

Gross Anatomy Learning Objectives for Competency-based Undergraduate Medical Education

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Gross Anatomy Competencies for Preclinical Learners

Topic	Learning Objective	Clinical Relevance	Comments
Introduction			
Terminology	Describe the anatomical position.	Effective communication with clinical colleagues and patients	
	Differentiate the major anatomical planes and describe terminology used for specific planes (e.g. median plane).	Effective communication with clinical colleagues and patients; execution/evaluation of imaging studies	
	Use correct terminology to discuss the relationships between anatomical structures (e.g. anterior, proximal).	Effective communication with clinical colleagues and patients; execution/evaluation of imaging studies	
	Use correct terminology to describe movements of various body parts (e.g. flexion, abduction).	Effective communication with clinical colleagues and patients	
Skin and Fascia	Describe the two layers of the skin (epidermis and dermis).	Foundational knowledge; physical exam; surgical procedures (mole removal); evaluation of injury during trauma (e.g. wounds, burns)	Details about the skin are discussed in the histology competency document.
	Describe the two major types of fascia (superficial and deep), their function and general locations.	Foundational knowledge; spread of infection or malignancy; evaluation of injury during trauma (e.g. compartment syndrome); surgical procedures (e.g. planning incisions)	
Musculoskeletal System	Explain the difference between the axial and appendicular skeleton.	Foundational knowledge; physical exam	

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	Distinguish the three basic structural types of joints (fibrous, cartilaginous, synovial).	Foundational knowledge; physical exam; evaluation of joint pain	Detailed knowledge of the classification of joints (e.g. syndesmoses, condyloid) has limited relevance to most fields, thus discussion could be delayed until clinical training.
	Describe the components of a typical synovial joint.	Foundational knowledge; physical exam; procedures (e.g. joint injection); evaluation of joint pain	
	Describe four basic types of bony features (elevation, depression, opening, space) and list examples of each type (e.g. tubercle, fossa, foramen, cavity).	Foundational knowledge; physical exam; evaluation of musculoskeletal problems	
	List the three types of muscle and where they are found in the body.	Foundational knowledge; physical exam; evaluation of musculoskeletal problems	
	Explain the terms origin and insertion with respect to a muscle.	Foundational knowledge; physical exam; evaluation of musculoskeletal problems	Some may prefer to use the terms "proximal attachment" and "distal attachment" as opposed to origin/insertion, however this may be confusing when discussing muscles that are not in the limbs.
Nervous System	Describe the general organization of the nervous system (e.g. central vs. peripheral).	Foundational knowledge; physical exam; evaluation of neural problems (e.g. neuropathy, pain, paresthesia); evaluation of musculoskeletal problems (e.g. weakness, atrophy)	

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	Explain the difference between cranial nerves and spinal nerves, and list how many of each are found in the body.	Foundational knowledge; physical exam; evaluation of neural problems (e.g. neuropathy, pain, paresthesia); evaluation of musculoskeletal problems (e.g. weakness, atrophy)	
	Describe the structure of the spinal cord and the organization of the meninges.	Foundational knowledge; procedures (e.g. lumbar puncture); administration of anesthesia; evaluation of musculoskeletal problems (e.g. weakness, atrophy); evaluation of pain; evaluation of malignancy (e.g. meningioma); evaluation of imaging studies	The structure of the spinal cord is applicable to gross anatomy to understand the location of cell bodies and axons in peripheral nerves. An understanding of gray vs. white matter would be included in this objective, however other details (e.g. major nuclei, tracts, blood supply) are in the neuroscience competency document.
	Explain the relationship between the spinal cord and vertebral column.	Foundational knowledge; procedures (e.g. lumbar puncture); administration of anesthesia; evaluation of musculoskeletal problems (e.g. herniated nucleus pulposus); evaluation of injury during trauma (e.g. fracture); evaluation of pain; evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Define the concept of a spinal cord segment, and explain what a dermatome is; contrast with peripheral cutaneous nerve territories.	Foundational knowledge; physical exam (e.g. reflexes, dermatomal rashes); evaluation of musculoskeletal problems (e.g. weakness, atrophy); evaluation of neural problems (e.g. neuropathy, pain, paresthesia, referred pain)	
	Identify the parts of a typical spinal nerve, and describe the distribution of the dorsal and ventral rami.	Foundational knowledge; physical exam; evaluation of musculoskeletal problems (e.g. weakness, atrophy); evaluation of neural problems (e.g. neuropathy, pain, paresthesia); evaluation of imaging studies	
	Explain how spinal nerves exit the vertebral canal.	Foundational knowledge; evaluation of musculoskeletal problems (e.g. weakness, atrophy); evaluation of pain (e.g. nerve compression, herniated nucleus pulposus); evaluation of imaging studies	
	Describe the basic structure of a neuron and explain the difference between 'neuron' and 'nerve'.	Foundational knowledge; evaluation of musculoskeletal problems (e.g. weakness, atrophy); evaluation of pain	This concept is often discussed as part of the histology or neuroscience content, however it is applicable to gross anatomy to understand the course of neurons within peripheral nerves.

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	Define the following terms in the context of the nervous system: nucleus, tract, ganglion, nerve.	Foundational knowledge; evaluation of musculoskeletal problems (e.g. weakness, atrophy); evaluation of pain	This concept is often discussed as part of the histology or neuroscience content, however it is applicable to gross anatomy to understand the location of cell bodies and axons in peripheral nerves.
	Describe the different structural types of neurons (unipolar, bipolar, pseudounipolar, multipolar).	Foundational knowledge; physical exam; evaluation of musculoskeletal problems (e.g. weakness, atrophy); evaluation of pain	This concept is often discussed as part of the histology or neuroscience content, however it is applicable to gross anatomy to understand the location of cell bodies and axons in peripheral nerves.
	Describe the different functional types of neurons (somatic afferent, somatic efferent, visceral afferent, visceral efferent) and explain generally what they innervate.	Foundational knowledge; physical exam; evaluation of musculoskeletal problems (e.g. weakness, atrophy); evaluation of pain	
	Name the two divisions of the autonomic nervous system (ANS) and their basic functions.	Foundational knowledge; physical exam; evaluation of visceral problems (e.g. mydriasis, miosis); evaluation of visceral pain	
	Explain the terms “preganglionic fiber” and “postganglionic fiber” in the context of the ANS.	Foundational knowledge; physical exam; evaluation of visceral problems (e.g. mydriasis, miosis); evaluation of visceral pain; surgical procedures (e.g. vagotomy); administration of anesthesia (e.g. sympathetic block)	

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	Describe the locations of sympathetic cell bodies (thoracolumbar lateral horn, sympathetic chain ganglia, prevertebral ganglia) and the general routes of their preganglionic and postganglionic neurons.	Foundational knowledge; physical exam; evaluation of visceral problems (e.g. Horner's syndrome, hyperhidrosis); evaluation of visceral pain; surgical procedures (e.g. sympathectomy); administration of anesthesia (e.g. sympathetic block); pain management for cancer (e.g. stellate ganglion block)	
	Explain the following terms associated with the sympathetic nervous system: white ramus communicans, gray ramus communicans, internal/external carotid plexuses, splanchnic nerve, cardiac nerve.	Foundational knowledge; physical exam; evaluation of visceral problems (e.g. Horner's syndrome); evaluation of visceral pain	
	Describe the locations of parasympathetic cell bodies (cranial nerve nuclei, sacral lateral horn, parasympathetic ganglia) and the general routes of their preganglionic and postganglionic neurons.	Foundational knowledge; physical exam; evaluation of visceral problems (e.g. mydriasis, erectile dysfunction); evaluation of visceral pain; surgical procedures (e.g. vagotomy, prostatectomy)	
	List the cranial nerves that contain preganglionic parasympathetic neurons.	Foundational knowledge; physical exam; evaluation of visceral problems (e.g. mydriasis); evaluation of visceral pain; surgical procedures (e.g. vagotomy)	

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	Discuss the function of visceral afferent neurons that travel with sympathetic and parasympathetic neurons.	Foundational knowledge; physical exam; evaluation of visceral and referred pain; surgical procedures (e.g. vagotomy, sympathectomy); administration of anesthesia (e.g. sympathetic block)	
Cardiovascular System	Explain the anatomical and functional differences between arteries and veins.	Foundational knowledge; physical exam; procedures (e.g. catheterization, venous access)	
	Define the following terms: anastomosis, collateral circulation, end artery, venae comitantes, venous plexus, portal system.	Foundational knowledge; surgical procedures; execution/evaluation of imaging studies	
Lymphatic System	Describe the basic organization (lymphatic capillaries, vessels, nodes, trunks, ducts) and function of the lymphatic system.	Foundational knowledge; physical exam (e.g. edema); spread of infection or malignancy; procedures (e.g. lymph node dissection)	
	Name the regions of the body that convey lymph to the right lymphatic duct and thoracic duct, and explain how this lymph enters the circulation.	Foundational knowledge; physical exam (e.g. edema); spread of infection or malignancy; procedures (e.g. lymph node dissection)	
	Identify and locate the major groups of lymph nodes in the body.	Foundational knowledge; physical exam (e.g. edema); spread of infection or malignancy; procedures (e.g. lymph node dissection)	Objectives related to the immunologic role of organs such as the spleen and thymus are discussed in the histology competency document.

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Radiology	Explain how images are generated in major imaging modalities used in clinical medicine (radiography, computed tomography, magnetic resonance imaging, ultrasonography and mammography).	Execution (e.g. ultrasound exam) and evaluation of imaging studies	Details are likely not necessary for preclinical learners, but they should have a basic understanding, e.g. that radiographs and CT are obtained by X-rays, while MRI relies on the molecules in tissues.
	Describe the conventions used to view various types of imaging studies (e.g. radiographs are viewed as if you are facing the patient).	Evaluation of imaging studies	Students need to interpret imaging studies on USMLE Step I, thus this content is necessary in the preclinical phase of training.
	Explain how the density, thickness and shape of a structure affects its appearance on radiographic images.	Evaluation of imaging studies	Students should understand how high density vs. low density structures appear on various modalities to aid identification of unknown structures (e.g. on radiographs, bone appears white, air appears dark and soft tissues are shades of gray).
	Define the terms used to describe anatomic structures on common imaging studies (radiolucent, radioopaque, high/low attenuation, high/low signal intensity, echogenicity: anechoic, hypoechoic, hyperechoic).	Evaluation of imaging studies	Students need to interpret imaging studies on USMLE Step I, thus this content is necessary in the preclinical phase of training.

