Cross sectional anatomy brain pdf

Medically reviewed by University of Illinois — Written by Ann Pietrangelo — Updated on December 16, 2016 OverviewThe complex human brain controls who we are: how we think, feel, and act. It gives meaning to our world and our place in it. The brain also controls all major body functions.The brain is housed in the skull, which protects it from injury. Averaging a pound at birth, the brain grows to approximately three pounds by adulthood. The brain, along with the spinal cord is a crucial component of the central nervous system (CNS). Two types of cells exist in the brain. Neurons send and receive signals to and from your brain and the rest of the body. Glial cells, sometimes called neuroglia or glia, form myelin, a fatty, insulating layer around nerve fibers. The cells maintain stability, and provide nutrition and support.Each part of the brain performs a particular function and is linked to other parts of the brain. In between the skull and brain are three layers of tissue, called meninges. They protect the brain. The strong, outermost layer is named the dura mater. The middle layer, the arachnoid mater, is a thin membrane made of blood vessels and elastic tissue. It covers the entire brain. The pia mater is the innermost layer, with blood vessels that run deep into the brain. CerebrumForebrain, largest part of the brain divided into two halvesPerforms higher functioning processes such as vision, hearing, speech, emotion, and movementLeft hemisphereLeft side of cerebrumResponsible for language in most right-handed people and about 50 percent of left-handed people; controls analytical reasoning and calculations; processes motor and sensory signals for the right side of the bodyRight hemisphereRight side of cerebrumInterprets visual cues and spatial processing, including emotional, artistic, and visual reasoning; processes motor and sensory signals for left side of the bodyCorpus callosumBetween the two hemispheresConnects the left and right hemispheresFrontal lobeLargest section of brain, front of the headHelps form reasoning, emotions, movementParietal lobeMiddle part of brainHelps us understand our spatial relation to other people and objects; interprets touch and painOccipital lobeBack of the brainHelps process visual informationTemporal lobesOn each side of the brainHelps with memory, language, smell, the ability to recognize faces; interprets emotionsCerebellumHindbrain Controls fine motor movements, balance, and postureBrainstemIn front of the cerebellum, connected to the spinal cordControls basic bodily functions that are necessary for survivalMidbrainTop section of the brainstemControls eye movements, facial sensation, balance, and hearingPonsMiddle section of the brainstemControls sensory analysis, motor skills, sleep, and consciousnessMedulla oblongataLowest section of brainstemControls respiratory drive, swallowing, coughing, gag reflex; helps to regulate circulation, blood pressure, and heart rateLimbic systemSet of structures above the brainstemResponsible for emotionsThalamusFound under the cerebrumResponsible for integrating all of the sensory signals coming from the spinal cord and limbic system HypothalamusSits right below the thalamusSends messages to pituitary gland and helps to regulate temperature, thirst, water balance, sleep, hormone production, and appetiteAmygdalaStructure in limbic systemProcesses aggressive behavior and fearHippocampusStructure in limbic systemHelps us remember new informationPituitary glandBase of the brainSecretes hormonesBasal gangliaWithin the deep part of the cerebrumCoordinates steady movementsThe cerebrum, or forebrain, forms the biggest part of the brain and is divided in two halves. The left hemisphere is largely responsible for language. The right hemisphere is important for interpreting visual cues and spatial processing. The cerebrum controls coordination, temperature, sight, sound, reasoning, learning, and emotions.The space between the two hemispheres is called the great longitudinal fissure. The corpus callosum connects the two sides and transfers signals from one side of the brain to the other.The cerebrum has billions of neurons and glia that form the cerebral cortex, its outermost layer. This is commonly known as gray matter. Connection fibers between neurons beneath the surface of the brain are called white matter.The cerebellum, or hindbrain, handles fine motor movements, balance, and posture. It helps us to perform quick and repetitive movements.The brainstem is in front of the cerebellum and is connected to the spinal cord. Its job is to pass signals between the cerebral cortex and the rest of the body. It helps to control our most basic functions and is made up of three parts. The midbrain controls eye movements, facial sensation, balance, and hearing. Signals from the cortex to the spinal cord and nerves move through the pons, which controls sensory analysis, motor skills, sleep, and consciousness. The lowest part of the brainstem is the medulla oblongata, which helps controls heart and lung functions, among other functions.The frontal lobe is the largest part of the brain, located in the front of the head. It helps to form reasoning, emotions, and movement. The parietal lobe is the middle part of the brain. It helps us to understand our place in relation to other people and things. It also helps us to interpret touch and pain. The occipital lobe is the back of the brain and helps us process visual information.The temporal lobes are located on each side of the brain. They help with memory, language, and our sense