%	57.63%
	Ushna	31.86%	41.25%
	Anushna Shita	1.54%	1.12%
Vipaka	Madhura	75.04%	48.83%
	Katu	24.97%	51.16%
Doshagnata	Vata	71.60%	47.38%
	Pitta	17.30%	27.84%
	Kapha	11.10%	24.78%

GRAPH NO. 4 : OBJECTIVE PARAMETERS IN PATIENTS OF GROUP-B :



DISCUSSION

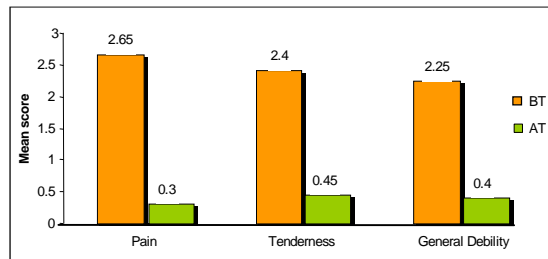
Asthi Kshaya is explained in almost all texts of Ayurveda along with 18 types of Kshayas. Harita has explained Asthi Kshaya along with the Rajayakshma.

Age : As explained in the Nidana aspect, both Ayurveda and Modern science consider old age as one of the causative factor of Osteoporosis. The definition of Jirna (Vriddha) itself says “*Ataha param hiyamana dhatwindriya bala virya- - - -vayu Dhatu prayam kramena jirnamucchyate Aavarsha shatam*”¹⁶. This means that, in old age the Dhatu becomes Kshina along with Indriya, Bala, and Virya etc. This age is said to be dominated by Vata.

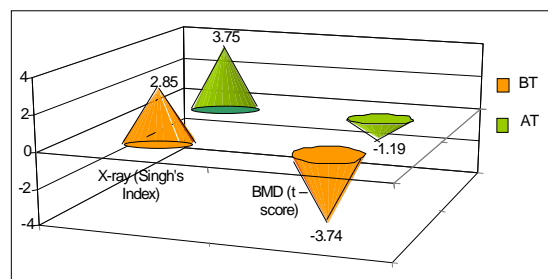
The reason for Dhatu Kshaya in old age is explained by Sushruta as “*Sa eva annaraso vriddhanaam jaraparipakwa shariratwad aprinano bhavati*”¹⁷. The Ahara Rasa can not nourish the old aged because the body becomes paripakwa due to senility. Dalhana commenting on this says that, Aprinana should be taken as Ishat Prinana, which means slight nourishment. The nourishment can not increase the Dhatu. Instead this slight nourishment is meant to keep the person alive. In old age, catabolism overpowers anabolism leading to degeneration (Osteoporosis). Modern science accepts this fact by saying, there is decreased calcium absorption in old age and thus the bone formation is decreased and the bone resorption is increased because of increased osteoclastic activity resulting in Osteoporosis. So the fact that maximum numbers of patients were present between the age group of 50-60 years is justified.

Sex : There was higher incidence of osteoporosis in females. The reason is, by the time Peak Bone Mass (PBM) is achieved, bone mass is 1/4th to 1/3rd greater in men than women. For example a study conducted in America revealed that, total body bone mass in men was 2965 gms compared with 2368 gms in women. However the male skeleton is also larger compared to

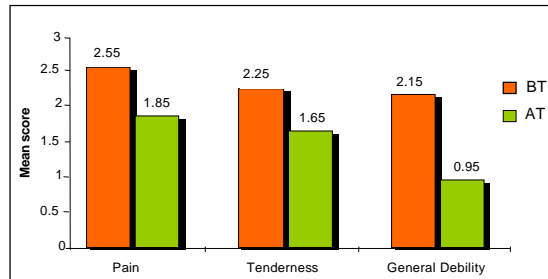
GRAPH NO. 1 : SUBJECTIVE PARAMETERS IN PATIENTS OF GROUP-A :



GRAPH NO. 2 : OBJECTIVE PARAMETERS IN PATIENTS OF GROUP-A :



GRAPH NO. 3 : SUBJECTIVE PARAMETERS IN PATIENTS OF GROUP-B :



female skeleton. The BMD is also 13% higher in males compared to females. Hence when bone resorption starts as a natural consequence of aging, women tend to lose more bone mass compared to men. The ratio of incidence of osteoporosis in men to women is 1:4.

