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Review Article

Asthi Sharir

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Analysis of Asthi Sharir in relation to the different types of Asthi mentioned in Ayurvedic Samhitas

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The ancient scholars of Ayurveda categorized the body's elements into three fundamental components: Dosha, Dhatu, and Mala. According to Acharya Sushruta, a pioneer of Ayurveda, Asthi (bones) are the last structures to deteriorate in the body. The knowledge of Asthi can be traced back to the Vedic period, evolving through various Samhitas over time. Bones serve as the structural core of the body, providing essential support for physiological functions. Classical Ayurvedic texts offer a detailed account of Asthi, including its nomenclature, classification, enumeration, types, fractures (Bhagna), and their treatment. A special focus is given to the types and terminology of bones, analyzed through both classical and modern linguistic perspectives. This study primarily aims to conduct an analytical discussion on the number and classification of Asthi, various types of bones (Asthi Prakaras), and grammatical validation of their nomenclature. As the understanding of bones has evolved from the Pre-Vedic era to the present, concepts, beliefs, methodologies, and applications have undergone significant transformations. However, the terminology and classifications of Asthi and Bhagna (fractures) remain consistent with contemporary knowledge and are elaborately described in ancient texts.

Keywords: Ayurveda, Asthi, Asthi Sankhya, Asthi Prakara, Bones, Fractures

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Introduction

The importance of understanding the skeletal system has been emphasized since ancient times. As noted by Galen, a renowned physician, knowledge of bones is fundamental because they form the structural foundation of the body. All bodily organs and systems rely on the skeletal framework for support, stability, and function. Without an understanding of bone structure, one's comprehension of many other physiological aspects remains incomplete.

Ayurveda, an eternal science dedicated to human life, encompasses physical, psychological, and spiritual well-being. It provides a holistic approach to health, considering every aspect of existence. The physical world, including the human body, can be broadly categorized into soft and hard components. While soft tissues include organs and muscles, hard structures like bones and teeth form the skeletal system, which provides shape, support, locomotion, and protection for delicate internal organs. According to *Acharya Sushruta*, a pioneer in *Ayurveda*, after death, most bodily tissues decay, but *Asthi* (bones) endure. Even when the body is buried or cremated, bones remain as the last surviving remnants of an individual. The study of bones in *Ayurveda* can be traced back to the Vedic period, progressing chronologically through various *Samhitas*. Different *Ayurvedic* texts offer diverse perspectives on the enumeration, nomenclature, and classification of bones, reflecting evolving thought processes and methodologies.

Literary Review

The *Atharva Veda* references the study of bones, with *Narayana*, the author of an *Atharva* hymn, being associated with the early traditions of medicine. In ancient India, healers often served as both priests and physicians, blending spirituality with medical knowledge. *Narayana* is also credited with composing the Purusha Sukta (RV.X.90 = AV.XIX.6), which contains numerous anatomical references, including those related to bones. The Atharva Veda (X.2.1-8) explicitly mentions the human skeletal system.

Bones are described as hardest & most enduring part of body, persisting even after death when soft tissues like flesh and muscles have decomposed.

According to *Sushruta*[1], bones remain intact even after burial or cremation, serving as the final identity of an individual post-mortem. The *Shabdastomkara* also defines bones as body structures that withstand time, remaining long after death. In traditional terminology, "*Hada*" is considered a synonym for *Asthi*.[2]

Although all substances in the body are composed of the five *Mahabhutas* (*Akasha, Vayu, Agni, Jala*, and *Prithvi*), *Asthi* predominantly consists of Prithvi (Earth) and *Vayu* (Air) *Mahabhuta.*[3] The primary functions (*Asthi Karmas*) include:

1. Deha Dharana - Supporting & maintaining body
2. Majja Pushti - Nourishing the bone marrow
3. Providing structural support for muscles (*Mamsa*), veins (*Sira*), and ligaments (*Snayu*)[4]

Enumeration of *Asthi* in different *Samhitas* [5,6,7]

Different Ayurvedic texts provide varying numbers of bones in the human body, as shown in Table no. 1:

SN	Textbook	Number of Bones
1.	Charaka Samhita	360
2.	Sushruta Samhita	360
3.	Ashtanga Hridaya	360
4.	Ashtanga Sangraha	360
5.	Bhavaprakasha	360
6.	Kashyapa Samhita	360
7.	Bhela Samhita	360

Classification of *Asthi* Based on Shape and Position [8]

Bones are categorized into five types based on their size, shape, and location in the body, as outlined in Table no. 2:

SN	Type of Asthi	Sushruta Samhita	Ashtanga Sangraha	Ashtanga Hridaya	Bhavaprakasha
1.	Kapala (Flat bones, skull)	+	+	+	+
2.	Ruchaka (Teeth-like bones)	+	+	+	+
3.	Taruna (Cartilaginous bones)	+	+	+	+
4.	Valaya (Curved/ring-like bones)	+	+	+	+
5.	Nalaka (Long bones, limbs)	+	+	+	+

This classification highlights the systematic approach used in *Ayurveda* to categorize bones based on their function and structure.