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Back			
Vertebral column	Name the parts of a typical vertebra, and describe the features of each regional type.	Physical exam; evaluation of back pain (e.g. osteoarthritis, herniated nucleus pulposus); evaluation of injury during trauma (e.g. fracture); evaluation of congenital anomalies (e.g. spina bifida, spondylolisthesis); execution/evaluation of imaging studies	
	Describe the organization (bones, joints, ligaments), function and movements of the vertebral column.	Physical exam; evaluation of back pain (e.g. osteoarthritis, herniated nucleus pulposus); evaluation of injury during trauma (e.g. fracture); evaluation of congenital anomalies (e.g. spondylolisthesis); execution/evaluation of imaging studies	
	Describe the normal and abnormal curvatures of the vertebral column: primary, secondary, kyphosis, lordosis, scoliosis.	Physical exam; evaluation of back pain (e.g. lordosis with pregnancy); evaluation of congenital anomalies (e.g. scoliosis); execution/evaluation of imaging studies	
	Discuss various reasons and methods for clinically accessing the vertebral canal.	Procedures (e.g. lumbar puncture, laminectomy); administration of anesthesia (e.g. epidural, spinal anesthesia)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Identify components of the vertebral column on radiographs, axial images and sagittal cross-sectional images of the spine.	Evaluation of imaging studies	
Back	Identify palpable bony landmarks used during examination of the back region.	Physical exam (e.g. scoliosis)	
	Describe the features of the scapula and its movements relative to the thoracic wall (i.e. scapulo-thoracic "joint").	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. fracture); evaluation of imaging studies	
	Name the major muscles of the back and describe their attachments, actions, and innervations. Distinguish intrinsic vs. extrinsic muscles.	Physical exam; evaluation of musculoskeletal problems (e.g. strains, spasms); evaluation of back pain	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions. Individual muscles of the erector spinae and transversospinalis groups have limited relevance to most fields and thus discussion could be delayed until clinical training.
	Describe the blood supply and venous drainage of the intrinsic back muscles via segmental arteries and veins.	Evaluation of injury during trauma; evaluation of imaging studies	
	Describe the blood supply and venous drainage of the superficial extrinsic back muscles via branches and tributaries of the subclavian and axillary vessels.	Evaluation of injury during trauma; evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain the cutaneous innervation of the back via dorsal rami of spinal nerves.	Evaluation of neural problems (e.g. pain, paresthesia)	Dermatomes of the back have limited clinical relevance compared to other areas, thus could be de-emphasized.
Thorax			
Breast	Describe the anatomical structure of the breast.	Breast exam; evaluation of breast cancer; mammography; pregnancy and lactation; surgical procedures	
	Explain the position of the breast on the chest wall in relation to the skin, superficial fascia and pectoral muscles.	Clinical signs of breast cancer; placement of breast implants; surgical procedures	
	Describe the lymphatic drainage of each quadrant of the breast.	Breast exam; lymphatic spread of breast cancer	Subgroups of the axillary lymph nodes have limited relevance to most fields, thus discussion could be delayed until clinical training.
Thoracic wall	Identify palpable landmarks of the thorax (clavicle, sternum, suprasternal notch, sternal angle, xiphoid process, ribs, costal margin) utilized for physical exam or clinical procedures.	Physical exam; access to thoracic cavity during procedures (e.g. chest tube thoracostomy)	
	Name the parts of the thoracic cage. Explain how the ribs articulate with the thoracic vertebrae and aid respiratory function.	Evaluation of injury during trauma; access to thoracic cavity during procedures; evaluation of respiratory function; execution/evaluation of imaging studies	

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	Name the three layers of intercostal muscles and explain their function in respiration.	Access to thoracic cavity during procedures; evaluation of respiratory function	Attachments and fiber directions of intercostal and subcostal muscles have limited clinical relevance; attachments and functional details about the pectoral muscles are in the shoulder unit.
	Describe the position of the intercostal vessels and nerves with respect to the ribs.	Access to thoracic cavity during procedures; administration of anesthesia	
	Describe the blood supply and venous drainage of the thoracic wall.	Access to thoracic cavity during procedures; planning surgical incisions; evaluation of arterial or venous blockage (e.g. aortic coarctation)	
	Explain the innervation of the thoracic wall.	Physical exam; administration of anesthesia; access to thoracic cavity during procedures; planning surgical incisions	
	Identify the sternum, ribs, and intercostal musculature on radiographs and axial images of the chest.	Evaluation of imaging studies	
Lungs and Respiration	Describe the lobes and fissures of the lungs, and their positions relative to the thoracic wall.	Physical exam; evaluation of respiratory function; access to thoracic cavity during procedures; execution/evaluation of imaging studies; surgical procedures; evaluation of lung cancer	The <i>names</i> of bronchopulmonary segments have limited relevance to most fields, thus discussion could be delayed until clinical training. The <i>concept</i> of a bronchopulmonary segment may be useful to discuss from a functional standpoint.

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	Describe the anatomy of the trachea and its division into main, lobar and segmental bronchi.	Evaluation of respiratory function (e.g. aspiration of foreign body); procedures (e.g. intubation, bronchoscopy); execution/evaluation of imaging studies; surgical procedures; evaluation of congenital anomalies (e.g. TEF, tracheomalacia)	
	Differentiate between parietal pleura and visceral pleura and explain where the pleural cavity (space) is located.	Physical exam; access to thoracic cavity during procedures; pneumothorax/hemothorax; execution/evaluation of imaging studies; surgical procedures	
	Describe the location of the lines of pleural reflection and the pleural recesses.	Physical exam; access to thoracic cavity during procedures; pneumothorax; plural effusion; execution/evaluation of imaging studies; surgical procedures	
	Explain the blood supply of the lung and the pulmonary circulation.	Evaluation of respiratory function (e.g. pulmonary embolism)	
	Describe the lymphatic drainage of the lung and major groups of nodes at the hilum/adjacent to trachea.	Lymphatic spread of lung cancer; clinical signs of cancer (e.g. distortion of carina)	
	Describe the innervation of the lungs and pleura.	Evaluation of chest pain or referred pain	

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	Describe the structure and innervation of the diaphragm.	Evaluation of respiratory function; execution/evaluation of imaging studies; evaluation of referred pain to the shoulder; evaluation of CDH	
	Discuss the mechanism of respiration including the role of the diaphragm, the intercostal muscles, and other accessory muscles of respiration.	Evaluation of respiratory function; execution/evaluation of imaging studies	
	Identify the lobes of the lungs, trachea, main bronchi and diaphragm on radiographs and axial images of the chest.	Evaluation of imaging studies	All practicing physicians should be minimally competent in evaluation of chest xrays.
Heart	Describe the orientation of the heart in the body including its relationship to the thoracic wall and what comprises the heart surfaces and borders.	Physical exam; execution/evaluation of imaging studies; procedures (e.g. placing EKG leads); evaluation of congenital anomalies (e.g. dextrocardia)	
	Discuss each chamber of the heart and its features. Describe the two septa that separate the heart chambers.	Physical exam; surgical procedures; evaluation of congenital anomalies (e.g. VSD); execution/evaluation of imaging studies	
	Describe the valves of the heart and explain how they function.	Physical exam; surgical procedures (e.g. valve repair); evaluation of congenital anomalies; execution/evaluation of imaging studies (e.g. echocardiography)	

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	List the great vessels (superior vena cava, aorta, pulmonary trunk, pulmonary veins, inferior vena cava) and describe their anatomical relationships.	Physical exam; execution/evaluation of imaging studies; evaluation of congenital anomalies (e.g. patent ductus arteriosus)	
	Describe the path of blood through the heart.	Physical exam; execution/evaluation of imaging studies; surgical procedures; evaluation of congenital anomalies (e.g. atrial or ventricular septal defect)	
	Describe the coronary circulation.	Execution/evaluation of imaging studies (e.g. coronary angiography); procedures (e.g. angioplasty, coronary bypass); evaluation of myocardial infarction; recognition of variations that may impact health	Major branches are sufficient for preclinical learners (right and left coronary, SA nodal branch, right marginal branch, posterior interventricular, AV nodal branch, LAD, circumflex; great, middle and small cardiac veins, coronary sinus).
	Explain the concept of coronary dominance and explain how it can be affected by common variations of the coronary arteries.	Execution/evaluation of imaging studies (e.g. coronary angiography); procedures (e.g. angioplasty, coronary bypass); evaluation of myocardial infarction; recognition of variations that may impact health	
	Explain the components of the conduction system, and the nerves that modify the heart rate. Discuss the source of autonomic nerves, where they synapse, and how they travel to the heart.	Physical exam; evaluation of abnormal heart rhythms (e.g. ECG); evaluation of chest pain or referred pain	

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	Explain the organization of the three layers of the pericardium and the location of the pericardial cavity.	Physical exam; procedures (e.g. pericardiocentesis); execution/evaluation of imaging studies	Transverse and oblique pericardial sinuses have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Identify the great vessels and chambers of the heart on radiographs and axial images of the chest.	Evaluation of imaging studies	
Mediastinum	Describe the borders and subdivisions of the mediastinum.	Physical exam; execution/evaluation of imaging studies; evaluation of congenital anomalies; evaluation of malignancy	
	Describe the three-dimensional relationships between the major structures in the mediastinum, specifically the thymus, great vessels, heart, trachea, esophagus, azygos system of veins, thoracic duct, phrenic nerves, vagus nerves and sympathetic chains.	Physical exam; execution/evaluation of imaging studies; evaluation of congenital anomalies; evaluation of malignancy (e.g. mass in mediastinum may affect nerve function)	
	Describe the azygos system of veins.	Evaluation of arterial or venous blockage; evaluation of malignancy	Details about the pattern of the azygos system (e.g. hemiazygos) are not particularly clinically relevant, especially since the system is highly variable.

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	Describe the course of the phrenic nerve in the mediastinum and explain what it innervates.	Evaluation of malignancy (e.g. mass in mediastinum may affect nerve function); evaluation of respiratory function (e.g. hemidiaphragm paralysis); evaluation of pain (e.g. pericarditis); surgical procedures	
	Describe the course of the vagus nerve and its left recurrent laryngeal branch in the mediastinum; explain how compression of these nerves may produce hoarseness.	Evaluation of malignancy (e.g. mass in mediastinum may affect nerve function); evaluation of hoarseness; surgical procedures	
	Explain how structures travel between the thoracic and abdominal cavities (i.e. through or posterior to the diaphragm).	Evaluation of gastroesophageal reflux or hiatal hernia; evaluation of congenital anomalies	
	Identify major vessels and organs of the mediastinum on radiographs and axial images of the chest. Discriminate the structures that contribute to the borders between the lungs and mediastinum on chest xrays.	Evaluation of imaging studies	
Abdomen			
Abdominal wall	Identify palpable landmarks of the abdomen (costal margin, xiphoid, lower ribs, umbilicus, iliac crest, ASIS) utilized for physical exam or clinical procedures.	Physical exam; execution/evaluation of imaging studies (e.g. ultrasound exam)	
	Name the surface landmarks/reference planes that define the abdominal quadrants.	Physical exam; localization of abdominal pain; execution/evaluation of imaging studies (e.g. ultrasound exam)	Most clinicians reference abdominal quadrants during physical exam, thus discussion of the "nine region pattern" may not be particularly relevant.

