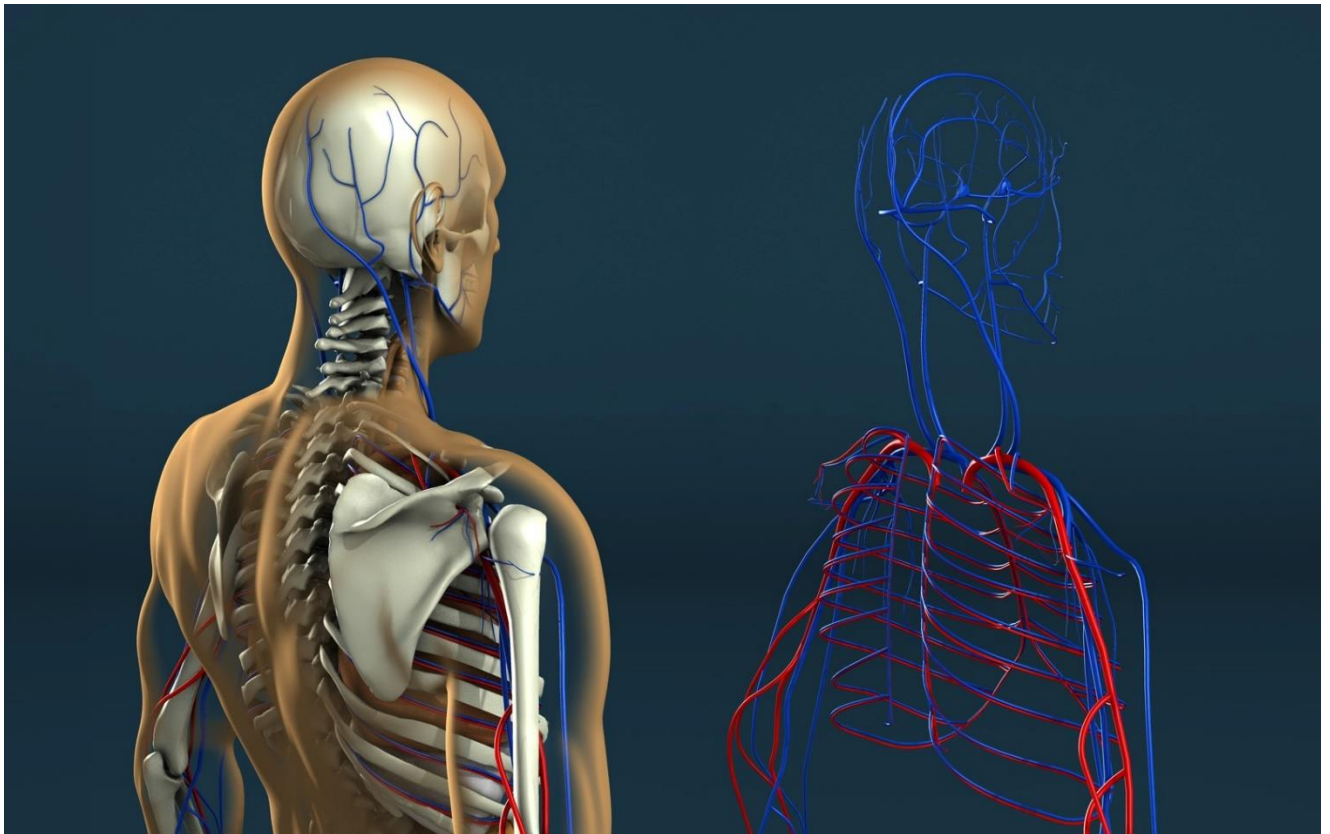


# Anatomy & Physiology Review of Each Body System



Knowing basic human anatomy is a fundamental part of being a successful Medical Coder. Anatomy is defined as the branch of science concerned with the bodily structure of humans, animals, and other living organisms, especially as revealed by dissecting and the separation of parts. In addition to medical terminology, human anatomy helps you assign a more precise diagnosis code. Its also very important for assigning procedure codes, which are specific to certain parts of the body in many cases. There are 8 questions on the CPC exam on anatomy and physiology. Although there are few questions in this section, it is important to get as many correct as possible to increase your score, and to give you room to score a little lower in other areas and still pass with a score of 70% or higher. The Anatomy section can be easy to conquer if you study and take good notes (write them in your book to refer to during testing).

