

Topic 2: Anatomy of the skeletal system

Anatomy of the skeletal system - bony tissue

- Bones are very vascularized
 - A lot of vessels in bones
- If there is a fracture
- A lot of nerves in the bone so if gets hurt it is very painful
- Perichondrium covers the cartilage which is why we still feel pain there
- Functions of bone:
 - Support: the body
 - Protection
 - Movement
 - Store calcium and phosphate: when women are pregnant fetus takes calcium which is why they need to take in more nutrients
 - Blood cell formation: red marrow
 - Fat storage: insulation, protect bones? (fat in yellow marrow in middle of canal)
 - Hormone production
- Classification of bones
 - Based of shape and not size (long, short, flat, irregular)
 - Long
 - Compact (hollow centre)
 - Spongy (near joint ends)
 - Short
 - Flat
 - can sometimes have curvature
 - Irregular
 - [vertebrae, hip bones]
- Gross anatomy of bone
 - Hyaline cartilage covers the extremities part of the bone
 - Prevent trauma, make it move more slowly because of articulation, some parts have liquid to make movement more smooth
 - Diaphysis,
 - Looks a bit like the nerve but is a bone
 - Spongy bone area in long bone had cartilage before but ossification occur
 - Long bones
 - Osteoclasts cut cells
 - Osteoblasts produce cell
 - Inner osteogenic layer???
 - Mostly compact only a little spongy
 - Short, irregular and flat
 - Cartilage that cover articular surfaces
 - Red bone marrow found
 - Diploe of flat (25%)

- Irregular (hip bones and vertebrae) (60%) where we take out to see if there is any problems in creation for people
- Microscopic anatomy of bones
 - Bone matrix produced by osteocytes
 - Calcium strengthens and supports the body
 - Osteon
 - Only in compact bone not spongy
 - Structural units of compact bone
 - First lamellae in one direction and one over it faces the opposite way this is important as it strength the bone hard to break each layer if opposite direction
 - Canals and canaliculi
 - Circumferential lamellae
 - Interstitial lamellae
 - Osteocyte only in lacunae (some parts extend to canaliculi but not entire cell)
- Microscopic anatomy of bones
 - Spongy
 - Trabeculae
 - Irregular lamellae
- Chemical composition of bone
 - Organic
 - $\frac{1}{3}$ of bone
 - Osteoid, made mostly of collagen, produced by osteoblast (at first outside)
 - Inorganic
 - Stronger than organic
 - $\frac{2}{3}$ of bone
- Formation and remodelling
 - Ossification
 - Intramembranous ossification
 - CT becomes bone
 - Endochondral ossification
 - Origin is hyaline cartilage that ossified and became bone
 - Epiphyseal plate cartilage (more black, in children and adolescents)
 - Epiphyseal line (in adults, more white since more ossified)
- Postnatal bone growth: long bone
 - Have to know all the different zones (fig 6.12)
 - Only in long bone
 - Resting bone is immature cartilage cells
 - Endochondral
- Bone remodeling
 - Growth

- Osteoclasts destroy the other parts of the bone and osteoblasts make new cells this continues for whole life
- Epiphyseal plate closure (18 in female; male 21 this is why men tend to be taller than women)
- Epiphyseal plate stays same size in children - the resting zone waiting for stage 2 with eventually all become calcified can't keep making more
- GROWTH IN WIDTH
 - growth in width = appositional growth
 - layers of bone are laid down on top of one another
 - (1) osteoblasts on periosteal side secrete bone matrix
 - (2) osteoclasts on the endosteal side remove bone matrix
- Osteocytes found in lacunae
- estrogens create ossification before testosterone starts it
- Hormones that are important
 - PTH, Thyroid hormone, GH, testosterone and estrogen, vitamin D (without it no reabsorption), insuline, vitamin C (production of collagen fibres), calcitonin
- Reabsorption and secretion happen at same time (most of life) but eventually as get older reabsorption happens faster (osteoporosis)
- Wolf's law
 - Bones grow/remodel based on demands put on them
 - Tension = compression in bone
- Osteoporosis
 - Reabsorption > formation
 - Smoking reduces estrogen levels and bones can't form as fast
 - Age affects it
- Compact bone: osteon, small unit, lamella, lacunae between lamellae, central canal (arteries, veins...), lamellas face opposite directions to strengthen bone (collagen fibres make strong)
- Spongy bone: no osteon, lamella (not organized), trabeculae, vessels, (in flat bones)
- Haversian canal: middle of canal in osteon
- Interstitial lamellae: between osteon
- Circumferential: closer to outside
- Yellow marrow in medullary canal