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Topic	Learning Objective	Clinical Relevance	Comments
	Recognize the position of abdominal viscera relative to abdominal quadrants.	Physical exam; evaluation of abdominal pain; execution/evaluation of imaging studies (e.g. ultrasound exam); evaluation of injury during trauma	
	Describe the organization of the abdominal wall, specifically the fascial and muscle layers and the rectus sheath.	Evaluation of injury during trauma; access to abdominal cavity during procedures (e.g. laparoscopic cholecystectomy); surgical incisions and closure of abdominal wall; abdominal hernia; evaluation of congenital anomalies (e.g. gastroschisis); evaluation of pelvic trauma (e.g. extravasation of urine from penile rupture)	Attachments of abdominal muscles have limited relevance to most fields, thus discussion could be delayed until clinical training; pyramidalis is minor and not particularly relevant; umbilical folds on internal aspect of abdominal wall are not relevant to most fields and thus discussion could be delayed until clinical training.
	Describe the blood supply and venous drainage of the abdominal wall.	Access to abdominal cavity during procedures; planning surgical incisions; evaluation of portal hypertension (e.g. caput medusa)	
	Describe the lymphatic drainage of the abdominal wall.	Spread of infection or malignancy	Knowledge of the general pattern is likely sufficient for preclinical learners (drainage to axillary, superficial inguinal or deep nodes along major vessels).

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	Explain the innervation of the abdominal wall and name the landmarks used to identify key abdominal dermatomes (xiphoid process, umbilicus, pubic symphysis).	Physical exam; evaluation of abdominal pain or referred pain; access to abdominal cavity during procedures; planning surgical incisions; administration of anesthesia	
	Discuss the functional importance of the abdominal wall in increasing intra-abdominal pressure, providing support and moving the trunk.	Effective communication with patients (e.g. strengthen muscles for back pain); evaluation of motor deficits; pregnancy/childbirth	
	Identify the muscles of the abdominal wall (rectus abdominis, external oblique, internal oblique, transversus abdominis) on axial images of the abdomen.	Evaluation of imaging studies (e.g. for hernia diagnosis)	
Inguinal region	Name the palpable landmarks used to identify the inguinal ligament.	Physical exam (e.g. evaluation of inguinal hernia); surgical incisions	
	Describe the organization of the inguinal canal including the superficial (external) and deep (internal) inguinal rings.	Physical exam (e.g. evaluation of inguinal hernia); surgical incisions and procedures (e.g. hernia repair)	Details about the borders of the canal (e.g. conjoint tendon) have limited relevance to most fields, thus discussion could be delayed until clinical training.
	List the major contents of the inguinal canal in females and males.	Physical exam (e.g. cryptorchidism, testicular torsion, inguinal hernia); pregnancy (e.g. round ligament pain); surgical procedures (e.g. vasectomy)	
	Discuss the difference between indirect and direct inguinal hernias and their relationship to the inferior epigastric vessels and the deep ring.	Physical exam (e.g. evaluation of inguinal hernia); surgical incisions and procedures (e.g. hernia repair)	

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	Define the boundaries of the inguinal (Hesselbach's) triangle through which direct hernias pass.	Physical exam (e.g. evaluation of inguinal hernia)	
Testis/spermatic cord	Describe the components of the spermatic cord and explain the derivation of fascial layers from the abdominal wall.	Physical exam; surgical procedures (e.g. vasectomy); evaluation of testicular problems (e.g. hydrocele, torsion)	
	Explain the function and innervation of the cremaster muscle.	Physical exam (e.g. cremasteric reflex)	
	Describe the gross structure of the testis, epididymis and vas (ductus) deferens.	Physical exam; evaluation of infertility; execution/evaluation of imaging studies (e.g. testicular ultrasound); evaluation of testicular problems (e.g. malignancy, cryptorchidism); surgical procedures	
	Describe the blood supply, venous and lymphatic drainage of the testis. Explain how the pampiniform venous plexus aids regulation of testicular temperature (countercurrent cooling mechanism).	Physical exam; evaluation of testicular problems (e.g. varicocele, torsion); surgical procedures; lymphatic spread of testicular cancer	
Peritoneum	Differentiate between parietal peritoneum and visceral peritoneum and explain where the peritoneal cavity is located.	Access to abdominal cavity; spread of infection; evaluation of abdominal pain; ascites	
	Explain the difference between peritoneal ligaments, mesenteries and omenta.	Surgical procedures; spread of infection; execution/evaluation of imaging studies	

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	Differentiate between intraperitoneal, primarily retroperitoneal and secondarily retroperitoneal organs.	Surgical procedures; lymphatic spread of infection or malignancy; execution/evaluation of imaging studies	
	Describe the borders of the lesser sac (omental bursa) and explain its relationship to the greater sac.	Surgical procedures; execution/evaluation of imaging studies; fluid accumulation; spread of infection	
Upper GI	Describe the location, structure and general function of organs in the upper abdomen (liver, gallbladder, distal esophagus, stomach, duodenum, pancreas and spleen).	Physical exam; evaluation of abdominal pain; evaluation of gastroesophageal reflux; surgical procedures; execution/evaluation of imaging studies; evaluation of malignancy; evaluation of congenital anomalies (e.g. pyloric stenosis; annular pancreas); evaluation of trauma (ruptured spleen)	Functional lobes of the liver have limited relevance to most fields, thus discussion could be delayed until clinical training; the suspensory ligament of the duodenum (ligament of Treitz) has limited clinical relevance to most fields and is best discussed during clinical training.
	Describe the major ligaments and omenta associated with the liver, stomach and transverse colon (falciform ligament, lesser omentum and greater omentum).	Surgical procedures; spread/limiting spread of infection; execution/evaluation of imaging studies	Peritoneal ligaments are primarily relevant to surgical fields, thus a detailed discussion of ligaments (e.g. gastrosplenic ligament) can be reserved for clinical training.
	Describe the duct system for the passage of bile from the liver to the duodenum, and for storage in the gallbladder.	Surgical procedures (e.g. cholecystectomy); execution/evaluation of imaging studies; evaluation of malignancy	

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Topic	Learning Objective	Clinical Relevance	Comments
	Discuss the relationship of the superior mesenteric vessels to the uncinata process of the pancreas, the third part of the duodenum and the left renal vein.	Evaluation of abdominal pain; execution/evaluation of imaging studies; evaluation of malignancy	
	Describe the blood supply and venous drainage of organs in the upper abdomen associated with the foregut.	Surgical procedures; evaluation of ischemia or portal hypertension; execution/evaluation of imaging studies	
	Explain the lymphatic drainage of organs in the upper abdomen associated with the foregut.	Lymphatic spread of infection or malignancy; surgical procedures (e.g. lymph node dissection)	A knowledge of general concepts is likely sufficient for preclinical learners (drainage from nodes near major vessels to cisterna chyli to thoracic duct).
	Explain the autonomic innervation of organs in the upper abdomen associated with the foregut.	Evaluation of abdominal pain or referred pain; administration of anesthesia; surgical procedures (e.g. vagotomy); pain management for cancer (e.g. celiac plexus neurolysis)	A knowledge of general concepts is likely sufficient for preclinical learners (e.g. "thoracic splanchnic nerves" is adequate instead of greater, lesser and least splanchnics).
	Identify the liver, gallbladder, esophagus, stomach, duodenum, pancreas and spleen on radiographs and axial images of the abdomen.	Evaluation of imaging studies	
	Identify the celiac trunk and its major branches (left gastric, splenic and common hepatic arteries) on angiograms of the abdomen.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
Lower GI	Describe the general structure and function of the jejunum and ileum, and their locations in the abdominal cavity relative to surface landmarks.	Physical exam; evaluation of abdominal pain; surgical procedures; execution/evaluation of imaging studies; evaluation of malignancy; evaluation of congenital anomalies (e.g. volvulus, Meckel's diverticulum)	
	Describe the general structure, function and location of the large bowel and differentiate intraperitoneal from retroperitoneal portions.	Physical exam; evaluation of abdominal pain; surgical procedures; execution/evaluation of imaging studies; procedures (e.g. colonoscopy); evaluation of malignancy; evaluation of congenital anomalies (e.g. left-sided colon)	Names of individual taeniae have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Explain the location of the appendix in the abdominal cavity and with respect to surface landmarks of the abdomen.	Physical exam; evaluation of abdominal pain; surgical procedures (e.g. appendectomy); execution/evaluation of imaging studies	
	Describe the blood supply and venous drainage of the small and large bowel.	Surgical procedures; evaluation of ischemia or portal hypertension; execution/evaluation of imaging studies	The differences in the vascular pattern supplying the jejunum vs. ileum (e.g. length of vasa recta) has limited clinical relevance to most fields, thus discussion could be delayed until clinical training.
	Discuss sites of collateral circulation between the blood supply of the foregut, midgut and hindgut organs.	Surgical procedures; evaluation of ischemia or portal hypertension; execution/evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain the lymphatic drainage of the small and large bowel.	Lymphatic spread of infection or malignancy; surgical procedures (e.g. lymph node dissection)	A knowledge of general concepts is likely sufficient for preclinical learners (drainage from nodes near major vessels to cisterna chyli to thoracic duct).
	Explain the autonomic innervation of the small and large bowel.	Evaluation of abdominal pain or referred pain; administration of anesthesia; pain management for cancer	
	Identify the jejunum, ileum and parts of the colon on radiographs, fluoroscopic images and axial images of the abdomen.	Evaluation of imaging studies	
	Identify the superior mesenteric artery and its major branches (jejunal, ileal, right colic, middle colic) on angiograms of the abdomen.	Evaluation of imaging studies	
	Identify the inferior mesenteric artery and its major branches (left colic, sigmoidal, superior rectal) on angiograms of the abdomen.	Evaluation of imaging studies	
Retroperitoneum	Describe the structure of the kidney, the layers of fat and fascia that surround it, and its relationship to surface landmarks of the abdominal wall.	Physical exam; kidney stones; surgical incisions and procedures; evaluation of injury during trauma; evaluation of congenital anomalies (e.g. pelvic kidney); execution/evaluation of imaging studies	
	Explain the blood supply and venous drainage of the kidney.	Surgical procedures; execution/evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the location, blood supply and venous drainage of the suprarenal (adrenal) gland.	Evaluation of malignancy or benign masses; execution/evaluation of imaging studies	Objectives regarding the function of the adrenal gland are in the histology competency document.
	Explain the course of the ureter from the renal pelvis to the bladder and describe its relationships to surrounding structures (e.g. bifurcation of common iliac vessels, uterine artery, ductus deferens).	Kidney stones; surgical procedures; execution/evaluation of imaging studies	
	Describe the general pattern of lymphatic drainage of retroperitoneal structures (e.g. kidneys, ureters, etc.) and contrast with the general pattern of intraperitoneal organs.	Lymphatic spread of infection or malignancy; surgical procedures (e.g. retroperitoneal lymph node dissection)	A knowledge of general concepts is likely sufficient for preclinical learners (drainage to retroperitoneal nodes to cisterna chyli to thoracic duct).
	Identify muscles of the posterior abdominal wall (quadratus lumborum, psoas major, iliacus) and describe their function.	Execution/evaluation of imaging studies; surgical incisions; evaluation of musculoskeletal problems	The objectives for the diaphragm are listed in the thorax section; details about quadratus lumborum are not likely clinically relevant.
	Identify the large vessels of the retroperitoneum (aorta, inferior vena cava) and describe their anatomical relations and major branches/tributaries.	Surgical procedures; execution/evaluation of imaging studies; evaluation of vascular problems (e.g. AAA, IVC filter)	
	List major branches of the lumbar plexus that arise in the retroperitoneum (femoral, genitofemoral, obturator) and describe their position relative to the psoas major muscle.	Physical exam (e.g. dermatomes of lower extremity, cremasteric reflex); evaluation of musculoskeletal problems (e.g. weakness in lower limb)	Objectives regarding other nerves (e.g. lateral femoral cutaneous) and functional considerations are listed in the lower limb unit.
	Describe the course of the sympathetic chain in the retroperitoneum.	Evaluation of visceral or referred pain; administration of anesthesia; pain management for cancer (e.g. superior hypogastric plexus block)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Identify structures of the retroperitoneum (kidney, adrenal gland, aorta, IVC, renal vessels, retroperitoneal fat) on radiographs and axial images of the abdomen.	Evaluation of imaging studies	
	Identify the aorta and its major retroperitoneal branches (renal, lumbar, common iliac) on abdominal aortograms and axial images.	Evaluation of imaging studies	
Pelvis & Perineum			
Bony pelvis	Describe the structure of the bony pelvis including its joints and associated ligaments.	Physical exam; pregnancy/childbirth; evaluation of injury during trauma; execution/evaluation of imaging studies; access to pelvic cavity during procedures	
	Name the features of the bony pelvis that are assessed during prenatal exams to evaluate adequacy of the pelvis for childbirth (pelvic inlet via diagonal conjugate, interspinous distance, intertuberous distance, width of subpubic arch).	Physical exam; pregnancy/childbirth	Recent research indicates that there are numerous pelvic shapes rather than 4 distinct types reported by Caldwell and Moloy, thus discussion of these classifications is best reserved for clinical training. Additionally, pelvic shapes have limited relevance for most fields.
	Describe the locations of and relationships between the true pelvic cavity, the false pelvis and the perineum.	Physical exam; pregnancy/childbirth; execution/evaluation of imaging studies; spread of infection; surgical procedures	