Socio-economical status, Occupation & Habitat : The higher incidence of Asthi kshaya in lower socio-economical group may be because of their life styles, lack of nutritious food etc. Nature of work plays a definite role in the incidence of osteoporosis. When subjected to mechanical stress, bone tissue increase deposition of mineral salts and production of collagen fibers. Removal of mechanical stress (sedentary lifestyle) results induces removal of mineral salts and collagen fibers¹⁸. Hence the incidence of Osteoporosis is high in people who do not perform physical activity. As per the habitat, the higher incidence of osteoporosis in urban people may be because of the nature of work, food habits, mental stress etc. Urban people lead a sophisticated and sedentary life. The modernized form of food known as junk food contains fewer nutrients and hence leads to improper nourishment of bones.

Addiction : Maximum number of patients i.e. 82.50% had the habit of consuming tea. The role of tea in the incidence of osteoporosis is not known. Total 15% each had the habit of smoking & alcohol intake and 12.50% had the habit of tobacco chewing. Tobacco is toxic to osteoblasts and it affects estrogen metabolism leading to osteoporosis. Alcohol causes osteoporosis but, its role in the pathogenesis of osteoporosis is poorly understood¹⁹.

Menopause : All the 31 women in the study had attained menopause. Menopause is one of the risk factors of osteoporosis, because of sex hormone (estrogen) deficiency²⁰. Estrogen in women stimulates the osteoblastic activity and inhibits the osteoclastic activity thereby, it maintains the bone mass. After menopause which is known as the transitional period of hormonal imbalance, estrogen level declines progressively leading to increased osteoclastic activity and decreased osteoblastic activity. Hence resorption exceeds formation finally resulting into osteoporosis.

Effect of therapy on pain & tenderness : Group-A showed better results in reduction of pain and tenderness compared to Group - B. Pain is due to the aggravated Vata and the tenderness is because of the pain in the bones and joints. Among the Panchakarmas, Basti is the treatment of choice for the Vata disorders. The Purvakarmas i.e. Snehana and Swedana mitigate Vata and the ingredients of Basti such as Godugdha,

Ghrita, Madhu and Guggulu also mitigate the Vata. When aggravated Vata is mitigated the symptoms like pain and tenderness are also pacified. Abhyanga has a soothing effect on the body. It brings about the relaxation of the muscles. Fomentation also relaxes the muscles and increases blood circulation because of vasodilatation. Hence these procedures relieve the pain and tenderness. Moreover, Guggulu itself is anti-inflammatory and analgesic drug which relieves pain and tenderness.

Effect of therapy on general debility : Group-A showed better results compared to group - B in providing strength to the patients. General debility in osteoporosis is because of Dhatu Kshaya and Bala Kshaya. Godugdha and Ghrita present in Basti are Jivaniya, Rasayana, Balya, Dhatu Poshaka and Vrishya. Ajasthi Bhasma is Madhura in Rasa and Vipaka. It is Balya, Rasayana, and Dhatu Poshaka. Milk was given as Anupana Ajasthi Bhasma. Hence the combined effect of Basti, Shamana and Anupana has provided Bala to the patients of Asthi kshaya.

Effect of therapy on X-ray (Singh's index) and BMD (t-score) : In both the groups the effect of therapy on Singh's Index and Bone Mineral Density (BMD) was almost similar. But, Group - A showed slightly better results than group - B.

Regarding Tikta Ksheera Basti, Arunadatta says that, the combination of Snigdha and Shoshana property produces Khara property which is also the guna of the Asthi. This nourishes the Asthi as per Samanya Siddhanta²¹. The Panchabhoutika composition of ingredients of Basti is similar to Asthi. These ingredients will reach the Asthivaha Srotas and will be acted upon by the Parthiwagni, Vayavyagni and Tejasagni and gets transformed into Asthi Poshakamshas on which the Asthi Dhatwagni will act upon and converts into Sthayi Asthi Dhatu. Hence there will be increase of the decreased Asthi.

