

Anatomical Study of *Asthi vaha srotas* & Clinical Study of *Asthi Kshaya* w.s.r to “Osteoporosis”

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Abstract

Ayurveda is a life science. The researchers of Ayurveda could rule out the presence of srotas spreading throughout the human body. These srotas are governed by vayu which is using all the srotas of the body to carry out all the activity of human body, without which the human society will not exist. Several synonymous words have been described by the Ayurvedacharyas for srotas. The aim of the study was to justify that srotas are nothing but innumerable channels/pathways/cells without which no activities of the human body will develop and to understand the Asthi vaha srotas, Asthi Kshaya and its correlation with osteoporosis. In introductory chapter we have discussed about srotas and provided an insight into the rich Ayurvedic literature comprising the word srotas, the definition and types of srotas, the detailed description of Asthi vaha srotas, the detailed etiological factors, the specific poorvaroopas, the characteristics and clinical features i.e., the roopa, the meticulously described etiopathogenesis i.e., the samprapti and the logical management of disease with special reference to Asthi Kshaya. The modern science provides a systemic description of bone introduction, bone composition and systemic description of osteoporosis starting from different types of definition, the epidemiology of the disease at the global level with special reference to India, the etiological factors, pathogenesis of the disease, classification, clinical features, different laboratory investigation including haematology–radiology–bone mineral density tests etc. The section on drug review begins with the logical reasoning and basis of selection of trial drugs viz., Asthi Srinkhala, Mukta Pisti, Haridra, Amalaki. Further pages in this section are exclusively dedicated to the detailed study of each of the drugs comprising of the following details viz., taxonomical classification, Sanskrit synonyms, Hindi names, English names, habitat, properties, part used, dose, morphology, chemical constituents, general uses etc. The section ends with an attempt to highlight the role of several preventive modalities for preventing the onset of this dreaded disease. The clinical study of this research provides a detailed analysis of the methodology of research in the present clinical trial.

Keywords: *Asthi vaha srotas, Asthi Kshaya, osteoporosis*

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INTRODUCTION

The word *Srotas* is derived from “*Sru*” *gatau dhatu*, which means movement. *Acharya Charaka* said that the path which helps for transportation of substances is called *SROTAS* [1].

Ayurveda is a life science and according to this science the human body is made up of three

types of *doshas* namely, *vata*, *pitta* and *kapha* and they follow *srotas* to perform their activities. *Ayurveda* has accepted that the human body is made up of innumerable *srotas* which are responsible for performing all the activities of the body without these *srotas* human life will not exist. All the three *doshas* of the body perform their functional activities with the help of these *srotas*. For the proper

development of human body, the proper functioning of these *srotas* are very necessary. Because of these *srotas* there is development of cells to tissues, tissues to organs and organs to systems. After that a well developed human body is formed.

Ayurveda has given most importance to *srotas* for every *Murtiman bhavas* of the body. By saying *Murtiman bhavas Ayurveda* means that flow of blood neurological activities, activities of organs, systems, nutrition to all the cells of the body are dependent on *srotas*. *Dhatuposhan siddhanta*, physiological and functional activities of human body, and formation of diseases are dependent on *srotas*.

Several synonymous words have been described by *Acharya Charaka* for *srotas* such as *Sira*, *Dhamanya*, *Rasayani*, *Nadya*, *Marga* and so many [2]. Some are micro and some are macro in structure and they adopt the same colour of the particular *dhatu* of the body to which it belongs.

Our body consists of several fine and small *srotas* (circulatory channels) which help in activities of our body. The specific varieties of *srotas* in the human body are same in number as the structural entities in it. *Srotas* (circulatory channels) carries the *dhatu* undergoing transformation to their destination.