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain how structures in the pelvic cavity communicate with the thigh, gluteal region and perineum.	Evaluation of injury during trauma; evaluation of musculoskeletal problems; evaluation of nerve compression (e.g. sciatica)	
	Identify components of the bony pelvis on radiographs and axial images of the pelvis.	Evaluation of imaging studies	
Pelvic viscera	Describe the anatomical features and general functions of the pelvic viscera in females (bladder, uterus, uterine tube, ovary, cervix, vagina, and rectum).	Physical exam; pregnancy/childbirth; execution/evaluation of imaging studies; surgical procedures; evaluation of injury during trauma; evaluation of infertility; evaluation of congenital anomalies (e.g. uterus bicornis)	
	Describe the anatomical features and general functions of the pelvic viscera in males (bladder, ductus deferens, seminal vesicle, ejaculatory duct, prostate, prostatic urethra and rectum).	Physical exam; execution/evaluation of imaging studies; surgical procedures; evaluation of injury during trauma; evaluation of infertility; evaluation of congenital anomalies (e.g. hypospadias)	
	Describe examples of anatomical features of the pelvic viscera in individuals with differences in sex development (DSD) (e.g. micropenis, clitoromegaly).	Physical exam; execution/evaluation of imaging studies; surgical procedures; evaluation of injury during trauma; evaluation of infertility; evaluation of congenital anomalies	

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Topic	Learning Objective	Clinical Relevance	Comments
	List structures that can be palpated during bimanual exams and digital rectal exams.	Physical exam; pregnancy/childbirth; evaluation of malignancy	Digital rectal exam is not currently recommended for prostate or colorectal cancer screening (source: UpToDate).
	Explain the peritoneal relationships of the pelvic viscera, including pouches and mesenteries.	Surgical procedures (e.g. caesarian section); evaluation of ascites; execution/evaluation of imaging studies (e.g. ultrasound exam for ectopic pregnancy)	
	Describe the general organization of pelvic fascia (parietal, visceral and endopelvic).	Physical exam (e.g. for pelvic prolapse); pregnancy/childbirth; execution/evaluation of imaging studies; spread of infection; surgical procedures	The names of condensations of endopelvic fascia (e.g. puboprostatic ligament, uterosacral ligament) are primarily relevant to obstetrics and urology, thus details can be reserved for clinical training.
	Describe the blood supply and venous drainage of pelvic organs in females (bladder, uterus, uterine tube, ovary, cervix, vagina, and rectum).	Surgical procedures (e.g. caesarian section, oophorectomy); execution/evaluation of imaging studies; evaluation of hemorrhoids	
	Describe the blood supply and venous drainage of pelvic organs in males (bladder, ductus deferens, seminal vesicle, prostate, rectum).	Surgical procedures (e.g. prostatectomy); execution/evaluation of imaging studies; evaluation of hemorrhoids	
	Describe the lymphatic drainage of pelvic organs in females (bladder, uterus, uterine tube, ovary, cervix, vagina, and rectum).	Lymphatic spread of infection or malignancy; surgical procedures (e.g. lymph node dissection)	A knowledge of general concepts is likely sufficient for preclinical learners (drainage primarily to internal iliac nodes; unique path for ovary and superior part of rectum).

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the lymphatic drainage of pelvic organs in males (bladder, ductus deferens, seminal vesicle, prostate, rectum).	Lymphatic spread of infection or malignancy; surgical procedures (e.g. lymph node dissection)	A knowledge of general concepts is likely sufficient for preclinical learners (drainage primarily to internal iliac nodes; unique path for superior part of rectum). The objective for drainage of the testis is in the abdomen section.
	Explain the autonomic innervation of the pelvic organs via the pelvic plexus and pelvic splanchnic nerves. Explain the effects of sympathetic vs. parasympathetic innervation.	Evaluation of pelvic pain or referred pain; administration of anesthesia (e.g. childbirth); pain management for cancer; evaluation of pelvic problems (e.g. incontinence, erectile dysfunction); surgical procedures (e.g. prostatectomy)	
	Identify pelvic organs (bladder, uterus, ovaries, rectum, prostate, seminal vesicles) on radiographs and axial images of the pelvis.	Evaluation of imaging studies	
	Identify the common, internal and external iliac arteries on angiograms and axial images of the pelvis.	Evaluation of imaging studies	
Pelvic muscles and nerves	Explain the function of the pelvic floor, its innervation, and the two major muscles that comprise it.	Physical exam (e.g. pelvic prolapse); evaluation of injury (e.g. during childbirth); evaluation of imaging studies; surgical procedures; effective communication with patients (e.g. Kegel exercises)	The parts of levator ani have limited relevance to most fields, thus discussion could be delayed until clinical training.

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Topic	Learning Objective	Clinical Relevance	Comments
	Name the muscles that form the anterolateral and posterolateral walls of the pelvic cavity; explain how the piriformis subdivides the greater sciatic foramen into two regions.	Evaluation of imaging studies; surgical procedures	Objectives regarding the function of piriformis and obturator internus are discussed in the lower extremity section.
	Name the ventral rami that form the sacral plexus and describe the location of the plexus in the pelvic cavity.	Physical exam (dermatomes of lower extremity); evaluation of musculoskeletal problems (e.g. sciatica)	
	Identify obturator internus, piriformis and levator ani on axial images of the pelvis.	Evaluation of imaging studies; evaluation of musculoskeletal problems (e.g. incontinence or herniation due to weak/damaged pelvic floor)	
Perineum	Explain the subdivisions of the perineum (urogenital and anal regions), the borders of these regions and their spatial orientation.	Physical exam; evaluation of imaging studies	
	Describe the structure and general function of the anal canal.	Physical exam; evaluation of imaging studies; evaluation of anal pathology (e.g. hemorrhoids, anal fissure, incontinence)	The three parts of the external anal sphincter have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Describe the anatomic borders and contents of the ischioanal fossa.	Physical exam; evaluation of imaging studies; evaluation of anal pathology (e.g. anal abscess, fistula)	
	Explain the blood supply and venous drainage of the anal canal with particular attention to differences superior and inferior to the pectinate line.	Evaluation of anal pathology (e.g. hemorrhoids); surgical procedures (e.g. ligation); evaluation of portal hypertension	