of smell. They also help us to recognize faces and objects and interpret the reactions of other people.The limbic system is responsible for emotions. The thalamus is the hub for information coming and going to the cortex. It deals with the sensation of pain and alertness. The hypothalamus is a tiny structure that sends messages to the pituitary gland. It also helps to control sexual behavior, eating, sleeping, body temperature, and movement. The amygdala is involved in processing aggressive behavior and fear. The hippocampus helps us to remember new information.The brain has four ventricles connected by cavities and tubes. The two lateral ventricles in the cerebral hemispheres communicate with a third located in the center of the brain. It communicates with the fourth at the base of the brain through a tube called the cerebral aqueduct.Cerebrospinal fluid flows through the fourth ventricle and around the brain. This is a clear, watery liquid produced in the ventricles. It cushions the brain and spinal cord, and is continually absorbed and replenished.The pineal gland is an outgrowth at the back of the third ventricle. Its purpose isn't fully understood, but is thought to play a part in sexual maturation.The pituitary is a small gland at the base of the brain that secretes hormones. It plays a key role in the function of other glands, organs, sexual development, and growth. Last medically reviewed on December 16, 2016Healthline has strict sourcing guidelines and relies on peer-reviewed studies, academic research institutions, and medical associations. We avoid using tertiary references. You can learn more about how we ensure our content is accurate and current by reading our editorial policy. The whole brain atlas Neuroimaging Primer - Harvard Medical School lecture notes: Introduction to Neuroimaging by Keith Johnson and Alex Becker the Brain Module Developed by Jeffrey E. Zapawa and Anthony L. Alcantara, MD This MRI brain cross sectional anatomy tool is absolutely free to use. Use the mouse scroll wheel to move the images up and down alternatively use the tiny arrows (>>) on both side of the image to move the images. IMAIOS und ausgewählte Dritte verwenden Cookies oder ähnliche Technologien insbesondere für die Erhebung von Nutzungsdaten. Mithilfe von Cookies können wir Informationen wie die Eigenschaften Ihres Geräts sowie bestimmte personenbezogene Daten (z. B. IP-Adressen, Navigations-, Nutzungs- oder Geolokalisierungsdaten, eindeutige Kennungen) analysieren und speichern. Diese Daten werden zu folgenden Zwecken verarbeitet: Analyse und Verbesserung des Nutzererlebnisses und/oder unseres Inhaltsangebots, unserer Produkte und Dienstleistungen, Erhebung und Analyse von Nutzungsdaten, Interaktion mit sozialen Netzwerken, Anzeige von personalisierten Inhalten, Leistungsmessung und Attraktivität der Inhalte. Weitere Informationen finden Sie unter Datenschutzerlärung. Sie können Ihre Zustimmung jederzeit nach freiem Ermessen erteilen, verweigern oder widerrufen, indem Sie unser Cookie-Einstellungstool aufrufen. Wenn Sie der Verwendung dieser Technologien nicht zustimmen, gehen wir davon aus, dass Sie auch der Speicherung von Cookies auf der Grundlage eines berechtigten Interesses widersprechen. Sie können der Verwendung dieser Technologien zustimmen, indem Sie auf "Akzeptieren" klicken. Author: Adrian Rad BSc (Hons) • Reviewer: Dimitrios Mytilinaios MD, PhD Last reviewed: July 27, 2022 Reading time: 39 minutes Cross-sections are two-dimensional, axial views of gross anatomical structures seen in transverse planes. They are obtained by taking imaginary slices perpendicular to the main axis of organs, vessels, nerves, bones, soft tissue, or even the entire human body. Cross-sections provide the perception of 'depth', creating three-dimensional relationships between anatomical structures in your mind's eye. They build the entire picture, improve your understanding, consolidate the information and facilitate recall. In addition, modern imaging techniques like ultrasound, computed tomography (CT) and magnetic resonance imaging (MRI) are based on cross sectional anatomy. Therefore, cross-sections are essential for establishing a precise diagnosis, planning therapy and performing radiologically guided interventions. The importance of sectional anatomy has already been explored in detail. This article will describe classical cadaveric cross sections taken at various levels of the human body. Main landmarks seen at vertebral cross section levels C3 Body of hyoid bone C4 Superior border of thyroid cartilage, bifurcation of common carotid artery C6 Cricoid cartilage, laryngotracheal junction, pharyngoesophageal junction, middle cervical ganglion T1 Sternoclavicular joint, apex of lungs T3/4 Top of arch of aorta, manubrium of sternum T4/T5 Sternal angle, beginning/end of arch of aorta, bifurcation of trachea T6 Upper border of liver T7 Inferior angle of scapula T8/9 Xiphisternal joint T10 Esophageal hiatus of respiratory diaphragm L1 Hilum of kidney/spleen, cisterna chyli, pylorus of stomach, duodenojejunal flexure, conus medullaris L3 Umbilicus L4 Iliac crest, bifurcation of abdominal aorta L5 Convergence of right and left common iliac veins (Inferior vena cava) S2 Dural sac terminates Orientation of cross sections Before diving into the deep end, it's important to understand the general orientation of axial anatomy. Every single cross section is viewed from the feet of the patient in a supine position (lying horizontally on his/her back). This means that structures on the right side of the patient's body will be on the