Cow's milk is the richest natural source of calcium present on earth. The ratio in which calcium and phosphorus are present in cow's milk is ideal for their proper absorption & assimilation and consequently for bone formation along with vitamin-D²². Vitamin-D present in cow's milk helps in bone formation by maintaining the proper levels of calcium in the blood along with the parathyroid hormone. Vitamin-K activates osteocalcin the major non-collagen protein in bone. Cow's milk also contains lactoferrin an iron binding protein that boosts the growth and activity of the osteoblasts, the cells that build bone and reduces the

rate at which these cells die by up to 50-70%. These also decrease the formation of osteoclasts, the cells responsible for breaking down of bone, thus helping to build the bone and prevent osteoporosis.

Ajasthi Bhasma is Samana Dravya of the Asthi Dhatu. By the chemical analysis of Ajasthi Bhasma we find that it contains 51.66% of Calcium and 18.59% Phosphorus as phosphate. Calcium and phosphate may combine to form calcium phosphate which is the major component of bone mineral complex called as hydroxyapatite.

Properties of Ajasthi Bhasma : It is having Madhura in Rasa and Vipaka, Ushna, Sukshma, Vyavayi Guna and has Ushna Virya.

Pharmaceutico-Chemical analysis of Ajasthi Bhasma : The chemical composition of Ajasthi Bhasma is as follows; Total Ash value - 84.39% w/w, Acid insoluble ash - 0.46% w/w, Iron as 'Fe₂O₃' - 3.52% w/w, Calcium as 'CaO' - 51.66% w/w, Sulphate as 'SO₄' - 8.60% w/w, Phosphate as 'PO₄' - 18.59% w/w²³.

Probable mode of action of Tikta Ksheera Basti : The Virya of Basti dravya, because of its Anupravana Bhava is transmitted all over the body by the Apanadi Vatas and thus has a systemic effect. Guda is also called as the Mula of the Sharira. This Virya of the basti dravya extracts the morbid doshas from all parts of the body i.e. "Apada mastaka" to the Pakwashaya, just as the sun extracts the rasas (kledatwa) from the earth²⁴. Charaka and Hemadri have said that basti is useful in Kshina Dhatus and Bhagna (fractures) of the Asthi and Sandhi. Basti is called as the 'Ardha Chikitsa' - half of the whole treatment and some call it as the 'Sampurna Chikitsa' i.e. the whole treatment²⁵.

Stepwise mode of action of Basti:

Ama Pachana : To clear the obstruction (Sanga) in Asthivaha srotas caused by Ama and to combat the other lakshanas of Ama, Ama pachana was done with Panchakola churna. When Amapachana is achieved (Pakat), the Srotomukha become clear and the stage is set to bring back the vitiated Doshas from Shaakha to Koshtha.

Snehana : Snehana is said to reach the Asthi Dhatu by performing Abhyanga for 800 Matra Kala approximately 15 minutes²⁶. Snehana enters the body through minute pores of skin by the virtue of its Anupravana Bhava. Thus entering the Asthivaha srotas,

it causes Vishyandana²⁷. It destroys the obstruction in Asthivaha Srotas (*Malanam Vinihanti Sangam*). Snehana is Vata Nashaka (*Sneho Anilam Hanti*)²⁸. So it pacifies the Vata.

Swedana : Swedana also pacifies Vata especially, when performed after Snehana. If Swedana is done after proper Snehana, it liquefies the Doshas which causes obstruction in the minute channels²⁹. Hence, by the combined effect of Amapachana, Snehana and Swedana the morbid Doshas are brought to Koshtha. The Pharmacodynamics of these three procedures is nothing but Paka, Vishyandana, Srotomukha Vishodhana and Vayu Nigrahana. These factors are responsible for the movement (Gati) of Doshas from Shaakha to Koshtha³⁰. Here, Paka is by Amapachana and Swedana, Vishyandana is by Snehana and Swedana; Sroto Mukha Vishodhana is done by Amapachana, Snehana & Swedana and Vayu Nigraha is performed by Snehana and Swedana.

Basti : After proper Snehana and Swedana, when the Doshas come from Shaakha to Koshtha, Tikta Ksheera Basti is given to expel these Doshas from the body and to nourish the Kshina Asthi Dhatu. Sushruta says that the eighth basti enters the Asthi Dhatu³¹. Thus entering the Asthi its action can be explained on the following factors.

