



Introduction to Human Anatomy

A Foundational Guide for Medical Coders



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1. The Role of Anatomy in Medical Coding

Medical coding is the process of converting medical procedures and diagnoses found in medical records into universally accepted numerical codes (CPT / ICD). Medical coders work with a patient's medical record every day, and that record is built entirely around documentation of the patient's health conditions.

Why anatomy matters: To be a successful medical coder, a solid working knowledge of human anatomy and physiology is a must. Physiology is the branch of biology dealing with the functions and activities of living organisms and their parts.

What is Anatomy?

Anatomy is the branch of biology concerned with the study of the structure of organisms and their parts. It is traditionally divided into two broad fields — macroscopic and microscopic anatomy.

Macroscopic (Gross) Anatomy	The examination of body parts using unaided eyesight — structures large enough to see without magnification.
Microscopic Anatomy	The use of optical instruments to study tissues (histology) and cells — structures too small to see with the naked eye.

Human anatomy deals with the anatomical structures of the human body, including cells, tissues, organs, and organ systems.

Levels of Structural Organization in the Human Body

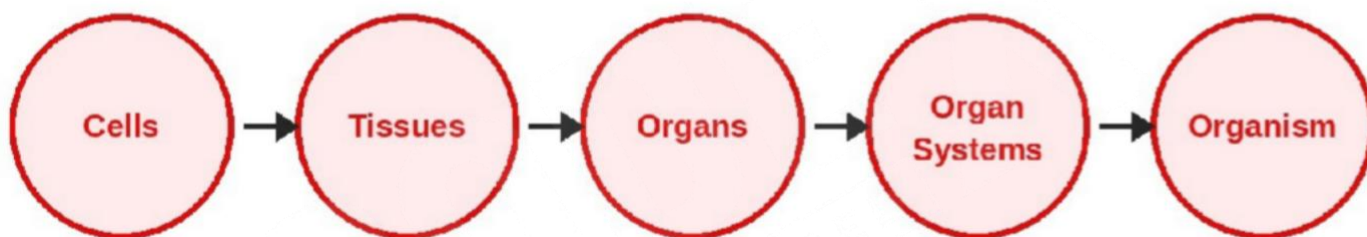


Figure 1 — The four levels of structural organization, from single cells to the complete organism.

2. Cells—The Building Blocks of Life

Cells are the fundamental structural, functional, and biological units of all living organisms. Every tissue, organ, and organ system in the human body is ultimately built from cells working together.

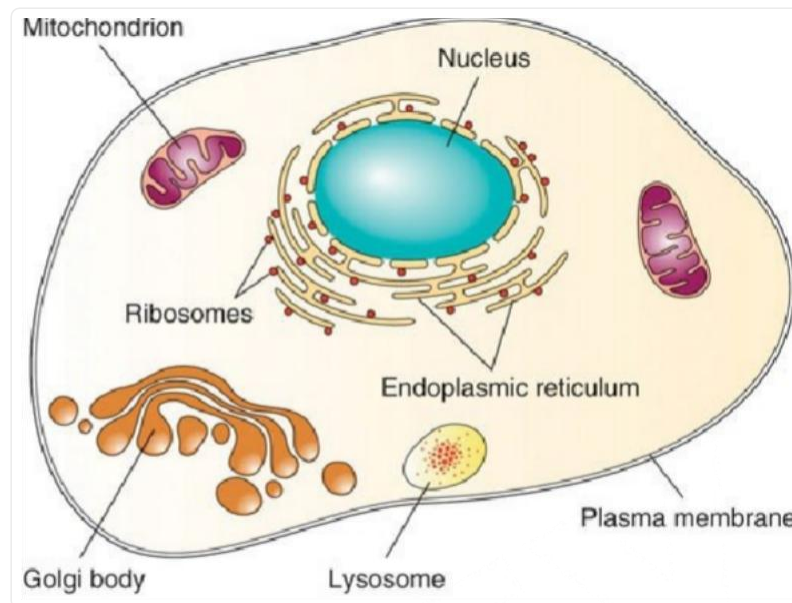


Figure 2 — A typical animal cell, showing the nucleus, mitochondria, ribosomes, endoplasmic reticulum, Golgi body, lysosome, and plasma membrane.

3. Tissues

A tissue is a group of similar cells, along with their intercellular matrix, that work together to perform specific structural and physiological functions. The human body is built from four primary tissue types.

Epithelial Tissue

Covers body surfaces, lines cavities and organs, and forms glands.

Examples: skin, lining of the digestive tract.

Connective Tissue

Supports, binds, and protects other tissues and organs. It consists of cells, fibers, and ground substances.

Examples: bone, cartilage, blood, and adipose (fat) tissue.

Muscular Tissue

A specialized, contractile tissue composed of elongated cells (muscle fibers) that shorten to produce movement, maintain posture, and generate heat.

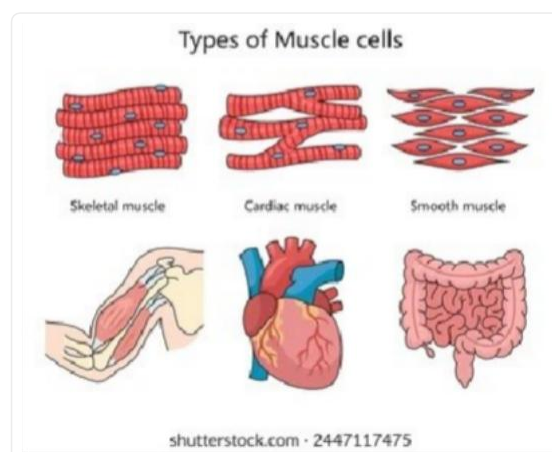


Figure 3 — The three types of muscle tissue: skeletal, cardiac, and smooth muscle.

Nervous Tissue

Composed of neurons that transmit electrical signals for communication throughout the body.

Examples: brain, spinal cord, and nerves.

4.Organs

A group of different tissues working together forms an **organ**. Familiar examples include the liver, stomach, kidney, spleen, lungs, and heart — each combining epithelial, connective, muscular, and nervous tissue in different proportions to do its job.

5.OrganSystems

When a group of organs works together to carry out a shared function, the result is called an **organ system**. All of the body's organ systems, working together, make up the complete human body. There are 11 organ systems in the human body:

The 11 Organ Systems of the Human Body

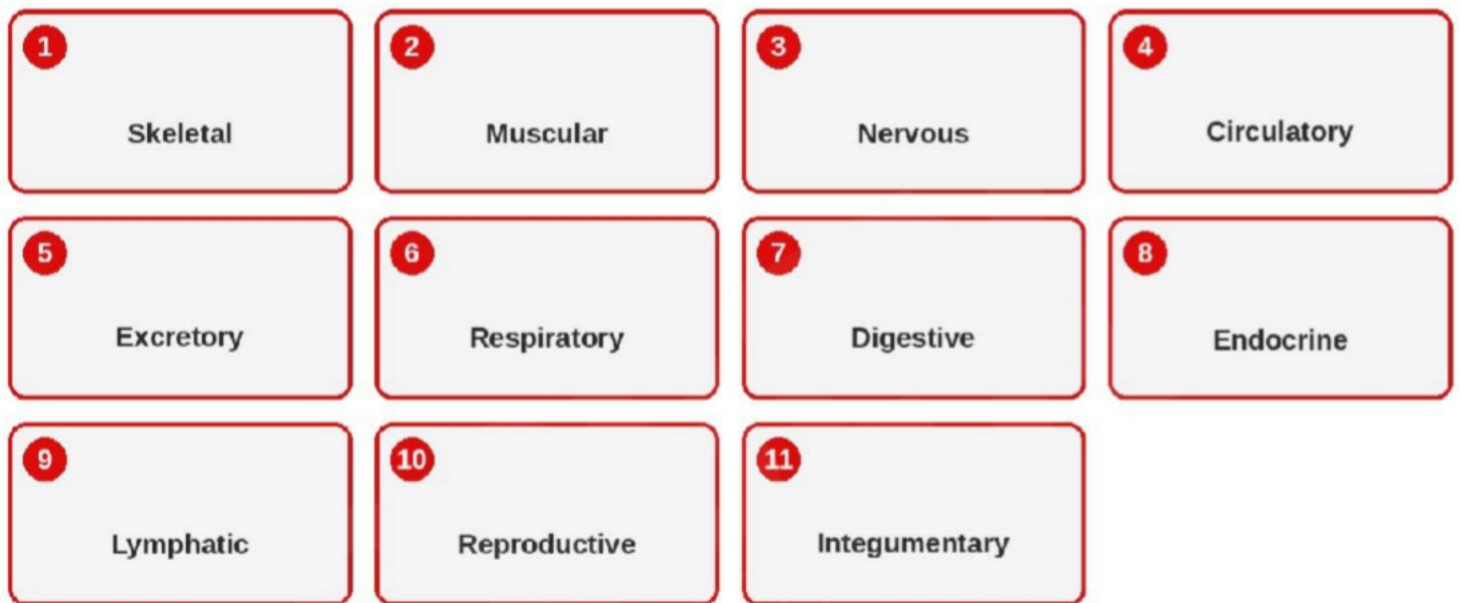


Figure 4 — The 11 organ systems of the human body.

For medical coders: Recognizing which organ system a diagnosis or procedure relates to is often the first step in narrowing down the correct ICD / CPT code family — making this organizational map one of the most practical anatomy references you'll use.



Integumentary System

Medical Coding Notes

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1. Overview

The **integumentary system**, comprising skin, hair, nails, and glands, acts as the body's primary protective barrier against environmental hazards, pathogens, and dehydration.

The system features three layers:

- **Epidermis** — protection
- **Dermis** — support
- **Hypodermis** (subcutaneous layer) — insulation

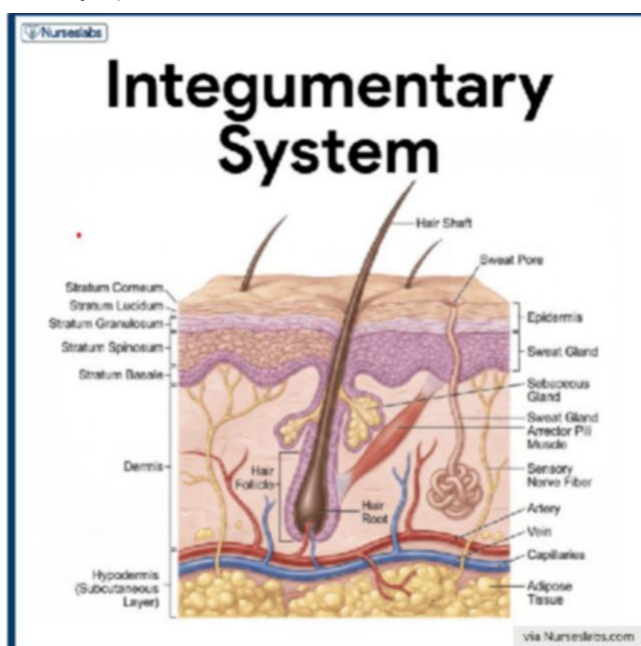


Figure 1 — Layers of the skin and associated structures. Source: Nurseslabs.

2. The Epidermis

The epidermis is the outermost, non-vascularized layer of the skin, acting as a protective barrier against the environment. It consists primarily of keratinocytes in five layers, which constantly regenerate, shedding old cells every 30 days. It also contains melanocytes (pigment) and Langerhans cells (immune protection).

Layers of the Epidermis (Deep to Superficial)

- **Stratum Basale** (Basal Layer): the deepest, single layer of cuboidal cells where keratinocytes are produced, along with melanocytes (pigment production) and Merkel cells (touch reception).
- **Stratum Spinosum** (Spinous Layer): several layers of keratinocytes connected by desmosomes, which provide structural strength and flexibility.
- **Stratum Granulosum** (Granular Layer): keratinocytes here fill with keratin and lipid granules, beginning the process of differentiation and flattening.
- **Stratum Lucidum** (Clear Layer): a thin, transparent layer of dead skin cells found only in the thick skin of the palms and soles.
- **Stratum Corneum** (Horny Layer): the outermost layer, composed of multiple layers of dead, flattened keratinocytes (corneocytes) that form a tough, waterproof barrier.

3. The Dermis & Hypodermis

Dermis

The thick, fibrous middle layer of skin situated between the epidermis and subcutaneous tissue, providing structural integrity, elasticity, and nourishment to the skin. It consists of two main connective tissue layers — the thin **papillary dermis** and thick **reticular dermis** — containing collagen, elastin, blood vessels, nerves, hair follicles, and glands.

Hypodermis (Subcutaneous Tissue)

The deepest layer of the skin, located beneath the dermis, primarily composed of adipose lobules (fat cells) and loose connective tissue. It connects the skin to muscles and bones, providing insulation, shock absorption, energy storage, and facilitating movement.

4. Nail Anatomy

Nail anatomy, or the nail unit, consists of the hard nail plate, the underlying nail bed, the nutrient-producing matrix, and surrounding protective skin structures like the cuticle and nail folds. The matrix creates new keratinized cells, pushing the nail plate forward. It protects the fingertips and acts as a tactile tool.