left side of the cross-sectional image, and vice-versa. Looking at transverse anatomical sections is similar to looking in the mirror, so keep this trick in mind when examining any axial image. We will start with a cross section of the head, where the different structures of the brain are visible. The brain is part of the central nervous system responsible for various functions, ranging from simple homeostasis to higher cognitive functions like critical thinking, memory etc. In order to appreciate the overall transverse anatomy of this organ, we'll examine an axial view through the thalamus. The thalamus is a subcortical, gray matter structure that acts as a relay center between the cerebrum and brainstem. Cross section through the thalamus: Diagram Orienting yourself within such a cross section is easy. The star of the show (brain) is easily recognizable because it appears highly convoluted, full of ridges (gyri) and indentations (sulci). The paired thalami appear as two circular masses in the midline, forming the walls of the third ventricle. The neurocranium appears as a meshwork (trabecular bone) filled with holes (diploe) and a red substance (bone marrow). If you remember the anatomy of the neurocranium, the anterior bone of the forehead (frontal bone) contains a large cavity (frontal sinus). Therefore, the top portion of the cross section points anteriorly. By default, the bottom of the illustration points posteriorly and since you're looking from the patient's feet, the left side represents the patient's right, and vice versa. If you imagine the cross section as an onion, three major 'layers' can be observed, from exterior to interior: external soft tissues, neurocranium and brain. The fibrous epicranial aponeurosis extends anteroposteriorly over the superior part of the skull like a blanket. Two lateral masticatory muscles (temporalis muscles) are found on either side of the skull, overlying the temporal bones. Several bones of the neurocranium are visible beneath the soft tissues, from anterior to posterior: frontal, sphenoid, parietal and occipital bones. The frontal bone contains the irregularly shaped frontal sinuses in the midline and the right orbital plates laterally. A triangular structure (ethmoidal notch) is located between the orbital plates, containing the crista galli of the ethmoid bone. The frontal bone articulates with the greater wing of the sphenoid posteriorly, which in turn articulates with the parietal bones. The most posterior bone is the occipital bone. The neurocranium protects the brain. The brain consists of two cerebral hemispheres separated by the longitudinal cerebral fissure. Four cerebral lobes are visible, from anterior to posterior: frontal, insular, temporal and occipital lobes. Except for the insula, they are located underneath the skull bones bearing the same name. The insular lobes are easy to locate because they appear as bilateral, undulating structures, like two worms, within the brain deep to the temporal lobes. The occipital lobe contains the visual area - the area around the calcarine fissure, which is connected to the thalamus by a white bundle tract (optic radiation). The center of the brain contains the two thalami which sandwich the third ventricle. The fornix appears as a dot anterior to the thalami, but this white matter tract follows a complex path, curving around the thalami. The basal ganglia (head of caudate nucleus, globus pallidus, putamen) are located anterior to the thalamus and they are separated from the thalamus by the posterior limb of the internal capsule. The splenium of the corpus callosum is located posterior to the thalamus, at the bottom of the longitudinal fissure. It looks like a bridge connecting the cerebral hemispheres. The anatomy of the brain illustrated here is not exhaustive by any means. Take a look at the following videos explaining various brain sections and practice identifying them using the quizzes. After the brain, let's take a look at a couple of sections where other important structures of the head and neck are visible. The head is an anatomical structure that rests on top of the mobile neck. Let's examine their overall anatomy by taking a transverse cut through the maxillary sinus. Cross section through the maxillary sinus: Diagram There is no hidden agenda with regards to orientation, so it's as easy as it gets. The brain (namely the brainstem and the cerebellum) points posteriorly (bottom of the image) and as you know from anatomy, the skull bones containing the paranasal sinuses are located anteriorly (top of the image). Starting posteriorly, the cerebellum and pons are enclosed laterally by the temporal bones and posteriorly by the occipital bone. You can easily spot the cerebellum due to its striated appearance. Anterior to the pons, the temporal bone is continued with the bones of the viscerocranium (sphenoid, maxilla, zygomatic). The sphenoid bone is shaped like a butterfly and contains the sphenoidal sinus. The bilateral maxillary sinuses are located anterior to the sphenoid within the maxilla. They are separated by the nasal skeleton and middle nasal concha. The nasal framework is continued anteriorly with the nasal septum and cartilage. Two muscles of mastication (temporal, lateral pterygoid) are visible posterolateral to the maxillary sinus. The internal carotid artery and mandibular nerve are observed anterior to the pons, traveling towards the neurocranium to emerge in the middle cranial fossa. However, the head and neck contain several other structures not evident above. Let's see them in a head and neck