Whether or not you are coding in a specialty setting, you will still need to be familiar with the entire anatomy. Your doctor will not concentrate only on one bodily system – you shouldn't either. You will need to know how all of the body's systems work and the principles of physiology to make sure you are successfully doing the job.

### **There are several branches of anatomy:**

- Histology           the study of the microscopic structure of organs, tissues and cells
- Zootomy            anatomical study of animals
- Phytotomy        anatomical study of plant, which is the anatomical study of plants
- Human anatomy   also known as anthropotomy
- Embryology        also known as developmental anatomy, which is the study of embryo development from a single-celled zygote to a fully formed fetus.
- Gross anatomy    the branch of anatomy has a large-scale focus on organs and body structures as a whole
- Comparative       the comparative study of the anatomy of different organisms.

In this section, we will go into detail regarding the anatomy of each body system. This will assist you in understanding each system in correlation to its importance in applying the appropriate corresponding medical codes.

### **Musculoskeletal System Anatomy**

Procedure codes related to the musculoskeletal system are generally related to fracture repair codes, casting, relocation of dislocated joints and other musculoskeletal repair codes.

The skeletal system in the adult body is made up of 206 individual bones. These bones are arranged into two major divisions: the axial skeleton and the appendicular skeleton. The axial skeleton runs along the body's midline axis and is made up of 80 bones in the following regions:

- Skull
- Hyoid
- Auditory ossicles
- Ribs
- Sternum
- Vertebral column

The appendicular skeleton is made up of 126 bones in the following regions:

- Upper limbs
- Lower limbs
- Pelvic girdle
- Pectoral (shoulder) girdle

### Vertebrae

Twenty-six vertebrae form the vertebrae column of the human body. Except for the singular sacrum and coccyx, each vertebrae is named for the first letter of its region and its region and position along the superior- inferior axis. For example, the most superior thoracic vertebrae are called T1 and the most inferior is called T2. They are named by region:

- Cervical (neck) – 7 vertebrae
- Thoracic (chest) – 12 vertebrae
- Lumbar (lower back) – 5 vertebrae
- Sacrum 1 vertebrae
- Coccyx (tailbone) – 1 vertebrae

### Ribs and Sternum

The sternum, or the breastbone, is a thin, knife-shaped bone located along the midline of the anterior side of the thoracic region of the skeleton. The sternum connects to the ribs by thin bands of cartilage called the costal cartilage. There are 12 pairs of ribs that together with the sternum form the ribcage of the thoracic region. The first seven ribs are known as the “true ribs” because they connect the thoracic vertebrae directly to the sternum through their own band of costal cartilage. Ribs 8, 9, and 10 all connected to the sternum through cartilage that is connected to the cartilage of the seventh rib, so they are considered as “false ribs”. Ribs 11 and 12 are also false ribs but are also considered to be “floating ribs” because they do not have any cartilage attachment to the sternum at all.

### Types of Bones

All the bones in the body can be broken down into five types: long, short, flat, irregular and sesamoid.

- **Long Bones** are longer than they are wide and are the major bones of the limbs. Long bones grow more than the other classes of bone throughout childhood and so are responsible for the bulk of our height as adults. A hollow medullary cavity is found in the center of long bones and serves as a storage area for bone marrow. Examples of long bones include the femur, tibia, metatarsals and phalanges.
- **Short Bones** are about as long as they are wide and are often cubed or round. The carpal bones of the wrist and the tarsals bones of the foot are examples of short bones.
- **Flat Bones** greatly vary in size and shape but have the common feature of being very thin in one direction. Because they are thin, flat bones do not have medullary cavity like the long bones. The frontal, parietal and occipital bones of the cranium – along with the ribs and hip bones – are examples of flat bones.

