

CHAPTER 7

LECTURE OUTLINE

I. INTRODUCTION

- A. Familiarity with the names, shapes, and positions of individual bones helps to locate other organs and to understand how muscles produce different movements due to attachment on individual bones and the use of leverage with joints.
- B. The bones, muscles, and joints together form the musculoskeletal system.
- C. The branch of medical science concerned with prevention or correction of the musculoskeletal system is called orthopedics.

II. DIVISIONS OF THE SKELETAL SYSTEM

- A. The axial skeleton consists of bones arranged along the longitudinal axis of the body. The parts of the axial skeleton, composed of 80 bones, are the skull, hyoid bone, vertebral column, sternum, and ribs (Figure 7.1, Table 7.1).
- B. The appendicular skeleton comprises one of the two major divisions of the skeletal system.
 - 1. It consists of 126 bones in the upper and lower extremities (limbs or appendages) and the pectoral (shoulder) and pelvic (hip) girdles, which attach them to the rest of the skeleton.
 - 2. Bone of the appendicular skeleton can be seen in Figure 7.1 and Table 7.1.

III. TYPES OF BONES

- A. Almost all of the bones of the body can be classified on the basis of shape: long, short, flat, irregular, and sesamoid (Figure 7.2).
- B. Sutural bones are classified on the basis of location (Figure 7.6).

IV. BONE SURFACE MARKINGS

- A. Bones show characteristic surface markings which are structural features adapted for specific functions.
- B. There are two major types of surface markings.
 - 1. Depressions and openings participate in joints or allow the passage of soft tissue.
 - 2. Processes are projections or outgrowths that either help form joints or serve as attachment points for connective tissue.

- C. Table 7.2 describes the various surface markings and their functions, along with examples of each.

V. SKULL

- A. The skull, composed of 22 bones, consists of the cranial bones (cranium) and the facial bones (face) (Figures. 7.3 through 7.13).

B. General Features

1. The skull forms the large cranial cavity and smaller cavities, including the nasal cavity and orbits (eye sockets).
2. Certain skull bones contain mucous membrane lined cavities called paranasal sinuses. (Figure 7.13)
3. The only moveable bone of the skull, other than the ear ossicles within the temporal bones, is the mandible.
4. Immovable joints called sutures hold the skull bones together.
5. The cranial bones have many functions.
 - a. They protect the brain.
 - b. Their inner surfaces attach to membranes that stabilize the positions of the brain, blood vessels, and nerves.
 - c. The outer surfaces of cranial bones provide large areas of attachment for muscles that move the various parts of the head.
 - d. Facial bones form the framework of the face and protect and provide support for the nerves and blood vessels in that area.
 - e. Cranial and facial bones together protect and support the special sense organs.

C. Cranial Bones

1. Frontal Bone
 - a. The frontal bone forms the forehead, the roofs of the orbits, and most of the anterior part of the cranial floor (Figure 7.3).
 - b. **Clinical Connection:** A “black eye” results from accumulation of fluid and blood in the upper eyelid following a blow to the relatively sharp supraorbital margin (brow line).
2. Parietal bones form the greater portion of the sides and roof of the cranial cavity (Figure 7.4).

3. Temporal bones form the inferior lateral aspects of the cranium and part of the cranial floor (Figure 7.4).
4. The occipital bone forms the posterior part and most of the base of the cranium (Figures 7.4-7.7).
5. The sphenoid bone is called the keystone of the cranial floor because it articulates with all the other cranial bones, holding them together (Figures 7.7, 7.8, 7.11).
6. The ethmoid bone forms part of the anterior portion of the cranial floor, the medial wall of the orbits, the superior portion of the nasal septum, and most of the superior side walls of the nasal cavity. It is a major superior supporting structure of the nasal cavity (Figures 7.9, 7. 11).

D. Facial Bones

1. Nasal bones form part of the bridge of the nose (Figure 7.3).
2. The lacrimal bones form a part of the medial wall of each orbit and are the smallest bones of the face (Figures 7.3, 7.4, 7.12).
3. Palatine bones form the posterior portion of the hard palate, part of the floor and lateral wall of the nasal cavity, and a small portion of the floors of the orbits (Figures 7.6, 7.7).
4. The inferior nasal conchae (turbinates) form a part of the inferior lateral wall of the nasal cavity (Figures 7.3, 7.9a).
5. **Clinical Connection:** Cleft palate and cleft lip result from a lack of fusion of portions of the palatine and maxillary bones during fetal development.
6. The vomer, found on the floor of the nasal cavity, is one of the components of the nasal septum (Figures 7.3, 7.7).
7. The maxillae unite to form the upper jawbone and articulate directly with every bone of the face except for the mandible (Figures 7.3, 7.4, 7.7, 7.11, 7.13).
8. They form part of the floors of the orbits, part of the lateral walls and floor of the nasal cavity, and most of the hard palate.
9. The zygomatic bones (cheekbones) form the prominences of the cheeks and part of the lateral wall and floor of each orbit (Figure 7.12).
10. The mandible (jawbone) is the largest, strongest facial bone and the only moveable skull bone (other than the ear ossicles) (Figure 7.10).
 - a. The mandible articulates with the temporal bone to form the temporomandibular joint (Figure 7.4).

- b. **Clinical Connection:** Temporomandibular joint (TMJ) syndrome is dysfunction to varying degrees of the temporomandibular joint. Causes appear to be numerous and the treatment is similarly variable.

E. Nasal Septum

1. The nasal septum is a vertical partition that divides the nasal cavity into right and left sides (Figure 7.11).
 - a. **Clinical Connection:** A deviated nasal septum is a lateral deflection of the septum from the midline, usually resulting from improper fusion of septal bones and cartilage.
2. The orbits (eye sockets)
 - a. The orbits contain the eyeballs and associated structures and are formed by seven bones of the skull (Figure 7.12).
 - b. Five important foramina are associated with each orbit
 1. Foramina are listed in Table 7.3.