cross section passing through the tongue at the level of the second cervical vertebra (axis). Cross section through the tongue and C2: Diagram This cross-section has the exact same orientation as the previous one. The posterior landmark is provided by the second cervical vertebra (axis) while the anterior one is provided by the tongue. However, there are quite a few differences between them. First of all, the brain is no longer visible because this particular transverse cut passes below the base of the skull. The brain has been replaced instead by a vertebra with an atypical structure (axis), the spinal cord and several muscular layers of the neck. The muscles are divided by a ligament running posteriorly from the axis and along the midline known as the nuchal ligament. From anterior to posterior, they include the obliquus capitis inferior, rectus capitis posterior major, semispinalis, splenius capitis and trapezius. The splenius capitis is overlaid by the upper part of the sternocleidomastoid muscle, close to its insertion point. Anterior to the sternocleidomastoid one can see an irregular, flesh-like structure representing the parotid gland. The retromandibular vein passes through it. Medial to the parotid glands you can see various muscles (digastric, longus capitis, longus colli) which continue in front of the axis. Anterior to the parotid glands are two muscles of mastication (masseter, medial pterygoid). These muscles are split by the ramus of the mandible. Posterior to the medial pterygoid muscle one can see the internal jugular vein. Going towards the center of the image, we can see the palatine tonsils (bowtie shape), as well as the tongue which sits anterior to them. The tongue is easily spotted due to its centrally located septum and perpendicular muscle fibers. The tongue is surrounded by teeth within the oral cavity, the movement of which are controlled by several facial muscles. The buccinator muscle follows the contour of the tongue. The facial vein is located lateral to the buccinator. It's impossible to represent all the anatomy of the head and neck in two cross sections. After you master them using our videos and quizzes, take a look at several other ones which illustrate other structures in these regions. Maxillary sinus level Explore study unit Tongue level Explore study unit Explore more of the head and neck sectional anatomy with our quiz. The arm is a region of the upper extremity located between the shoulder and elbow. It contains a single bone (humerus) and two muscle compartments: anterior (flexor) and posterior (extensor). Let's explore the cross-section of the arm by taking a slice at the level of the biceps brachii: Cross section through the biceps brachii muscle: Diagram Orientation shouldn't be too difficult in the above cross-section. If you have mastered the anatomy of the arm, you know that the big, bulging biceps is positioned anteriorly (top of the image). The neurovasculature bundle is always located medially (at the right of the image) at this level, so it helps you to distinguish medial from lateral. It looks like an aggregation of cavities. Differentiating medial from lateral is important in order to establish which arm is depicted, left or right. The humerus is the scaffold of the arm running from the shoulder joint to the elbow joint. Several muscles attach to various aspects of the humerus. The anterior compartment of the arm (coracobrachialis, brachialis, biceps brachii) is located anterior to the humerus and its intermuscular septa. The biceps brachii is the thickest muscle in this cross-section, covering the other two. The posterior compartment contains only the triceps brachii muscle, which is located posterior to the intermuscular septa. The triceps is larger compared to the muscles of the anterior compartment. The neurovasculature of the arm lies medially in this cross section. Moving medially away from the humerus one can see the brachial artery, brachial vein, basilic vein, median nerve and ulnar nerve. The blood vessels are easier to spot than nerves due to their larger diameter. The radial nerve is located posterolateral to the humerus. The superficial cephalic vein is located in the subcutaneous tissue beneath the skin, which envelopes the structures of the arm. Complete your understanding of arm cross sections by using the following resources: Biceps brachii muscle level Explore study unit The next section that we are going to explore is a section of the forearm. The forearm is a region of the upper extremity located between the elbow and wrist. It contains two bones (radius, ulna) and two muscle compartments: anterior (flexor) and posterior (extensor). Let's explore a cross-section of the forearm at the level of the flexor carpi ulnaris muscle: Cross section of the forearm through the flexor carpi ulnaris muscle: Diagram Getting your bearings in the above cross-section is not easy because the forearm can have different orientations in space, depending if it is pronated or supinated. The forearm is pronated in the above cross-section. How can you tell? The radius, ulna and the interconnecting interosseous membrane are aligned almost vertically. If the forearm would be in the anatomical position (supinated), these structures would be aligned almost horizontally. Also, which is lateral and medial? To prevent confusion, think in terms of radial and ulnar sides because they are more logical and easier to locate. They will always correspond to the lateral and medial sides of the forearm respectively, regardless of how the forearm is positioned. The radius and ulna