- **Irregular** have a shape that does not fit the pattern of the long, short, flat bones. The vertebrae, sacrum and coccyx of the spine – as well as the sphenoid, ethmoid and zygomatic bones of the skull – are all irregular bones.
- **Sesamoid** formed after birth inside of tendons that run across joints. Sesamoid bones grow to protect the tendon from stresses and strains at the joint and can help to give a mechanical advantage to muscles pulling on the tendon. The patella and the pisiform bone of the carpals are the only sesamoid bones that are counted as a part of the 206 bones of the body. Other sesamoid bones can form in the joints of the hands and feet but are not present in all people

### **Storage**

The skeletal system stores many different types of essential substances to facilitate growth and repair of the body. The skeletal system's cell matrix acts as our calcium bank by storing and releasing calcium ions into the blood as needed. Bone cells (release osteocalcin), which regulates blood sugar and fat disposition. Yellow bone marrow (used to store energy in the form of lipids). Red bone marrow stores some iron in the form of the molecule ferritin and uses this iron to form hemoglobin in red blood cells.

### **Diseases and Conditions**

Musculoskeletal health issues from arthritis to cancer, can impair our mobility and lead to loss quality of life or even death. Common musculoskeletal issues are:

- Arthritis – Osteoarthritis, Rheumatoid Arthritis, Gout
- Fibromyalgia
- Herniated Disk
- Hiatal Hernia
- Myoclonus
- Myositis
- Scoliosis
- Tendinitis and Tendinosis
- TMJ Disorders

### **Growth and Development**

The skeleton begins to form early in fetal development as a flexible skeleton made of hyaline cartilage and dense irregular fibrous connective tissue. These tissues act as soft, growing framework and placeholder for the bony skeleton that will replace them. As development progresses, blood vessels begin to grow into the soft fetal skeleton, bringing stem cells and nutrients for bone growth. Osseous tissue slowly replaces cartilage and fibrous tissue in a process called calcification. At birth, the skeleton of a newborn has more than 300 bones; as a person ages, these bones grow together and fuse into larger bones, leaving adults with only 206 bones.

### **Support and Protection**

The skeletal system's primary function is to form a solid framework that supports and protects the body's organs and anchor the skeletal muscles. The bones of the axial skeleton act as a hard shell to protect the internal organs – such as the brain and the heart – from damage caused by external forces. The bones of the appendicular skeleton provide support and flexibility at the joints and anchor the muscles that move the limbs.

### **Movement**

The bones of the skeletal system act as attachment points for the skeletal muscles of the body. Almost every skeletal muscle works by pulling two or more bones either close together or further apart. Joints act as pivot points for the movement of the bones. The regions of each bone where muscles attach to the bone grow larger and stronger to support the additional force of the muscle. In addition, the overall mass and thickness of a bone increase when it is under a lot of stress from lifting weights or supporting body weight.

### **Integumentary System**

This system includes the skin, nails, hair, sweat and oil glands and mammary glands. These structures function together to protect the body from the outside world, as well as retain bodily fluids, protect from disease, regulate body temperature and eliminate waste. They also provide sensation. Procedure codes related to the integumentary system range from simple incision and drainage of fluid-filled cysts to skin grafts and removal of cancerous lesions.

### **Respiratory System**

The respiratory system is made up of the nose and nasal cavity, pharynx, larynx, trachea, bronchi, and lungs. All working together, these organs supply the blood with oxygen, which is delivered to all parts of the body. Procedure codes related to the respiratory system range from removal of foreign body from the nose to surgical closure of a tracheostomy.

### **Cardiovascular System**

The cardiovascular system is made up of the heart, arteries and veins that run throughout the body. The system distributes oxygen, removes waste products and provides temperature control. Procedure codes related to the cardiovascular system range from venipuncture to take a blood sample, to a heart transplant.

### **Lymphatic System**

This system consists of the lymph nodes, ducts, tissues, capillaries and vessels that transport lymph fluid to the circulatory system. This is a major component of the immune system. Procedure codes related to the lymphatic system include removal of the spleen, biopsy and excision of lymph nodes.

## **Digestive System**

The digestive system begins at the mouth and runs all the way through the body to the anus. It is the system in which we eat, digest, and eliminate our food waste. There may be many codes that may be identified in these systems, including diagnosis codes relating to upset stomach, or nausea, to repair or incision of tongue, mouth, liver and appendix.

## **Urinary System**

The urinary system includes the kidneys, ureter, bladder and urethra. These organs work together to filter blood by removing waste, as well as controlling the amount of salt and water in the body. Diagnosis codes relating to the urinary system range from urinary tract infections to bed-wetting and procedure codes range from insertion of catheters to surgical removal of kidney stones.