F. Unique Features of the Skull

1. Sutures
 - a. Sutures are immovable joints found only between skull bones and hold skull bones together.
 - b. Sutures include the coronal, sagittal, lamboidal, and squamous sutures, among others (Figures 7.4, 7.6).
2. Paranasal Sinuses
 - a. Paranasal sinuses are cavities in bones of the skull that communicate with the nasal cavity (Figure 7.13)
 - b. They are lined by mucous membranes and also serve to lighten the skull and serve as resonating chambers for speech.
 - c. Cranial bones containing the sinuses are the frontal, sphenoid, ethmoid, and maxillae.
 - d. **Clinical Connection:** Sinusitis occurs when membranes of the paranasal sinuses become inflamed due to infection or allergy.

G. Fontanelles

1. Fontanelles are dense connective tissue membrane-filled spaces between the cranial bones of fetuses and infants. They remain unossified at birth but close early in a child's life (Figure 7.14).

- a. The major fontanels are the anterior, posterior, anterolaterals, and posterolaterals .
- b. Fontanels have two major functions.
 - 1. They enable the fetal skull to modify its size and shape as it passes through the birth canal.
 - 2. They permit rapid growth of the brain during infancy.

H. Hyoid Bone

- 1. The hyoid bone is a unique component of the axial skeleton because it does not articulate with any other bones.
 - a. The hyoid bone consists of a horizontal body and paired projections, the lesser and greater horns. (Figure 7.15)

VI. VERTEBRAL COLUMN

- A. The vertebral column, along with the sternum and ribs, makes up the trunk of the skeleton.
 - 1. The 26 bones of the vertebral column are arranged into five regions: cervical, thoracic, lumbar, sacral, and coccygeal (Figure 7.16).
 - 2. Normal Curves of the Vertebral Column
 - 3. The four normal vertebral curves are the cervical and lumbar (anteriorly convex curves) and thoracic and sacral (anteriorly concave curves) (Figure 7.16b).
 - 4. In the fetus, there is only a single anteriorly concave curve (Figure 7.16c).
 - 5. The cervical curve develops as the child begins to hold his head erect.
 - 6. The lumbar curve develops as the child begins to walk.
 - 7. All curves are fully developed by age 10.
 - 8. Between adjacent vertebrae, from the first cervical (atlas) to the sacrum, are intervertebral discs that form strong joints, permit various movements of the vertebral column, and absorb vertical shock (Figure 7.16d).
- B. Parts of a typical vertebra include a body, a vertebral arch, and several processes (Figure 7.17).
- C. Regions of the Vertebral Column
 - 1. Cervical Region
 - a. There are 7 cervical vertebrae (Figure 7.18a).
 - b. The first cervical vertebra is the atlas and supports the skull (Figure 7.18a, b).
 - c. The second cervical vertebra is the axis, which permits side-to-side rotation of the head (Figure 7.18a, c).

- d. The third to sixth correspond to the structural patterns of the typical cervical vertebrae (Figure 7.18d).
 - e. The seventh called the vertebra prominens is somewhat different (Figure 7.18)
 - 2. Thoracic Region
 - a. There are 12 thoracic vertebrae (Figure 7.19).
 - b. These vertebrae articulate with the ribs.
 - 3. Lumbar Region
 - a. There are 5 lumbar vertebrae (Figure 7.20).
 - b. They are the largest and strongest vertebrae in the column.
 - 4. Table 7.4 summarizes the major structural differences among the cervical, thoracic, and lumbar vertebrae.
- D. Sacrum
 - 1. The sacrum is formed by the union of 5 sacral vertebrae (Figure 7.21) and serves as a strong foundation for the pelvic girdle.
- E. Coccyx
 - 1. The coccyx is formed by the fusion of 4 coccygeal vertebrae (Figure 7.21).
 - 2. **Clinical Connection:** Caudal anesthesia (epidural block), frequently used during labor (in childbirth), causes numbness in the regions innervated by the sacral and coccygeal nerves (approximately from the waist to the knees).

VII. THORAX

- A. The term thorax refers to the entire chest.
 - 1. The skeletal part of the thorax (a bony cage) consists of the sternum, costal cartilages, ribs, and the bodies of the thoracic vertebrae (Figure 7.22).
 - 2. The thoracic cage encloses and protects the organs in the thoracic and superior abdominal cavities. It also provides support for the bones of the shoulder girdle and upper limbs.
- B. Sternum
 - 1. The sternum is located on the anterior midline of the thoracic wall.
 - a. It consists of three parts: manubrium, body, and xiphoid process (Figure 7.22a).
- C. Ribs

1. The 12 pairs of ribs give structural support to the sides of the thoracic cavity (Figure 7.22b).
2. The first 7 pairs of ribs are called true ribs; the remaining five pairs, false ribs (with the last two false ribs called floating ribs).
3. Figure 7.23a shows the parts of a typical rib.
4. **Clinical Connection:** Rib fractures, dislocations, and separations. Rib fractures are the most common types of chest injuries.

VIII. DISORDERS: HOMEOSTATIC IMBALANCES

- A. Protrusion of the nucleus pulposus into an adjacent vertebral body is called a herniated (slipped) disc (Figure 7.24). This movement exerts pressure on spinal nerves, causing considerable pain.
- B. Spina bifida is a congenital defect caused by failure of the vertebral laminae to unite at the midline. This may involve only one or several vertebrae; nervous tissue may or may not protrude through the skin.

IX. MEDICAL TERMINOLOGY

Alert students to the medical terms associated with the abnormalities of the vertical column.