As the *srotas* are numerous but for the study point of view *Acharya Charak* has described thirteen types of *srotas* including *Asthi vaha srotas*. According to *Acharya Susurtha* there are nine in males and 12 in females in numbers. According to *Sarangadhara* in males there are 10 in numbers and in females there are 13 in number. The *moola* (site of origin) of *srotas* carrying *asthi dhatu* are *Medo* and *Jaghan* (kati region). Bones make the base of locomotor system in our body.

Osteoporosis condition affects both the sexes and all races albeit to different degrees. The lifetime risk for an osteoporotic fracture is 30–40% in women and 13–15% in men. Women are at high risk as compared to men. The risk even increases at menopause, which is a physiological transition period of hormonal imbalance [3]. As *Ashtanga samgraha* says

Shareeram dharayenthe dhatvaharashcha sarvada means the supporting of the human body is done by *dhathu* and *ahara*. Among the *saptha dhathus* the *asthi dhathu* is the one which is responsible for the function of *shareera dharana*. *Asthi dhatu* is the *dhatu* which gives a profile to the body and protects the imperative organs [4]. Man without *Asthi dhatu* would have been a nebulous bolus of soft tissues. Hence *Asthi dhatu* can precisely be termed as the construction bars, on the systematic framework of which man stands tall and handsome.

Thus a state of symmetry of *dhatu*s is health and the commotion of the same is termed as disease. Here in the present study *Asthi Kshaya* was taken for the study in relation to osteoporosis—a metabolic disorder of the bone. 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”.

The adult skeleton undergoes a continuous process of remodeling where in bone resorption is coupled with bone formation. When bone resorption exceeds formation, then osteoporosis occurs [5].

AIMS AND OBJECTIVE

The aim of the study was to justify that *srotas* are nothing but innumerable channels/pathways/cells without which no activities of the human body will develop and to understand the *Asthi vaha srotas*, *Asthi Kshaya* and its correlation with osteoporosis and to assess the safety and efficacy of *kalpita yoga* (*Mukta shukti*, *Amlaki*, *Haridra* & *Asthi shrinkhala*) in the management of *Asthi Kshaya* (osteoporosis).

MATERIALS AND METHODS

A total of 40 uncomplicated patients of *Asthi Kshaya* (osteoporosis) patients with clinical feature of *Asthidhatu Kshaya* and osteoporosis were selected from OPD & IPD of Major SD Singh PG Ayurvedic Medical College & Hospital, Fatehgarh-Farrukhabad, Uttar Pradesh, India irrespective of sex, caste and race.

Inclusion Criteria

1. Patients presenting with the classical features of *Asthi Kshaya* (osteoporosis) were taken for the study.
2. Postmenopausal 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 BMD test.

Exclusion Criteria

The following patients were excluded from the study:

1. Patients below the age of 40 years and above the age of 60 years were excluded.
2. B.M.D.T. above -1 and less than -3.5.
3. Congenital disorders (Dysosteogenesis and Marfan's syndrome).
4. Patients diagnosed with endocrine disorders (hyperthyroidism, hyperparathyroidism, untreated Cushing's syndrome).
5. Patients with evidence of malignancy.
6. Patients suffering from major systemic illness necessitating long-term drug treatment.
7. Rheumatoid arthritis, epilepsy.
8. Patients suffering from cardiac dysfunction, chronic hepatic/renal failure, osteomalacia, malabsorption syndrome, renal stones.
9. Organ transplantation.
10. Prolonged immobilization.
11. Long bone fracture in last six months.
12. Patient not ready to give an informed consent. All patients who are consuming any drug which is known to affect bone metabolism in doses for e.g. SERMs, bisphosphonates, calcitonin, Vitamin D, corticosteroids, methotrexate, anticonvulsants and diuretics.

Withdrawal Criteria

The patients were withdrawn from the trial when they developed any serious adverse or if there was noncompliance of treatment before three months.

