A PHYSIOLOGICAL REVIEW ON ASTHI DHATU IN AYURVEDA WITH MODERN PERSPECTIVE

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ABSTRACT

According to Ayurveda, the body is made up of seven different types of tissues known as Sapta Dhatu. These seven tissues collaborate with one another to ensure that the human body functions perfectly physiologically. One of the seven Dhatus mentioned in Ayurveda is Asthi. We are attempting to compile information about Asthi Dhatu defined in unique texts in this article, covering everything from its formation to nutrition, number, nature, distribution, character, significance, and effects on the body when it deviates from its ty

KEYWORDS: Asthi Dhatu, Asthivaha Srotas, Dhatu, Bones.

INTRODUCTION

The human body is composed of Dosha, Dhatu, and Mala, according to Ayurveda. Dhatu is responsible for the structural and operative integrity of the body. Dhatu refers to the elements that make up the body and perform numerous physiological tasks. They function as bodily tissues to support and stabilize the body. Asthi Dhatu, one of the seven Dhatus, is connected to Sharira's Dharana. It participates in movement in conjunction with its joints, as well as with muscles, tendons, and ligaments. The membrane that houses the Asthi Agni, which leaves the body in Pakvashaya, is known as the Purisha Dhara Kala. Prithvi Mahabhuta is dominant in Asthi Dhatu. Poshaka (unstable) Meda Dhatu creates Asthi Dhatu, which then enters the Purisha Dhara Kala and is consumed by the Asthiagni. Teeth are also generated during this process, making them the Upadhatu (secondary tissue) of Asthi Dhatu in addition to the body's bones. The hair and nails are the malas (waste products) of this metabolic process. According to Ayurveda, Dhatu and Dosha both contain Ashraya Ashrayi Bhava or Dosha is considered to reside there. For Pitta Dosha, for instance, the residing sites are Rakta and Sweda. Like so, Asthi Dhatu is where Vata Dosha primarily resides. Given this, Vata Dosha vitiation is thought to be a significant contributor to the pathophysiology of Asthi Dhatu Dushti. Inflammatory and obstructive diseases in the bone are caused by the vitiation of the Pitta and Kapha doshas, respectively. Kesha, Danta, and Nakha Vikruti are part of Asthi's Upadhatu and Mala Dushti. So, deformities in these body organs may also result from pathology in Asthi Dhatu. To comprehend the underlying pathology of disease, one must have a basic understanding of Dhatu.
how Asthi Dhatu is abnormal, one must first understand how it is normal. These days, early ageing and changes in lifestyle have increased the prevalence of bone-related illnesses. Due to the significant occurrence of Asthi-related disorders, it is crucial to correctly diagnose these conditions and integrate their pathophysiology from both an Ayurvedic and modern perspective. This will allow for the proper initiation of treatment. In order to better understand Asthi Dhatu and bone-related problems from both an Ayurvedic and modern perspective, and to prevent and treat the disease, it is being attempted.

AIMS AND OBJECTIVES
1. To study the concept of Asthi Dhatu discussed in Ayurveda with reference to osseous tissue.
2. To study the concept of Dhatu discussed in Ayurveda.
3. To study the concept of bones as per modern literature of anatomy.

MATERIAL AND METHODS
All available literature for the conceptual study of Dhatu, Asthi Dhatu and concept of osseous tissue in various forms like textbooks, handbooks, magazines, original research articles, search engines like Google, academic research databases like PubMed, Google scholar etc.

ASTHI DHATU
Bones are typically regarded as Asthi. Sthayi and Poshaka Dhatu are the two different forms of Dhatu. Sthayi Dhatu can be used to refer to Asthi or bone rather than the entire Asthi Dhatu. Poshaka Asthi, a liquid form of Asthi Dhatu that runs through the Asthivaha Srotas and nourishes the Sthayi Asthi Dhatu, is another kind of Asthi Dhatu. Recent research suggests that the osseous tissue can be viewed as the Sthayi Asthi Dhatu and the nutrients, such as calcium, phosphorus, magnesium, etc., that are necessary for the sustenance of the bone tissue, as the Poshaka Asthi Dhatu.

ORIGIN OF ASTHI DHATU
Starting with the Rasa (fluid) Dhatu, each Dhatu develops from the layer of prior tissue. Each Dhatu serves as a harbinger of the one after it. In the Dhatu Nirman sequence, Asthi Dhatu is formed by Meda Dhatu. With the help of its own Dhatwagni, Prithvi, and Vayu Mahabhoot, Meda Dhatu transforms into Khar (hard/rough) portion. Asthi is the name given to that portion of Khar.4

NIRUKTI (ETYMOLOGY AND DERIVATION)
The word Asthi is a combination of two Sāṃskrit words “as” and “kthin”. They together give the meaning “stability”.5