The percentage of Snigdha Guna in Niruha basti is 67.52% and the percentage of Shoshana guna because of tikta dravyas is 21.59%. Similarly in Anuvasana Basti it is 31.38% and 60.15% respectively. Hence the combination of Snigdha and Shoshana guna produces Khara guna and nourishes the Asthi Dhatu (Arunadatta). The action of Tikta Ksheera Basti on Asthi Dhatu can also be explained on the basis of Pancha Mahabhoutika Theory. Predominance wise the Panchabhoutika composition of Asthi is Prithvi, Vayu, Agni, Akasha and Jala Mahabhuta. The Basti contains Ksheera, Ghrita, Madhu, Guggulu and Tikta Dravya as its main ingredients. The prepared Basti Dravya is Madhura (64.77%) and Tikta Rasa (21.43%) Pradhana. The percentage of Madhura and Tikta Rasa in Anuvasana Basti is 27.43% and 60.15% respectively. The percentage of Katu Rasa in Niruha and Anuvasana Basti is 5.25% and 2.04%. If we analyze the Panchabhoutika composition of Madhura, Tikta and Katu Rasa it is Prithvi + Jala, Vayu + Akasha, and Agni + Vayu respectively. Hence, the total Panchabhoutika composition of Basti Dravya is similar to the Asthi Dhatu and hence nourishes the Asthi.

To conclude in a nut shell, the basti dravyas which are similar to the Asthi Dhatu, in Panchabhoutika composition, will reach the Asthivaha Srotas and will be acted upon by the Parthivagni, Vayavyagni and Tejasagni and gets transformed into Asthi Poshakamshas or the Poshaka Asthi Dhatu. The anabolic aspect of Asthi Dhatwagni will act upon this Poshaka Asthi Dhatu and converts it into Sthayi Asthi Dhatu. Hence there will be increase of bone mass. The percentage of Vataghnata of Niruha and Anuvasana Basti is 71.60% and 47.38% respectively. Hence by the Shamana of aggravated Vata, the Kshina Asthi Dhatu returns to normalcy. The Ksheera Basti reaches the Pakwashaya which is the Purishadhara Kala and the ingredients of Basti i.e. Ksheera, Ghrita and Madhu nourish the Purishadhara Kala and thus also nourish the Asthidhara Kala. According to Modern Embryology both bone tissue and the large intestine are formed by the mesenchymal cells of the mesoderm.

Probable Pharmacokinetics & Pharmacodynamics of Tikta Ksheera Basti according Scientific Parameters : According to modern science basti as a process can be compared with the enema. There are two types of enemas, 1. Evacuant enema and 2. Retention enema. Ksheera basti may be considered as the nourishing retention enema.

Retention enema : The fluid containing the drugs is retained in the rectum so that the drug may act locally e.g. steroid enema in ulcerative colitis, or systemically after absorption through the mucous membrane e.g. paraldehyde enema for the production of basal anaesthesia. The rectum has rich blood and lymph supply and drugs can cross the rectal mucosa like the other lipid membranes; thus unionized and lipid soluble substances are readily absorbed from the rectum, through the rectal venous plexus. There are two rectal venous plexus; 1.the internal rectal venous plexus and 2.the external rectal venous plexus. The portion of the drug absorbed from the upper rectal mucosa is carried by the superior haemorrhoidal veins into the portal circulation whereas that absorbed from the lower rectum enters directly into the systemic circulation via the middle and inferior haemorrhoidal veins.

The absorption of the drug from the rectum follows the laws of transfer of the molecules across the biological membranes. Most drugs are absorbed by passive diffusion, a few by active transport or carrier mediated transport. Pinocytosis is a mechanism for transport of molecules across membranes. Usually unionized and lipid soluble substances are absorbed by simple diffusion or passive diffusion. "Diffusion is

a law of transport of molecules from the region of higher concentration to the region of lower concentration". The absorption of the basti dravyas is also by diffusion and many factors influence this rate of diffusion and thus absorption. These factors are as follows;

Physical state : Liquids are absorbed better than solids.

Ingredients of basti, their solubility and their homogenous mixing : Lipids and lipid soluble drugs penetrate into the cell more rapidly than the water soluble drugs. The homogenous mixture of basti dravyas is important.

Temperature : Luke warm solutions are rapidly absorbed because of vasodilatation, whereas cold solutions are absorbed slowly.

Size of the molecule, its disintegration time and dissolution time : Simpler and smaller the size of the molecule, faster is the absorption. If the disintegration and dissolution time of the compound is less then the absorption is faster.