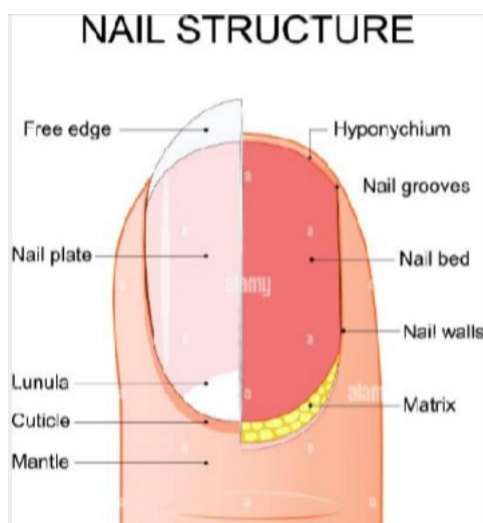


Figure 2 — Structure of the nail unit.

- **Nail Plate (Body):** the hard, translucent, and visible portion made of dead, keratinized epithelial cells.
- **Nail Matrix:** the “factory” at the root of the nail, mostly hidden under the skin, that creates new nail cells. Damage here can cause permanent deformity.
- **Lunula:** the white, half-moon-shaped base of the visible nail matrix.
- **Nail Bed:** the skin under the nail plate, which contains blood vessels that provide nutrients and give the nail its pink color.
- **Cuticle (Eponychium):** living skin at the base of the nail that produces a protective seal of dead skin cells (cuticle) on the nail plate.
- **Hyponychium:** the area of skin under the free edge of the nail, forming a seal to protect the nail bed.
- **Nail Folds (Lateral & Proximal):** skin folds that hold the nail in place and protect the sides and base of the nail.
- **Mantle:** the layer of skin that covers the nail root.

5. Skin Glands

Skin glands are specialized exocrine organs within the skin that secrete substances to protect and regulate the body. The main types include sebaceous glands (producing oil/sebum for lubrication) and sudoriferous glands (producing sweat for cooling, comprising eccrine and apocrine types). They are primarily found in the dermis layer.

Sebaceous Glands

Oil-producing glands often connected to hair follicles (pilosebaceous unit), creating oil for skin/hair. Found everywhere except the palms and soles, with high concentration on the face and scalp.

Eccrine Sweat Glands

Located all over the body, these glands open directly onto the skin surface and release watery sweat for temperature regulation. They are highly active during physical activity and heat.

Apocrine Sweat Glands

Restricted to areas like the axilla (armpits) and groin, these glands open into hair follicles and produce a thicker, nutrient-rich sweat that bacteria break down, causing odor.

6. Skin Disorders by Category

Inflammatory Skin Disorders

- Acne
 - Eczema
 - Psoriasis
- Rosacea
 - Contact Dermatitis

Infectious Skin Disorders

Bacterial

- Impetigo
- Cellulitis
- Folliculitis

Viral

- Herpes Simplex
- Warts
- Chickenpox

Fungal

- Ringworm
- Athlete's Foot
- Candidiasis

Parasitic

- Scabies
- Lice Infestation

Pigmentation Disorders

- Vitiligo
 - Melasma
- Albinism

Autoimmune & Chronic Conditions

- Lupus
- Scleroderma

Hair & Gland Disorders

- Alopecia Areata
- Hidradenitis Suppurativa

Skin Cancers & Growths

- Melanoma
 - Basal Cell Carcinoma
- Squamous Cell Carcinoma

Other Common Conditions

- Urticaria
 - Calluses
- Corn
 - Ulcers

7. Coding Terminology & Suffixes

Skin Suffixes

-derma / -dermis	Skin (e.g., <i>epidermis</i> , <i>dermatitis</i>)
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-itis	Inflammation (e.g., <i>dermatitis</i>)
-osis	Abnormal condition (e.g., <i>dermatosis</i>)
-oma	Tumor or growth (e.g., <i>melanoma</i>)
-pathy	Disease (e.g., <i>dermatopathy</i>)

Nail Suffixes

-onychia / -onychium	Related to nails
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Common Combined Medical Terms

Onychomycosis	<i>onycho</i> (nail) + <i>mycosis</i> (fungal infection)
Dermatology	<i>dermato</i> (skin) + <i>logy</i> (study)



The Skeletal System

A Foundational Guide for Medical Coders

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1. Overview of the Skeletal System

The skeletal system includes all of the bones and joints in the body. A total of **206** bones make up the adult human skeleton.

- The skeleton provides support and protection for the soft tissues that make up the rest of the body.
- The skeletal system also provides attachment points for muscles, allowing movement at the joints. Ligaments and tendons hold the bones together.
- New blood cells are produced by the red bone marrow inside the bones. The skeletal system is divided into the **Axial** and **Appendicular** skeleton.

Key fact: Bone marrow contains hemopoietic stem cells, the source of all new blood cells in the body.

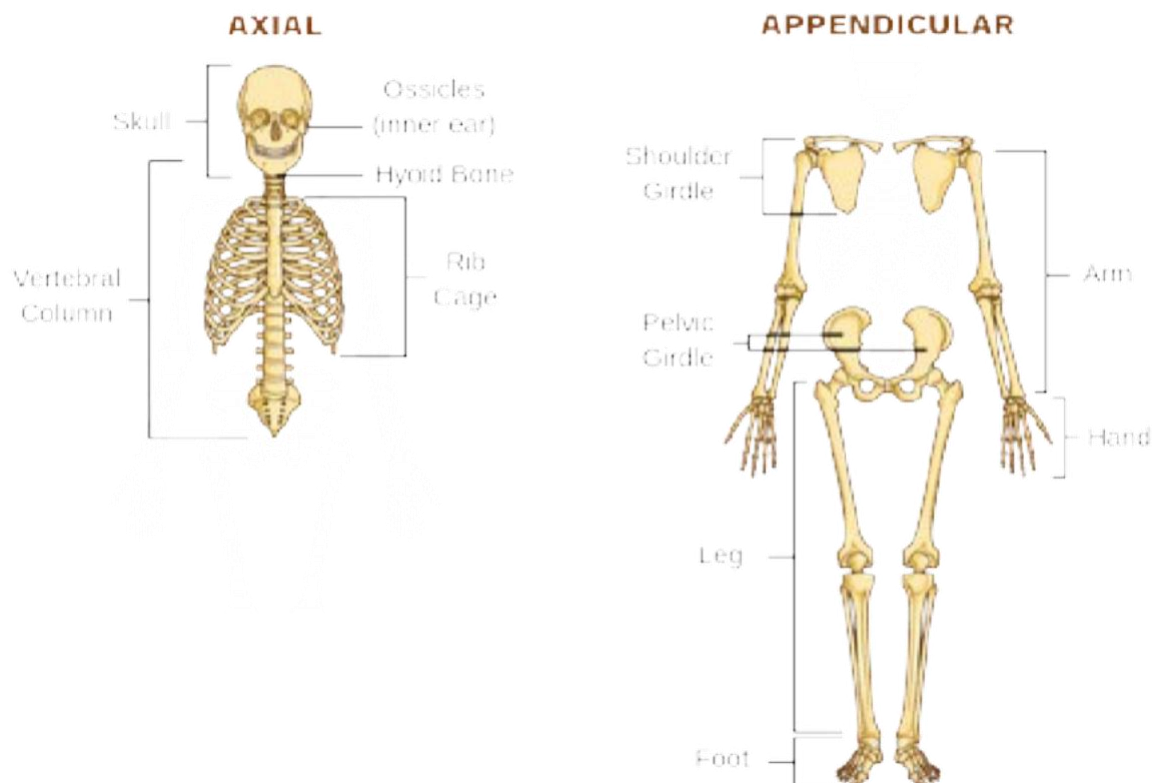


Figure 1 — The axial skeleton (skull, vertebral column, rib cage) and the appendicular skeleton (limbs and girdles).

The Axial Skeleton — 80 Bones

Skull Bones with Hyoid — 29 Bones

Group	Bones	Includes
Facial bones	14	Inferior nasal concha (2), Lacrimal bones (2), Zygomatic bones (2), Maxilla (2), Nasal bones (2), Palatine bones (2), Vomer, Mandible
Cranial bones	8	Ethmoid, Frontal, Occipital, Sphenoid, Parietal (2), Temporal (2)
Ossicles	6	Stapes (2), Malleus (2), Incus (2)
Hyoid	1	Hyoid bone

Rib Cage — 12 Pairs

- True ribs — 1st to 7th ribs
- False ribs — 8th to 10th ribs
- Floating ribs — 11th & 12th ribs

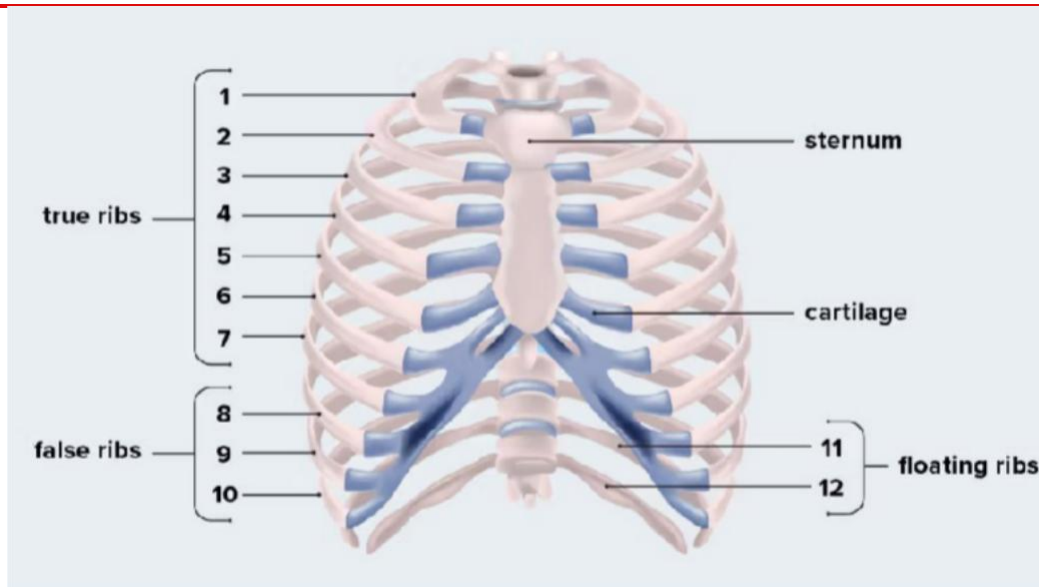


Figure 2 — The rib cage: true, false, and floating ribs, sternum, and costal cartilage.

Sternum — 1 Bone

A single flat bone at the center of the chest that anchors the rib cage.

Vertebral Column — 26 Bones

- Cervical spine — 7 bones
- Thoracic spine — 12 bones
- Lumbar spine — 5 bones
- Sacral spine — 5 bones, fused into a single bone
- Coccyx — 1 or 2 bones

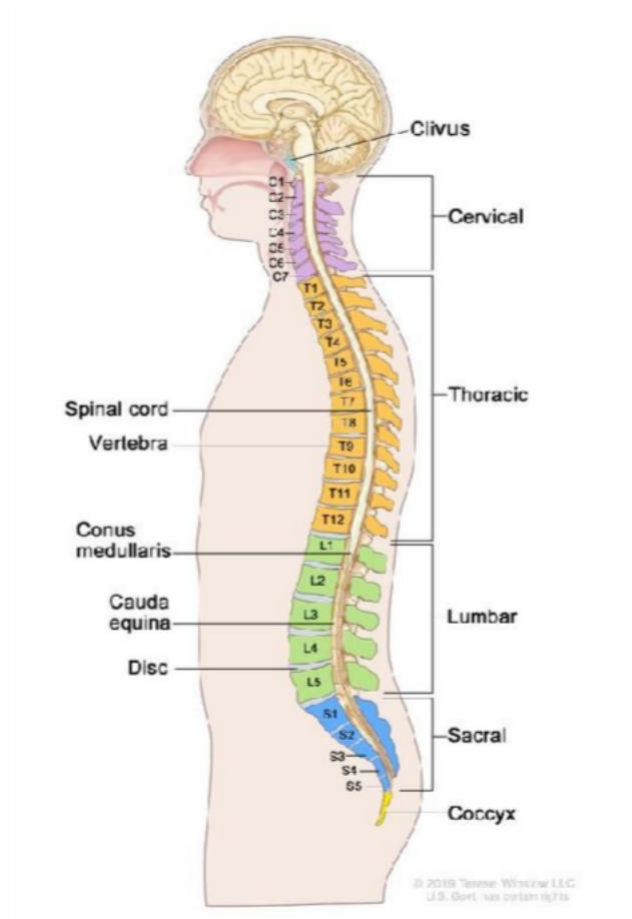


Figure 3 — The vertebral column: cervical, thoracic, lumbar, sacral, and coccygeal regions.