Types of *Asthi* (Bones) in *Ayurveda*

***1. Kapala Asthi*[9] -** These are flat bones with two distinct layers separated by a hollow space filled with red bone marrow. Examples include bones in the knee (*Janu*), hip (*Nitamba*), shoulder (*Amsa*), cheeks (*Ganda*), palate (*Talu*), temples (*Shankha*), groin (*Vankshana*), and the central region of the head (*Madhyashira*).

***2. Valaya Asthi*[10] -** These bones are circular or ring-shaped, such as the ribs in the thoracic region. The bones found in the chest (Ura*),* sides of the torso (*Parshva*), and back (*Prustha*) fall under this category.

***3. Taruna Asthi*[11] -** These are soft *Bones*[12], mainly present between vertebral joints. A circular layer of *Taruna Asthi* exists between two vertebrae, helping absorb shocks before they reach the brain. Bones in the nose (*Ghrana*), ear (*Karna*), neck (*Greeva*), and eye sockets (*Akshikuta*) are classified as *Taruna Asthi*.

***4. Ruchaka Asthi*[13] -** These bones are involved in chewing and tasting food, making them essential for digestion. The teeth (*Dashana*) are considered *Ruchaka Asthi*, totaling 28 or 32 in number. Additionally, *Sharangadhara* describes teeth as *Upadhatu* (secondary tissue) of *Asthi Dhatu*.

***5. Nalika Asthi*[14] -** These are long, tubular bones that are hollow inside and filled with bone marrow (*Majja*). Up to the age of 20, they appear red, after which they gradually turn yellow. These bones are primarily found in the arms and legs and include all bones that do not fall under the other four categories.

Discussion

The enumeration (*Sankhya*) of human body parts holds significant importance in Ayurveda, as emphasized by *Acharya Charaka*. According to *Chakrapani*, understanding the quantitative aspects of bodily structures is essential in clinical practice, as it serves as a primary source of anatomical knowledge. The seventh chapter of the *Sharir Sthana* [15] in *Ayurveda* underscores the value of *Sharir Sankhya* (enumeration of body parts), Stating that clinician with comprehensive knowledge of body structure & numbers will not face confusion, unlike those who lack analytical understanding.

In modern anatomy, the adult human skeleton consists of 206 bones. However, early Indian anatomists counted either 360 (Atreya tradition) or 300 (Sushruta tradition). This discrepancy arises due to differences in classification, where Ayurvedic scholars included:

- Teeth, nails, and cartilages as part of the skeletal system
- Prominent bone features (e.g., processes, tubercles) as separate bones

The three main reasons for this difference are:

1. Distinct Naming of Bone Features - Some bony projections (e.g., malleoli of the ankle and styloid processes of the wrist) were given individual names and considered separate bones.
2. Emphasis on Homology - *Ayurvedic* scholars often viewed the right and left halves of the body as symmetrical and counted their bones separately.
3. Artificial Symmetry - Certain anatomical assumptions, such as the presence of an extra joint in the thumb and big toe or 12 costal tubercles instead of 10, led to variations in enumeration.

Variations in *Asthi Sankhya* (Enumeration of Bones)

1. Rib Count -
   - *Charaka Samhita* mentions 24 ribs (*Parsvaka*), 24 sockets (*Sthalaka*), and 24 tubercles (*Arbuda*), leading to 36 ribs on each side when counted using the *Sushruta*

2. Cervical Vertebrae Count -
   - *Charaka Samhita* lists 15 neck bones
   - *Sushruta Samhita* lists 9 neck bones
   - *Vagbhata's* texts list 13 neck bones
   - Modern anatomy identifies 7 cervical vertebrae

Sushruta's approach:

- He counted the first six cervical vertebrae as separate bones
- The seventh cervical vertebra was divided into three parts (body, spine, and transverse processes)
- This method resulted in a total count of 9 cervical bones

This variation in bone enumeration highlights the methodological differences between *Ayurvedic* and modern anatomical studies. While *Ayurveda* took a more holistic and functional approach, modern anatomy relies on structural classifications based on embryological and osteological principles.