are the bones supporting the forearm. They run from the elbow joint to the wrist joint. The anterior compartment of the forearm is located anterior to the radius, ulna and interosseous membrane. In this case, they face the trunk due to pronation. The visible deep muscles (flexor pollicis longus, flexor digitorum profundus) are located in close proximity to the forearm bones. They are overlaid by the superficial muscles (flexor carpi radialis, flexor digitorum superficialis, flexor carpi ulnaris). You can easily remember these muscles using the acronym 'Fail, Fail, Fail'. The posterior compartment of the forearm is located posterior to the radius, ulna and interosseous membrane. In this cross section, they face away from the trunk. The visible deep muscles (abductor pollicis longus, extensor pollicis longus) are located closely to the forearm bones. They are covered by the superficial muscles (extensor digitorum, extensor digiti minimi, extensor carpi ulnaris). The visible radial group of muscles (brachioradialis, extensor carpi radialis) is easy to identify because they surround the radius. Last but not least, let's learn about the blood vessels and nerves that are visible in this transverse section. On the radial side, superficial to the flexor pollicis longus muscle, one can find the radial artery. The median nerve, which innervates most of the anterior compartment, runs along the deep aspect of the flexor digitorum superficialis muscle. The ulnar nerve, which innervates flexor carpi ulnaris muscle and the medial part of the flexor digitorum profundus muscle, runs in the same plane as the ulna between the two muscles that it innervates. The two superficial veins flowing through the subcutaneous tissue are the cephalic (radial side) and basilic (ulnar aspect) veins. Learning the structures in a single, static cross section can only get you so far. Take a look at the following videos and quizzes in order to learn more about the cross sectional anatomy of the forearm. Let's now move on to the lower extremity and look at a couple of cross sections. Our first stop is the thigh. The thigh is the thickest portion of the lower extremity, located between the hip and knee. It consists of three muscle compartments (anterior, posterior, medial) which create movement by acting on the femur bone. An overview of the anatomical structures of the thigh can be shown in a transverse section that passes through the adductor longus muscle. Cross section of the thigh through the adductor longus muscle: Diagram As usual, analyzing cross sections begins by orienting yourself. The anterior side (top of image) is marked by the strong and highly developed quadriceps muscles, which appear as four evident thick bands, especially in athletes. The medial and lateral sides follow their standard locations in transverse anatomy. Let's begin with the osteology of the thigh. The femur is the strongest bone in the human body and the framework of this region. Its shaft appears as a round, white cortical bone surrounding a reddish bone marrow. The muscles of the anterior compartment of the thigh are located anterior to the femur. There are five muscles in total, four of which form the powerful quadriceps muscle. The vastus medialis and vastus intermedius are located deep within the anterior compartment, close to the femur. They are overlaid by the vastus lateralis and rectus femoris. The fifth muscle, sartorius, is a synergistic muscle to the quadriceps muscle. It is located more medially and slightly posterior to the plane of the rectus femoris. Continuing medially around the thigh, we arrive at the medial (adductor) compartment of the thigh. There are six muscles in this compartment, but only four are visible. Deep within the compartment, the following three muscles are arranged from anterior to posterior: adductor longus, adductor brevis and adductor magnus. The latter occupies most of the medial compartment at this level of the thigh. Gracilis is the most superficial muscle. The posterior compartment of the thigh is composed of three muscles, collectively known as the hamstrings. If you are physically active and sport, you definitely know where they are because you've probably suffered a lot of strains in this area. All three (biceps femoris, semitendinosus, semimembranosus) lie deep to the adductor magnus muscle. A thick band of deep fascia that stabilizes the hip (iliotibial tract) descends along the lateral aspect of the thigh between the vastus lateralis and biceps femoris muscles. Finally, let's clarify the neurovasculature of the thigh. The femoral artery and vein are the most important vessels of this region. They travel within the adductor (Hunter's) canal bound by the adductor longus and adductor magnus (posteriorly), vastus medialis (anteriorly) and sartorius (anteromedially). The deep femoral vessels can be seen medially and in close proximity to the femur. The sciatic nerve travels within the posterior compartment of the thigh, anterior to the biceps femoris. The great saphenous vein is a superficial vessel of this region that is located anteromedially, anterior to the adductor longus muscle. Practice your newly acquired knowledge by tackling the following quiz: Adductor longus muscle level Explore study unit The next section is a leg cross section. The leg is the region of the lower extremity that extends between the knee and ankle joints. It consists of two bones (tibia, fibula) and three muscle compartments (anterior, lateral, posterior). In order to understand the cross-sectional anatomy of the leg, we'll slice it at the level