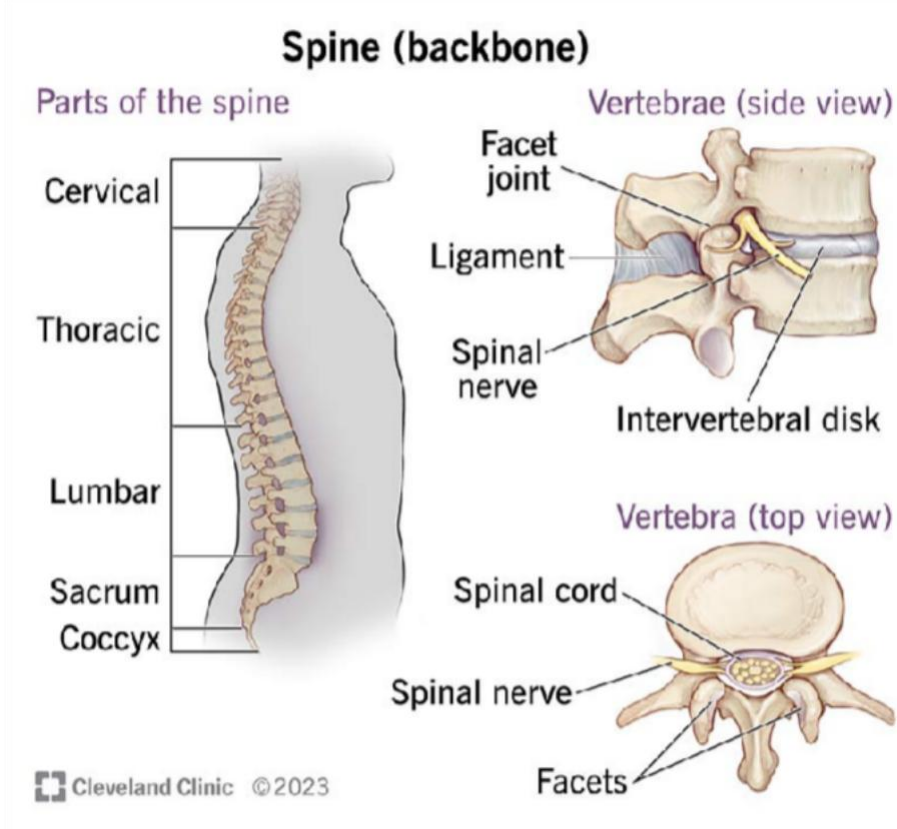


Figure 4 — Parts of the spine and vertebra anatomy, including the facet joint, spinal nerve, and intervertebral disk.

The Appendicular Skeleton — 126 Bones

Upper Extremity — 64 Bones (32 per side)

Group	Bones	Includes
Pectoral girdle	2	Clavicle, Scapula
Arm	1	Humerus
Forearm	2	Ulna, Radius
Carpals	8	Scaphoid, Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate
Metacarpals	5	Metacarpals 1–5
Phalanges	14	Finger bones

Lower Extremity — 62 Bones (31 per side)

Group	Bones	Includes
Pelvic girdle	1	Hip bone
Thigh	1	Femur
Knee cap	1	Patella
Leg	2	Tibia, Fibula
Tarsals	7	Talus, Calcaneum, Cuboid, Navicular, Medial/Lateral/Intermediate cuneiform
Metatarsals	5	Metatarsals 1–5
Phalanges	14	Toe bones

Types of Bones

There are five types of bones in the human body:

Long Bones	Femur, Humerus, Ulna, Radius, Tibia, and Fibula — even the metacarpals, metatarsals, and phalanges — are considered long bones. They have a shaft with a hard outer and spongy inner surface containing bone marrow, two ends with growth plates (epiphyses), and cartilage-covered ends.
Short Bones	Carpals & tarsals — generally provide support and stability.
Flat Bones	Scapula, sternum, skull bones, and ribs — generally protect vital organs.
Irregular Bones	Vertebrae, sacrum, and mandible.
Sesamoid Bones	Patella — usually short and irregular, embedded in a tendon.

Types of Joints (Articulation)

The meeting point, or junction, between two bones forms a **joint**. Joints are classified based on their structure and function.

Three major types of joints: Fibrous, Cartilaginous, and Synovial.

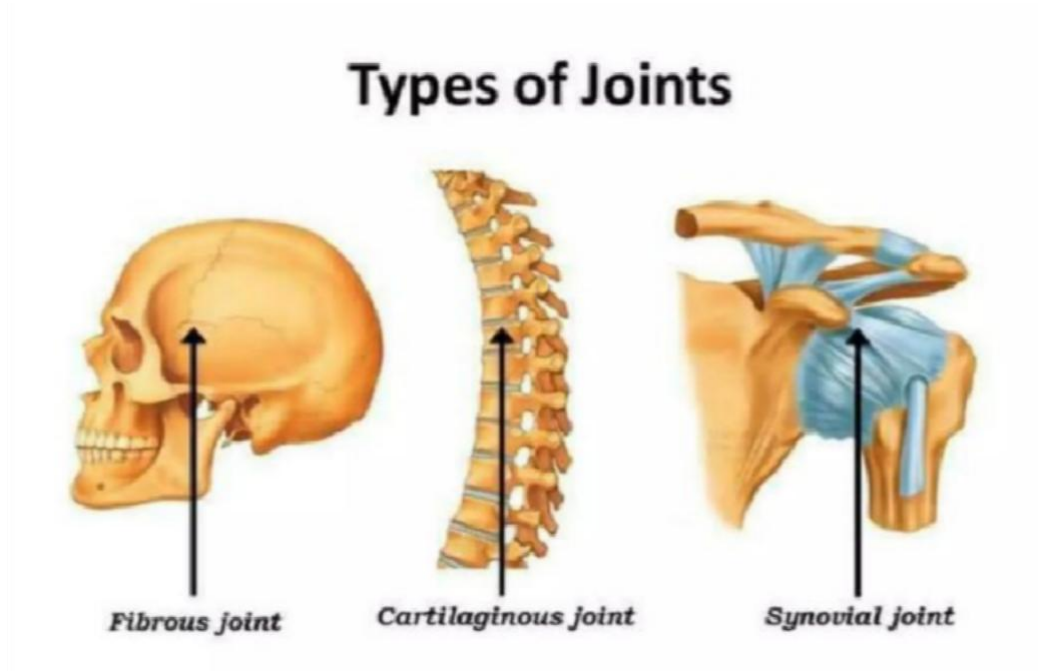


Figure 5 — Fibrous, cartilaginous, and synovial joints.

Fibrous Joints — Immovable Joints / Synarthrosis

Bones are held together by fibrous connective tissue. Fibrous joints are further classified into three types:

Sutures	Skull bones
Syndesmoses	Tibia and fibula, radius and ulna (slightly moveable)
Gomphoses	Tooth and maxilla or mandible

Cartilaginous Joints — Slightly Moveable Joints / Amphiarthrosis

The articulating ends of two bones are made up of cartilage, with no synovial cavity or synovial fluid. Cartilaginous joints are further classified into two types:

Synchondroses	First sternocostal joint (immovable)
Symphyses	Pubic symphysis

Synovial Joints — Movable Joints / Diarthrosis

The bones forming the joint are surrounded by an articular capsule, and the joint includes a synovial cavity with synovial fluid. Synovial joints are further classified into six types:

Ball and socket	Shoulder & hips (all-direction movements)
Condylloid	Radiocarpal wrist (flexion, extension, abduction, adduction)
Gliding / plane	Intercarpal & acromioclavicular (sliding movements)
Hinge	Elbow & knee (flexion and extension in one plane)
Pivot	Atlanto-axial, radioulnar (rotation movements)
Saddle	Carpometacarpal (flexion, extension, abduction, adduction)

Body Planes

Body planes are used to transect the human body in order to describe the location of structures and the direction of movements. There are three body planes:

- **Sagittal plane** — parallel to the sagittal suture; divides the body into left and right.
- **Coronal plane** (frontal plane) — divides the body into dorsal and ventral (back and front, or posterior and anterior) portions.
- **Transverse plane** (axial plane) — divides the body into cranial and caudal (head and tail) portions.

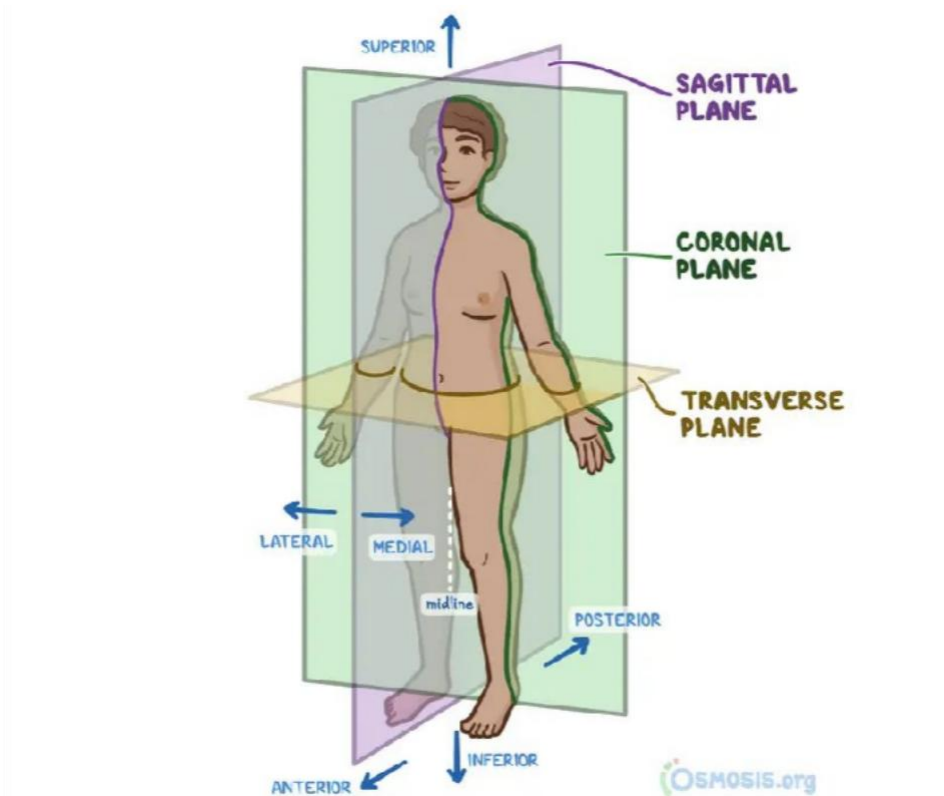


Figure 6 — The sagittal, coronal, and transverse body planes.

Common Conditions, Fractures & Arthritis

Common Conditions Related to the Skeletal System

Osteoporosis	The bones become weak and prone to fracture.
Osteopenia	Bone mineral density is lower than normal.
Osteomalacia	Softening of the bones, often caused by a vitamin D deficiency.
Paget's disease	Excessive breakdown and formation of bone, followed by disorganized bone remodeling.

Bone tumor	An abnormal (neoplastic) growth in the bone; may be benign or malignant.
Osteomyelitis	Inflammation of bone due to infection.
Scoliosis, kyphosis, lordosis	Deformity of the vertebral column.

Fracture Types

Fracture: A break in the bone. The two major classifications are open (compound) and closed (simple). Common fracture patterns include:

- Greenstick fracture
- Transverse fracture
- Oblique fracture
- Spiral fracture
- Comminuted fracture
- Impacted fracture
- Avulsion fracture

Arthritis

Arthritis: Inflammation of one or more joints, causing pain and stiffness in the affected area. There are two major classifications:

Osteoarthritis — a chronic degenerative joint disease involving the breakdown of cartilage and underlying bone.

Rheumatoid arthritis — also a chronic disease; an autoimmune disease characterized by inflammation of the lining of the joints.

Medical Terms — Word Roots

Body Part	Root
Head	Cephalo / Cranio
Neck	Cervico
Chest	Thoraco / Pectoral
Hand	Chiro
Joint	Arthro
Wrist	Carpo
Finger / toe	Dactylo
Rib	Costo
Bone	Osteo
Foot	Podo
Big toe	Hallux
Vertebra	Spondylo
Ankle	Tarso
Arm	Brachi
Cartilage	Chondro
Spinal cord	Myel/o
Straight	Orth/o

Medical Abbreviations

Abbreviation	Meaning
ACL	Anterior cruciate ligament
AKA	Above the knee amputation
DJD	Degenerative joint disease
Fx / #	Fracture
IPJ	Interphalangeal joint
LCL	Lateral collateral ligament
MCL	Medial collateral ligament
ORIF	Open reduction and internal fixation
PCL	Posterior cruciate ligament
PET	Positron emission tomography
PIP	Proximal interphalangeal (joint)
RA	Rheumatoid arthritis
RCL	Radial collateral ligament
TMJ	Temporomandibular joint
UCL	Ulnar collateral ligament

For medical coders: Recognizing skull, axial, and appendicular bone groupings — along with fracture and joint terminology — is a key step in narrowing down the correct ICD / CPT code family for musculoskeletal diagnoses and procedures.



The Muscular System

Muscle Types, Regional Anatomy & Clinical Terms for Medical Coders

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Overview of the Muscular System

There are more than 600 muscles in the human body. The muscular system helps maintain posture, strength, balance, and movement of the body at the joints.

Muscle Type	Description
Cardiac Muscles	Muscles found in the heart; involuntary.
Smooth Muscles	Responsible for the contraction of hollow organs, such as blood vessels, the gastrointestinal tract, the bladder, or the uterus.
Skeletal Muscles	Attached to bones by tendons and produce all the movements of body parts in relation to each other; under voluntary control.

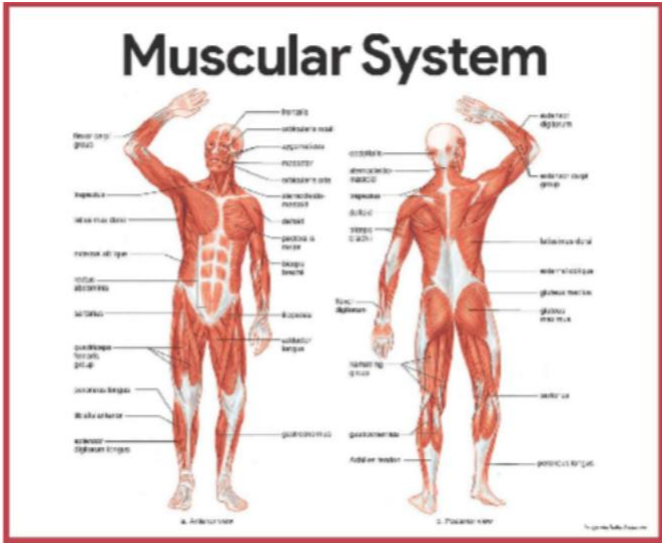


Figure 1 — Anterior and posterior views of the major skeletal muscles.