## **Reproductive System**

The reproductive systems are divided into the male and female organs and vary greatly. These organs work together to create life. Procedure codes relating to the reproductive organs range from circumcision to artificial insemination.

## **Nervous Systems**

The nervous system is divided into the central and the peripheral parts. It includes the brain, spine, spine, nerves and neurons. Working together, this system coordinates activity of the muscles, monitors the organs, constructs input from the senses and initiates action. Procedure codes relating to the nervous system range from checking a patient's reflexes to placement of a spinal cord shunt.

## **Auditory and Ocular System**

The auditory and ocular. Or eye, systems are generally grouped together as they are both sensory organ systems. They include the hearing organs, including the bones within the auditory system, as well as the sensory organs that allow you to see, including the eyelids and tear ducts. Diagnosis and procedure codes within the sensory system range from Otitis Media (Middle Ear Infection) to surgical repairs of the cornea.

## **Immune System**

The immune system is made up of the molecular and genetic components that defend the body from foreign organisms. This system creates antibodies and releases them into the blood to fight off specific antigens. Because the immune system is located within the blood, many of the procedure and diagnosis codes related to it are also related to the blood, such as a complete blood count (CBC).

1. Where are the cataracts located?

- a. Inside the choroid layer of the eye
- b. Behind the lens of the eye
- c. Within the optic nerves behind the eye
- d. Within the vitreous humor of the eye

2. In arteries and veins, there is an inner layer that helps circulate blood flow. What is it called?

- a. Smooth muscle
- b. Adventitia
- c. Endothelium
- d. Valve

3. Which of the following bodily functions does nerve IX do?

- a. Contracts bladder
- b. Stimulates saliva flow
- c. Slows heartbeat
- d. Constricts pupils

4. Which of the following is located in the third order branch of arterial vascular families?

- a. Middle colic
- b. Splenic
- c. L. internal carotid
- d. Renal cortical

5. The tarsals and metatarsals are bones located in which body part (s)?

- a. Lower legs
- b. Hands
- c. Feet
- d. Forearms

6. Jaundice is caused by the malfunction of what organ?

- a. Stomach
- b. Liver
- c. Gallbladder
- d. Pancreas

7. Which of the following is **not** a main function of the kidneys?

- a. pH regulation
- b. Maintenance of blood pressure
- c. Release of adrenaline throughout the body
- d. Conversion of vitamin D to calciferol

8. Which organ is located at the bottom of the stomach?

- a. Jejunum
- b. Duodenum
- c. Cecum
- d. Ileum

9. Which of the following shoulder muscles are located on the back of the shoulder blade?

- a. Subscapularis
- b. Infraspinatus
- c. Deltoid
- d. Pectoralis major

10. Hypertension, or consistently high blood pressure, can cause issues all over the body. Which of the following is **not** a serious complication caused by hypertension?

- a. Kidney failure
- b. Gangrene
- c. Retinopathy
- d. Atherosclerosis

11. Where on the tongue is the lingual frenulum located?

- a. Underneath, in the middle
- b. Toward the throat
- c. Underneath, to the right
- d. Toward the front of the mouth

12. Which of the following is a deep forearm muscle?

- a. Extensor indicis
- b. Anconeus
- c. Extensor digitorum
- d. Extensor carpi ulnaris

13. The pituitary gland secretes many of the body's hormones. The anterior pituitary gland secretes up to six. Which hormone, secreted by the anterior pituitary gland, stimulates testosterone (male) and progesterone (female) production?