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain the lymphatic drainage of the anal canal with particular attention to differences superior and inferior to the pectinate line.	Lymphatic spread of infection or malignancy	
	Explain the innervation of the internal and external anal sphincters.	Evaluation of incontinence; surgical procedures (repair of trauma during childbirth)	
	Identify the anus and ischioanal fossa on axial images of the pelvis.	Evaluation of imaging studies	
	Describe the anatomy of the vulva in females (mons pubis, labia majora, labia minora, vestibule, clitoris, urethra, bulbs of the vestibule, greater vestibular (Bartholin's) glands, vagina) and discuss the function of these structures.	Physical exam; procedures (urethral catheterization, transvaginal ultrasound)	Muscles in the superficial perineal space have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Note the position of the structures that open into the vestibule of the vulva (urethra, vagina, ducts of greater vestibular glands).	Physical exam; evaluation of imaging studies; procedures (urethral catheterization, transvaginal ultrasound)	
	Name the components of the penis and the parts and course of the male urethra.	Physical exam; evaluation of imaging studies; procedures (urethral catheterization); surgical procedures (e.g. circumcision); evaluation of congenital anomalies (e.g. hypospadias)	Muscles in the superficial perineal space have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Name the fascial layer that separates the superficial from deep perineal spaces (perineal membrane) and discuss its attachments.	Spread of fluid during trauma (e.g. urethral rupture)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the contents of the deep perineal space in females (urethra, sphincter urethrae, compressor urethrae, vagina).	Evaluation of incontinence; evaluation of imaging studies; surgical procedures (repair of trauma during childbirth)	
	Describe the contents of the deep perineal space in males (urethra, sphincter urethrae, bulbourethral (Cowper's) gland).	Physical exam; evaluation of imaging studies; procedures (urethral catheterization)	
	Explain the blood supply and venous drainage of the genitalia via the pudendal vessels.	Evaluation of injury during trauma; evaluation of erectile dysfunction	Specific branches of the pudendal vessels have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Describe the lymphatic drainage of perineum.	Lymphatic spread of infection or malignancy	
	Describe the innervation of the genitalia via the pudendal nerve, and the relationship of the nerve to the ischial spine.	Administration of anesthesia (e.g. pudendal block); evaluation of infertility or erectile dysfunction; surgical procedures (e.g. prostatectomy)	
	Describe the sexual response in females and males, and the nerves responsible.	Evaluation of infertility or erectile dysfunction; surgical procedures (e.g. prostatectomy)	
	Explain the innervation of the internal and external urethral sphincters.	Evaluation of incontinence	
Lower Extremity			
Gluteal region	Identify bony landmarks of the pelvis and femur that serve as points of attachment for the muscles of the gluteal region.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. pelvic fracture)	
	List palpable landmarks of the gluteal region utilized for physical exam or clinical procedures.	Physical exam; procedures (gluteal injections)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Name the muscles of the gluteal region and describe their general attachments, actions and innervations.	Physical exam (e.g. range of motion, gait); evaluation of musculoskeletal problems (e.g. Trendelenburg gait); execution/evaluation of imaging studies	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.
	Explain how major nerves of the gluteal region exit the pelvic cavity (superior gluteal, inferior gluteal, sciatic).	Evaluation of injury during trauma; evaluation of musculoskeletal problems (Trendelenburg gait); evaluation of nerve compression (e.g. piriformis syndrome)	Clunial nerves have limited clinical relevance to most fields and are best discussed during clinical training if needed.
	Describe the blood supply and venous drainage of the gluteal region via the superior and inferior gluteal vessels.	Evaluation of injury during trauma; surgical procedures	
	Identify the gluteal muscles on axial images of the pelvis and lower extremity.	Evaluation of imaging studies	
Hip joint	Describe the anatomy of the hip joint and its movements.	Physical exam; evaluation of hip pain (e.g. osteoarthritis); evaluation of injury during trauma (e.g. dislocation, hip fracture); evaluation of congenital anomalies (developmental dysplasia); execution/evaluation of imaging studies (e.g. ultrasound exam)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain the blood supply of the hip joint.	Evaluation of injury during trauma (e.g. hip fracture); evaluation of avascular necrosis (Legg-Calve-Perthes disease)	
	Identify components of the hip joint on radiographs and axial images of the lower extremity.	Evaluation of imaging studies	
Thigh	Describe the major features of the femur.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. fracture); evaluation of imaging studies	
	Identify bony landmarks of the pelvis and femur that serve as points of attachment for the muscles of the thigh.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. avulsion fracture)	
	Describe the organization of the fascia lata including the iliotibial (IT) band and the intermuscular septa.	Physical exam; evaluation of musculoskeletal problems (e.g. IT band syndrome); evaluation of injury during trauma (e.g. compartment syndrome due to hematoma)	
	Name the muscles of the anterior thigh and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. quadriceps tear, tendon rupture); execution/evaluation of imaging studies (e.g. ultrasound)	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.

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Topic	Learning Objective	Clinical Relevance	Comments
	Name the muscles of the medial thigh and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. adductor strain); execution/evaluation of imaging studies (e.g. ultrasound)	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.
	Name the muscles of the posterior thigh and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. hamstring tear); execution/evaluation of imaging studies (e.g. ultrasound)	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.
	Describe the borders and contents of the femoral triangle.	Physical exam (e.g. femoral pulse); procedures (e.g. femoral catheterization); execution/evaluation of imaging studies	
	Describe the course and principal branches of the femoral artery.	Physical exam (e.g. femoral pulse); procedures (e.g. femoral catheterization); evaluation of imaging studies; evaluation of peripheral artery disease (PAD)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain the concept of superficial vs. deep venous drainage of the lower extremity, and describe the course of the great saphenous and femoral veins.	Procedures (e.g. femoral vein catheterization, saphenous cutdown); evaluation of imaging studies; evaluation of deep vein thrombosis (DVT)	
	Describe the course and distribution of the major nerves of the thigh (femoral, lateral femoral cutaneous, obturator, sciatic).	Physical exam; evaluation of nerve compression (e.g. obturator nerve entrapment, meralgia paresthetica); evaluation of musculoskeletal problems (e.g. weakness, paralysis)	
	List the regions of the body drained by lymphatics that converge at the superficial and deep inguinal nodes.	Lymphatic spread of infection or malignancy	
	Identify features of the femur on radiographs of the lower extremity.	Evaluation of imaging studies	
	Identify muscles of the thigh on axial images of the lower extremity.	Evaluation of imaging studies	
	Identify the femoral artery and its major branches (deep femoral, medial circumflex, lateral circumflex) on angiograms of the lower extremity.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
Knee joint and popliteal fossa	Describe the anatomy of the knee joint including the surrounding bursae and its movements.	Physical exam (e.g. patellar reflex, drawer tests); evaluation of knee pain (e.g. bursitis, patellar tendonitis, osteoarthritis); evaluation of injury during trauma (e.g. ligament sprains or tears); evaluation of congenital anomalies (e.g. genu valgum/varum); execution/evaluation of imaging studies	
	Describe the borders of the popliteal fossa and the location of the popliteal vessels.	Physical exam (e.g. popliteal pulse); evaluation of injury during trauma (e.g. rupture during knee dislocation); evaluation of PAD or DVT; execution/evaluation of imaging studies (e.g. popliteal aneurysm)	
	Identify components of the knee joint (bones, ligaments, menisci) on radiographs and MR images.	Evaluation of imaging studies	
Leg	Describe the major features of the tibia and fibula.	Physical exam; evaluation of musculoskeletal problems (e.g. tibial stress fracture); evaluation of imaging studies; evaluation of injury during trauma (e.g. fracture)	
	Identify bony landmarks of the femur, tibia, fibula and tarsals that serve as points of attachment for the muscles of the leg.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. avulsion fracture)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain how the interosseous membrane and intermuscular septa of the leg create three compartments.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. compartment syndrome due to hematoma)	
	Name the muscles of the anterior leg and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. medial tibial stress syndrome); execution/evaluation of imaging studies (e.g. ultrasound to assess injury)	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.
	Name the muscles of the posterior leg and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. gastrocnemius strain); execution/evaluation of imaging studies (e.g. ultrasound to assess injury)	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.

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Topic	Learning Objective	Clinical Relevance	Comments
	Name the muscles of the lateral leg and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems; execution/evaluation of imaging studies (e.g. ultrasound to assess injury)	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions. The term "peroneal" is still used by clinicians, so students should be aware of it.
	Name the principal branches of the popliteal artery (anterior tibial, posterior tibial, fibular) and describe their course and distribution.	Physical exam (e.g. posterior tibial and dorsalis pedis pulses); procedures; evaluation of imaging studies; evaluation of peripheral artery disease (PAD)	Branches of the posterior tibial artery in the plantar foot have limited relevance to most fields, thus discussion could be postponed until clinical training if relevant.
	Describe the course of the major tributaries of the popliteal vein (small saphenous, posterior tibial, anterior tibial).	Physical exam (e.g. phlebitis or varicose veins); evaluation of superficial (SVT) or deep vein thrombosis (DVT); procedures (e.g. vein ablation)	
	Describe the course and distribution of the major nerves of the leg (tibial, common fibular, superficial fibular, deep fibular).	Physical exam; evaluation of nerve compression (e.g. fibular neuropathy); evaluation of lower extremity pain or paresthesia; evaluation of musculoskeletal problems (e.g. foot drop)	Plantar branches of the tibial nerve have limited relevance to most fields, thus discussion could be postponed until clinical training if relevant.
	Identify features of the tibia and fibula on radiographs of the lower extremity.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Identify the compartments of the leg (anterior, superficial and deep posterior, lateral) on axial images of the lower extremity.	Evaluation of imaging studies	
	Identify the popliteal artery and its major branches (anterior tibial, posterior tibial, fibular) on angiograms of the lower extremity.	Evaluation of imaging studies	
Ankle joint	Describe the anatomy of the ankle joint and its movements.	Physical exam; evaluation of ankle pain (e.g. ankle sprain); execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. fracture)	Detailed information about ankle ligaments (e.g. individual parts of the deltoid ligament) has limited relevance to most fields, thus discussion could be delayed until clinical training.
	Identify the bones comprising the ankle joint on radiographs.	Evaluation of imaging studies	
Foot	Name the bones of the foot and describe their positions relative to one another.	Physical exam; evaluation of foot pain (e.g. hallux valgus); execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. fracture)	
	Describe the location and movements of the subtalar joint.	Physical exam; evaluation of ankle pain (e.g. ankle sprain); execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. fracture)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the arches of the foot and the structures supporting them.	Physical exam; evaluation of foot pain (plantar fasciitis); execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. navicular stress fracture, spring ligament tear)	
	Identify the bones of the foot on radiographs.	Evaluation of imaging studies	
	Name the intrinsic muscles of the foot and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems; execution/evaluation of imaging studies	The intrinsic muscles of the foot have limited relevance to most fields and thus discussion could be postponed until clinical training if relevant. Many patients with musculoskeletal problems in the foot visit podiatrists.
	Describe the course of the dorsalis pedis, medial plantar and lateral plantar arteries in the foot.	Physical exam (dorsalis pedis pulse); evaluation of injury during trauma; evaluation of imaging studies (e.g. angiograms)	The arteries in the plantar foot have limited relevance to most fields, thus discussion could be postponed until clinical training if relevant.
	Describe the structure of the dorsal venous arch and the formation of the great saphenous vein on the dorsal aspect of the foot.	Procedures (e.g. peripheral venous cannulation, saphenous cutdown); evaluation of imaging studies	
	Describe the course and distribution of the major nerves of the foot (medial plantar, lateral plantar, superficial fibular, deep fibular).	Physical exam; evaluation of foot pain/paresthesia (e.g. Morton's neuroma, diabetic neuropathy)	Plantar branches of the tibial nerve have limited relevance to most fields, thus discussion could be postponed until clinical training if relevant.