Quantity and concentration gradient of the basti dravyas : Higher the quantity lesser is the retention time. Concentrated solutions are absorbed more rapidly than the weak solutions.

pH of the GI fluid : Alkaline drugs are absorbed in the alkaline medium i.e. distal ileum and large intestine, whereas acidic drugs are absorbed in the stomach and proximal part of the small intestine.

Ionization : Unionized component predominantly lipid soluble are absorbed rapidly.

Surface area of absorption : Absorption is more in intestines than in stomach, because of the larger surface area of the former (estimated to be that of a tennis court, singles size).

Vascularity : Richer the vascularity greater the absorption.

Structural and functional status of the rectum: In healthy and empty rectum the absorption is more and the diseased condition and the presence of stool delays absorption³².

The concentration of the basti dravyas is higher in the lumen of the rectum and lower in the cells surrounding the rectum. Hence the molecules of basti move from higher concentration to the lower concentration i.e. from the rectum to the surrounding

cells and their, they are absorbed into the rectal veins. The basti is in liquid form and the ingredients are mixed thoroughly to get the homogenous solution. The temperature of the liquid is lukewarm, which brings about vasodilatation and aids the faster absorption. The size of the molecules is also smaller and the basti is in the lipoidal form because of the presence of cow's milk and ghee; hence they are absorbed across the mucous membrane of the rectum. Lipid soluble drugs diffuse by dissolving in the lipoidal matrix of the membrane, the rate of transport being proportional to lipid: water partition coefficient of the drug. The lipid soluble substances like vitamin-A, D and K, and essential minerals such as calcium, phosphorus, magnesium, sodium, potassium and chlorine etc. present in the milk are in unionized form and hence are absorbed rapidly. The pH of the rectum is alkaline and the pH of the basti dravyas is also alkaline which helps faster absorption.

The total quantity of the Niruha basti dravya was 640 ml and the mean retention time was 30 minutes. The quantity of the AnuvAsana basti dravya was 80 ml and the mean retention time was 9 hours. The surface area of the small intestine and rectum is more and it has very rich blood supply, moreover the basti was given in the morning after the patient has passed the stool i.e. when the rectum was empty. Hence all these factors enhance the absorption of the basti dravyas from the rectum through the rectal mucosa. The basti dravyas absorbed from the lower part of the rectum enters the systemic circulation via middle and inferior haemorrhoidal veins and the dravyas absorbed from the upper part of the rectum is thrown into the portal circulation through the superior haemorrhoidal veins.

The cow's milk which is the main ingredient of the Ksheera Basti is rich in calcium, phosphorus, magnesium, potassium, sodium, chlorine etc. It also contains fat soluble vitamins like vitamin-A, D and K. These minerals and vitamins help in bone formation. A study conducted by Finnish researchers, published in November-2005 issue of American Journal of Clinical Nutrition revealed that, only dairy calcium is better than synthetic calcium supplements for growing girl's bones. The superiority of milk over other calcium supplements is because; the bone health is not a mono-nutrient issue and milk contains all the essential vitamins and mineral nutrients required for bone formation. Apart from this the ghee contains phospholipids which plays an important role in the mineralization of bones.

CONCLUSIONS

Osteoporosis is a progressive systemic skeletal disease characterized by low bone mass and micro-architectural deterioration of bone tissue. Incidence is more in females than males, the ratio being 4:1. The risk even increases with the onset of menopause which is a physiological transition period of hormonal imbalance. Along with Vata Vardhaka Nidanah, Sroto-Pradushaka Nidanah of Medavaha, Asthivaha, Majjavaha and Purishavaha Srotas and factors affecting the Jatharagni, Bhutagni especially Parthiwagni, Vayvagni and Tejasagni and Asthi Dhatwagni also play an important role in the pathogenesis of Asthi Kshaya.

The Chikitsa mentioned in the classics stress upon the use of the Basti prepared with the combination of Ksheera, Ghrita and Tikta dravyas. All the Acharyas have also mentioned the use of Swayoni dravyas in the management of Asthi kshaya. There was a significant relief in the subjective parameters in patients of Group-A as compared to the Group-B. Regarding the objective parameters both the groups showed almost equal response. There was a marked gain of bone density in both the groups. Assistance of an expert Radiologist should be taken to grade the osteoporosis by Singh's index, before and after the treatment.