- a. Growth Hormone
- b. Prolactin
- c. Luteinizing hormone (LH)
- d. Oxytocin

14. Which nerves stem from the spinal cord and essentially wrap around the ribs?

- a. Brachial plexus
- b. Sciatic
- c. Musculocutaneous
- d. Intercostal



15. Which of the following is **not** a layer of the stomach muscularis?

a. Oblique

c. Longitudinal

b. Pylorus

d. Circular

## Rationale

1. Behind the eyes      Cataracts are an aging condition that causes blurry vision due to the clouding of the lens. They should be caught and treated early on because they could cause blindness if left untreated. Typically, they are located behind the lens of the eye. They are not located within the vitreous humor of the eye, inside the choroid layer of the eye, or within the optic nerves behind the eye.  
**Reference: ICD-10-CM Expert 2020 Edition, page 594**
2. Endothelium      Arteries and veins, small as they may be, have multiple parts that keep them working. There are four layers to each artery/ vein: adventitia (outer layer), smooth muscle (second layer), internal elastic lamina (third layer) and endothelium (inner layer). The endothelium in the veins connects to the valves, which keeps blood flowing through at the correct pace, For the question, the endothelium is the correct answer since it is the innermost layer and does assist with blood flow. Valves are only found in veins, and while they assist with blood flow, they are not considered a “layer”. The adventitia is the outer layer of both arteries and veins, not the innermost layer. Smooth muscles are in the middle, along with the internal elastic lamina.  
**Reference: ICD-10-CM Expert 2020 Edition, page 8.**
3. Stimulates salvia flow      the parasympathetic nervous system is an essential part of the autonomic nervous system. It sends signals via five different nerve/ nerve clusters (III, VII, IX, X and the pelvic splanchnic). Each nerve/ nerve cluster has different responsibilities from constricting the pupils to contracting the bladder. Nerve IX is responsible for stimulating saliva flow. Contracting the bladder is done by the pelvic splanchnic nerves; constricting the pupil is done by nerves III and IV and slowing the heartbeat is done by nerve X.  
**Reference: ICD-10-CM Expert 2020 Edition, page 32.**
4. Renal cortical      Located in Appendix L of the CPT codebook, the arterial vascular families diagram stretches over two and a half pages and has every part of the body covered. The third order branch, broken down into left and right when necessary, is listed by main artery. Looking at the four options, the renal cortical, located in the Abdominal Aorta section of the arterial vascular family, is located within the third order. The Splenic, L. internal carotid and middle colic are all located in the second order branch.  
**Reference: ICD-10-CM Expert 2020 Edition, pages 856-858.**

5. Feet The hands and feet have similar bones but have different names. These can be verified by two common diseases, carpal tunnel syndrome and tarsal tunnel syndrome. Carpal tunnel syndrome is pain, numbness or tingling in the wrist and hand, and tarsal tunnel syndrome is pain, numbness and tingling in the foot and part of the ankle. Both are caused by damage to the surrounding nerves. The carpal (hand) and tarsal (feet) bones are affected by these diseases. The tarsal bones are in the feet.  
**Reference: ICD-10-CM Expert 2020 Edition, page 41**
6. Liver Jaundice is a condition that causes the skin, mucous membranes and whites of the eyes to turn yellowish color. It is a sign that there is too much bilirubin in the blood. Bilirubin, found in bile, is regulated by the liver. When jaundice occurs, it is a sign there may be a severe issue with the liver. The stomach, pancreas and gallbladder, while connected to the liver in one way or another, do not directly contribute to jaundice, so they are incorrect answers.  
**Reference: ICD-10-CM Expert 2020 Edition, page 717**
7. Release of adrenaline The kidneys are extremely vital to the body. They have many important functions for a coder to know. The main functions of the kidneys are excretion, maintenance of blood volume/ concentration, regulation and erythrocyte concentration upkeep, and the conversion of vitamin D to calciferol. The kidneys do not relate adrenaline throughout the body, so this would be the answer to the question.  
**Reference: ICD-10-CM Expert 2020 Edition, page 862**
8. Duodenum The digestive system, while seemingly simple, is very complex. It stretches from the mouth all the way to the rectum and anus. Most of the digestive system is concentrated in the stomach and intestinal area, which has about 12 organs squeezed into one area. All four answer options are located in this area, and they are all located within inches of each other. The ileum and cecum are located closer to the rectum and appendix than the stomach, so that eliminates these two answers. The jejunum, while located close to the stomach, is not directly at the bottom of the stomach and the beginning of the small intestine. So, this answer would not be correct either. The duodenum is located right where the stomach end and the small intestine begins. It leads to the jejunum, which can be confusing when it comes to their location. But because of its location, the duodenum is the correct answer to the question.  
**Reference: ICD-10-CM Expert 2020 Edition, page 302**
9. Infraspinatus There are four main muscles attached to the shoulder blades and the collarbone: the subscapularis, supraspinatus, teres minor and infraspinatus. Out of these four, three are located in the back of the shoulder blade, with one wrapping from front to back (and is located closer to the collarbone). Out of the selections for this question, the subscapularis and the infraspinatus are located on the shoulder blade. This, then, will be the correct answer to the question. The deltoid muscle is located on the actual shoulder, and the pectoralis major is located in the chest.  
**Reference: AMA CPT Professional 2020 Edition, page 117**