Major Muscle Groups by Region

Chest

Pectoralis major, external and internal intercostal muscles, diaphragm (major muscle for respiration).

Abdomen

Transversus abdominis, rectus abdominis, oblique (external and internal).

Back

Trapezius, latissimus dorsi, erector spinae.

Upper Extremity — Shoulder

Deltoid; rotator cuff (supraspinatus, infraspinatus, teres minor, subscapularis).

Upper Extremity — Arm

Anterior compartment: biceps, brachialis. Posterior compartment: triceps.

Lower Extremity — Thigh

Anterior compartment: quadriceps. Posterior compartment: hamstring.

Lower Extremity — Leg

Anterior compartment: tibialis anterior, extensor digitorum, extensor hallucis longus. Posterior compartment: gastrocnemius, soleus.

Common Diseases of the Muscular System

1. **Myasthenia gravis** — a chronic autoimmune neuromuscular disease characterized by varying degrees of weakness of the skeletal (voluntary) muscles of the body.
2. **Duchenne muscular dystrophy** — caused by an absence of dystrophin, a protein that helps keep muscle cells intact.
3. **Rotator cuff tear** — a tear of one or more of the tendons of the four rotator cuff muscles of the shoulder.
4. **Talipes** — clubfoot; the front half of the foot turns inwards and downwards.
5. **Tendonitis** — an inflammation or irritation of a tendon.
6. **Rhabdomyolysis** — a condition in which damaged skeletal muscle breaks down rapidly.
7. **Myotonia** — an inability to relax the voluntary muscle after vigorous effort.
8. **Muscle strain** — an injury to a muscle in which the muscle fibres tear as a result of overstretching.
9. **Muscle cramp** — a strong, painful contraction or tightening of a muscle that comes on suddenly and lasts from a few seconds to several minutes.

Medical Terms

Term	Word Root
Muscle	My/o
Diaphragm	Phreni
Tendon	Ten/o
Movement	Kinesi/o

Medical Abbreviations

Abbreviation	Meaning
AROM	Active range of motion
DTR	Deep tendon reflex
EMG	Electromyogram
PROM	Passive range of motion; premature rupture of membranes
ROM	Range of motion
SLR	Straight leg raising



The Circulatory System

Heart Anatomy, Circulation Pathways & Clinical Terms for Medical Coders

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Overview of the Circulatory System

The circulatory system is one of the important organ systems in the human body, consisting of the heart and great vessels that circulate blood and transport nutrients, oxygen, carbon dioxide, and hormones to various cells in the body. It consists of:

Component	Description
Heart	The muscular pump that drives blood through the body.
Blood Vessels	Arteries, veins, and capillaries that carry blood to and from tissues.
Blood	Consists of plasma, red blood cells, white blood cells, and platelets.

Heart Structure & Function

The heart is a muscular organ located in the chest at the mediastinum, between the lungs, behind the sternum, and above the diaphragm muscle. It pumps oxygenated blood to the various parts of the body and deoxygenated blood to the lungs.

The heart wall has three layers — outer epicardium, middle myocardium, and inner endocardium. The heart is enclosed by a sac called the pericardium, a double-walled sac covering the heart and greater vessels, containing pericardial fluid.

Four Chambers

Right and left atrium; right and left ventricle.

Four Valves

Aortic valve — between left ventricle and aorta.

Pulmonary valve — between the right ventricle and pulmonary artery.

Bicuspid (mitral) valve — between left atrium and left ventricle.

Tricuspid valve — between right atrium and right ventricle.

The heart valves are attached to the ventricular walls via the chordae tendineae; they are attached to the papillary muscles so that the cusps are held in position.

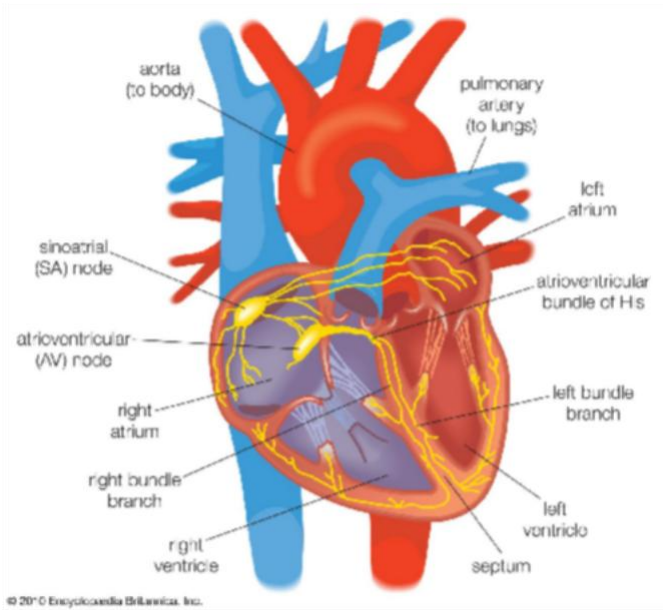


Figure 1 — Heart chambers, great vessels, and the electrical conduction pathway.

Pulmonary & Systemic Circulation

Pulmonary Circulation

The circulation of blood between the heart and lungs for purification of blood. Oxygen-poor blood from the superior and inferior vena cava enters the right atrium of the heart and flows through the tricuspid valve into the right ventricle; from there, blood is pumped to the lungs through the pulmonary artery.

Gas exchange happens in the lungs at the alveoli. Carbon dioxide moves from blood capillaries to the lungs, and oxygen moves from the lungs to blood capillaries. Four pulmonary veins return the oxygen-rich blood to the left atrium of the heart.

Systemic Circulation

The circulation of blood to all parts of the body from the heart. Systemic circulation is the portion of the cardiovascular system that transports oxygenated blood away from the heart through the aorta from the left ventricle.

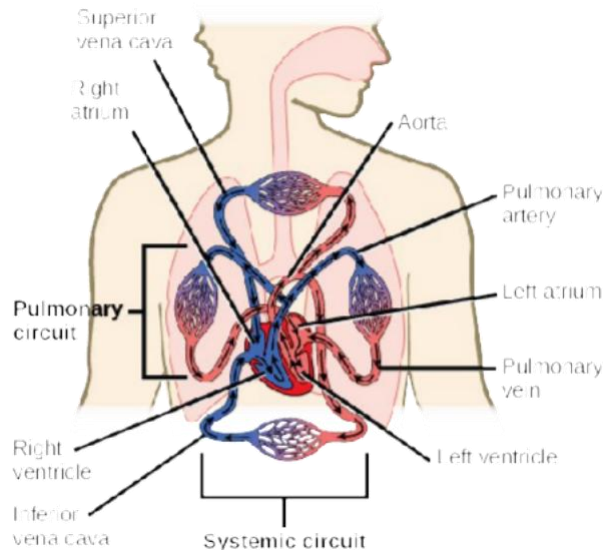


Figure 2 — Pulmonary circuit and systemic circuit.

Coronary Circulation

Supplies blood to heart muscles by the right and left coronary arteries. The vessels that remove deoxygenated blood from the heart muscle are known as cardiac veins.

Right coronary artery (RCA): AV node artery, right marginal artery, posterior descending artery, postero-lateral artery.

Left coronary artery / left main coronary artery (LMCA): left circumflex artery (LCX), obtuse marginal artery, left anterior descending artery (LAD), diagonal artery.

Major Vessels

The aorta is the largest artery in the human body, arising from the left ventricle of the heart. The aorta distributes oxygenated blood to all parts of the body through the systemic circulation.

The venae cavae are large veins that return deoxygenated blood from the body into the heart. The superior vena cava and the inferior vena cava both empty into the right atrium.

Arteries carry oxygen-rich blood away from the heart. Arteries branch into small passages called arterioles and then into the capillaries.

Capillaries are the smallest and thinnest of the blood vessels in the body. Capillaries carry blood very close to the cells of the tissues of the body in order to exchange gases, nutrients, and waste products.

Veins carry oxygen-poor blood back to the heart. Capillaries merge into venules, then veins, then vena cava.

The arteries possess stronger and thicker walls than the veins. Both have three layers: tunica intima, tunica media, and tunica externa.

Electrical Conduction System of the Heart

The heart has the ability to create its own electrical impulses for continuous, involuntary functioning. Impulses travel in the following order:

1. The sino-atrial (SA) node
2. The atrioventricular (AV) node

3. The bundle of His
4. The left and right bundle branches
5. The Purkinje fibres

Blood Composition & Pressure

The human body contains about 4 to 5 litres of blood, made up of red blood cells, white blood cells, platelets, and plasma.

Red Blood Cells (Erythrocytes)

- Transport oxygen in the blood through the red pigment hemoglobin.

White Blood Cells (Leukocytes)

- Important functions in the body's immune system.
- Neutrophils, eosinophils, basophils, lymphocytes, and monocytes.

Platelets (Thrombocytes)

- Responsible for the clotting of blood.
- Normally remain inactive in the blood until they reach damaged tissue or leak out of the blood vessels through a wound.

Plasma

- The liquid portion of the blood that makes up about 55% of the blood's volume.
- Around 90% of plasma is made of water.

Blood Pressure

Refers to the pressure in large arteries of the systemic circulation.

- Systolic — ventricles contract.
- Diastolic — ventricles relax.

Measure	Normal Value
Normal BP	120 / 80 mmHg
Pulse Rate	72 beats per minute
RBC	4 to 6 million cells per microliter of blood
WBC	4,000 to 11,000 per microliter of blood
Platelet	150,000 to 450,000 cells per microliter of blood

Common Diseases of the Circulatory System

1. **Aortic aneurysm** — a bulge in a section of the aorta.
2. **Coronary artery disease (CAD)** — a disease in which a waxy substance called plaque builds up inside the coronary arteries.
3. **Deep vein thrombosis** — a blood clot in a deep vein, usually in the legs.
4. **Rheumatic heart disease** — permanent damage to heart valves caused by rheumatic fever.
5. **Atherosclerosis** — a disease of the arterial vessels, in which the walls of the blood vessels become thickened and hardened by plaques.
6. **Hypertension** — a condition in which the arteries have persistently elevated blood pressure.
7. **Hypercholesterolemia** — the presence of high levels of cholesterol in the blood.
8. **Myocardial infarction** — the irreversible death (necrosis) of heart muscle secondary to prolonged lack of blood (oxygen) supply.

7 Medical Terms

Term	Word Root
Heart	Cardio
Vessels	Angio / Vasculo / Vaso
Artery	Arterio
Veins	Phlebo
Blood	Hemato
RBC	Erythrocytes
WBC	Leukocytes
Platelet	Thrombocytes

Medical Abbreviations

Abbreviation	Meaning
ABI	Ankle-brachial index
ABG	Arterial blood gas
ASHD	Arteriosclerotic heart disease
BP	Blood pressure
CABG	Coronary artery bypass graft
CAD	Coronary artery disease
CHF	Congestive heart failure
CPR	Cardiopulmonary resuscitation
CVP	Central venous pressure
DVT	Deep vein thrombosis
ECG	Electrocardiogram
ESR	Erythrocyte sedimentation rate
FHT	Fetal heart tones
HB	Hemoglobin
HDL	High-density lipoprotein
HTN	Hypertension
ICA	Internal carotid artery
LAD	Left anterior descending
LCA	Left coronary artery
LDL	Low-density lipoprotein
LVH	Left ventricular hypertrophy
MI	Mitral insufficiency; myocardial infarction
PICC	Peripherally inserted central catheter
PTCA	Percutaneous transluminal coronary angioplasty

Abbreviation	Meaning
RVH	Right ventricular hypertrophy
SVT	Supraventricular tachycardia
WBC	White blood cell



The Digestive System

GI Tract Anatomy, Accessory Organs & Clinical Terms for Medical Coders

CODING DECODED

Overview of the Digestive System

The digestive system is a group of organs that convert food into energy to supply the entire body and eliminates waste material. The digestive system begins at the mouth / oral cavity, and continues through the pharynx, esophagus, stomach, small intestine, large intestine, rectum, and ends at the anus.

A few accessory organs assist in digestion: teeth, tongue, salivary glands, liver, gallbladder, and pancreas.

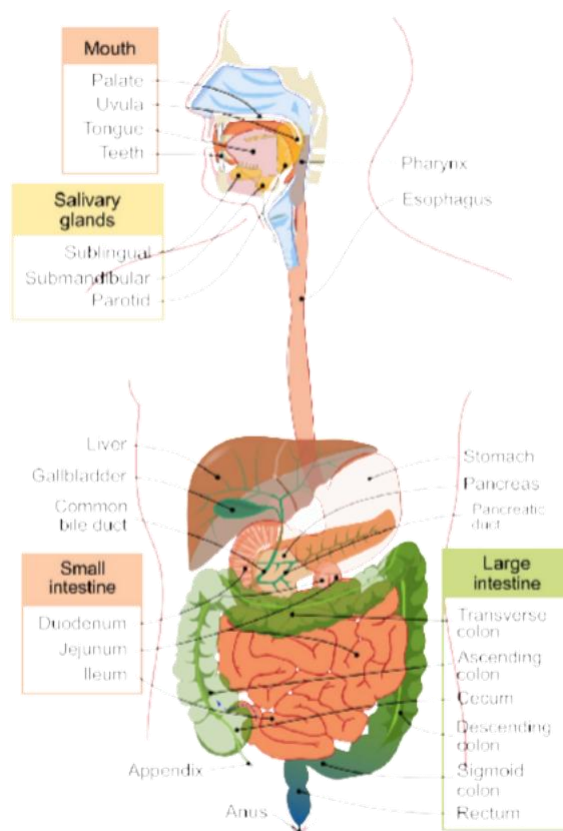


Figure 1 — The gastrointestinal tract and accessory digestive organs.