of the soleus muscle. Cross section of the leg through the soleus muscle: Diagram Generally speaking, it is very easy to recognize a cross section through the leg, mostly due to the tibia. This bone is located directly beneath the skin on the anterior aspect of the leg (top of the image). This is the same reason why the slightest touch hurts so much. Following logically from anatomy, the fibula is located laterally to the tibia, hence it pinpoints the lateral aspect of the cross section. The tibia and fibula are the two bony pillars of the leg, anchoring several muscles. They are joined by an interosseous membrane and their shafts appear as two solid, oval, white structures. The anterior leg muscles are located anteriorly to the interosseous membrane in the anterolateral aspect of the leg. The deepest muscle of this group (extensor hallucis longus) is covered by two superficial ones (extensor digitorum longus, tibialis anterior). Tibialis anterior forms the bulk of the anterior compartment. The muscles of the lateral group are easy to identify because they sit very close and lateral to the fibula. From anterior to posterior, they are named fibularis longus and fibularis brevis. Both are innervated by the superficial fibular nerve. The posterior compartment of the leg is the largest and most complicated of them all. There are seven muscles in total, all of which are located posterior to the interosseous membrane of the leg. The visible deep muscles (tibialis posterior, flexor digitorum longus) are located right against the membrane and the two bones. They are covered by the superficial muscles (soleus, gastrocnemius). The two heads of the gastrocnemius are the bulkiest and most superficial, forming the visible calf muscles. In terms of neurovasculature, several blood vessels and nerves can be seen. The anterior tibial vessels and deep fibular nerve travel on the anterior surface of the interosseous membrane, supplying the anterior compartment of the leg. The posterior tibial vessels are located posterior to the tibialis posterior, supplying the posterior compartment of the leg. The tibial nerve, a branch of the sciatic nerve, pierces the tibialis posterior and innervates all the muscles of the posterior compartment. The superficial great and small saphenous veins travel through the subcutaneous tissue beneath the skin on the anteromedial and posteromedial aspects of the leg, respectively. Do you want to master the cross-sections of the leg? Take a sneak peak at the resources offered below and start identifying them under exam conditions. Until now, we have seen several cross sections of the head, neck, upper and lower limbs. It's now time to move on to the trunk, where the thoracic and abdominal organs are located. In these areas the main interest is in the organs and the vessels and not in the muscles. Let's start with a cross section of the thoracic region. The thorax, or chest, is the superior part of the trunk situated between the neck and abdomen. It consists of a thoracic wall that encloses the thoracic cavity, which contains various neurovasculature structures and organs. Let's examine some of these structures in a cross section passing through the third thoracic vertebra. Cross section of the thorax through T3: Diagram Paradoxically speaking, orienting yourself is a lot easier in this cross section compared to the limbs, in spite of the increased complexity of the thorax. The typically shaped third thoracic vertebra lies posteriorly (bottom of image) while the lungs are pointing laterally. The esophagus can help you distinguish left from right because it normally sits slightly to the left of the vertebra. As usual, we'll explore the cross-section by starting with the osteology and the thoracic wall. The manubrium of the sternum is located anteriorly, articulating with the clavicle and the first rib. Since the ribs of the thoracic cage are oriented inferiorly, portions of the second, third and fourth ribs are visible around the contour of the lungs. Intercostal muscles and spaces are also interspersed between the visible rib fragments. The vertebra forms the posterior pillar of the thoracic wall. Overlying the thoracic cage are various muscles of the trunk, such as the pectoralis (major, minor), serratus (anterior, posterior), rhomboid major, and trapezius. Within the thoracic cage, you can see the two lungs in the centre of the image. Due to the level of the section, only their superior lobes are visible. Two tubular organs are located between the lungs: the esophagus located directly anterior to T3 and the trachea located in front of the esophagus. Surrounding the trachea there are three arterial lumens representing the left subclavian artery, left common carotid artery and brachiocephalic trunk. Anterior and right lateral to the brachiocephalic trunk are two brachiocephalic veins (dark shapes), left and right, respectively. However, something fairly obvious is missing above, don't you think? You know that the thorax contains a major organ called the heart. Let's take a look at it by taking a cross section at a lower level, passing through the seventh thoracic vertebra. Cross section of the thorax through T7: Diagram This cross section is fairly similar to the previous one, with a few exceptions. The middle and inferior lobes of the lungs are visible, together with the dividing fissures. The pulmonary veins (left and right) which bring oxygenated blood to the heart together with the left lobar bronchus are also apparent. The small region anterior to the thoracic vertebra has changed as well. The trachea