PARIBHASHA (DEFINITION)
Asthi is a body component which stays for a longer time (Asyate) and which takes part in movements (Kshipyate) with muscles. It is also termed as the Sara (extract) of the body which remains even after the destruction of all other body components.6

PRAYAY (SYNONYMS)
2. Kulyam: Tubular or canal like structure.
5. Sara: Extract of body which remains even after death.
7. Dehadharakam: This maintains body skeleton and bears body weight.
8. Karkaram: Rough
PANCHABHAUTIKA SANGHATANA, GUNA (FUNDAMENTAL CONSTITUTION AND PROPERTIES)

Fundamental constitution of Asthi Dhatu shows predominance of Prithvi Mahabhuta. The physical properties of "Asthi Dhatu" are Guru (heaviness), Khara (roughness), Kathina (hardness), Sihula (bulkiness), Sthira (static), with a definite physical form.\(^7\)

UTPATTI AND POSHANA OF ASTHI DHATU (METABOLISM AND DEVELOPMENT)

The Asthi Dhatu is formed from its precursor Meda Dhatu. The nourishing portion of Meda Dhatu and constituents of Ahara Rasa are transformed into Asthi Dhatu by action of Asthi Dhatvagni. Agni Mahabhuta and Vayu Mahabhuta play a major role in the solidification and roughness of Asthi by acting upon Prithvi Mahabhuta. Porosity in bones is due to actions of Vayu and Akasha Mahabhuta.\(^8\)

UPADHATU AND MALA (METABOLIC BY PRODUCTS AND WASTE PRODUCTS)

During the process of metabolism and development of Asthi Dhatu, Nakha (nails) are formed as the metabolic by products.\(^9\) Sharangadharacarya considered Danta (teeth) only as metabolic by product of Asthi Dhatu.\(^10\) Kesha (scalp hair) and Loma (body hair) are waste products of metabolism of Asthi Dhatu.\(^11\)

SANKHYA (QUANTITY)

There are total 360 well-formed Asthi in human body.\(^12\) Sushruta opines the total number as 300.\(^13\) Currently, most sources state that there are total 270 bones in human body at the time of birth. Many bones fuse together and form 206 separate bones.

TYPES OF ASTHI

There are five types of bones in human body.\(^14\)

1. Kapalasthi: These are flat in nature. Literally it means bone which covers and protects the brain. Asthi present in the Janu, Nitamba, Amsa, Ganda, Talu, Shankha, Vankshana and Madhyashira are known as KapalaAsthi.

2. Valayasthi: These are round in shape or particularly hemi circle in shape. Asthi in Pani, Pada, Uru, Parshva and Prustha are Valayasthi. Some commentators don’t agree with it as they count some other bones in this category as Pada, Hasta, Griva and Prishsta.

3. Tarunasthi: These are soft in nature. Literally it means which have either not fully developed i.e., ossified. Also, the bones of child have come under same scenario. Asthi present in the Ghrana, Karna, Greeva and Akshikuta are called as Tarunasthi. Bhoja also added Kantha in list.

4. Nalikasthi: These are long like tubes and hollow from within. They are reed shaped. Asthi which are left from above description is listed in this type. Commentators like Dalhana and Bhoja have specified some of bones like HastaAnguli, PadaAnguli, PadaTala, Kurcha, BahuAsthi, JanghaAsthi etc in examples of this type.

5. Ruchakasthi: The bones which are different from all and are utilized to chew food and enjoy the taste. These are for taste sensation. The Dashanas are known as Ruchakasthi. These are 28 or 32 in all. So, here Ruchaka i.e., Danta (teeth) is also regarded as Asthi along with various other stiff parts.

TIME SPAN

The Asthi Dhatu is formed on 6\(^\text{th}\) day from the Ahara Rasa (nutrient fluid).\(^15\) However, Sushruta opines that the Asthi Dhatu is formed in a time span of twenty days.\(^16\)

KARMA (FUNCTIONS)

The important function of Asthi Dhatu is providing structure and support to the body. It also nourishes the successor Majja Dhatu.\(^17\) Furthermore, according to modern physiology, bone tissue also performs the following tasks: mechanical, facilitates hearing, facilitates movement, protects internal organs, and it indirectly contributes to the creation of formed parts.
ASTHISARA (CHARACTERISTICS OF BEST QUALITY OR ESSENCE)
The persons with Asthi Sara have prominent Parshni (heels), Gulpha (ankles), Janu (knee Joint), Aratni (elbows), Jatru (collarbones), Chibuka (chin), Shira (head), Parshva (flanks), joints, bones and teeth. These people have a robust and firm body, are long-lived, and are very active and enthusiastic.\(^{18}\)

ASTHIVAYA SROTAS
The Moola Sthana of Asthivaha Srotas are Meda Dhatu and Jaghana.\(^ {19}\)

