UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Anatomy 2

2122-1-H4101D002-H4101D008M

Aims

The objectives of the course are to provide expertise in normal anatomy, cytology, histology, embryology. Teachnig will include reference to topographic, radiologic, and clinical anatomy.

Practical activities using models (also virtual 3D), light microscope observations and clinical case simulations will be used to reach the teaching objectives.

Contents

The primary goal of the course is to provide a good knowledge of the embryonic development and of the gross anatomy of the human body, and of the aging changes required for a correct physical examination and understanding of the diseases pathogenesis.

Detailed program

REGIONAL ANATOMY

THE ABDOMEN

Surface anatomy.

Surface landmarks of the abdominal wall: xiphoid process, costal margin, iliac crest, pubic tubercle, symphysis pubis, inguinal ligament, superficial inguinal ring, umbilicus, linea alba, linea semilunaris and tendinous insersections of the rectus abdominis. Abdominal lines: transpyloric plane, subcostal plane, intercristal plane. Abdominal quadrants.

Abdominal wall.

Anterolateral abdominal wall. Skin, superficial fascia, deep fascia. Muscles: external and internal oblique, transversus, rectus abdominis, pyramidalis. Rectus sheath. Fascia transversalis. Arteries, veins, limph vessels and nerves of the anterolateral abdominal wall. Inguinal canal: deep and superficial inguinal rings, walls of the inguinal canal. Development of the inguinal canal. Fascial layers of the spermatic cord and scrotum.

Posterior abdominal wall. Lumbar vertebrae. Iliac part of the hip bone. Muscles: psoas major, quadratus lumborum, transversus abdominis, diaphragm.

Peritoneum: general arrangement, ligaments, omenta, mesenteries, peritoneal cavity. Relationships of the different organs to their peritoneal covering. Intraperitoneal, retroperitoneal and subperitoneal organs. Peritoneal pouches, spaces and recesses. Lesser sac and epiploic foramen. Functions of the peritoneum.

Organs contained in the abdominal cavity: stomach, duodenum, cecum, ascending, descending and transverse colon, appendix, liver, gallbladder, spleen, kidney, pancreas.

Main arteries, veins, nerves and plexuses, limph vessels and limph nodes contained in the abdominal cavity.

THE PELVIS

Surface anatomy.

Pubic tubercle, symphysis pubis, posterior part of sacrum, sacral hiatus, coccyx.

Pelvic walls.

Hip bones, sacrum and coccyx, symphysis pubis, sacroiliac joints, promontory of sacrum, ileopectineal line, pubic arch. Pelvic inlet and pelvic outlet. Sacrotuberous and sacrospinous ligaments. Greater and lesser sciatic foramina. Anterior, posterior and lateral pelvic walls. Relation to sacral plexus.

Major focus on pelvic floor (inferior pelvic wall) : pelvic diaphragm with levator ani muscle and its different groups of muscular fibers; pelvic fascia.

Perineum. Anal triangle and its contents; anal sphincter; ischiorectal fossa and pudendal canal. Urogenital triangle: urogenital diaphragm and superficial perineal pouch. In male: penis, scrotum and male urethra. In female: clitoris, female urethra, greater vestibular glands, vagina, vulva.

Organs contained in the pelvic cavity: sigmoid colon, rectum, ureters, urinary bladder. In male: vas deferens, seminal vesicles, ejaculatory ducts, prostate, prostatic urethra. In female: ovary, uterine tube, uterus, vagina.

Main arteries, veins, nerves and plexuses, limph vessels and limph nodes contained in the thoracic cavity

UPPER AND LOWER LIMBS

Detailed knowledge of all the bones, joints and muscles and their relation to blood vessels, nerves and limphatic structures.

SYSTEMATIC ANATOMY

MUSCULAR-SKELETAL SYSTEM (LOCOMOTOR)

Abdominal wall. Anterolateral and posterior abdominal wall muscles. Inguinal ligament. Inguinal canal (see details in REGIONAL ANATOMY)

Pelvic floor. Pelvic diaphragm. Perineum (see details in REGIONAL ANATOMY)

CARDIOVASCULAR SYSTEM

***Blood vessels*.** Vessels structure: arteries, veins, capillaries. Anastomoses. Fetal circulation and its modification at birth. General organization of adult circulatory system, pulmonary and systemic vascularization. In systemic circulation major focus on: aorta and its branches; polygon of Willis; blood supply of the upper and lower limbs; blood supply of all organs and of the orbits, nasal and oral cavities; superior and inferior caval veins system; portal vein, portal-systemic anastomoses; parietal vessels.

LYMPHATIC SYSTEM

General organization of the lymphatic circulation. Thoracic and right lymphatic ducts: origin and course, relation with organs and other structures. Other major lymphatic trunks. Main lymph node chains and stations. Lymphoid organs: thymus, spleen, lymph nodes and tonsils; their position, relations and morphologic features. Limphatic drainage of the limbs, neck, chest, abdomen and pelvis.