is no longer visible because it has split up more superiorly to the main bronchi. However, the descending aorta appears left laterally together with the azygos vein in the midline. Do you know why Kenhub's anatomy quiz questions are your secret to success when learning cross sections? They are versatile and use spaced repetition, helping you save time, cement your knowledge and ease retention. Anterior to the aorta and azygos vein and in between the lungs lies the heart. Due to its inferolateral orientation in the thorax, the right atrium and ventricle face anteriorly, while the left atrium and ventricle face posteriorly. The ascending aorta is seen emerging from the left ventricle. The ribs, sternum and muscles of the chest wall also appear more distinctly. Understanding the anatomy of the thorax can be challenging. Why don't you use Kenhub's learning materials to ease your learning? They are right here for you: Now solidify your knowledge with our tailored quiz on the cross sections through the thorax. Continuing our way down the body, we arrive at the abdomen, which is located between the thorax and the pelvis. The abdominal wall surrounds the abdominal cavity, which houses several abdominal structures and organs. Let's slice the abdomen through the eleventh thoracic vertebrae to see some of them: Cross section of the abdomen through T11: Diagram If you think getting your bearings inside the thorax was easy, then the abdomen is a piece of cake. As usual, the vertebra is located posteriorly (bottom of image). Distinguishing right from left is equally easy by using the liver as reference. As you know, this large organ is located on the right hand side of the abdomen, hence the left of the image is the patient's lateral right. Here's a tip - you can approximate the level of the cross-section in the thorax and abdomen if you look at the vertebra. They increase in size as you descend the vertebral column and have specific characteristics depending on their type. We'll start by looking at the abdominal wall. In addition to the posterior thoracic vertebra, you can see the ribs wrapping around the abdominal cavity. The xiphoid process of the sternum and costal cartilages of the 7th to 12th ribs are situated anteriorly. The abdominal wall also consists of several muscles. Located posteriorly and from medial to lateral, they are named: longissimus thoracis, iliocostalis lumborum, and latissimus dorsi. Interspersed between the ribs are the external intercostal muscles while anteriorly one can see the rectus abdominis, or the 'six-pack' muscles. Located deeper and encircling the entire cavity is the muscular diaphragm. In terms of organs, the large mass located lateral-right is the right lobe of the liver. Medial to it, in the midline, lies its left lobe. The second solid, parenchymatous organ seen at this level is the spleen, which is located posterior and lateral-left within the abdomen. Anterior to the spleen you can also see four additional hollow structures. The most posteromedial one has an irregular internal border, hence it is the stomach. More anterior, there are two hollow organs with a regular internal border. These represent the descending and transverse parts of the colon. Lastly, the large hollow structure located close to the anterior abdominal wall is the pyloric part of the stomach. It also has an irregular internal border (mucosal folds). As you can see, the regularity of structures can help you to identify them. There are some neurovascular structures left to discuss. The abdominal aorta is situated anterior to the vertebra and slightly to the left of it. To the right of the aorta and encased within the large lobe of the liver is the inferior vena cava. The hepatic vein is located anterior to the inferior vena cava and within the right lobe of the liver. The abdomen doesn't simply stop at the level of T11. It continues inferiorly, so let's take another transverse slice through it at the level of the first lumbar vertebra. Cross section of the abdomen through L1: Diagram It looks quite differently, right? The most obvious changes are the reduced size of the liver and appearance of several additional organs. The kidneys are visible anterior to the posterior abdominal wall and laterally to the vertebra, quadratus lumborum and psoas major muscles. Lateral to the right kidney is the much reduced right lobe of the liver. Anterior to it, you can see the ascending colon followed by the transverse colon. The latter forms two distinct cavities posterior to the anterior abdominal wall because the transverse colon hangs in the abdomen rather than travelling straight across. The spleen is located lateral to the left kidney, while the duodenum, jejunum and descending colon are found anteriorly to the kidney and spleen. They appear in various shapes and sizes due to their convoluted course through the abdomen. The abdominal aorta has a different shape due to the branching off of the superior mesenteric artery. Anterior to the inferior cava you can see the parenchymatous pancreas, bile duct and superior mesenteric vein. If you want to learn more details about the cross sections of the abdomen, take a look below: As the final step in exploring the abdomen, test your knowledge with the quiz below. The pelvis is the inferior part of the trunk, extending inferior from the abdomen. It consists of the pelvic girdle and perineum and supports the urinary and reproductive organs. As you know, the pelvic structures in men and women are not identical. We'll examine the male structures first by slicing the pelvis at the level of