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Topic	Learning Objective	Clinical Relevance	Comments
Upper Extremity			
Shoulder	Describe the anatomy of the sternoclavicular joint and its role in movements of the shoulder.	Physical exam; execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. sternoclavicular sprain)	
	Describe the anatomy of the acromioclavicular joint and its role in supporting the shoulder region.	Physical exam; evaluation of musculoskeletal problems (e.g. ligament sprain); execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. shoulder separation)	
	Describe the anatomy of the glenohumeral (shoulder) joint including the surrounding bursae and its movements.	Physical exam; evaluation of musculoskeletal problems (e.g. shoulder bursitis); execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. shoulder dislocation)	
	List palpable landmarks of the shoulder region utilized for physical exam or clinical procedures.	Physical exam; procedures (shoulder joint aspiration or injection)	
	Identify features of the clavicle, scapula and proximal humerus that serve as points of attachment for the muscles of the shoulder region.	Physical exam; evaluation of musculoskeletal problems (e.g. rotator cuff tears); execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. shoulder dislocation, humeral fracture)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Name the muscles of the shoulder and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. rotator cuff tear or tendon rupture); execution/evaluation of imaging studies (e.g. ultrasound)	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.
	List the muscles that comprise the rotator cuff and explain their roll in supporting the glenohumeral joint.	Physical exam; evaluation of musculoskeletal problems (e.g. rotator cuff tear or tendon rupture); execution/evaluation of imaging studies (e.g. ultrasound)	
	Describe the borders of the quadrangular and triangular spaces and the triangular interval; name the structures that pass through them.	Evaluation of injury during trauma (e.g. axillary n. compression); evaluation of shoulder pain/paresthesia (e.g. quadrangular space syndrome, triangular interval syndrome); evaluation of imaging studies (e.g. axillary angiogram)	The triangular space has limited clinical relevance, thus discussion might be emphasized less than the other two spaces or reserved for clinical training.
	Describe the blood supply and venous drainage of the shoulder region including the three primary vessels that provide collateral circulation (dorsal scapular, suprascapular, circumflex scapular).	Evaluation of injury during trauma; evaluation of imaging studies (e.g. axillary angiogram)	
	Identify features of the scapula, clavicle and humerus on radiographs of the shoulder.	Evaluation of imaging studies	
	Identify bones, muscles and the synovial cavity on MRI arthrograms of the shoulder.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
Axilla	Describe the borders and general contents (axillary vessels, brachial plexus, lymphatics, axillary tail of breast) of the axilla.	Physical exam (e.g. breast exam); evaluation of injury during trauma (e.g. shoulder dislocation); procedures (e.g. venous access, sentinel node biopsy); surgical procedures (e.g. mastectomy, axillary lymph node dissection); execution/evaluation of imaging studies	
	Describe the course and principal branches of the axillary artery (thoracoacromial, lateral thoracic, anterior and posterior circumflex humeral, subscapular, thoracodorsal, circumflex scapular).	Evaluation of injury during trauma (e.g. shoulder dislocation); evaluation of imaging studies (e.g. axillary angiogram)	
	Explain the concept of superficial vs. deep venous drainage of the upper extremity, and describe the course of the cephalic, basilic and axillary veins.	Procedures (e.g. venous access, insertion of pacemaker wires); evaluation of imaging studies	
	Describe the structure of the brachial plexus including its roots, trunks, divisions, cords and major branches.	Physical exam; evaluation of injury during trauma; administration of anesthesia (e.g. brachial plexus block); evaluation of upper extremity pain	
	Describe the relationship of the roots, trunks and cords of the brachial plexus relative to the scalene muscles, first rib, and axillary artery, respectively.	Evaluation of injury during trauma; administration of anesthesia (e.g. brachial plexus block); evaluation of upper extremity numbness or pain (e.g. thoracic outlet syndrome)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the course of the axillary nerve in the axilla and posterior shoulder, including its relationship to the surgical neck of the humerus. Name the structures it innervates.	Physical exam; evaluation of injury during trauma (e.g. shoulder dislocation, fracture of surgical neck of humerus)	
	List the regions of the body drained by lymphatics that converge at the axillary lymph nodes.	Lymphatic spread of infection or malignancy	Subgroups of the axillary lymph nodes have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Identify the axillary artery and its major branches on angiograms of the upper extremity.	Evaluation of imaging studies	
Arm	Describe the major features of the humerus.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. fracture); evaluation of imaging studies	
	Identify bony landmarks of the scapula, humerus, radius and ulna that serve as points of attachment for the muscles of the arm.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. avulsion fracture)	
	Explain how the arm is organized into two fascial compartments.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. compartment syndrome); evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Name the muscles of the arm, and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. biceps tendonitis); execution/evaluation of imaging studies (e.g. ultrasound)	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.
	Describe the course and principal branches of the brachial vessels.	Physical exam (e.g. brachial pulse); evaluation of injury during trauma; evaluation of imaging studies (e.g. angiograms)	
	Describe the course of the musculocutaneous nerve in the arm and name the structures it innervates.	Physical exam; evaluation of injury during trauma (e.g. Erb's palsy)	
	Describe the course of the radial nerve in the arm and name the structures it innervates.	Physical exam; evaluation of injury during trauma (e.g. midshaft fracture of humerus, compression in the radial groove)	
	Describe the course of the median nerve in the arm.	Physical exam; evaluation of injury during trauma	
	Describe the course of the ulnar nerve in the arm.	Physical exam; evaluation of injury during trauma; evaluation of musculoskeletal problems (e.g. ulnar neuropathy at the elbow)	
	Identify features of the humerus on radiographs of the upper extremity.	Evaluation of imaging studies	
	Identify muscles of the arm on axial images of the upper extremity.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Identify the brachial and deep brachial arteries on angiograms of the upper extremity.	Evaluation of imaging studies	
Elbow joint and cubital fossa	Describe the anatomy of the elbow joint including the surrounding bursae and its movements.	Physical exam; evaluation of elbow pain (e.g. olecranon bursitis); execution/evaluation of imaging studies; evaluation of injury during trauma (e.g. ligament sprains or tears)	
	Describe the anatomy of the proximal radioulnar joint and explain its function.	Physical exam; evaluation of injury during trauma (e.g. subluxation of radial head); execution/evaluation of imaging studies	
	Describe the borders of the cubital fossa and its major contents (biceps tendon, brachial artery, median nerve).	Physical exam (e.g. brachial pulse, blood pressure measurement, biceps reflex)	
	Describe the position of the median cubital vein in the fascia superficial to the cubital fossa.	Procedures (e.g. venipuncture)	
	Identify the bones that comprise the elbow joint on radiographs.	Evaluation of imaging studies	
Forearm	Describe the major features of the radius and ulna.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. fracture); evaluation of imaging studies	
	Identify bony landmarks of the humerus, radius, ulna and hand that serve as points of attachment for the muscles of the forearm.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. avulsion fracture)	