Blood and nerve supply of all the structures and organs of the lymphatic system.

DIGESTIVE SYSTEM

Oral cavity and parotid region: see ANATOMY 1- REGIONAL ANATOMY

Position, relations and morphological features of the gastrointestinal tract organs: esophagus, stomach, small intestine (duodenum, jejunum, ileum), large intestine (cecum, appendix, colon and rectum). Other organs of the digestive system: liver, bile ducts, gallbladder, pancreas; their position, relations, morphological features. Relationships of the different organs to their peritoneal covering. Intraperitoneal, retroperitoneal and subperitoneal organs.

Blood and nerve supply of the oral cavity, tongue, salivary glands and of all the organs of the digestive system.

URINARY SYSTEM

Position, relations and morphological features of the urinary tract organs: kidney with its covering, renal pelvis, minor and major calyces, ureter, bladder, female urethra, male urethra with the main aspects of its three parts (prostatic, membranous and penile).

Blood and nerve supply of all the organs of the urinary system.

ENDOCRINE SYSTEM

General characteristics of hormones.
Position, relations and morphological features of the endocrine organs: pituitary gland and its connection with the hypothalamus, thyroid, parathyroid, adrenal gland, endocrine pancreas, pineal gland. Gastroenteropancreatic (GEP) system.

Blood and nerve supply of all the organs of the endocrine system.

FEMALE REPRODUCTIVE SYSTEM

Position, relations and morphological features of the female genital organs: ovary, uterus, uterine tube, vagina. External genitalia: morphology and structure. Main characteristics of placenta.

Blood and nerve supply of all the organs of the female reproductive system.

MALE REPRODUCTIVE SYSTEM

Position, relations and morphological features of the male genital organs: testis, epididymis, vas deferens, prostate, seminal vesicles and bulbourethral glands. Fascial layers of the spermatic cord and scrotum. External genitalia: morphology and structure.

Blood and nerve supply of all the organs of the male reproductive system

NERVOUS SYSTEM

Development of the nervous system: neurulation, neural crest formation and differentiation, primary and secondary brain vesicles and their development, formation of midline structures, development of the spinal cord. Neural tube defects and major disorder of brain development.

Introduction to the study of the nervous system.

General organization: central and peripheral nervous system.

Central nervous system :

- External and internal morphological features of spinal cord, brainstem, cerebellum, diencephalon and telencephalon. Relationships among the different parts of the central nervous system.

- Spinal cord: laminar and columnar organization of the gray matter, organization of the white matter, arrangement and position of the most important ascending and descending tracts. Reflex arc. Pain control: the gating theory. Meningeal spaces and their content. Cerebrospinal fluid circulation in the spinal cord. Lumbar cistern.

- Brainstem: subdivision into medulla, pons and midbrain and their organization; position of cranial nerves nuclei and of other major nuclei ; reticular formation, general arrangement and its functional significance ; mesencephalic tectum with superior and inferior colliculi. Ascending and descending pathways. 4th ventricle and cerebral aqueduct.

- Cerebellum: cerebellar vermis and hemispheres. Cerebellar lobes. Correlation between anatomical and functional areas. Organization of gray and white matter, structure of the cerebellar cortex, intracerebellar nuclei. Cerebellar afferent and efferent tracts. Cerebellar peduncles. Relation to the 4^{th} ventricle. Functions of the cerebellum

- Diencephalon: basic division into thalamus, hypothalamus, subthalamus, epithalamus. Thalamus: nuclear groups, main thalamic nuclei and their major connections, white matter. Hypothalamus: classification of nuclei and their main connections; relationship to pituitary gland. Subthalamus: subthalamic nucleus, fields of Forel. Epithalamus: habenular nuclei, pineal gland. Functional significance of the different parts of diencephalon. Relation to the 3rd ventricle

- Telencephalon: general appearance of the cerebral hemispheres (lateral, medial and inferior surface), subdivision in lobes and gyri, main sulci. Organization of the white matter in association, commissural and projecting fibers. Internal capsule, location and detailed arrangement of its fibers. Corpus callosum, its division and relationship. Organization of the cerebral cortex, particularly the neocortex with its different cell types. Cortical areas and localization of functions. Basal ganglia (striatum and globus pallidus), their location, organization and relationships to lateral ventricles and internal capsule; functional correlation with subthalamic nucleus and substantia nigra in movement control.

- The limbic system: cortical and subcortical components. Cortical structures: limbic lobe and hippocampal formation; subcortical structures: amygdala, septal nuclei, ventral striatum, nucleus accumbens, various thalamic and hypothalamic nuclei. Structure of the trilaminar cortex of hippocampus and dentate gyrus. Connecting pathways of the limbic system, afferent and efferent fibers.

