Development of the human spine

Health & Medicine

One of the first structures to appear during embryogenesis, the spine develops from the mesoderm layer and shares a common origin with the skin, muscles, and gonads. It continues to develop throughout infancy and puberty.

Each vertebra of the spine is composed of minerals and protein. Calcium is the predominant mineral, with several others. Collagen and cartilaginous structures form the protein matrix of the bones. Calcium salts such as calcium phosphate in the form of hydroxyapatite are embedded in a collagen matrix containing osteocytes and vascular tissues. The vertebrae are mostly compacted bone, which supports the weight-bearing function of these structures. Our post-menopausal subject is losing bone mass at a rate of about 1% per year (see Calcium).

The spine is interdependent with the paraspinal muscle groups (longissimus, multifidus, and rotatores). The longissimus muscles have their origin at the transverse processes of vertebrae from the cervical and thoracic regions. The multifidus muscles originate from the mamillary processes of the lumbar vertebrae. Rotatores are the deepest group and attach at the transverse processes of the thoracic vertebrae (see Human Anatomy). These muscles hold the vertebrae in position and add stability to the many joints in the spine. The bones in turn provide a surface for the muscles to attach and operate, functioning in many different ways to move the body and affect posture.

Endocrine glands produce hormones that affect the bones of the spine. In response to hypocalcemia, the parathyroid glands produce parathyroid hormone. The parathyroid hormone promotes the resorption of bone and the release of calcium into the bloodstream. When blood levels of calcium are sufficient, parathyroid hormone secretion decreases and allows calcium to be absorbed by bone tissue to a greater extent. Sex hormones such as estrogen have an important effect on the density of the bones. After menopause, bones have a tendency to osteoporosis and calcium loss. Some research suggests that this occurs because of the loss of estrogen's life-promoting effects on the osteoblasts (Simon, 2003).

There are several relationships between the spinal vertebrae and skin. One way the spine and skin are connected is through the nervous system. The spinal ganglion is intimately attached to the vertebrae. They pass through these bones and connect to the skin forming the dermatomes. Dermatomes are reflexive areas on the surface that relate to the areas of cutaneous innervation from a nerve root. Vertebrae are also connected to the skin through vitamin D. When sunlight hits human skin, cholesterol is converted to vitamin D. The effect of vitamin D is to increase the uptake of calcium by the bones.