Gross Anatomy Competencies for Preclinical Learners

Topic	Learning Objective	Clinical Relevance	Comments
	Explain how the forearm is organized into two fascial compartments.	Physical exam; evaluation of musculoskeletal problems; evaluation of injury during trauma (e.g. compartment syndrome); evaluation of imaging studies	
	Name the muscles of the forearm, and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. lateral or medial epicondylitis, mallet finger); evaluation of imaging studies	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.
	Describe the course and principal branches of the radial and ulnar arteries in the forearm and at the wrist.	Physical exam (e.g. radial pulse, Allen test); procedures (e.g. arterial blood gas); evaluation of injury during trauma; evaluation of imaging studies (e.g. angiograms)	
	Describe the course of the radial and ulnar veins.	Evaluation of injury during trauma; evaluation of imaging studies	
	Describe the course of the median nerve in the forearm and name the structures it innervates.	Physical exam; evaluation of injury during trauma; evaluation of upper extremity pain (e.g. pronator syndrome)	
	Describe the course of the ulnar nerve in the forearm and name the structures it innervates.	Physical exam; evaluation of injury during trauma	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the course of the radial nerve in the forearm and name the structures it innervates.	Physical exam; evaluation of injury during trauma; evaluation of upper extremity pain (e.g. posterior interosseous neuropathy)	
	Identify the radius and ulna and their major features on radiographs of the upper extremity.	Evaluation of imaging studies	
	Identify the ulnar and radial arteries on angiograms of the upper extremity.	Evaluation of imaging studies	
Wrist joint	Describe the anatomy of the wrist joint and its movements.	Physical exam; evaluation of wrist pain; evaluation of injury during trauma (e.g. Colles' fracture); evaluation of imaging studies	Detailed knowledge of wrist ligaments (e.g. radiocarpal and ulnocarpal ligaments) have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Identify the bones that comprise the wrist joint on radiographs.	Evaluation of imaging studies	
Hand	Identify the bones of the hand (carpals, metacarpals, phalanges).	Physical exam; evaluation of injury during trauma (e.g. scaphoid fracture); execution/evaluation of imaging studies	
	Describe the anatomy of the joints of the hand and their movements (e.g. midcarpal, carpometacarpal, metacarpophalangeal and interphalangeal joints).	Physical exam; evaluation of joint pain (e.g. osteoarthritis); evaluation of injury during trauma (e.g. ligament sprain); procedures (e.g. joint injection); execution/evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe specializations of deep fascia in the wrist and hand (flexor and extensor retinacula, palmar aponeurosis, fibrous digital sheaths, extensor hoods) and discuss their functions.	Physical exam; evaluation of musculoskeletal problems (e.g. Dupuytren's contracture, trigger finger)	
	Describe the structure and contents of the carpal tunnel.	Physical exam; evaluation of wrist pain (e.g. carpal tunnel syndrome); execution/evaluation of imaging studies	
	Describe the borders and contents of the anatomical snuff box.	Physical exam (e.g. radial pulse); evaluation of injury during trauma (e.g. scaphoid fracture); evaluation of imaging studies	
	Describe the structure and function of the synovial sheaths in the hand.	Physical exam; evaluation of hand pain (e.g. tenosynovitis, carpal tunnel syndrome); spread of infection	
	Name the intrinsic muscles of the hand, and describe their general attachments, actions and innervations.	Physical exam; evaluation of musculoskeletal problems; evaluation of imaging studies	Detailed information of attachment points have limited relevance to most fields, thus discussion could be delayed until clinical training; students should be encouraged to examine attachments to understand muscle action, rather than memorizing lists of origins and insertions.
	Describe the course and principal branches of the ulnar artery in the hand (superficial palmar arch, common palmar digital arteries, proper palmar digital arteries).	Physical exam; evaluation of injury during trauma; evaluation of imaging studies (e.g. angiograms)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the course and principal branches of the radial artery in the hand (deep palmar arch, princeps pollicis, radialis indicis).	Physical exam; evaluation of injury during trauma; evaluation of imaging studies (e.g. angiograms)	
	Distinguish superficial from deep venous drainage of the hand.	Procedures (e.g. venous access); evaluation of injury during trauma; evaluation of imaging studies	
	Describe the course of the median nerve in the hand and name the structures it innervates.	Physical exam; evaluation of injury during trauma (e.g. carpal bone fracture); evaluation of hand pain (e.g. carpal tunnel syndrome)	
	Describe the course of the ulnar nerve in the hand and name the structures it innervates.	Physical exam; evaluation of musculoskeletal problems (e.g. Guyon canal syndrome); evaluation of injury during trauma (e.g. fracture of hook of hamate); evaluation of hand pain	
	Describe the course of the superficial branch of the radial nerve in the hand.	Physical exam; evaluation of injury during trauma	
	Describe the cutaneous innervation of the hand and name the autogenous zones for the median, radial and ulnar nerves.	Physical exam; evaluation of injury during trauma	
	Explain the distribution of dermatomes on the hand.	Physical exam; evaluation of musculoskeletal problems (e.g. herniated nucleus pulposus)	
	Identify the bones of the hand on radiographs of the upper extremity.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Identify the superficial palmar arterial arch and digital arteries on angiograms of the upper extremity.	Evaluation of imaging studies	
Neck			
	Identify palpable landmarks of the neck utilized for physical exam or clinical procedures (SCM, hyoid, thyroid cartilage, cricoid cartilage, trachea).	Physical exam (e.g. thyroid exam); administration of anesthesia (e.g. cervical plexus block); procedures (e.g. cricothyrotomy)	An objective about the anatomy of the trachea is in the thorax section.
	Describe the location in the neck where the cutaneous branches of the cervical plexus can easily be accessed for anesthesia.	Administration of anesthesia (e.g. cervical plexus block)	
	Describe the organization of the cervical fascia (superficial, investing, pretracheal, prevertebral, carotid sheath) including communications between the neck and other regions.	Spread of infection	
	Describe the borders and name the contents of posterior triangle.	Physical exam; administration of anesthesia (e.g. cervical plexus block); procedures (e.g. central venous access); evaluation of injury during trauma; execution/evaluation of imaging studies	The attachment points of muscles in the posterior triangle have limited relevance to most fields, thus discussion could be delayed until clinical training.
	Describe the borders of the anterior triangle and name its subdivisions (submental, submandibular, carotid and muscular triangles); list the main contents of each subtriangle including the contents of the carotid sheath.	Physical exam (e.g. carotid pulse); spread of infection or malignancy; procedures (e.g. central line); surgical procedures (e.g. carotid endarterectomy); evaluation of injury during trauma; execution/evaluation of imaging studies	The borders of the subtriangles have limited clinical relevance, thus should not be emphasized, however they may be a useful learning tool to organize the anatomy in this region.

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Topic	Learning Objective	Clinical Relevance	Comments
	Name the structures that pass anterior to the anterior scalene and through the scalene triangle.	Thoracic outlet syndrome; administration of anesthesia (e.g. interscalene block)	
	Describe the anatomy of the thyroid and its relationships to surrounding structures.	Physical exam (e.g. goiter); evaluation of thyroid disease; evaluation of malignancy; surgical procedures (e.g. thyroidectomy); evaluation of congenital anomalies (e.g. pyramidal lobe); execution/evaluation of imaging studies	
	Explain the position of the parathyroid glands.	Evaluation of parathyroid disease; evaluation of malignancy; surgical procedures (e.g. en-bloc resection, parathyroidectomy)	
	Describe the blood supply and venous drainage of the thyroid and parathyroid glands.	Surgical procedures (e.g. thyroidectomy, parathyroidectomy)	
	Describe the course and principal branches of the subclavian artery.	Thoracic outlet syndrome; evaluation of injury during trauma; evaluation of imaging studies	
	Describe the position of the common carotid artery in the neck, the location of the carotid bifurcation and the branches of the external carotid artery.	Physical exam (e.g. carotid pulse); surgical procedures (e.g. carotid endarterectomy); evaluation of stroke; evaluation of injury during trauma; evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the course and positions of the internal jugular and subclavian veins in the neck.	Physical exam (e.g. jugular venous distension); procedures (e.g. central line); thoracic outlet syndrome; evaluation of injury during trauma; execution/evaluation of imaging studies	
	Name the major groups of superficial lymph nodes in the neck (occipital, postauricular, preauricular, tonsillar, submandibular, submental, superficial cervical, supraclavicular) and describe their locations.	Lymphatic spread of infection or malignancy	
	Describe the location of the deep cervical lymph nodes and list the regions of the body that ultimately drain into these nodes.	Lymphatic spread of infection or malignancy	
	Describe the course of the recurrent laryngeal nerves in the neck.	Evaluation of hoarseness; surgical procedures (e.g. thyroidectomy); evaluation of injury during trauma	
	Identify the location of the sympathetic trunk in the neck.	Evaluation of visceral problems (e.g. Horner's syndrome, hyperhidrosis); evaluation of visceral pain; surgical procedures (e.g. sympathectomy); administration of anesthesia (e.g. sympathetic block)	
	Identify features of cervical vertebrae, the hyoid bone and trachea on radiographs of the neck.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Identify major structures of the neck on axial images (e.g. SCM, strap muscles, airway and its cartilages, thyroid gland, common/internal/external carotid arteries, internal jugular vein).	Evaluation of imaging studies	
	Identify the subclavian, vertebral and common/internal/external carotid arteries on angiograms of the neck.	Evaluation of imaging studies	
Head			
Cranium	Describe the bones that comprise the calvaria, the sutures between them, and junction points of major sutures (pterion, bregma, lambda).	Physical exam (e.g. changes in shape during birth, craniosynostosis); evaluation of injury during trauma (e.g. fracture); evaluation of imaging studies	
	Describe the location of the anterior and posterior fontanelles in the fetal skull.	Physical exam (e.g. craniosynostosis)	
	Describe the organization and function of the meninges including the reflections of dura mater (falx cerebri, tentorium cerebelli) and arachnoid granulations.	Surgical procedures (e.g. craniotomy); evaluation of hematoma (e.g. epidural, subdural); evaluation of pain (e.g. headache, meningitis); evaluation of malignancy (e.g. meningioma); evaluation of injury during trauma (e.g. concussion); evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the course and distribution of the middle meningeal artery, including its relationship to the pterion.	Evaluation of hematoma (e.g. epidural); evaluation of injury during trauma (e.g. skull fracture); evaluation of imaging studies	
	Explain the blood supply to the brain via the internal carotid and vertebral arteries; describe the branches of the cerebral arterial circle (of Willis).	Physical exam (e.g. stroke); evaluation of injury during trauma	This concept is often discussed as part of the neuroscience content.
	Describe the organization of the major venous dural sinuses that drain blood from the brain.	Evaluation of hematoma (e.g. subdural); cerebral venous thrombosis; evaluation of imaging studies	This concept is often discussed as part of the neuroscience content.
	Describe the relationship between the cavernous sinus and the following structures: internal carotid artery, CN III, CN IV, CN V1, CN V2, CN VI.	Evaluation of malignancy; cavernous sinus thrombosis; internal carotid aneurysm; evaluation of imaging studies	
	Identify features of the cranium on lateral and AP radiographs of the head.	Evaluation of imaging studies	
	Identify the internal carotid artery, vertebral artery and branches of the cerebral arterial circle (of Willis) on angiograms of the head.	Evaluation of imaging studies	
	Identify the dural venous sinuses on MR venograms of the head.	Evaluation of imaging studies	
Cranial nerves	Name each cranial nerve and the opening(s) through which each nerve communicates with the cranial cavity.	Physical exam; evaluation of neurologic problems (e.g. cranial nerve palsies); evaluation of injury during trauma (e.g. fracture); evaluation of malignancy; evaluation of imaging studies	Objectives relating to details about the cranial nerves are listed under the relevant sections (e.g. CN V and CN VII are discussed in the section on the face).

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain the course of sympathetic neurons that innervate structures in the head.	Evaluation of visceral problems (e.g. Horner's syndrome, miosis)	
Face	List the major bones that comprise the facial skeleton and identify the major foramina of the face.	Physical exam; evaluation of neurologic problems (e.g. sensory loss); evaluation of injury during trauma (e.g. fracture); evaluation of congenital anomalies (e.g. micrognathia); evaluation of imaging studies	
	Name the primary muscles of facial expression used in clinical practice (frontalis, orbicularis oculi, orbicularis oris, buccinator, zygomaticus major) and describe their action and innervation.	Physical exam; evaluation of neurologic problems (e.g. Bell's palsy); evaluation of stroke	
	Explain the location, structure and innervation of the parotid gland, including the course of the parotid duct.	Physical exam; evaluation of pain (e.g. parotitis, sialolithiasis); evaluation of malignancy; evaluation of injury during trauma (e.g. facial laceration); evaluation of imaging studies	
	Describe the path of the facial nerve through the parotid gland, and name its five terminal branches and their distribution.	Physical exam; evaluation of facial paralysis	
	Describe the blood supply of the face.	Physical exam (e.g. facial pulse); evaluation of injury during trauma (e.g. facial laceration)	
	Explain how infections from the face may spread to the meninges via the venous system.	Spread of infection	