- Blood supply of the brain and spinal cord. Arteries of the brain: internal carotid artery, vertebral and basilar arteries, their course, relations and terminal branches. Detailed knowledge of circle of Willis. Arteries of the spinal cord: posterior and anterior spinal arteries. Regional arteries of the brain and segmental spinal arteries. Veins of the brain: deep and superficial veins; detailed knowledge of dural venous sinuses. Veins of the spinal cord.

- Ventricular system and cerebrospinal fluid. Ventricles and canals in the brain and spinal cord which form the ventricular system: lateral ventricles, third ventricle, cerebral aqueduct (of Sylvius), fourth ventricle, central canal of the spinal cord with its terminal ventricle. Location, shape and relationships with cerebral and spinal structures, communication with subarachnoid space. Coroid plexuses. Circumventricular organs. Cerebrospinal fluid: formation, circulation, absorption, composition and function. Blood-brain and blood-cerebrospinal fluid barriers. Subarachnoid space and position of the major subarachnoid cisterns.

- Coverings of the brain and spinal cord (meninges). Meninges of the brain. Dura mater, its layers and

septa: falx cerebri, falx cerebelli, tentorium cerebelli forming tentorial notch, diaphragm sellae. Subdivision in supra and infratentorial compartments. Dural venous sinuses. Arachnoid mater. Formation of subarachnoid space. Pia mater. Meninges of the spinal cord, extradural space.

Peripheral nervous system :

- Origin and composition of the nerve roots. Relations with bone structures, meninges and medullary spaces. Constitution and relationships of the nervous plexuses. Origin, composition, peripheral distribution and relationships of the spinal nerves.

- Localization of the nuclear complexes of the spinal nerves. Origin and composition of the cranial nerves. Course of the cranial nerves, with particular reference to the exit holes from the cranial cavity and to their relationships.

Autonomic nervous system :

in ANATOMY 2B

THE MAJOR NEURAL PATHWAYS

in ANATOMY 2

CLINICAL NEUROANATOMY

in ANATOMY 2B

SPECIAL SENSES

The eye: in ANATOMY 2B

The ear: in ANATOMY 2B

LABORATORIES

Lectures will be partnered by multi approach interactive laboratories, to allow students a closer study of the examined topics. In particular, students will use both different anatomy models (Skull and skeleton; Upper and Lower limbs; Heart; Thorax and Abdomen; Male and Female Pelvis; Eye and Ear; Brain), and multimedia sources such as 3D virtual models, to recognize the main features of each organ. Some laboratories will focus on computer-assisted learning, to allow students to recognize radiological images, such as computed tomography and magnetic resonance imaging. In addition, some laboratories will be focused on quizzes based on lectures' topics, and/or on basic clinical cases, later discussed with the teacher.

Prerequisites

See Anatomia Istologia Umana

Teaching form

Frontal lessons and practical sections.

Lessons will take place in presence, subject to any ministerial changes following the COVID pandemic situation

Textbook and teaching resource

-G. Anastasi e altri autori. Trattato di Anatomia Umana (3 volumi). Edi-Ermes (ed), 2009.

-“Prometheus” testo-atlante di Anatomia, II edizione, 3 volumi

-S. Standring. Anatomia del Gray – Le basi anatomiche per la pratica clinica – 41° ed. EDRA

- H. Ellis/V. Mahadevan. Anatomia clinica (Italian edition F. Cappello). Idelson-Gnocchi 2019

Per approfondimento sul sistema nervoso centrale :

L. Heimer. The Human Brain and Spinal Cord –Functional neuroanatomy and dissection guide. Springer-Verlag (ed), 1995.

-“Barr: Il Sistema Nervoso dell’Uomo. Basi di Neuroanatomia” di Kiernan JA e Rajakumar N. II edizione. Edises (2015)

Istituzioni di Anatomia dell'Uomo - Sistema nervoso centrale (a cura di E. Gaudio) - XII ed. - Piccin (2016)

Istituzioni di Anatomia dell'Uomo - Sistema nervoso periferico ed organi di senso (a cura di R. De Caro) - XII ed. - Piccin (2017)

Haines DE. Neuroanatomia nel contesto clinico. Strutture, sezioni, sistemi e sindromi. Atlante. Edi-Ermes

Atlanti:

- Netter. Atlante di anatomia umana, Frank H. Netter, Editore: Edra

- Anatomia umana. Atlante. Curatori: G. Anastasi, C. Tacchetti, Editore: Edi. Ermes

Semester

annual

Assessment method

A mid-course assessment is scheduled for the end of the first semester, by a multiple choice quiz focused on Citology, Histology, Embriology, head and neck and thoracic region anatomy (nervous system and vascular system excluded) and musculoskeletal system.

At the end of the Course an oral examination is employed to test students' knowledge and it will follow a practical demonstration at the light microscope of the capacity of the student to recognize the normal microscopic features of human organs.

During the exam anatomical models and diagnostic images might be used to assess students' knowledge.

Exams in attendance, subject to any ministerial changes following the COVID pandemic situation

Office hours

See Anatomia Istologia Umana