Enumeration of Bones in Different Texts

Charaka Samhita arrived at a total of 15 cervical bones by categorizing the cervical vertebrae similarly to the vertebral column. On the other hand, *Vagbhata's* enumeration of 13 cervical bones appears to be a compromise between the classifications of *Charaka* and *Sushruta*. Various *Ayurvedic* texts provide different counts of *Asthi* (bones),

But each classification follows its own anatomical and philosophical principles. While these variations exist, they do not create any major contradictions, as all methodologies are internally consistent within their respective systems.

Classification of *Asthi* (Bones) According to *Samhitas*

The categorization of bones (*Asthi Prakara*) in *Ayurveda* is primarily based on the principles of *Shalya Tantra* (surgical science). The classification follows a pentad (five-type) system, as uniformly described in the *Ayurvedic* texts.

Below is Table no. 3, presenting the division of bones according to *Sushruta Samhita*:

Table 3: Classification of *Asthi* as per Sushruta Samhita

SN	Type of Asthi (Prakara)	Total Number	Examples
1.	Taruna Asthi (Soft bones)	14	Ghrana (Nasal bones) - 3 Karna (Ear bones) - 2 Griva (Neck bones) - 9 Aksikosa (Eye socket bones)
2.	Valaya Asthi (Ring-shaped bones)	110	Parshva (Ribs) - 72 Prstha (Back bones) - 30 Uras (Chest bones) - 8
3.	Nalaka Asthi (Long tubular bones)	125	Padanguli (Toes) - 3x5=15 (both feet) = 30 Padatala (Sole bones) Padakurcha (Foot arch bones) - 20 Gulpha (Ankle bones) Parsni (Heel bones) - 2 Jangha (Shin bones) - 4 Uru (Thigh bones) - 2 Hastanguli (Fingers) - 3x5=15 (both hands) = 30 Hastatala (Palm bones) Hastakurcha (Wrist bones) - 20 Manika (Metacarpal bones) Karpurasthi (Carpal bones) - 2 Prakosthasthi (Forearm bones) - 4 Bahunalaka (Upper arm bones) - 2 Trikasrita (Sacral bone) - 1 Amsaphalaka (Shoulder blade) - 2 Kanthanadi (Throat-related bones) - 4 Hanwasthi (Jaw bones) - 2
4.	Kapala Asthi (Flat Bones)	19	Janu (Knee) - 2 Nitamba (Hip) - 4 Amsa (Shoulder) - 2 Ganda (Cheek) - 2 Talu (Palate) - 1 Sankha (Temple) - 2 Sira (Head Region) - 6
5.	Ruchaka Asthi (Teeth-like Bones)	32	Danta (Teeth) - 32
	Total	300	

Understanding the Basis for Bone Classification in *Ayurveda*

Upon logical reasoning (*Tarka*) & *Pramana* (evidence-based analysis), it becomes evident that five primary bone types in *Ayurveda* serve as major divisions rather than absolute categories. These divisions repr. five distinct ways of classifying bones based on diff. anatomical & functional properties.

1. Ossification-Based Classification
   - *Taruna Asthi* (Soft or undeveloped bones) - Early-stage bones that are not fully hardened.
   - *Pakva Asthi* or *Ghanasthi* (Fully ossified bones) - Fully developed, hardened bones.

2. Surface Area-Based Classification
   - *Kapala Asthi* (Bones with a broad surface area) - Flat bones like skull bones, which have a greater width than thickness.
   - *Akapala Asthi* (Bones with smaller surface area) - Slender or cylindrical bones, where surface area is relatively lesser (e.g., *Nalaka Asthi*).

3. Shape-Based Classification
   - *Vartulakara Asthi* (Round/curved bones - *Valaya Asthi*) - Bones that provide elasticity and support, particularly in respiration (e.g., ribs).
   - *Avartulakara Asthi* (non-round bones) - Bones that lack a circular or curved shape.

4. Length & Function-Based Classification
   - *Nalaka Asthi* (Long bones for locomotion) - Found in the limbs, facilitating movement.
   - *Analaka Asthi* (Non-tubular bones) - Other bones that primarily serve a protective function, such as *Kapala* and *Valaya Asthi*.

5. Sensory Function-Based Classification
   - *Ruchaka Asthi* (Bones with sensory properties) - Teeth, which help in tast. food during chewing.
   - *Kharasthi* (Regular bones) - Bones without sensory function.

This fivefold division offers a structured approach to understanding bones in *Ayurveda*, correlating shape, structure, function, and ossification.