the distal end of the coccyx. Cross section of the male pelvis through the coccyx: Diagram How can you get your bearings in the above illustration? Just the same as in all the previous cases. The rectum, represented by a cavity, is located posteriorly (bottom of the image). Alternatively, you can search for the coccyx, which also points posteriorly. In case these structures are not clearly visible, you can use the proximal ends of the femurs as reference. If you are a real anatomy whizz, you know that the neck of the femur points slightly anteriorly when forming the articulation of the hip joint. This is another trick that you can use to distinguish anterior from posterior. The pelvic girdle forms the framework of the pelvis. Due to the level of the cross-section, only the pubic bone (anterior) and ischium (posterior) are observed. They form the acetabulum, which is represented by the reddish semilunar shape. If you know the orientation of the section, you can easily identify the bones because the pubic bone sits anteriorly in the pelvis. The acetabulum articulates with the head of the femur, which continues laterally with the neck and greater trochanter. The incomplete pelvic girdle in this cross section surrounds three central visceral structures. From anterior to posterior, these include the urinary bladder, prostate and rectum. The rectum is partially enclosed by the levator ani which is situated posteriorly. The main muscles of the pelvis are located in the posterior gluteal region. The inferior gemellus (lateral) and obturator internus (medial) are located deeply, in close proximity and posterior to the femur and acetabulum. The large, superficial gluteus maximus covers these two muscles. The sciatic nerve can be found sandwiched between the two muscle layers. The muscles of the anterior compartment of the thigh are located anterior to the femur. You've already seen some of them when we discussed the cross section through the thigh. However, some additional ones are present here, from medial to lateral: pectineus, iliopsoas, rectus femoris and tensor fascia latae. The sartorius is the most superficial one, located anterior to the previous three. The femoral artery, vein and nerve are located in the femoral triangle formed by the sartorius (lateral), pectineus and iliopsoas. The vein is easiest to spot because it has the largest diameter out of the three. Medial to the femoral triangle, in the midline, you can see the spermatic cord and the rectus abdominis muscle. Now that we've covered the male pelvis, let's take a look at the female one by examining a cross-section passing through the coccyx as well, but at a slightly higher level. Cross section of the female pelvis through distal end of coccyx: Diagram You can use very similar landmarks to orientate this cross section, exactly like in the male version. Quite evidently, the bony and muscular anatomy have not changed much in this image, since men and women have the exact same bones and muscles. The sigmoid colon is visible posteriorly simply because the cross section was taken at a higher level, superior to the rectum. Medial to the iliopsoas muscle one can see the external iliac artery and vein. In addition, the internal iliac vessels are located medially to the pelvic bones. As usual, the veins and arteries can be easily differentiated by the caliber of their lumens. However, you can see that the pelvic viscera in the centre has a slightly different arrangement. That's because the uterus is located anterior to the sigmoid colon and rectum and posterior to the urinary bladder. These two cross-sections only provide you with an overview of the male and female pelvis. Start reviewing your newly acquired knowledge using the quizzes and study several additional axial sections to form a complete view of the pelvic structures. All content published on Kenhub is reviewed by medical and anatomy experts. The information we provide is grounded on academic literature and peer-reviewed research. Kenhub does not provide medical advice. You can learn more about our content creation and review standards by reading our content quality guidelines. References: Ilis, H., Logan, B. M., Dixon, A. K., & Ellis, H. (2009). Human sectional anatomy: Atlas of body sections, CT and MRI images. London: Hodder-Arnold Article, review, layout: Adrian Rad Dimitrios Mytilinaios Illustrators: Orientation of cross sections - Irina Münstermann, José Miguel Mata Cross section through the thalamus (diagram) - National Library of Medicine Cross section through the maxillary sinus (diagram) - National Library of Medicine Cross section through the tongue and C2 (diagram) - National Library of Medicine Cross section through the biceps brachii muscle (diagram) - National Library of Medicine Cross section of the thigh through the adductor longus muscle (diagram) - National Library of Medicine Cross section of the leg through the soleus muscle (diagram) - National Library of Medicine Cross section of the thorax through T3 (diagram) - National Library of Medicine Cross section of the thorax through T7 (diagram) - National Library of Medicine Cross section of the abdomen through T11 (diagram) - National Library of Medicine Cross section of the abdomen through L1 (diagram) - National Library of Medicine Cross section of the male pelvis through the coccyx (diagram) - National Library of Medicine Cross section of the female pelvis through distal end of coccyx (diagram) - National Library of Medicine Cross sectional anatomy: want to learn more about it? 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