If available, Dual Energy X-ray Absorptiometry (DEXA) should be used to examine the BMD. Assessment of bio-markers of bone turnover should be done. If possible Radio Labeled Assays i.e. labeling the Basti Dravyas and Ajasthi Bhasma with a Radio Active Isotope and assessing its effect on the bone tissue should be done.

Thus it can be concluded that the Chikitsa sutra mentioned by Acharyas for Asthi kshaya thousands of years ago i.e. the use of Basti prepared with the combination of Ksheera, Ghrita and Tikta Dravya and the use of Swayoni Dravyas is effective even today.

REFERENCES

1. Sushruta, Sushruta Samhita, with the Nibandhasangraha commentary of Sri Dalhanacharya, edited by Vaidya Yadavaji Trikamji Acharya and Narayan Ram Acharya, Chaukhambha Orientalia, Varanasi, 4th edition, 1980, page 67, Sutrasthana chapter 15, shloka 3
2. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 62, Sutrasthana chapter 9 shloka 4.
3. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of

- Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 62, Chakrapani commentary on Sutrasthana chapter 9 shloka 4.
4. Vagbhata, Asthtanga Hridaya, with the commentaries 'Sarvangasundara' of Arunadatta and Ayurvedarasayana of Hemadri, Krishnadas Academy, Varanasi, 2000, page 186, Sutrasthana chapter 11, shloka 26-28.
 5. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 62, Sutrasthana chapter 17 shloka 67.
 6. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 180, Sutrasthana chapter 28 shloka 27; Vagbhata, Asthtanga Hridaya, with the commentaries 'Sarvangasundara' of Arunadatta and Ayurvedarasayana of Hemadri, Krishnadas Academy, Varanasi, 2000, page 187, Sutrasthana chapter 11, shloka 31.
 7. Sushruta, Sushruta Samhita, with the Nibandhasangraha commentary of Sri Dalhanacharya, edited by Vaidya Yadavaji Trikamji Acharya and Narayan Ram Acharya, Chaukhambha Orientalia, Varanasi, 4th edition, 1980, page 68, Sutrasthana chapter 15, shloka 8.
 8. John. P. Bilezikian et.al. Endocrinology and metabolism clinics of North America, Osteoporosis, Saunders Philadelphia, 2004, page 1.
 9. Harrison's Principles of internal medicine, Vol II, Mc Graw - Hill companies, 2001, Page 2228
 10. Anoop Kuttikat et.al. Management of osteoporosis, J. Indian Rheumatological Association: Vol. 12, page 104
 11. Gupta A., Osteoprosis in India - The nutritional hypothesis, Natl Med J Ind 1996; 9: 268 -74
 12. Harrison's Principles of internal medicine, Vol II, Mc Graw - Hill companies, 2001, Page No. 2249 & www.nof.org <http://www.nof.org> / April 25th 2005.
 13. John. P. Bilezikian et.al. Endocrinology and metabolism clinics of North America, Osteoporosis, Saunders Philadelphia, 2004.
 14. Singh. M; Nagrath. A.R. and Maini, P.S. changes in the trabecular pattern of the upper end of the femur as an index to Osteoporosis; Journal of Bone and joint surgery, 52A, 457-467, 1970
 15. Pauline M. Camacho, Paul D. Miller, Osteoporosis - A Guide for clinicians, Wolters Kluwer (India) Pvt. Ltd., New Delhi, World Health Organization criteria for assessing Osteoporosis severity, page 5.
 16. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 280, Vimanasthana chapter 8 shloka 122.
 17. Sushruta, Sushruta Samhita, with the Nibandhasangraha commentary of Sri Dalhanacharya, edited by Vaidya Yadavaji Trikamji Acharya and Narayan Ram Acharya, Chaukhambha Orientalia, Varanasi, 4th edition, 1980, page 64, Sutrasthana chapter 14, shloka 19.
 18. John. P. Bilezikian et.al. Endocrinology and metabolism clinics of North America, Osteoporosis, Saunders Philadelphia, 2004, page 52.
 19. Harrison's Principles of internal medicine, Vol II, Mc Graw - Hill companies, 2001, page 2230.
 20. John. P. Bilezikian et.al. Endocrinology and metabolism clinics of North America, Osteoporosis, Saunders Philadelphia, 2004, page 196.
 21. Vagbhata, Asthtanga Hridaya, with the commentaries 'Sarvangasundara' of Arunadatta and Ayurvedarasayana of Hemadri, Krishnadas Academy, Varanasi, 2000, page 187, Arunadatta on Sutrasthana chapter 11, shloka 31.
 22. Human physiology- C.C.Chatterji, vol-I, page-715
 23. Madhaviata G. Bhat, Concept of Dhatu & Dhatvagni w.s.r to Asthi & Asthyagni, M.D (Ayu) thesis, Dept. of Basic Principles, IPGT&RA, GAU, Jamnagar, 1995.
 24. Sushruta, Sushruta Samhita, with the nibandhasangraha commentary of Sri Dalhanacharya, edited by Vaidya Yadavaji Trikamji Acharya and Narayan Ram Acharya, Chaukhambha Orientalia, Varanasi, 4th edition, 1980, page 288, Chikitsasthana, chapter 35, shloka 27.
 25. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 683, Siddhithana chapter 1 shloka 38-39.
 26. Sushruta, Sushruta Samhita, with the Nibandhasangraha commentary of Sri Dalhanacharya, edited by Vaidya Yadavaji Trikamji Acharya and Narayan Ram Acharya, Chaukhambha Orientalia, Varanasi, 4th edition, 1980, page 288, Chikitsasthana Dalhana on chapter 24, shloka 30.
 27. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 120, Sutrasthana chapter 22 shloka 11.
 28. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 678, Siddhithana chapter 1 shloka 7.
 29. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 678, Siddhithana chapter 1 shloka 7.
 30. Agnivesha, Charaka Samhita, Revised by Charaka and Dhridhabala with the Ayurveda Dipika commentary of Chakrapanidatta, edited by Vaidya Yadavaji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi, Fifth edition, 2001, page 180, Sutrasthana chapter 28 shloka 33.
 31. Sushruta, Sushruta Samhita, with the Nibandhasangraha commentary of Sri Dalhanacharya, edited by Vaidya Yadavaji Trikamji Acharya and Narayan Ram Acharya, Chaukhambha Orientalia, Varanasi, 4th edition, 1980, page 288, Chikitsasthana 35, shloka 30.
 32. Satoskar R. S., Bhandarkar S. D., Pharmacology and Pharmacotherapeutics, 12 edition, Part-I, Popular Prakashan Bombay, 1991. Page 04.

