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ASTHI DHATU – AYURVEDA AND MODERN PERSPECTIVE

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ABSTRACT

In *Ayurveda*, the body is believed to be composed of seven sorts of tissues referred to as *Sapta Dhatu.* These seven tissues work in coordination with every for perfect physiological functioning of human body. *Asthi* is one among the seven *Dhatu* which are described in *Ayurveda*. In this article we are trying to gather information of *Asthi Dhatu* defined in one of a kind texts from its formation to nutrition, number, nature, distribution, character, its significance and results on body when it deviates from its normal persona or wide variety like *Asthi Kshaya* and *Asthi Vriddhi*. Some other factors which are related to *Asthi Dhatu* are also described like *Asthidhara Kala* and *Asthivaha Srotas*. In Modern, Bones are the hard-connective tissues forming the substance of the skeleton of most vertebrates, composed of a collagen prosperous natural matrix impregnated with calcium, phosphate, and different minerals. Bones defend the various organs of the body, produce pink and white blood cells, save minerals, furnish structure and assist the body and allow mobility.

KEYWORDS: *Asthi Dhatu, Asthivaha srotas, Asthi Sankhya, Bone.*

INTRODUCTION

Asthi is one of the primary & most essential structures of the body. According to *Ayurveda*, human body is made of *Dosha*, *Dhatu* & *Mala.*[1] Among the seven *Dhatus*, *Asthi Dhatu* is related to *Dharana* of *Sharira*. It helps in the formation of suited body frame owing to its challenging nature. The phrase *Asthi* is derived from the "*Asyathe iti asthi*". It suggests that *Asthi* is a substance that is now not typically decomposed as fast as different related components of the body like muscles, vessels etc.[2] It stays for long time period even after death.

Bone is the substance that types the skeleton of the body. It is chiefly composed of calcium phosphate & calcium carbonate.[3] Bone & cartilaginous framework of the body represent the skeleton. In some vertebrates the skeleton framework is discovered each externally and internally.[4] In human beings the exoskeleton is very rudimentary, being represents by means of nails & enamel only. Study of the shape & characteristic of the skeleton & bony shape are known as osteology.[5]

According to *Ayurveda, Asthi Sharira* is the learning about human body in terms of anatomy of bones. In *Charaka Samhita Sharira Sthana* 7th chapter, defined that a physician properly versed in the enumeration of the components of the body will no longer be burdened for duration of practice.[6] *Sushruta Samhita Shareera Sthana* 5th chapter *Shareera Sankhya Vyakarana* normally offers with the numbering of the *Anga* & *Pratyanga* of the body.[7] In this article, our aim is tocompare the *Acharyas's* view of *Asthi Sankhya Shareera* with the modern human anatomy.

Formation of *Asthi Dhathu*:

Charaka in his *Chikitsa Sthana* defined that from *Medadhatu*, *Asthi* get formed. From *Asthi Dhatu*, *Majja* is formed.[8] *Chakrapani* commented on this thinking as,due to the motion of respective *Dhatwagni*, *Uttarotara Dhatus* are formed.[9] *Sharangadhara* defined that *Medo Dhatu* get *Pakwa* by using *Medo Dhatwagni* & *Vayu*will do the *Shoshana* of this substance & this varieties the *Sara* of the *Shareera* i.e. *Asthi Dhatu*.[10]

The procedure by means of which bone are formed is referred to as ossification or osteogenesis.[11] Mesenchymal cells which differentiate into osteogenic cells structure astructural foundationwhich give upward shove to bone at once or through an intermediate stage of cartilage. Thus, ossification is categorized as.

- Ossification in membrane
- Ossification in cartilage

Ossification in membrane is a pressing affair & the process is carried out with excessive rapidity whereas ossification in cartilage is a gradual & leisurely procedure.[12]

Table no 1.

1.	***Panchbhautikatva* of *Asthi*[13]**	***Prithvi* and *Vayu***
2.	***Updhatu* of *Asthi***	***Dant***
3.	***Mala* of *Asthi***	***Kesh, Loma, Nakha***
4.	***Guna* of *Asthi***	***Guru, Khara, Kathin, Sthula, Sthira Murtimada***

Asthi Karma

Dehadharana, Majjapushti& supporting the *Mamsa, Sira*&*Snayu* are the *Asthi Karma*. *Acharya Sushruta* mentioned the importance of *Asthi & Sandhi* as they support the human body just as trees are supported by the middle core *Sara* present inside the trunk. Major structure like *Sira, Snayu* are held in their proper position as they are attached to the bones. Hence none of these structures are fall off.[14]

Bones provide protection to the underlying soft tissues and organs. Hence even all other accompanying structures that are attached to the bones shrivel and degenerate, bones remain unchanged owing to their firmness. Bone tissue makes up about 18% of the weight of the human body. The skeletal system performs several basic functions like support, protection, assistance in movement, mineral homeostasis, blood cell production and Triglyceride storage.