Ayurvedic Drug

Muktashuktipishti : 250 mg
Amalaki churna: 1.5 g
Asthi srunkhala kalka: 1 g

Haridra churna: 500 mg

Route of Administration: Oral

Dosage: 3.25 g twice daily

Anupaana: Lukewarm milk/water

Time of Administration: After breakfast and dinner

Treatment Period: 6 months

Modern Drug as Standard Treatment

Tab Calcimax

Route of Administration: Oral

Dosage: 500 mg BD

Treatment Period: 6 months

Recruitment

Confirmatory period: 1 week

Treatment period: 6 months

Follow-up period: 3 months

Methods of Assessment

- a) General information including previous treatment for osteoporosis.
- b) Presenting symptoms as per modern medicine and Ayurvedic symptomatology.
- c) Physical examination.
- d) Radiography (X-ray) Dorsal and Lumbar spine—Lateral view.
- e) Bone Mineral Density (B.M.D.) T -Score, assessed at wrist using the Sunlight Omnisense 7000 S, Quantitative Ultra Sonography machine. Omnisense has the best precision level in the QUS market, between 0.4–0.81%, depending on skeletal site. The high sensitivity of Omnisense enable it to detect the smaller changes that take place at the radius, a skeletal site that includes mostly the cortical bones.
- f) Laboratory investigations.
Serum Calcium assessed by using the OCPC method.
Marker of bone formation (assessed in the serum).

Adverse Events: Any major or minor adverse events, during treatment period or during follow-up visits were clearly pointed out and its appropriate and timely management was done.

OBSERVATION AND RESULTS

In the present clinical study, 40 uncomplicated patients of *Asthi Kshaya* (osteoporosis) were randomly divided into two groups viz., Group-1 (n=20) and Group-2 (n=20) (Table 1).

Group-1 patients were administered with *Kalpita yoga* containing *Muktashuktispishti*-250 mg, *Amalaki churna*-1.5 g, *Asthisrunkhala kalka*-1.0 g, *Haridra churna*-500 mg with lukewarm water twice daily for 24 weeks (Table 2).

Group-2 patients were administered with Elemental Calcium-500 mg (in the form of Calcium Carbonate) + Vitamin D3-250 IU for 24 weeks. Several observations regarding the subjective parameters and the objective parameters were recorded at each visit at an interval of four weeks and analysed under the following two heads viz (Table 3):

1. Demographic profile; 2. Clinical profile

Table 1: Age group & Sex Cross-Tabulation.

Sex	Age group (in years)	Group A	Group B	Total	Percentage
Male	41–45	2	0	02	05.00%
Male	46–50	1	2	03	07.50%
Male	51–55	2	3	05	12.50%
Male	56–60	2	1	03	07.50%
Female	41–45	1	0	01	02.50%
Female	46–50	4	2	06	15.00%
Female	51–55	4	6	10	25.00%
Female	56–60	4	6	10	25.00%

Table 2: Distribution of Patients of Osteoporosis (Asthi Kshaya) According to B.M.I.

B.M.I.	Group A	Group B	Total	Percentage
< 20	2	00	02	05.00%
20–25	7	05	12	30.00%
25–30	3	11	14	35.00%
>30	8	04	12	30.00%

Note: Among 40 patients, 35% of patients were having B.M.I. in range 20–25, 30% of patients were having B.M.I. in range 25–30 & >30 and 5% of patients were having B.M.I. in range less than 20.

Table 3: Radiological Assessment-Wise Distribution of the Patients of Asthi Kshaya (Osteoporosis) Before Treatment.

Radiological assessment X-Ray L/S	Group A	Group B	Total	Percentage
Lumbosacral spondylosis	01	00	01	02.50%
NAD	08	13	21	52.50%
Osteophytes	01	00	01	02.50%
Osteophytes Osteoporosis	08	06	14	35.00%

Osteoporosis	02	01	03	07.50%
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Table 4: Radiological Assessment-Wise Distribution of the Patients of Asthi Kshaya (Osteoporosis) After Treatment.