हिन्दी सारांश

अस्थिक्षय (ओस्टियोपोरोसिस) की चिकित्सा में तिक्त क्षीर बस्ति और अजास्थि भस्म के प्रभाव का अध्ययन

संजय कङ्कलमट्टी एवं पि. जि. सुब्बनगौड़

आयुर्वेद में धातु साम्यता को स्वास्थ्य कहा गया है। धातुओं में अस्थि धातु शरीर को धारण करती है। अस्थि धातु की विषमता से व्याधि उत्पन्न हो सकती है। यह विषमता वृद्धि या क्षय जन्य हो सकती है। अस्थि क्षय एक ऐसी व्याधि है जिसमें अस्थि धातु का क्षय हो जाता है। अस्थि क्षय को आधुनिक मतानुसार ओस्टियोपोरोसिस समझा गया है। आश्रयाश्रयी भाव के अनुसार जब वात की वृद्धि होती है तब अस्थि का क्षय होता है। संहिताओं में अस्थि क्षय की चिकित्सा में तिक्त क्षीर बस्ति और स्वयोनि द्रव्यों का उपयोग बताया है। प्रस्तुत अध्ययन में अस्थि क्षय के ४० रोगियों को दो समूहों में विभाजित किया गया (समूह 'अ'-२० रोगी, समूह 'ब'-२० रोगी)। समूह 'अ' के रोगियों को तिक्त क्षीर बस्ति, काल बस्ति की अवधि अनुसार (१६ दिन) देने के बाद अजास्थि भस्म ५०० मि. ग्रा. दिन में दो बार दूध के अनुपान के साथ ३ महिनों तक दिया गया। समूह 'ब' के रोगियों को केवल अजास्थि भस्म ५०० मि. ग्रा. दिन में दो बार दूध के अनुपान के साथ ३ महिनों तक दिया गया। इन दोनों वर्गों में, तिक्त क्षीर बस्ति और अजास्थि भस्म वर्ग के रोगियों में अच्छे परिणाम देखे गये।