Asthi Prakara

Acharya Sushruta explained 5 types of Asthi i.e. Kapala, Ruchaka, Taruna, Valaya and Nalaka.[15]

1. Kapala- These are flat in nature. Literally, it is potential bonewhich covers and defends brain. This kind of Asthi present at Janu, Ganda, Shira, Nitamba, Talu, Amsa, Shankha.
2. Ruchaka- Dashanas are viewed as the Ruchakasthi.
3. Taruna- These are Mridu Asthi i.e. which does not get Ghanata is regarded as Taruna Asthi. Asthiexistingat Ghrana, Karna, Ghriva, Akshikosha are instance for Taruna Asthi.
4. Valyasthi-bones which are curved in shape andwhich are present over Parshwa, Prushta, Uras are considered as Valayasthi.
5. Nalakasthi- These are the long bones which existat Hastanguli, Padanguli, Padatala, Kurcha, Bahu,Asthi, Jangha Asthi.

In modern aspect almost all bones of the body can be categorized into 5 main kinds, primarily based on shape i.e. long, short, flat, irregular, pneumatic& sesamoid bone

1. Long bones – Present in upper and lower limbs. It has 3 parts – upper end, shaft and lower end. Example – Humerus, Radius, Ulna, Femur, Tibia and Fibula.
2. Short bones – These are small and cuboidal in shape.Example – Carpals and Tarsals bones.
3. Flat bone - These are expanded and plate like. They protect vital structures and provide extensive areas for muscular attachment. Example – Scapula, Sternum, Ribs and some Skull bones.
4. Irregular bone –Irregular bones serve various purposes in the body, such as protection of Nervous tissue, affording multiple anchors points for Skeleton muscle attachment etc. Example – Vertebrae, Sacrum, Coccyx, Pelvis (pubis, ilium, ischum) etc.
5. Sesamoid bones –These bones are embedded within a tendon or a muscle. They are nodules of bones which develop in certain tendons and do not possess periosteum and haversian systems. They ossify after birth. They have no separate arterial supply but supplied by the arteries of the muscle in which they are present. Example – Patella is the largest sesamoid bone and develop in tendon of Quadriceps femoris muscle. Pisiform develops in the tendon of Flexor carpi ulnaris.
6. Pneumatic bones – These bones contain an air filled cavity within them. It supports the nasal sinuses, are light weight, protection, provide resonance for voice.[16] Exmple – Bones around nose: Maxilla, frontal, ethmoid and sphenoid.

Asthi Sankhya

Experts of Vedas or the followers of Veda opines thatthere are 360 bones[17] although in *ShalyaTantra*theseare 300 only.[18] *Sushruta* rejects theVedic thinking of 360 bones.[19] According to modern, 206 bones are present in body.

Table no. 2: numbers of bones according to different *Acharya* and modern aspect.

Bones	***Charaka***	***Vagbhatta***	***Sushruta***	**Modern**
Danta (Teeth)	32	32	32	-
Dantaulukhala (Toothsocket)	32	32	-	-
Nakha(Nails)	20	20	-	-
*Panipada angulyasthi(*Phalanges and toes)	60	60	60	56
Panipada shalaka(Meta Phalanges and Metatarsals	20	20	16	10
Panipada shalakadhishtani(Carpals and tarsals)	4	4	10	-
Parshni(Calcaneum)	2	2	2	2