10. Gangrene                      Hypertension starts with high blood pressure every time you go to the doctor. If it is not dealt with soon enough, it can cause major problems. The more obvious problems that can arise are stroke or myocardial infarction (more commonly known as a heart attack). Hypertension can also cause issues with vision and, if left untreated, can cause hypertensive retinopathy and complete loss of vision. High blood pressure constantly pumping through blood vessels cause a buildup of plaque, which can lead to atherosclerosis. If not treated properly, atherosclerosis can lead to blood clots, which can lead to myocardial infarction or stroke. Kidney failure is another residual problem of hypertension. This, unlike atherosclerosis, is caused by the constant high pressure in the blood vessels. Gangrene, while caused by poor circulation and infection, is not a direct result of hypertension. It seems more often in patients who smoke and are obese and/or diabetic.  
**Reference: ICD-10-CM Expert 2020 Edition, page 651**
11. Underneath, middle        Underneath, in the middle. The tongue is a very versatile organ. It helps us smell, taste and can tell apart many textures. It is also made up of many parts, including the taste buds, which are numerous on their own. One of those parts, the lingual frenulum, is located in an area many people tend to not think of. Underneath, right in the middle of the tongue, is a tiny piece of tissue that keeps it attached bottom of your mouth. This is the correct answer to the question. As far as the anatomy of the tongue, the lingual tonsil is located closer to the front of the throat' the sublingual papilla is located at the bottom of the tongue, on either side of the lingual frenulum; and the filiform papillae are located toward the front of the mouth.  
**Reference: ICD-10-CM Expert 2020 Edition, page 11**
12. Extensor indicis            Looking at the anatomical illustrations section of your HCPCS or ICD-10 book, you will see a diagram of deep and superficial forearm muscles. Deep muscles are deeper and closer to the bone than superficial muscles, which lie right below the skin. Because of this, deep muscles are bigger and more plentiful. On the forearm diagram, the deep and superficial muscles are bold under their respective categories. Extensor indicis, located at the wrist and stretching upward toward the elbow, is a deep muscle.  
**Reference: HCPCS Level II Expert Edition, page 45**
13. Luteinizing Hormone      (LH) – Under the Endocrine System Anatomy part of the chapter for endocrine diseases, the different glands of the system are broken down into what they are and what they secrete. The pituitary gland, anterior and posterior, secrete many of the body's important hormones for growth. The LH hormone, or Luteinizing hormone, controls the Progesterone/ Testosterone levels in the body. For females, the rise of LH means that ovulation is at its peak. Prolactin is a hormone triggered after childbirth; it helps to stimulate milk production. Growth hormones help trigger the growth of muscles and bones. Oxytocin is a hormone secreted during childbirth and triggers uterine contractions.  
**Reference: ICD-10-CM Expert 2020 Edition, page 517**

14. Intercostal

All nerves essentially stem from the spinal cord since this is the main part of the nervous system. There are many important nerves that run through the body, and the ones that run alongside the ribs are just as important as the ones running down our arms and legs. Looking at a basic diagram, you will see that the nerves essentially “wrapping” around the ribs are called the intercostal nerves. The brachial plexus is located at the collarbone; the musculocutaneous nerve(s) run down the arm, and the sciatic nerves are located in the upper leg and run to the lower back.

**Reference: ICD-10-CM Expert 2020 Edition, page 29**

15. Pylorus

The stomach muscularis is comprised of three layers: longitudinal, circular and oblique. The muscularis mucosae, as it is officially called, lines the entire gastrointestinal tract from the esophagus to the rectum. The pylorus, while also located in the stomach, is the opening that leads to the duodenum.

**Reference: HCPCS Level II Expert 2020 Edition, page 32**