ASTHIDHARA KALA (LAYER OF BONE TISSUE)
Kala is the layer in outer coverings of body observed in sagittal section. The inner layer of large intestine is Purishadhara Kala that holds fecal matter, has relation with the layer Asthidhara Kala.\(^ {20}\)

ASTHISANGHATA (CONFLUENCE OF BONES)
The places where many bones are present are called confluences. The confluences of bones are fourteen in number. They include Gulpha (ankle), Janu (knee), and Vankshana (groin) in lower limbs and their counter parts Manibandha (wrist), Kurpara (elbow) and Kaksha(axilla) in upper limbs on each side. One is in the Trika (lower back) and the other on the Shira (skull).\(^ {21}\)

ASTHI MARMA (VITAL POINTS)
There are eight vital points formed from bones.\(^ {22}\) These are Katikataruna (vital spots on both sides of the vertebral column above and near the pelvic crest), Nitamba (vital points above the two pelvic bones meeting the flank), Amsaphalaka (vital points on scapula- one on each side of the vertebral column in the upper back region) and Shankha(vital spots on each side between the outer end of the brow and the ear).\(^ {23}\)

DISEASES OF ASTHI DHATU
Asthi Kshaya and Asthivriddhi Lakshanas are considered under Asthyashraya Vyadhis.

ASTHI KSHAYA LAKSHANAS
Asthishol (joint and bone pain), Nakhabhang (brittle and easily breakable nails), Dantabhang (weak, loose teeth which can easily fall off), Kasha, Lomashmashru Patana (loss of hairs of scalp, skin and beard), Dwija Patana (loss of teeth), Shrama (exertion) and Sandhishaithilya (subluxation of joint) are the symptoms of Asthi Kshaya.\(^ {24}\)

ASTHIVRIDDHI LAKSHANAS
Adhyasthi (extra pointed bone growth over bone or calcification) and Adhidanta (growth of extra teeth or hyperdontia) are the symptoms of Asthi Vriddhi.\(^ {25}\)

ASTHI PRADOSHAJA VIKAR
Adhyasthi, Adhi Danta, Danta Bheda, Asthibheda, Danta Shula, Asthishula, Asthi Toda, Vivarnata, Kesha Loma Dosha, Shamshru Doshaah and Kunakha.\(^ {26}\)

MODERN REVIEW\(^ {27}\)
The skeleton of the majority of vertebrate animals is made up of bones, which are stiff organs. Bones safeguard the body's other organs, manufacture formed elements, store minerals, give the body structure and stability, and allow for motion. The internal and external structures of bones are intricate and occur in a range of shapes and sizes.

BONE TISSUE, or osseous tissue, is a particular kind of connective tissue. Internally, the bone has a structure resembling a honeycomb that contributes to the bone's rigidity. Numerous varieties of bone cells make up bone tissue. The development and mineralization of bone is facilitated by osteoblasts and osteocytes. The resorption of bone tissue is facilitated by osteoclasts. The lining cells that create a barrier on the bone surface are modified (flattened) osteoblasts. Ossein, an organic component of the mineralized matrix of bone tissue comprised primarily of collagen, and different salts make up the inorganic bone mineral component. Bone tissue is
mineralized tissue of two types, cortical bone and cancellous bone. Other types of tissue found in bones include bone marrow, endosteme, periostem, nerves, blood vessels and cartilage. Ossification is the scientific term for the process of bone production. These two processes: intramembranous ossification and endochondral ossification—take place throughout the fetal period of development. Endochondral ossification involves the production of bone from cartilage, whereas intramembranous ossification involves the formation of bone from connective tissue.

**DISEASES OF BONE**
- Osteoporosis
- Fractures
- Rickets and osteomalacia
- Osteomyelitis
- Paget disease
- Bone tumor, etc.

**DISCUSSION & CONCLUSION**
The word Asthi means bone. Bone provides the body a sturdy aspect. Dhatu is the Ayurvedic term for tissue. Rasa, Rakta, Mamsa, Meda, Asthi, Majja, and Shukra are the seven Dhatus. They can be understood anatomically as being made up of plasma, blood, muscle, fat or adipose tissue, bone, bone marrow, and seminal fluid. Understanding the fundamental pathology of the disease requires having a basic understanding of Dhatus. These seven Dhatus play a key role in both the pathophysiology of all diseases in the body and the body's immune system. Panch Mahabhootas are another component of these Sapta Dhatus. Any disruption in the balance of any Dhatu can cause a particular disease. For instance, in the context of Asthi Dhatu, when Vedana Lakshana worsens due to Asthi Dhatu Kshaya, it is recognized by modern science as osteoarthritis. Following the Meda Dhatu is the Asthi Dhatu. Here, the Dhatu is understood using all of the literature that is available, and understanding the Asthi Dhatu is extremely helpful when thinking about the bones in anatomy. Treatment of Asthi Dhatu diseases and their clinical manifestations benefits from knowing the notion of Asthi Dhatu.

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