Radiological assessment X-Ray L/S	Group A	Group B	Total	Percentage
Lumbosacral spondylosis	00	00	00	00.00%
NAD	09	14	23	57.50%
Osteophytes	03	00	04	10.00%
Osteophytes Osteoporosis	06	05	11	27.5 0%
Osteoporosis	02	01	03	07.50%

Table 5: BMD T-Score Assessment-Wise Distribution of the Patients of Asthi Kshaya (Osteoporosis).

Group	BMD T-score (BT)	BMD T-score (AT)
Group A		
N	20	20
Minimum	-3.3	-2.6
Maximum	-1.2	-1.0
Range	2.1	1.6
Mean	-2.070	-1.560
Standard Deviation	0.6845	0.4489
Median	-1.950	-1.450
Standard Error of Mean	0.1531	0.1004
Group B		
N	20	20
Minimum	-3.1	-2.6
Maximum	-1.2	-1.0
Range	1.9	1.6
Mean	-1.890	-1.625
Standard Deviation	0.4767	0.4399
Median	-1.800	-1.550
Standard Error of Mean	0.1066	0.0984

Although, significant improvement was seen in the Bone Mineral Density (BMD) T-Score across all the two groups viz., the BMD T-Score improved from -2.07 to -1.56 in Group A and from -1.89 to -1.625 in Group B. Also there was corresponding change in p-value across the two groups, yet most significant effect was observed among the patients of Group A (Table 4 and Table 5).

DISCUSSION

Asthi is the fifth among metamorphic chain of *dhatus*. From general properties of *Asthi dhatu*, its location, relation with other body tissues and its functions, *sthayiassthi dhatu* can be considered as bones.

From the *ahararasa asthiposhakansa* goes to the *sthayi asthi dhatu* by *Vyana vayu* through the *Asthi vaha srotas*. The *poshakansa* are permeated inside the *asthi* cells either by *syandana* (oozing) between the liquid or are transported in by the action of *vyana vayu*. These *asthi* cells can be correlated with *Asthi vaha srotas* and these are none other than osteocytes.

The importance of *medodhatwagni*, vitamin D, which is derived from sterols, is essential for absorption of calcium in the body. Hence the *moola* of *Asthi vaha srotas* is rightly considered as *meda*. Imbalance of *asthidhatwagni* leads to improper formation of *sthayi asthi dhatu* from *poshakaasthi dhatu*.

Asthikshaya is a condition explained in almost all the *samhitagranthas* of *Ayurveda*. It is explained along with the *kshaya* of all the *doshas*, *dhatus* and *malas* i.e., *asthadasha* (18 types) *kshaya*. In osteoporosis also there will be decrease in the bone tissue leading to increased susceptibility to fractures.

In classics there is no direct mentioning about the *asthikshayanidana* or factors that cause *asthikshaya*. But the relationship between *Asthi dhatu* and *vataadosha* is beautifully explained through *Ashraya ashrayibhava* mentioned in our classics; when *vata* increases, *asthikshaya* occurs and vice versa.

In order to have a proper interpretation of the *samprapti* of *Asthi Kshaya*, apart from the normal *vataprakopanidana*, the main factors for the materialization of the disease, *srotopradushakanidanas* of *medovaha*, *asthivaha*, *majjavaha* and *purishvahasrotas* should not be neglected, as they also play a definite role, either directly or indirectly in the pathogenesis of *Asthikshaya*.

The proper functioning of *Jatharagni*, *bhutagni*, *dhatwagni* is essential for the “*Samayaka dhatu posanaprakriya*” in order to maintain the qualitative and quantitative

normally of the *dhatus* while explaining concept of *dhatu utpatti*.

Charaka says that, even though food is taken in proper quantity and quality and is wholesome, it is not digested properly if a person is afflicted by *chinta*, *bhaya*, *shoka* and *krodha* etc. Hence these psychological factors have the direct influence on functioning of *agnis* and also results in *vataprakopa* leading to *Asthi Kshaya*.

