

Developmental Biology and Axial Skeleton Pathogenesis in Patients with Bone Loss

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DESCRIPTION

The human body consists of 206 bones. The appendicular skeleton and axial skeleton are the two main divisions of these bones. The bones along the vertical axis make up axial skeleton. Body's central core is where the bones are arranged. The entire set of bones along the body's long axis is known as the axial skeleton. The bones that make up the thoracic cage, laryngeal skeleton, vertebral column, and skull are all part of the axial skeleton. The axial skeleton is a fundamental component of the human skeletal system, providing essential support and protection to vital organs while facilitating various physiological functions. Comprising the skull, vertebral column, and rib cage, the axial skeleton serves as the central axis of the body, playing a crucial role in maintaining structural integrity, protecting the central nervous system, and enabling diverse movements. The mandible and the cranium are included in the skull which is a prominent part of the axial skeleton.

The cranium safeguards the brain which is one of the body's most vital organs. Comprising many bones, such as the frontal, parietal, temporal, and occipital, the cranium serves as a protective barrier for the brain, guaranteeing its security while upholding a careful equilibrium between flexibility and structural integrity. The skull not only serves as a protective structure but also protects as a vital sensory organs involved in perception and communication. The nasal cavity aids in the sense of smell, while the eye sockets or orbits shield the eyes. Hearing is aided by the auditory ossicles found in the temporal bones. The mandible, commonly known as the jawbone is another integral component of the axial skeleton. It allows for the temporomandibular joint, where it articulates with the temporal bone to facilitate vital tasks like speaking, chewing, and facial expression. Its movement highlights the dynamic character of the axial skeleton by reflecting the complex coordination of muscles and joints. Connecting the skull to the rest of the axial skeleton is the vertebral column, also known as the spine or backbone. Composed of individual vertebrae, the vertebral column serves as the body's central support structure, providing both stability and flexibility. The intervertebral discs are situated between adjacent

vertebrae which act as a shock absorber, allowing the spine to withstand compressive forces and facilitating various movements.

The vertebral column is divided into distinct regions, each with its unique characteristics. The cervical region, located in the neck, consists of seven vertebrae and supports the head's range of motion. The thoracic region, associated with the chest, features twelve vertebrae that articulate with the ribs, forming the posterior aspect of the rib cage.

The lumbar region, situated in the lower back, comprises five vertebrae and bears the majority of the body's weight. Beyond its mechanical functions, the vertebral column protects the spinal cord, a vital component of the central nervous system. The spinal cord transmits neural signals between the brain and peripheral nerves, orchestrating sensory and motor functions throughout the body. The sensitive spinal cord is protected from injury by the bony arches and protective structures of the vertebral column. Adjacent to the vertebral column is the rib cage, forming a protective enclosure around the thoracic organs, including the heart and lungs. Composed of twelve pairs of ribs and the sternum, the rib cage provides structural support and safeguards vital organs from external trauma. The intercostal muscles are situated between the ribs and contribute to respiratory movements. The rib cage exhibits a unique structure, with true ribs directly attaching to the sternum, false ribs connecting indirectly, and floating ribs lacking sternal attachment. This differentiation reflects the intricate balance between flexibility and protection, allowing the rib cage to accommodate both structural and functional requirements.

Collectively, the axial skeleton functions as a dynamic and adaptive framework, balancing stability with mobility to support various physiological processes. Its role extends beyond mechanical support, encompassing protection of vital organs, facilitation of sensory perception, and coordination of complex movements. Moreover, the axial skeleton undergoes significant developmental changes throughout a person's life. In the vertebral column, the process of ossification occurs, transforming the initially cartilaginous vertebrae into bony structures. The flexibility of the spine in early childhood gradually changes as the

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