Anatomy of the GI Tract

The GI (gastrointestinal) tract starts from the mouth. Inside the mouth are several accessory organs that assist in the digestion of food.

Mouth

The tongue, the teeth, and the salivary glands (parotid, sub-lingual, and sub-mandibular glands).

Teeth chop food into small pieces, then it is moistened by saliva, and the tongue pushes the food into the pharynx.

Pharynx

A funnel-shaped tube connected to the posterior end of the mouth. It moves the chewed food from the mouth to the esophagus. The pharynx also plays a role in the respiratory system, as air from the nasal cavity passes through the pharynx on its way to the larynx and to the lungs. The pharynx contains a flap of tissue known as the epiglottis that acts as a switch to route food to the esophagus and air to the larynx.

Esophagus

A muscular tube connecting the pharynx to the stomach. The cardiac sphincter is present at the junction between the esophagus and stomach.

Stomach

A muscular sac located on the left side of the abdominal cavity, just inferior to the diaphragm. It acts as a storage place for food so that it digests large meals properly. The stomach contains HCL (hydrochloric acid) and digestive enzymes that aid in

breaking down large substances into smaller substances. The digested material then passes to the small intestine via the pyloric sphincter.

Small Intestine

Located just inferior to the stomach, the small intestine takes up most of the space in the abdominal cavity. The entire small intestine is coiled like a hose, and the inside surface is full of many ridges and folds. These folds maximize the digestion of food and absorption of nutrients. By the time food leaves the small intestine, around 90% of all nutrients have been extracted from it.

Divided into: duodenum, jejunum, and ileum.

Large Intestine

From the small intestine, digested food passes to the large intestine via the ileocecal valve. The large intestine is a long, thick tube located just inferior to the stomach and wraps around the superior and lateral border of the small intestine. It absorbs water and contains many symbiotic bacteria that aid in the breaking down of wastes to extract some small amounts of nutrients. Faeces in the large intestine exit the body through the anal canal.

Divided into: cecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectum, and anus.

Accessory Digestive Organs

Accessory digestive organs found in the abdominal region are the liver, gallbladder, and pancreas.

Liver

Located in the right upper quadrant of the abdomen, to the right side of the stomach, just inferior to the diaphragm and superior to the small intestine. The liver is the largest internal organ in the body. It has many different functions, but its main function in digestion is the production of bile and its secretion into the small intestine (duodenum).

Gallbladder

A small, pear-shaped organ located just inferior to the liver. It is used to store and recycle excess bile from the small intestine so that it can be reused for the digestion of subsequent meals.

Pancreas

A large gland located just inferior and posterior to the stomach. The pancreas secretes digestive enzymes into the small intestine to complete the chemical digestion of foods. The endocrine function of the pancreas is insulin production.

Functions of the Digestive System

1. Ingestion
2. Secretion
3. Mixing and movement
4. Digestion
5. Absorption
6. Excretion

Common Diseases of the Digestive System

1. **GERD** — stomach acid flows backwards, causing discomfort.
2. **Crohn's disease** — inflammation that affects the lining of the digestive tract.
3. **Irritable bowel syndrome** — a problem that affects the large intestine.
4. **Diverticulosis** — small, bulging pouches develop in the digestive tract.
5. **Colitis** — inflammation of the inner lining of the colon.
6. **Colon polyp** — a small clump of cells that forms on the lining of the colon.

Common Signs & Symptoms

1. Abdominal pain

- 2. Blood in the stool
- 3. Bloating
- 4. Constipation
- 5. Diarrhea
- 6. Heartburn
- 7. Incontinence
- 8. Nausea and vomiting

Medical Terms

Term	Word Root
Mouth	Oral / Stomato
Lip	Labio / Cheilo
Tooth	Dento / Odonto
Tongue	Glosso / Linguo
Uvula	Uvulo
Salivary Gland	Sialo
Gums	Gingivo
Pharynx	Pharyngo
Esophagus	Esophago
Stomach	Gastro
Duodenum	Duodeno
Jejunum	Jejuno
Ilium	Ilio
Liver	Hepato
Gallbladder	Cholecysto
Common Bile Duct	Choledocho
Bile	Chol
Small Intestine	Entero
Colon	Colo
Cecum	Ceco
Sigmoid Colon	Sigmoido
Rectum	Procto / Recto
Anus	Ano

Medical Abbreviations

Abbreviation	Meaning
CT	Computed tomography
ERCP	Endoscopic retrograde cholangiopancreatography

Abbreviation	Meaning
GERD	Gastroesophageal reflux disease
GI	Gastrointestinal
HCL	Hydrochloric acid
IBS	Irritable bowel syndrome
IBD	Inflammatory bowel disease
LFT	Liver function test
LLQ	Left lower quadrant
LUQ	Left upper quadrant
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
RLQ	Right lower quadrant
RUQ	Right upper quadrant



The Respiratory System

Airway Anatomy, Breathing Mechanics & Clinical Terms for Medical Coders

CODING DECODED

Overview of the Respiratory System

The respiratory system is one of the vital systems in the human body. It plays a major role in providing adequate oxygen to all parts of the body and removing waste like carbon dioxide during the process of inhalation and exhalation.

A respiratory system is a group of organs — airway, lungs, pulmonary vessels, and respiratory muscles — which are responsible for taking in oxygen and sending out carbon dioxide. Oxygen is essential for the proper function of every tissue within the human body.

The respiratory system is divided into two main parts: the upper and lower respiratory tract.

Division	Structures
Upper Respiratory Tract	Nose, pharynx, larynx.
Lower Respiratory Tract	Trachea, lungs (bronchial tree & alveoli).

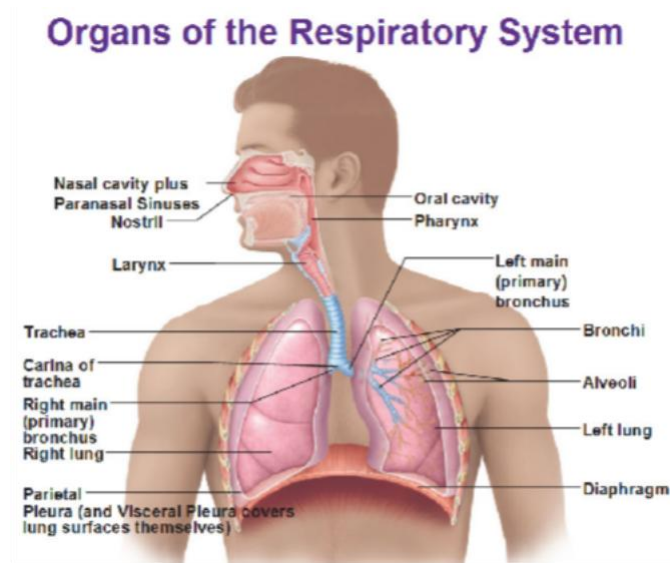


Figure 1 — Organs of the respiratory system.

Anatomy of the Airway

Nose & Sinuses

Air enters the nose or mouth and passes the sinuses (hollow spaces in the skull). The sinuses — frontal, ethmoid, maxillary, and sphenoid — help regulate the temperature and humidity of the air.

Pharynx

Air then moves into the pharynx. Both food and air pass through the pharynx before reaching their appropriate destinations — food to the esophagus, and air to the larynx.

Larynx & Epiglottis

Air then passes into the larynx, which is essential for speech. It contains two folds called vocal cords; the opening between the vocal cords is the glottis. As air leaves the lungs, the vocal cords vibrate and produce sound. Air then passes into the trachea.

The epiglottis is like a lid over the opening of the larynx, attached to the root of the tongue, which closes the larynx while food is passing.

Trachea

The trachea (windpipe) filters the air that is inhaled. It branches into the right and left bronchi, which are two tubes that carry air into each lung.

Bronchial Tubes & Bronchioles

The bronchial tubes lead to the lobes of the lungs. The right lung has three lobes, whereas the left lung has only two lobes. The smallest branches are called bronchioles.

Bronchial tubes are lined with tiny hairs called cilia, which move back and forth, carrying mucus up and out.

Mucus is a sticky fluid that collects dust, germs, and other matter that has invaded the lungs — usually expelled when we sneeze, cough, or spit.

The Lungs

The lungs are a spongy organ present in the thoracic cavity. The left lung is smaller than the right lung due to the presence of the heart more towards the left.

Alveoli & Gas Exchange

The lobes are filled with small, spongy sacs called alveoli, where the gas exchange of oxygen and carbon dioxide occurs. The alveolar walls are very thin, composed of a single layer of tissue called epithelial cells and tiny blood vessels called pulmonary capillaries. Blood passes through the capillaries.

Pleura

The pleura is the outer covering of the lungs; the pleural fluid present within acts as a lubricant. It consists of two layers.

Visceral pleura — attached to the surface of the lung; the inner layer, closer to the lungs.

Parietal pleura — attached to the chest wall; the outer layer, closer to the ribs.

Pulmonary Circulation

The pulmonary artery carries deoxygenated blood, containing more carbon dioxide and less oxygen, to the lungs, where carbon dioxide moves from the blood to the alveoli and oxygen moves from the alveoli to the blood. The oxygenated blood then goes to the heart through the four pulmonary veins, and the heart pumps it throughout the body.

The Diaphragm & Mechanics of Breathing

The diaphragm is a dome-shaped muscle at the bottom of the lungs that controls breathing and separates the chest cavity from the abdominal cavity.

Contracts — moves downward, enlarging the thoracic cavity and decreasing internal air pressure, so air flows into the lungs to equalize the pressure.

Relaxes — when the lungs are full, the diaphragm relaxes and elevates, making the thoracic cavity smaller and increasing chest pressure, so air is expelled to equalize pressure.

Inhalation

Air is taken in through the nose or mouth. Inhalation is initiated by the diaphragm and supported by the external intercostal muscles. When the diaphragm contracts, the rib cage expands and the contents of the abdomen move downward, resulting in a larger thoracic volume and negative pressure inside the thorax. As pressure in the chest falls, air moves into the lungs. While taking a deep breath, the external intercostal muscles and accessory muscles assist in further expanding the thoracic cavity.

Exhalation

Exhalation is a passive process — air is moved or exhaled out. Active or forced exhalation is achieved by the abdominal and internal intercostal muscles. The lungs have a natural elasticity and recoil from the stretch of inhalation; air flows back out until the pressures in the chest and atmosphere reach equilibrium. During forced exhalation, expiratory muscles, including the abdominal and internal intercostal muscles, generate abdominal and thoracic pressure, which forces air out of the lungs.

Average Breathing Rate

The average rate of breathing depends upon age.

Age Group	Normal Respiratory Rate
Adults	Normal respiratory rate is 12 to 16 breaths per minute (may reach 45 breaths per minute during strenuous exercise).
Newborn	Normal respiratory rate is about 40 breaths per minute (may slow to 20 breaths per minute when sleeping).

5. Common Diseases of the Respiratory System

1. Asthma
2. Bronchitis
3. Pneumonia
4. COPD (chronic obstructive pulmonary disease)
5. Emphysema
6. Tuberculosis
7. Pulmonary edema
8. Pulmonary embolism
9. Pulmonary hypertension
10. Fibrosis
11. Sarcoidosis
12. Pleural effusion
13. Asbestosis

Common Signs & Symptoms

1. Shortness of breath
2. Apnea
3. Dyspnea
4. Hypoxia
5. Anoxia
6. Bradypnea
7. Tachypnea

Medical Terms

Term	Word Root
Nose	Rhino / Naso
Sinus	Sino
Larynx	Laryngo
Pharynx	Pharyngo
Trachea	Tracheo
Bronchus	Broncho
Bronchiole	Bronchiolo
Lung	Pneumono / Pulmono
Breath	Pnea
Chest	Pectr/o, Thorac/o
Diaphragm	Phreno
Carbon Dioxide	Capn/o
Voice	Phon/o

Medical Abbreviations

Abbreviation	Meaning
ARDS	Adult or acute respiratory distress syndrome
COPD	Chronic obstructive pulmonary disease
DOE	Dyspnea on exertion
OSA	Obstructive sleep apnea
PAT	Paroxysmal atrial tachycardia
PFT	Pulmonary function test
RDS	Respiratory distress syndrome
SOB	Shortness of breath
URI	Upper respiratory infection
TB	Tuberculosis



The Urinary System

Kidney Anatomy, Excretory Pathways & Clinical Terms for Medical Coders

CODING DECODED

Overview of the Urinary System

The excretory system is a group of organs that performs the function of excretion of metabolic waste from the body. The lungs, skin, large intestine, and urinary system are different excretory systems.

The urinary system maintains the state of homeostasis by regulating water and solutes in the human body.