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain the innervation of the face via branches of the trigeminal nerve.	Physical exam; evaluation of pain (e.g. trigeminal neuralgia, herpes zoster infection); administration of anesthesia (e.g. nerve blocks)	
	Identify features of the facial skeleton on lateral and AP radiographs of the head.	Evaluation of imaging studies	
	Identify the parotid gland on axial images of the head.	Evaluation of imaging studies	
Scalp	Describe the layers, blood supply and innervation of the scalp.	Evaluation of injury during trauma (e.g. scalp laceration)	
Temporal and Infratemporal regions	Name the parts of the mandible and describe the components and action of the temporomandibular joint.	Physical exam; evaluation of musculoskeletal problems (e.g. temporomandibular disorders); evaluation of injury during trauma (e.g. mandibular fracture); evaluation of imaging studies	
	Name the four muscles of mastication and describe their actions and innervations.	Physical exam; evaluation of musculoskeletal problems (e.g. temporomandibular disorders); evaluation of injury during trauma (e.g. mandibular fracture); evaluation of imaging studies	Knowledge of attachments for the muscles of mastication has limited relevance to most fields and thus is best discussed during clinical training if relevant.
	Describe the course of the maxillary artery through the infratemporal fossa and list the major regions it supplies (nasal cavity, oral cavity,	Evaluation of injury during trauma; evaluation of imaging studies	
	Identify the mandible and temporomandibular joint on lateral and AP radiographs of the head.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
Pterygopalatine fossa	Describe the position of the pterygopalatine fossa with respect to other regions of the head (e.g. lateral to the nasal cavities).	Evaluation of malignancy; evaluation of imaging studies	Knowledge of the pterygopalatine fossa and its contents has limited relevance to most fields and thus discussion could be delayed until clinical training. Problems with lacrimation (e.g. dry eye) are rarely caused by innervation issues.
Nasal cavity	Describe the anatomical structure of the nasal cavity (septum, turbinates/meatuses on the lateral walls, mucosa).	Physical exam (e.g. nasal polyp); procedures (e.g. nasal endoscopy); evaluation of injury during trauma (e.g. septal fracture); evaluation of congenital anomalies (e.g. septal deviation); evaluation of imaging studies	Knowledge of the individual bones that comprise the nasal septum has limited relevance to most fields and thus is best discussed during clinical training. Clinicians more commonly use the term "turbinates" rather than conchae.
	Identify the locations of the paranasal sinuses and describe their sites of drainage into the nasal cavity.	Physical exam (e.g. sinusitis); procedures (e.g. nasal endoscopy); surgical procedures (e.g. balloon ostial dilation); evaluation of imaging studies	A detailed description of the ostio-meatal complex (e.g. uncinat process, hiatus semilunaris, ethmoid bulla, etc.) has limited relevance to most fields and thus discussion could be delayed until clinical training.
	Explain the relationship between the maxillary sinus and the maxillary teeth.	Physical exam; evaluation of pain; surgical procedures (e.g. dental surgery)	
	Describe the blood supply and venous drainage of the nasal cavity and the location and significance of Kiesselbach's plexus.	Physical exam; evaluation of epistaxis	A detailed description of blood supply (i.e. specific branches of the ophthalmic and maxillary arteries) has limited relevance to most fields and thus discussion could be delayed until clinical training.

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Topic	Learning Objective	Clinical Relevance	Comments
	Explain the innervation of the nasal cavity via branches of the trigeminal nerve.	Physical exam; evaluation of pain; administration of anesthesia	
	Identify the nasal septum and paranasal sinuses on radiographs and CT images of the head.	Evaluation of imaging studies	
Oral cavity	Describe the features of the tongue (terminal sulcus, foramen cecum, frenulum) and explain the function of the genioglossus muscle.	Physical exam; evaluation of neurologic problems (e.g. CN XII lesion); surgical procedures (e.g. for ankyloglossia); procedures (e.g. endoscopy, intubation); evaluation of congenital anomalies (e.g. macroglossia)	The genioglossus is the muscle that is tested clinically, thus knowledge of other muscles that move the tongue (e.g. styloglossus) is likely not relevant.
	Name the three major salivary glands and explain where their ducts empty into the oral cavity.	Physical exam (e.g. sialolithiasis); evaluation of pain (e.g. parotitis); evaluation of malignancy; evaluation of imaging studies	
	Describe the blood supply and venous drainage of the oral cavity and teeth.	Physical exam; surgical procedures	
	Describe the sensory and motor innervation of the tongue, including the nerves that convey taste sensations.	Physical exam; evaluation of neurologic problems (e.g. CN XII lesion); evaluation of taste problems (e.g. ageusia, dysgeusia)	
	Explain the innervation of the teeth and gums via branches of the trigeminal nerve.	Physical exam; evaluation of pain (e.g. tooth ache); surgical procedures	
	Identify the tongue and position of the oral cavity on radiographs, CT and MR images of the head.	Evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
Palate	Describe the position and function of the hard and soft palates.	Physical exam; evaluation of injury during trauma; evaluation of congenital anomalies (e.g. cleft palate); evaluation of imaging studies	
	Explain the function and innervation of the levator veli palatini and tensor veli palatini.	Physical exam (e.g. gag reflex); evaluation of dysphagia; evaluation of neurologic problems (e.g. vagus nerve palsy)	
	Describe the blood supply and innervation of the hard and soft palates.	Physical exam (e.g. gag reflex); surgical procedures (e.g. repair of cleft palate)	
	Identify the hard and soft palates on radiographs, CT and MR images of the head.	Evaluation of imaging studies	
Pharynx	Describe the three divisions of the pharynx and the anatomical features in each region.	Physical exam; evaluation of dysphagia; evaluation of pain (e.g. tonsillitis, adenoiditis); procedures (e.g. endoscopy); surgical procedures (e.g. tonsillectomy, adenoidectomy); evaluation of imaging studies	
	Explain the function of the muscles of the pharynx during deglutition and describe their innervation.	Physical exam; evaluation of dysphagia; procedures (e.g. endoscopy); evaluation of imaging studies	Detailed knowledge of individual pharyngeal muscles and their attachments has limited relevance to most fields and thus discussion could be delayed until clinical training.
	Describe the sensory innervation of the pharynx and explain the neural pathway of the gag reflex.	Physical exam (e.g. gag reflex); procedures (e.g. intubation)	

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Topic	Learning Objective	Clinical Relevance	Comments
	Identify the three divisions of the pharynx and their major features on radiographs, CT and MR images of the head and neck.	Evaluation of imaging studies	
Larynx	Describe the anatomical features of the laryngeal skeleton and the interior of the larynx.	Physical exam (e.g. vocalization); evaluation of laryngitis or hoarseness; procedures (e.g. intubation, laryngoscopy); evaluation of laryngeal cancer; evaluation of congenital anomalies (e.g. laryngomalacia)	Detailed information about individual laryngeal muscles and small cartilages (e.g. corniculate, cuneiform) has limited relevance to most fields and thus discussion could be delayed until clinical training.
	Explain the position of the vocal cords during quiet respiration, forced inspiration, phonation and effort closure/swallowing.	Physical exam (e.g. vocalization); evaluation of laryngitis or hoarseness; procedures (e.g. intubation, laryngoscopy)	
	Describe the sensory and motor innervation of the larynx via the superior laryngeal and recurrent laryngeal nerves.	Physical exam (e.g. vocalization); evaluation of hoarseness or vocal cord paralysis; administration of anesthesia	
	Identify the position of the larynx and laryngeal vestibule on radiographs, CT and MR images of the head and neck.	Evaluation of imaging studies	
Eye	Describe the general features of the orbit and the major openings through which nerves and vessels enter or leave.	Physical exam; evaluation of injury during trauma (e.g. orbital fracture, orbital compartment syndrome); evaluation of imaging studies	

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Topic	Learning Objective	Clinical Relevance	Comments
	Describe the anatomy of the eyelid and name the muscles that elevate and depress it.	Physical exam (e.g. blepharitis, chalazion, ptosis); evaluation of malignancy	
	Describe the structure of the lacrimal apparatus.	Physical exam (e.g. dry eye disease)	
	Identify the six extraocular muscles and describe their actions and innervations.	Physical exam (e.g. eye exam); evaluation of neurologic problems (e.g. cranial nerve palsies); evaluation of musculoskeletal problems (e.g. strabismus); evaluation of injury during trauma; evaluation of imaging studies	
	Describe the blood supply of the orbit and retina via the ophthalmic and central retinal arteries, respectively.	Physical exam (e.g. eye exam); evaluation of injury during trauma; evaluation of imaging studies	Specific branches of the ophthalmic artery has limited relevance to most fields and thus is best discussed during clinical training.
	Explain how blood from the orbit drains to the cavernous sinus.	Spread of infection	
	Describe the sensory innervation of the cornea and explain the neural pathway of the corneal reflex.	Physical exam (e.g. corneal reflex)	
	Describe the muscles that control the size of the pupil and explain their innervation by autonomic neurons.	Physical exam (e.g. pupillary light reflex)	
	Identify the orbit on radiographs of the head.	Evaluation of imaging studies	
	Identify the globe, extraocular muscles and optic nerve on CT and MR images of the head.	Evaluation of imaging studies	

Gross Anatomy Competencies for Preclinical Learners

Topic	Learning Objective	Clinical Relevance	Comments
Ear	Describe the components, function and innervation of the external ear.	Physical exam (e.g. evaluation of hearing); evaluation of ear pain (e.g. otitis externa, referred pain due to cancer); evaluation of congenital anomalies (e.g. microtia, atresia of external acoustic meatus)	
	Explain the orientation, structure and function of the tympanic membrane.	Physical exam (e.g. otoscopy); evaluation of injury during trauma; procedures (e.g. myringotomy)	
	Describe the position of the pharyngotympanic (eustachian) tube and mastoid air cells with respect to the tympanic cavity.	Evaluation of ear infections (e.g. otitis media); spread of infection (e.g. mastoiditis)	Although anatomy texts are using the term "pharyngotympanic", this is not popular with clinicians.
	List the contents of the middle ear cavity and explain their anatomical relationships.	Physical exam (e.g. otoscopy); evaluation of hearing loss (e.g. otosclerosis); evaluation of ear pain	
	Discuss the function and innervation of the tensor tympani and stapedius muscles.	Physical exam (e.g. hyperacusis)	
	Describe the course of the facial nerve through the petrous part of the temporal bone; name the branches that arise within the temporal bone and what they innervate.	Physical exam (e.g. hyperacusis, hypogeusia)	
	Describe the structure and general functions of the inner ear (cochlea, vestibular apparatus).	Physical exam (e.g. hearing assessment); evaluation of hearing loss, tinnitus and dizziness/vertigo (e.g. Meniere disease)	Detailed objectives about this content are located in the histology and neuroscience competency documents.
	Explain the innervation and blood supply of the inner ear.	Physical exam (e.g. hearing assessment); evaluation of hearing loss, tinnitus and dizziness/vertigo	