Sushruta's Observation on Bone Fractures (*Bhagna*) in Different *Asthi* Types [16]

Acharya Sushruta recognized that bones react differently to trauma, leading to various types of fractures.

The nature of fractures depends on the bone type, as detailed below**[17]**:

SN	Bone Type	Fracture Type (Bhagna)	Description
1.	Taruna Asthi (Soft bones)	Namayante	Bends rather than breaking.
2.	Nalaka Asthi (Long bones)	Bhajayante	Breaks completely.
3.	Kapala Asthi (Flat bones)	Vibhidhyante	Develops multiple fractures or cracks.
4.	Ruchaka Asthi (Teeth)	Sphutayante	Splits or shatters.
5.	Valaya Asthi (Curved/ring-shaped bones)	Sphutayante	Also shatters upon impact.

This detailed classification highlights *Sushruta's* advanced anatomical insights into bone structure and trauma response, aligning with modern orthopedic principles.

Analysis of Fracture Terminology in *Ayurveda*

A detailed linguistic and anatomical analysis of fracture terminology reveals a clear correlation between specific fracture types and specific bone structures. By breaking down *Sanskrit* terms based on *Dhatu Pada* (root words) as per *Panini Vyakarana* (*Ganakashtadhyayi*), we can derive the meaning and functional relevance of each fracture type in different bones.**[18]**

Comparison of *Ayurvedic* and Modern Fracture Classifications[19]

1. Taruna *Asthi* Fractures (*Namayante*) and Greenstick Fractures
   - *Ayurvedic* Insight: Since cartilaginous bones are softer in children, they tend to bend rather than break completely.
   - Modern Parallel: Greenstick fractures occur in children's bones, which bend and partially fracture instead of breaking cleanly.

2. Kapala Asthi Fractures (*Vibhidhyante*) and Skull Fractures
   - *Ayurvedic* Insight: Flat bones like the skull suffer from fissures or cleaving injuries rather than complete breaks.
   - Modern Parallel: Linear, Depressed, or Diastatic Fractures occur in the skull, leading to inward displacement or suture separation.

3. Valaya Asthi Fractures (*Sphutayante*) and Rib Fractures
   - *Ayurvedic* Insight: Curved bones (ribs) tend to split or crack rather than shatter.

- Modern Parallel: Separation fractures occur in rib bones, where they detach or develop cracks under stress.

4. Nalaka Asthi Fractures (*Bhajayante*) and Comminuted Fractures

- *Ayurvedic* Insight: Long bones (arms, legs) tend to break into multiple pieces upon trauma.
- Modern Parallel: Comminuted fractures occur when bones shatter into multiple fragments due to severe force.

Final Analysis of *Asthi Bhagna* and *Asthi Prakara*

Through the grammatical breakdown of *Dhatupada* (root words) and their meanings, it becomes evident that *Acharyas* in *Ayurveda* provided a clinically relevant classification of bone types (*Asthi Prakara*) and fractures (*Asthi Bhagna*). This knowledge can be applied both ways - certain bones are prone to specific types of fractures, and conversely, certain fracture patterns indicate the type of bone affected.

For example:

- *Taruna Asthi* (soft, cartilaginous bones) are more likely to bend rather than break.
- *Kapala Asthi* (flat bones) commonly sustain linear or fissure fractures.
- *Valaya Asthi* (curved bones, such as ribs) tend to detach or shatter upon trauma.
- *Nalaka Asthi* (long bones) are susceptible to transverse, oblique, or comminuted fractures due to their structural alignment.

Conclusion

The concept of *Asthi* (bones) has evolved from the Pre-*Vedic* period to modern times, with shifts in beliefs, methods, and applications. According to *Acharya Sushruta, Asthi* is the last remaining identity of a person after death, whereas modern anatomy defines bones as connective tissue characterized by the Haversian system. This fundamental difference in definition leads to variations in enumeration, classification, and functions between *Ayurveda* and modern science. The fivefold classification of bones (*Asthi Prakara*) in *Ayurveda* was primarily developed for *Shalya Tantra* (surgical and orthopedic applications), specifically in the context of fractures and dislocations.

However, this pentad classification is not just a categorization of bone types but rather a principle-based system that can be further subdivided into *Taruna* and *Ghanasthi* (based on ossification), *Vartulakara* and *Avartulakara* (based on shape), and so on.

This analysis proves that the earliest systematic classification of bones based on shape, size, and texture was introduced in *Ayurvedic Samhitas*, rather than modern anatomical texts, as is often believed.

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