The urinary system consists of the kidneys, the ureters, the bladder, and the urethra.

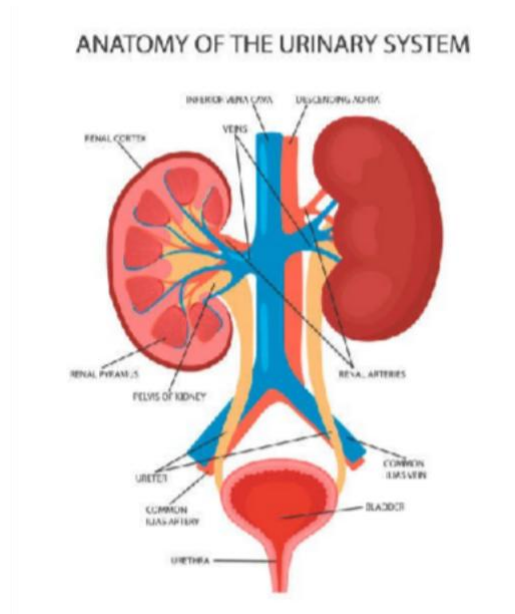


Figure 1 — Anatomy of the urinary system.

The Kidneys

The kidneys are a pair of organs located in the retroperitoneum, on the posterior wall of the abdomen. Their main function is to filter the blood. They create urine — composed of components like urea, water, ions, and toxic wastes — as the end product, which drains down to the bladder by a tube-like structure called the ureters.

Kidney Structure

The cortex is the outer region and the medulla is the inner area of the kidney. Renal pyramids are triangular structures found within the medulla.

The minor calyces are funnel-shaped structures that surround the tip of each pyramid. The minor calyx integrates to constitute the major calyx. The renal pelvis is the large collecting funnel that is formed by a bunch of major calyx.

Nephrons

The functional unit of the kidney, nephrons produce urine in the process of removing waste and excess substances from the blood. There are about 1 million units in each kidney.

Glomeruli — a cluster/ball of capillaries; the filtering membrane forms Bowman's capsule.

Renal tubules — proximal convoluted tubule (PCT); descending and ascending loop of Henle; distal convoluted tubule (DCT); collecting tubule.

Ureters, Bladder & Urethra

Ureters

Carry urine from the renal pelvis to the bladder. Two tubes, about 15–18 inches long and ½ inch in diameter. The ureteral orifice, at the bladder, prevents reflux of urine into the ureters and the renal pelvis.

Bladder

A muscle sac in the pelvis, just behind the pubic bone, that receives and stores urine — approximately 250 ml — until excreted from the body through the urethra. This process is called voiding or micturition (emptying the bladder).

The bladder has an internal sphincter (involuntary) and an external sphincter (voluntary, by training). It has an apex (trigone top) and a neck (lower part, supported by ligaments).

Urethra

A tube that connects the bladder to the genitals for the expulsion of urine, semen, etc. out of the body.

Female: about 1 to 1½ inches long; the urinary meatus is located between the clitoris and the vagina.

Male: about 8 inches long, passing from the bladder through the prostate gland and the penis to the meatus located at the end of the penis, carrying both urine and semen.

Common Diseases of the Excretory System

- 1. Pyelonephritis** — inflammation of the kidney due to a bacterial infection.
- 2. Glomerulonephritis** — inflammation of the glomeruli, structures in the kidneys made up of tiny blood vessels.
- 3. Nephrolithiasis** — kidney stones — small deposits, made of calcium, phosphate, and other components of foods, that build up in the kidneys. Formation may result when urine becomes overly concentrated.
- 4. Acute renal failure** — a condition in which the kidneys suddenly can't filter waste from the blood, developing within 7 days.
- 5. Chronic renal failure** — a progressive loss in kidney function over a period of months or years.
- 6. End-stage renal disease** — the final stage of chronic kidney disease, in which the kidneys no longer function well enough to meet the needs of daily life.
- 7. Diabetic nephropathy** — damage to the kidneys caused by diabetes.
- 8. Hypertensive nephropathy** — a kidney disease that occurs as a result of high blood pressure.
- 9. Renal cyst** — sacs of fluid that form in the kidneys.
- 10. Urinary tract infection** — an infection in any part of the urinary system — the kidneys, bladder, or urethra.
- 11. Cystitis** — inflammation of the bladder, usually caused by a bladder infection.
- 12. Bladder cancer** — an abnormal growth of cells in the bladder.

Common Signs & Symptoms

- 1.** Anuria
- 2.** Dysuria
- 3.** Oliguria
- 4.** Nocturia
- 5.** Hematuria

Medical Terminology

Term	Word Root
Kidney	Nephro / Reno
Bladder	Cysto / Vesico
Renal Pelvis	Pyel/o

Medical Abbreviations

Abbreviation	Meaning
ARF	Acute renal failure
ESRD	End-stage renal disease

Abbreviation	Meaning
ESWL	Extracorporeal shockwave lithotripsy
GFR	Glomerular filtration rate
GU	Genitourinary
KUB	Kidneys, ureters, bladder
UA	Urinalysis
UPJ	Ureteropelvic junction
UTI	Urinary tract infection



The Endocrine System

A Foundational Guide for Medical Coders

CODING DECODED

1. Overview of the Endocrine System

The **endocrine system** is the group of glands that secrete hormones. It regulates tissue function, body metabolism, growth and development, sexual function, reproduction, sleep, and mood.

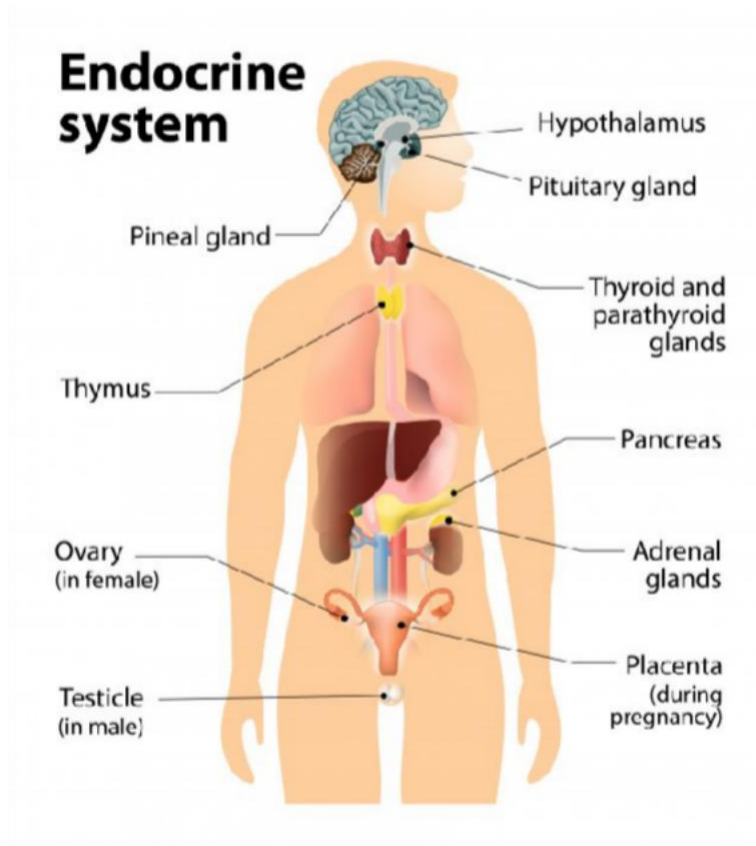


Figure 1 — The major glands of the endocrine system.

The Endocrine Glands Are

- Hypothalamus
- Pineal gland
- Pituitary gland
- Thyroid gland
- Parathyroid gland
- Adrenal gland
- Pancreas
- Ovaries / Testes

Endocrine vs. Exocrine Glands

Endocrine glands secrete their hormones directly into the bloodstream.

Exocrine glands produce and secrete substances onto an epithelial surface by way of a duct — for example, sweat glands, salivary glands, and the mammary and lacrimal glands.

Hypothalamus & Pineal Gland

Hypothalamus

A small portion of the brain just below the thalamus. It is the neural control center for all endocrine systems. Its hormones are:

- Thyrotropin-releasing hormone (TRH)
- Dopamine
- Growth hormone-releasing hormone

- Growth hormone-inhibiting hormone
- Gonadotropin-releasing hormone
- Corticotropin-releasing hormone
- Vasopressin

Pineal Gland (Pineal Body)

A small gland located at the center of the brain. It produces melatonin, which regulates sleep and also acts as an antioxidant.

Pituitary Gland

A small gland located at the base of the brain. Hormones released by the pituitary gland are:

- Thyroid-stimulating hormone
- Adrenocorticotrophic hormone
- Gonadotropin (follicle-stimulating hormone & luteinizing hormone)
- Growth hormone
- Prolactin — stimulates milk synthesis
- Melanocyte-stimulating hormone — stimulates melanin synthesis
- Oxytocin — uterine contraction during delivery
- Vasopressin

Thyroid, Parathyroid, Pancreas & Adrenal Glands

Thyroid Gland	Located in the neck just below the Adam's apple. Secretes thyroid hormone (T3 and T4).
Parathyroid Glands	Four small glands located in the neck just behind the thyroid gland. Secrete parathyroid hormone, which maintains calcium and phosphate levels.
Pancreas	Part of the digestive system, located in the abdominal cavity behind the stomach. Secretes insulin — its most important hormone — and pancreatic juice, which assists digestion and absorption of nutrients in the small intestine.
Adrenal Glands	Located just above the kidneys. Secrete adrenaline, the steroid hormone aldosterone, and cortisol.

Gonads — Testes & Ovaries

Testes	The male gonads. Their primary function is the production of sperm and testosterone.
Ovaries	The female gonads. Their primary function is the production of egg cells (ova). They secrete progesterone and estrogen, hormones important for the regulation of ovulation and menstruation.

Common Diseases of the Endocrine System

Diabetes Mellitus

Diabetes mellitus: High blood sugar level over a prolonged period.

Type 1 DM	Pancreas fails to produce enough insulin.
Type II DM	Cells fail to respond to insulin.
Gestational DM	Pregnant women develop high blood sugar level.

Other Common Conditions

Hypoglycemia	Low blood sugar level.
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Goiter	Swelling of the neck resulting from enlargement of the thyroid gland.
Hyperthyroidism	Excessive production of thyroid hormone.
Hypothyroidism	Low thyroid hormone.
Osteoporosis	Decreased bone density; increases the risk of fracture.
Osteomalacia	Softening of the bones caused by impaired bone metabolism.
Gigantism	Excessive growth.
Precocious puberty	Puberty occurring at an unusually early age.
Cushing syndrome	A condition that occurs from exposure to high cortisol levels for a long time.
Addison's disease	Occurs when the adrenal cortex is damaged and the adrenal glands do not produce enough cortisol and aldosterone.
Epididymitis	Inflammation of the tube at the back of the testicle that stores and carries sperm.
Hydrocele	A collection of fluid in the scrotum.
Polycystic ovary syndrome	Hormonal disorder causing enlarged ovaries with small cysts on the outer edges.
Hyperparathyroidism	Increased parathyroid hormone (PTH) levels in the blood.
Hypoparathyroidism	Underproduction of parathyroid hormone.

Medical Abbreviations

Abbreviation	Meaning
BMI	Body mass index
DM	Diabetes mellitus
DKA	Diabetic ketoacidosis
FSH	Follicle-stimulating hormone
TSH	Thyroid-stimulating hormone

For medical coders: Knowing which gland produces which hormone — and the diseases that result from over- or underproduction — is essential for correctly identifying the ICD / CPT code family for endocrine diagnoses and procedures.



The Nervous System

A Foundational Guide for Medical Coders

CODING DECODED

1. Overview of the Nervous System

The nervous system is very much important in controlling all the voluntary and involuntary actions of all parts of the body.

The nervous system consists of a special type of cell — the **neuron** or nerve cell. Every neuron is made of a cell body (also called a soma), dendrites, and an axon. Dendrites and axons are nerve fibres.