Gulpha(Ankle)	4	8	2	2
Mani	2	6	4	8
Arathni	4	4	4	4
Jangha	4	4	4	4
Janu(Tibial tuberosity)	2	2	-	-
Janu kapala(Patella)	2	2	-	2
Urunalaka(Femur)	2	3	3	5
Bahu nalaka(Humerus)	2	2	2	2
Amsa(Scapular region)	2	2	2	-
Amsa phalaka(Scapula)	2	2	2	2
Akshaka (Clavicle)	2	2	-	2
Jathru(Root of Neck)	1	-	-	-
Taluasthi(Palate, lacrimal)	2	2	1	4
Sroni phalaka(Hip Bone)	2	2	2	2
Bhagasthi(Pubis bone)	1	1	1	-
Prushtagata asthi(Back bones)	45	30	30	12+5
Greeva asthi(Cervical Vertebrae)	15	13	9	7
Uroasthi	14	8	8	1
Parshuka(Ribs)	24	24	24	24
ParshukaSthalaka (Ribs-Process))	24	24	24	-
Parshukaarbuda(Ribs- tubercle)	24	24	24	-
Hanuasthi(Maxilla and Mandible)	1	2	2	3
Hanumoola bandana(Root of Jaw)	2	-	-	-
Nasikagandakooda lalatam(Forehead)	1	-	-	-
Shankha(Temporal bone)	2	2	2	4
Shirakapala(Scalp bones)	4	6	6	6
Karnaasthi(Ear Ossicles)	-	2	2	6
Ganda koota(Zygomatic)	-	2	2	2
Nasasthi(Nasaasthi)	1	3	3	5
Kanhta nadi(Throat bones)	-	4	4	1
Anutrika(Coccyx)	-	-	1	1
Trika(Sacrum)	-	1	1	1
Kurparasthi(Elbow)	-	2	2	-
Gulpha sthanasthi(Styloid process)	-	4	-	-

DISCUSSION

There are distinct opinions involving the wide variety of bones amongst the Acharyas. It is ordinarily dependant on the visualization of one-of-a-kind bony parts. Sushruta has given a count number of 300 Asthi. His view on Asthi Sankhya looks extra specific in evaluation to Charaka and Vagbhatta in phrases of counting the variety of bones and classifying them. According to Charaka and Vagbhatta, Asthi Sankhya is 360 in number. Both the above-mentioned authors counted nails and nail mattress as bones. Charakacharya and Vagbhattacharya additionally included 32 Danta and 32 Danta Ulukhala underneath the heading of Asthi. It is now not counted as the bones according to anatomy. It can make a large distinction in whole count of Asthi. Facets, body, arches and transverse process collectively varieties a vertebrae and complete 33 vertebrae are existing in accordance to anatomy.

Acharyas covered all these components of vertebrae as separate bone. Many cartilages are additionally blanketed underneath the Asthi only. Sushruta's view of Asthi Sankhya appears to be nearer to the clarification of contemporary anatomy. According to anatomy there are 206 bones are current in the grownup human skeleton. During Balyavastha Asthis areMrudu. These do not take shape completely. So that the single bonecan be shown up as two or three pieces. During adulthood these come to be one. This can be cause for the change in the Asthi Sankhya.

While evaluating this view with the embryological improvement we can discover some similarities. For example: the newly fashioned verterbra is cartilaginous in structure. This cartilaginous mannequin of vertebra is quickly transformed into bone with the aid of ossification. The vertebrae ossify by means of the three main centres of ossification. At delivery every vertebra consists of three bony components i.e. two vertebral arches and a centrum related via two cartilages. The vertebral arches fuse posteriorly by using 3-5 years of age to shape spinous process. The vertebral arches articulate with the centrum at cartilaginous neurocentral joints which disappear with the aid of 3-6 years of age. These vertebral components may additionally be considered as the separate bone through the Acharyas. That can be the cause at the back to amplify in the number.

Incase of Nasasthi, there are three bones in the Nasa; two Nasasthi and one Nasapatala. There are two nasal bones in nostril and other one is the septal cartilage. Nasa Patala can be regarded as the septal cartilage. But it additionally consists of underneath Nasasthi. Acharyas explanation depicts that Parshukas are seventy two in number. In one Parshuka solely three components are considered. But as per the anatomical rationalization there are solely 12 pairs of ribs are present. Uraphalaka is made of 6 bones according to Samhita however sternum is viewed as the single bone in anatomy.

The cartilaginous mannequin of the sternum consists of manubrium, body and xiphoid process. Body of sternum is made up of 4 segments called sternebrae. This Cartilaginous mannequin of sternumgets ossified to structure the sternum. Six sternebre, manubrium and xiphoid manner might also be regarded as different bones by means of Acharyas. Hanu Asthi, Kasherukas are another such examples which is accessible in Samhitas. Danta and Dantaulukhala, cartilagionus shape additionally can be considered in the adjustments in their number.

CONCLUSSION

Ayurveda has contributed immensely toward the science of anatomy. The enormous knowledge of anatomy which *Sushruta* had and his contribution to a number of sections of anatomy is hilarious. Numbering and naming of various components of the body in *Samhitas*suggests that the information of our *Acharyas* used to be fairly superior in historic duration even though the facilities had been no longer so much. Changes in methodology of learn about and documentations of each structure makesome variations in the numbering of the structures.

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