So to conclude, *vataprakopakaniidanas* along with the *srotopradushakanidanas* of *meda*, *asthi*, *majja* and *purishvahasrotas*, *agnidusti* i.e., *jatharagni*, *parthivagni*, *tejasagni*, *vayagni* and *asthyagni* and *manasikanidanas* altogether form a complex mechanism of pathogenesis of *Asthi Kshaya*. When there is hyperfunctioning of any one of these *agnis* the formation of the *dhatus* may increase.

Thus it may be concluded that as long as this group of *dhatwagni* is normal, *dhatus* are maintained at the normal level and with its hypofunctioning there is *kshaya* of *dhatus* and on the contrary when it is in hyperfunctioning state, there is *vridhhi* of the *dhatus*, which may be selective or total.

Almost all the *samhitagranthas* have mentioned about the *lakshanas* of the disease *Asthi Kshaya*. *Acharya Charaka* has mentioned it along with the *lakshanas* of *asthadasha* (18 types) *kshaya*. In *Harita Samhita* the *lakshanas* of *asthikshaya* are described along with the *lakshanas* of *kshaya* (*Rajayakshma*).

Due to the above said reasons *lakshanas* of *asthikshaya* are reflected as *vikaras* and *pata* of *danta*, *kesha*, *roma*, *naksha* and *smasru*. The other *lakshanas* seen in *Asthi Kshaya* are either due to the *rachnatmaka* or *kriyatmakavikrti* of the *asthi dhatu* and its *mala*.

The present study has been conducted on 40 uncomplicated patients of *Asthi Kshaya* (osteoporosis). The subjects were selected from among the patients attending the Ayurvedic OPD of the Major SD Singh PG Ayurvedic Medical College & Hospital, Bewarroad, Fatehgarh, Farrukhabad, Uttar

Pradesh, India. Twenty patients were administered with *Kalpita yoga* containing *Muktashuktipishti*-250 mg, *Amalakichurna*-1.5 g, *Asthisrunkhala kalka*-1.0 g, *Haridra churna*-500 mg with lukewarm water twice daily for 24 weeks and twenty patients were treated with Tab Calcimax (as the standard control drug).

Significant improvement was seen in the chief objective parameter i.e., BMD T-Score among both the groups viz., the BMD T-Score improved from -2.07 to -1.56 in Group A and -1.89 to -1.625 in Group B. Also there was corresponding change in p value from 0.589 (BT) to 0.312 (AT).

Thus it may be concluded that the drugs selected in this study have shown a promising potential to benefit the patients of *Asthi Kshaya* (osteoporosis).

CONCLUSION

- The maximum number of patients (37.50%) was found to be in the age group of 51–55 years.
- Females in the age group of 46–50 years thereby suggesting more prevalence of the disease among the menopausal age group females. Most of patients were found to be Hindus, literate, married, addicted, with contemporary dietary habit (*Viruddhashana*).
- The maximum number of patients (35.00%) was found to be of having BMI in the range of 25–30.
- The mean duration of illness was 3.18 years and the maximum duration of illness (8 years) was found to be among the patients of Group A.
- The total number of patients with skeletal pain i.e., 82.50% before treatment decreased to 37.50% after treatment.
- The total number of patients without pain i.e., 17.50% before treatment increased to 65.00% after treatment.
- The mean Serum Calcium improved from 8.900 before treatment to 9.465 after treatment in Group A.
- The BMD T-Score improved from -2.07 to -1.56 in Group A.

Further studies with a longer duration of trial, covering a bigger population and assessing more specialized parameters such as blood and urine markers of bone forming/reabsorption, and DEXA scan is recommended to authenticate the result obtained in the present humble attempt. The drugs selected in this study have shown a promising potential to benefit the osteoporotic population and it is hoped that the present work would prove beneficial to future research scholars who wish to work towards the cause of finding a better remedy for the prevention /treatment of *Asthi Kshaya* (Osteoporosis).

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