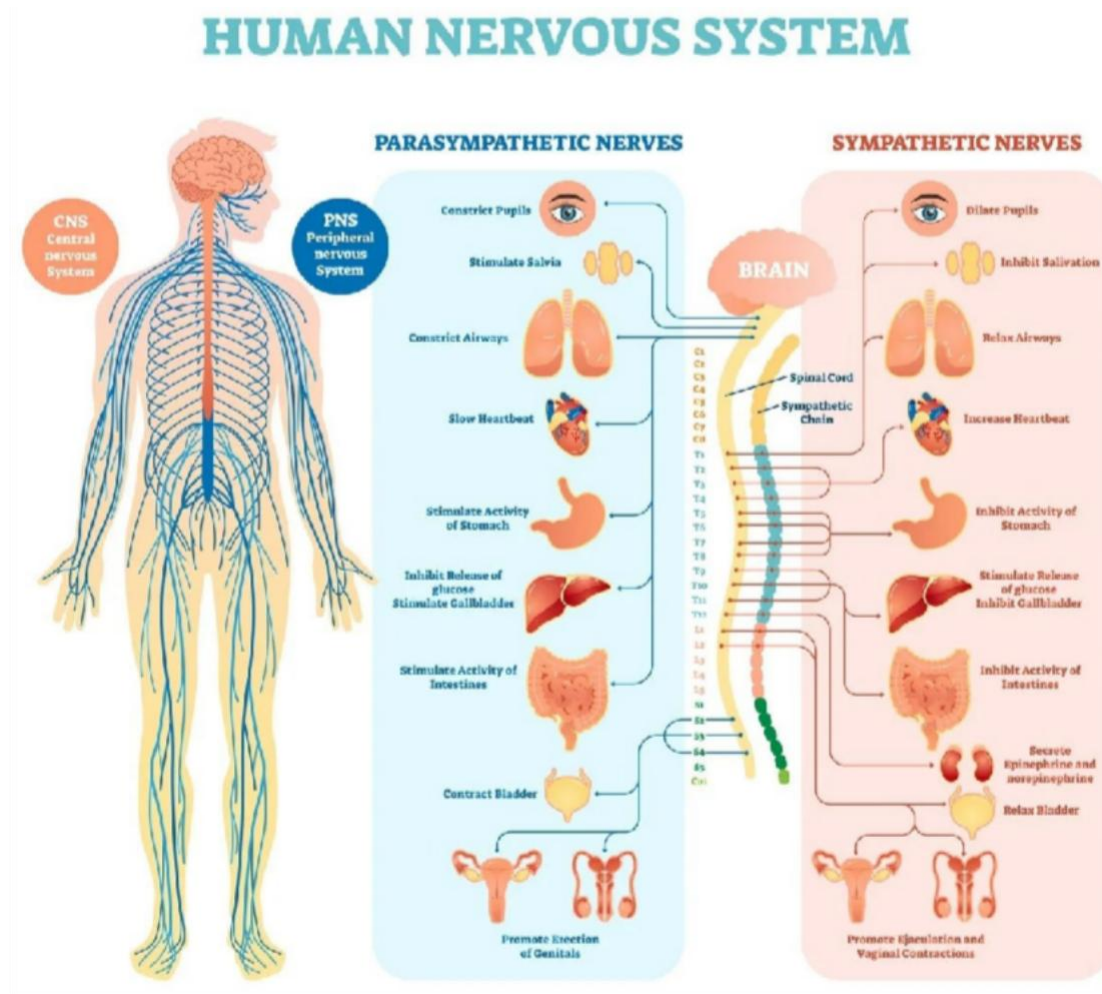


Figure 1 — The human nervous system: central nervous system, and the sympathetic and parasympathetic divisions of the autonomic nervous system.

Parts of the Nervous System

- **Central Nervous System** — brain and spinal cord
- **Peripheral Nervous System** — 12 pairs of cranial and 31 pairs of spinal nerves
 - Afferent (sensory) division
 - Efferent (motor) division
 - Somatic — voluntary movements
 - Autonomic nervous system — cardiac, smooth muscle, glands (sympathetic and parasympathetic)

The Brain

Brain: A mass of 12 billion neurons protected by cranial bones.

Parts of the Brain

- Cerebrum
- Cerebellum
- Brain stem
- Diencephalon
- Ventricles

- Meninges

The Cerebrum

The largest part of the brain, divided into right and left hemispheres — the left side governs the right side of the body, and the right side governs the left side of the body. There are four lobes in the cerebral hemisphere:

Frontal	Voluntary motor control, learning, planning, and speech.
Parietal	Sensory processing, distance, size, shape, and intellectual processes.
Occipital	Vision and visual memory.
Temporal	Auditory, olfactory, speech, judgment, and reasoning.

Note: The cerebral cortex is the outer layer of grey matter (short- and long-term memory), and the cerebral medulla is the white matter (conduction pathways). The corpus callosum is the large bundle of fibres connecting the two hemispheres. Gyri and sulci are the elevations and depressions on the brain surface; fissures are deep grooves.

Cerebellum, Brain Stem & Diencephalon

Cerebellum

The right and left hemispheres are connected by the central vermis. Outer grey and inner white matter form the arbor vitae. Function: coordination, movement, posture, balance, running, and walking.

Brain Stem

Consists of three parts:

Mid-brain	The upper part of the brain stem. Controls postural reflexes and walking, visual reflexes, and auditory control.
Pons	A two-way conduction pathway.
Medulla oblongata	The lowest part of the brain stem. About 75% of nerve fibres cross here. Controls vital functions such as respiration and circulation.

Diencephalon

The area between the cerebrum and the mid-brain.

Thalamus	The relay station for incoming sensory and outgoing motor impulses.
Hypothalamus	Controls appetite (hunger and thirst), temperature regulation, and regulates pituitary secretions.

Meninges & Cerebrospinal Fluid

Meninges

Three membranous coverings of the brain: dura, arachnoid, and pia.

Dura mater	Strong fibrous tissue that lines the skull bones. The epidural space lies between the bone and the dura mater; the subdural space lies between the dura and arachnoid layers.
Arachnoid	Resembles fine cobwebs, containing cerebrospinal fluid (CSF). The subarachnoid space lies between the arachnoid and pia layers.
Pia mater	Covers the surface of the brain and spinal cord.

Cerebrospinal Fluid (CSF)

Serves as a shock absorber for the brain and spinal cord. It is clear, colourless, and contains water, glucose, protein, and white blood cells. It provides nutrients and waste removal for brain tissue.

Key fact: 400–500 mL of CSF is produced daily, yet only about 140 mL is in circulation at any time. It circulates through the ventricles and into the central canal and subarachnoid spaces, and is absorbed back into the blood.

Ventricles & Spinal Cord

Ventricles

CSF-filled spaces containing a rich network of blood vessels and the choroid plexus, which maintains selective permeability to protect brain tissue.

- **Foramen of Monro** — connects the lateral ventricles to the third ventricle
- **Aqueduct of Sylvius** — connects the third and fourth ventricles

In the roof of the fourth ventricle are openings that allow CSF to move into the cisterna magna, a space behind the medulla that is continuous with the subarachnoid space.

Spinal Cord

The medulla oblongata continues as the spinal cord.

- The grey matter ("H"-shaped) contains the cell bodies of interneurons and motor neurons, divided into anterior, posterior, and lateral horns.
- White matter surrounds the grey "H" and is divided into anterior, posterior, and lateral columns — large bundles of nerve axons divided into smaller bundles called tracts (ascending, descending, and lateral organizational tracts).
- Two bundles of nerve fibres, called roots, project from each side of the cord: the dorsal nerve root (sensory afferent fibres), dorsal root ganglion (sensory cell bodies), and ventral nerve root (motor efferent fibres). The nerve roots join together to form a single, mixed **spinal nerve**.

Peripheral Nervous System — Cranial Nerves (12 Pairs)

Cranial Nerve	Function
I — Olfactory	Sensory: smell
II — Optic	Sensory: vision
III — Oculomotor	Motor: eye movement and pupil
IV — Trochlear	Motor: eye movement, peripheral vision
V — Trigeminal	Both: face and head (motor & sensory)
VI — Abducens	Motor: abducts the eye
VII — Facial	Both: facial expression, taste, tongue movement
VIII — Vestibulocochlear	Sensory: hearing and balance
IX — Glossopharyngeal	Both: tongue, throat, swallowing
X — Vagus	Both: thoracic and abdominal organ sense, inhibitor
XI — Accessory	Motor: spinal accessory, shoulder and head movement
XII — Hypoglossal	Motor: tongue and throat movement

Peripheral Nervous System — Spinal Nerves

31 pairs of spinal nerves:

Region	Nerves	Notes
Cervical	8 pairs	Exit above and below cervical vertebrae
Thoracic	12 pairs	One pair per thoracic vertebra
Lumbar	5 pairs	Nerves exit the cord at the 1st lumbar vertebra, but do not exit the spinal canal

Region	Nerves	Notes
		until reaching their intervertebral foramina — giving the cord a "cauda equina" look
Sacral	5 pairs	Exit through the sacral foramina
Coccygeal	1 pair	Terminal spinal nerve pair

Each nerve joins to form a network called a **plexus** (cervical, brachial, lumbar, and sacral).

Dermatome: an area of skin that is mainly supplied by a single spinal nerve.

Upper & Lower Extremity Nerves

Upper Extremity	Lower Extremity
Median nerve	Femoral nerve
Ulnar nerve	Sciatic nerve
Radial nerve	Common peroneal, tibial, and sural nerve

Common Diseases & Symptoms

Common Diseases of the Nervous System

Epilepsy	A disorder in which nerve cell activity in the brain is disturbed, causing seizures.
Parkinson's disease	A long-term degenerative disorder of the central nervous system.
Multiple sclerosis	A demyelinating disease in which the insulating covers of nerve cells in the brain and spinal cord are damaged.
Hemiplegia / Hemiparesis	Paralysis of one side of the body; hemiparesis is a weakness of the entire left or right side of the body.
Alzheimer's disease	A progressive disease that destroys memory and other important mental functions.
Encephalitis	Inflammation of the brain, often due to infection.
Meningitis	An acute inflammation of the protective membranes covering the brain and spinal cord.
Quadriplegia	Total loss of use of all four limbs.

Common Signs & Symptoms

- Pain
- Inability to concentrate
- Memory loss
- Loss of muscle strength
- Tremors
- Slurred speech
- Seizures
- Paralysis

Medical Terms & Special Senses

Medical Terms

Body Part / Concept	Root
Brain	Encephalo
Meninges	Meningo

Body Part / Concept	Root
Spinal cord	Myelo
Nerve	Neuro
Cerebrum	Cerebro
Cerebellum	Cerebello
Mind	Psycho, ment/o
Head	Cephal/o
Nerve root	Radic/o, radicul/o
Speech	Phas/o
Sensation	Esthesi/o

Special Senses

Body Part	Root
Ear	Auri
Hearing	Audio
Eye	Ophthalmo
Lens	Phako
Eyelid	Blepharo
Pupil	Coreo
Lip	Cheilo / Labio
Cornea	Kerato
Tympanic membrane	Myringo
Fingernail / Toenail	Onycho

Medical Abbreviations

Abbreviation	Meaning
ADD	Attention deficit disorder
ADHD	Attention deficit hyperactivity disorder
ANS	Autonomic nervous system
CNS	Central nervous system
CP	Cerebral palsy
CSF	Cerebrospinal fluid
CVA	Cerebral vascular accident
EEG	Electroencephalogram
HA	Headache
ICP	Intracranial pressure
IQ	Intelligence quotient
LOC	Level of consciousness; loss of consciousness
MS	Multiple sclerosis
PNS	Peripheral nervous system
Sz	Seizure
TIA	Transient ischemic attack

For medical coders: Distinguishing central vs. peripheral structures, and recognizing cranial and spinal nerve terminology, helps narrow down the correct ICD / CPT code family for neurological diagnoses and procedures.



The Reproductive System

A Foundational Guide for Medical Coders

CODING DECODED

1. Overview of the Reproductive System

Reproduction usually involves internal fertilization by sexual intercourse. During this process, the male inserts his erect penis into the female's vagina and ejaculates semen, which contains sperm.

The sperm passes through the cervix into the uterus, and then into the fallopian tubes for fertilization of the ovum — only one sperm is required to fertilize the ovum.

Upon successful fertilization, the fertilized ovum travels out of the fallopian tube and into the uterus, where it implants in the uterine wall. This is the beginning of gestation (pregnancy), which continues for nine months and concludes with childbirth (labor).

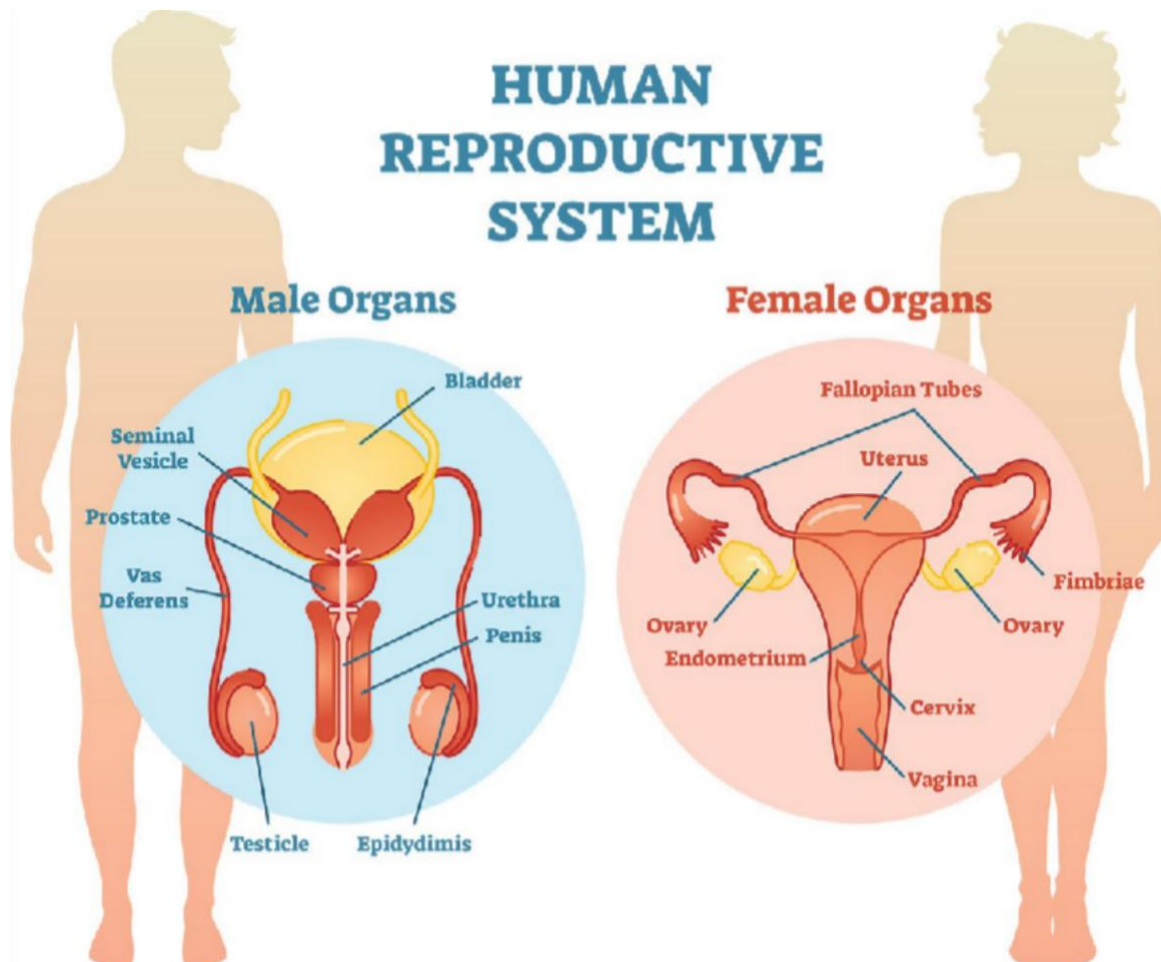


Figure 1 — The male and female reproductive organs.

Both Males and Females Have the Same Types of Organs

- **Gonads** — sex glands
- **Ducts / tubes** — carry the sex cells and secretions
- **Accessory organs**

The Female Reproductive System — Organs

The female reproductive system is a series of organs primarily located inside the body and around the pelvic region of a female:

- Ovaries
- Fallopian tubes
- Uterus
- Vagina
- Vulva
- Bartholin's glands

3. Ovaries, Fallopian Tubes & Uterus

Ovaries

The female gonads (sex glands) — small, almond-shaped glands located in the pelvic cavity, attached to the uterus by ligaments. They contain follicles (thousands of small sacs), each holding an immature ovum. When an ovum matures, the follicle enlarges and then ruptures to release the mature ovum — a process called ovulation, which occurs once a month.

Fallopian Tubes

Two tubes, about 5 inches long, attached to the uterus; their lateral ends have finger-like projections called fimbriae. The tubes serve as a passageway for the ovum.

Peristalsis	The rhythmic movement of the tube's muscle layer that helps move the ovum toward the uterus.
Cilia	Hair-like structures lining the tubes that keep the ovum moving toward the uterus.

Uterus

A hollow, muscular, pear-shaped organ located behind the urinary bladder and in front of the rectum. The uterus holds the fetus during pregnancy.

Part	Location	Description
Fundus	Top	Section where the fallopian tubes attach
Body (corpus)	Middle	The middle section
Cervix	Bottom	Narrow section that attaches to the vagina

Three layers of the uterus: Endometrium, myometrium, and perimetrium.

Vagina, Bartholin's Glands, Vulva & the Menstrual Cycle

Vagina

A muscular tube that connects the cervix of the uterus with the outside. It is a passageway for menstrual flow, receives the sperm and semen from the male, and acts as the birth canal during delivery of an infant.

Bartholin's Glands

Two small glands located on either side of the vaginal opening; they secrete mucus for lubrication during intercourse.

Vulva

Structures that form the external female genital area — labia majora, labia minora, and mons pubis.

The Menstrual Cycle

Approximately every 28 days, the pituitary gland releases a hormone that stimulates some of the ova to develop and grow. One ovum is released and passes through the fallopian tube into the uterus. Hormones produced by the ovaries prepare the uterus to receive the ovum.

The lining of the uterus, called the endometrium, sheds unfertilized ova each cycle through the process of menstruation. If the ovum is fertilized by sperm, it attaches to the endometrium and the fetus develops.

The Male Reproductive System — Organs

The function of the male reproductive system is to provide sperm for fertilization of the ovum. Parts of the male reproductive system:

- Testes
- Epididymis
- Vas deferens
- Seminal vesicles

- Ejaculatory ducts
- Prostate gland
- Cowper's gland
- Urethra
- Penis

Testes, Epididymis & Vas Deferens

Testes

Two male gonads (sex glands), located in the scrotum — a sac suspended between the thighs outside the body, where the temperature is lower for sperm production. Produces the male sex cell, sperm (spermatozoa), and male hormones:

- The main hormone is **testosterone**
- Aids in the maturation of sperm
- Responsible for secondary male sex characteristics such as body hair, facial hair, larger muscles, and a deeper voice

Epididymis

A tightly coiled tube about 20 feet long, located above the testes in the scrotum. Receives the sperm from the testes and stores them while they mature and become motile; also produces fluid that is part of semen.

Vas Deferens (Ductus Deferens)

One on each side, joins with the epididymis and extends up into the abdominal cavity, curving behind the urinary bladder and joining with a seminal vesicle.

Seminal Vesicles, Prostate, Urethra, Penis & Cowper's Glands

Seminal Vesicles	Two small, pouch-like tubes located behind the bladder at the junction of the vas deferens and ejaculatory ducts. Produce the yellow fluid making up 75% of semen and provide nourishment for sperm.
Ejaculatory Ducts	Two short tubes formed by the union of the vas deferens and seminal vesicles. Carry sperm and semen through the prostate gland into the urethra.
Prostate Gland	Located below the urinary bladder on either side of the urethra. Secretes alkaline prostate fluid, part of semen. Muscular tissue in the prostate contracts during ejaculation and closes the urethra to prevent the passage of urine.
Urethra	The tube that extends from the urinary bladder through the penis to the outside of the body. Carries urine from the bladder and semen from the reproductive tubes.
Penis	The external male reproductive organ; the male organ of copulation. Deposits semen in the vagina.
Cowper's Glands (Bulbourethral)	Two small glands located below the prostate, connected by small tubes to the urethra. Produce mucus that serves as a lubricant for intercourse.

Medical Terms

Body Part / Concept	Root
Penis	Balano / Pen/o
Vagina	Colpo / Vagino
Cervix	Cervic/o
Vulva	Vulvo / Epis/o
Women	Gyneco
Male	Andro
Uterus	Hystero / Metro/o

Body Part / Concept	Root
Breast	Mammo / Masto
Menstruation	Meno
Ovary	Oophoro
Testis	Orchio / Testo
Semen	Spermato
Vas deferens	Vaso
Prostate gland	Prostato
Fallopian tube	Salping/o

Medical Abbreviations

Abbreviation	Meaning
BPH	Benign prostatic hyperplasia
CS	Cesarean section
D&C	Dilatation and curettage
ED	Emergency department; erectile dysfunction
FHR	Fetal heart rate
IUCD	Intrauterine contraceptive device
IUD	Intrauterine device
OB/GYN	Obstetrics (and) gynecology
PID	Pelvic inflammatory disease
SGA	Small for gestational age
TAH	Total abdominal hysterectomy
VBAC	Vaginal birth after cesarean
LMP	Last menstrual period

For medical coders: Correctly distinguishing male vs. female reproductive structures, and recognizing obstetric and gynecologic terminology, is essential for identifying the correct ICD / CPT code family for reproductive diagnoses and procedures.



Lymphatic System

Medical Coding Notes

CODING DECODED

1. Overview

The **lymphatic system** is a network of vessels, organs, and tissues that helps with:

- Immune defense
- Fluid balance
- Absorption of dietary fats

For medical coding, students should understand the **anatomy, common diseases, and terminology** because these appear in medical documentation and diagnosis coding.

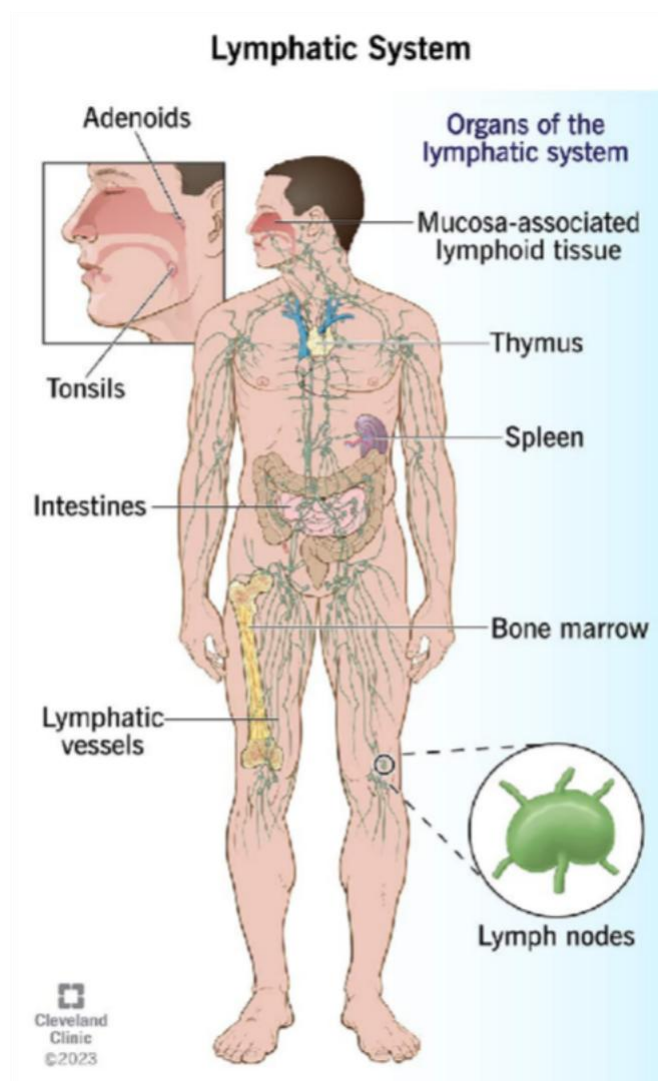


Figure 1 — Organs and structures of the lymphatic system. Source: Cleveland Clinic.

2. Major Components

Lymph

A clear fluid that travels through lymphatic vessels and contains lymphocytes and other substances.

Lymphatic Vessels

Transport lymph from body tissues back toward the bloodstream.

Lymph Nodes

Small structures that **filter lymph** and contain immune cells.

Common locations:

- Cervical — neck
- Axillary — armpit
- Inguinal — groin
- Mediastinal — chest
- Abdominal/mesenteric — abdomen

3. Major Lymphatic Organs

Spleen

Located in the **left upper abdomen**.

Main functions:

- Filters blood
- Removes old/damaged blood cells
- Participates in immune responses

Coding point: Do not confuse the spleen with lymph nodes. **Lymph nodes** → filter lymph. **Spleen** → filters blood.

Thymus

Located in the **upper chest behind the sternum**.

Main function:

- Maturation of **T lymphocytes (T cells)**

Bone Marrow

Important for:

- Production of blood cells
- Development and maturation of immune cells
- B-cell maturation

Tonsils

Lymphoid tissues located around the throat.

They help protect against microorganisms entering through the **nose and mouth**.

4. Important Anatomical Terms

Lymphadenopathy	Enlarged lymph nodes
Lymphadenitis	Inflammation of lymph nodes
Lymphedema	Swelling caused by impaired lymph drainage
Lymphocyte	Type of white blood cell involved in immunity
Lymphoma	Cancer involving lymphoid/immune cells
Splenomegaly	Enlarged spleen

Tonsillitis

Inflammation/infection of tonsils

5. Lymphatic Diseases Important for Coding

Lymphedema

Accumulation of lymphatic fluid in tissues due to impaired lymphatic drainage.

Documentation may mention:

- Swelling
- Edema
- Limb heaviness
- Chronic lymphedema
- Secondary lymphedema

Coding focus: Identify the **type, cause, and anatomical site** when documented.

Lymphadenopathy

Abnormal enlargement of lymph nodes.

Documentation may specify:

- Cervical lymphadenopathy
- Axillary lymphadenopathy
- Inguinal lymphadenopathy
- Generalized lymphadenopathy

Coding focus: Location and underlying cause are important.

Lymphadenitis

Inflammation of lymph nodes, often associated with infection.

Coding point: Do not automatically code lymphadenitis when documentation only states lymphadenopathy.

Lymphoma

Cancer involving lymphocytes/lymphoid tissue.

Major categories include:

- Hodgkin lymphoma
- Non-Hodgkin lymphoma

Coding focus: Type and specific site/subtype documented by the provider.

6. High-Yield Coding Terminology

Lymphatic vs Lymph Node

Lymphatic = relating to the lymphatic system.

Lymph node = a specific small organ that filters lymph.

Edema vs Lymphedema

Edema = general accumulation of fluid in tissues.

Lymphedema = swelling specifically related to impaired lymphatic drainage.

Note: Do not assume that every edema is lymphedema.

7. Medical Coding Connection

When reviewing medical documentation, look for:

Anatomy

- Lymph node
- Spleen
- Thymus
- Tonsils
- Lymphatic vessels

Condition

- Lymphedema
- Lymphadenopathy
- Lymphadenitis
- Lymphoma
- Splenomegaly

Site

- Cervical
- Axillary
- Inguinal
- Mediastinal
- Abdominal

Cause

Look for documentation of:

- Infection
- Cancer
- Surgery
- Trauma
- Congenital condition
- Other underlying disease

8. Quick Revision

Lymph nodes → Filter lymph

Spleen → Filters blood

Thymus → T-cell maturation

Bone marrow → Blood cell production + B-cell maturation

Lymphedema → Impaired lymph drainage
Lymphadenopathy → Enlarged lymph nodes
Lymphadenitis → Inflamed lymph nodes
Lymphoma → Malignancy of lymphoid/immune cells