Anatomy of the skeleton - axial skeleton

- Have to know table 6.2: bone markings

Bone markings

- Trochanter, tuberosity are responsible for insertion of muscles
- Memorize table function and shape

Skeleton

- Skull

- Cranial bones
 - Small bones between all flat bones
 - Cranial vault: superior, lateral and posterior
 - Cranial base: anterior cranial fossae, middle cranial fossae, posterior cranial fossae
 - Surround and protect brain
 - Attachments for head and neck
 - Ethmoid, frontal (only one), occipital (only one), parietal (2), sphenoid, temporal
 - Ethmoid bone for insertion of nerve olfactory nerve fibres
 - The parietal bones are connected, suture between sphenoid and frontal and sigmoid connected to nasal and maxillary (all with frontal) Occipital bone NEVER connected to frontal
 - Most lateral part of skull is parietal
 - Occipital bone
 - Foramen magnum = space where spinal cord connects
 - Sides of it called the occipital condyles
 - Temporal
 - Zygomatic process (part of the temporal bone that connects to the zygomatic bone)
 - Petrous part
 - Squamous region
 - Tympanic region
 - Mastoid process (large part that you can feel connects neck muscles)
 - Styloid process: connection area for tongue muscles: jugular foramen, carotid canal, internal acoustic meatus part of only temporal bone
 - Know figure 7.8
 - Carotid canal part of temporal not sphenoid
 - Sphenoid: complex, articulates with all other cranial bones
 - Orbital fissure between lesser and greater wing
 - Optic canal (for optic nerves) part of sphenoid bone
 - Ethmoid bone:
 - Participate in formation of posterior cranial fossae
 - Crista galli structure that attaches to dura mater that separates the 2 brain hemispheres
 - Ethmoidal cells (sometimes called sinuses)
 - Superior and middle nasal conchae are part of ethmoidal but not inferior
 - SLIDE 22 is important make sure to study
 - Sutural bone:
 - Irregular bone

- Appear later not at birth
- Intramembranous ossification
- Make sure to know slide 24
- Facial bones
 - Anterior part of skull, eye orbits and paranasal sinuses
 - 3 nasal conchae (2 are part of ethmoid but inferior is a facial bone), lacrimal, mandible, maxilla, nasal, vomer, zygomatic
 - Have to memorize figure 7.4a
 - One frontal bone but 2 nasal bone
 - Mandible: lower jaw bone-strongest and largest bone of the face
 - Maxillary
 - Cannot move it fused medially
 - Memorize slide 29
 - Vomer participate in nasal cavity and articulates to the perpendicular ethmoid, mandible, maxillary, occipital
 - We need bones in the neck to connect to muscles for swallowing (hyoid bone)
- Lordosis normal during pregnancy
- Fibrous cartilage form intervertebral disc
- No intervertebral disc between occipital and C1 and C1 and C2

Typical vertebra:

- superior / inferior to articulate each vertebra
- Vertebral foramen is the space for the spinal cord
- Cervical vertebra
 - Vertebral foramen large why?
 - Larger because spinal cord is larger placement of nerves that we need in upper limb (and it is an area of enlargement)
 - Transverse foramen only in this area vertebral arteries that join to the brain
 - Atlas C1
 - Articulate with occipital bone
 - Occipital condyle is area that attaches
 - Know diagrams on on slide 41
 - Superior C1 is larger than C2
 - C1 and occipital condyle yes it moves, but between C1 and C2 no
- Thoracic vertebrae
 - Spinal process is different
 - Directed posteriorly and inferiorly
 - C7 is most prominent
 - No transverse foramen
 - Costal demifacet of head for rib only in thoracic
 - Vertebral foramen is smaller
- Lumbar vertebrae
 - Body is much larger than others

- In sagittal position for inferior/superior
- Sacral vertebrae:
 - Sacral promontory: Evaluate pelvis for birth

Thoracic Cage:

- Sternum
 - Articulate with clavicle
 - Jugular notch: (called because 3 jugular veins meet there), goes to T2
 - Sternal angle: junction manubrium and body of sternum use to divide superior mediastinum and inferior mediastinum
 - Slide 50 diagram important (7.23)
- Ribs
 - 1-7 attached directly to sternum true ribs
 - 8-10 attached indirectly to sternum by costal cartilage false ribs
 - 11-12 not attached anteriorly
 - Superior part is larger than inferior but inferior has costal groove for vessels and nerves

Appendicular skeleton continued:

- Pectoral girdle
 - 2 pairs of bones: clavicles and scapula
 - Clavicles:
 - A lot of particularities but don't need to know all
 - Shape of an s
 - Acromial and sternal
 - Scapulae = shoulder blade
 - Acromion articulates with clavicle
 - Glenoid cavity articulates with head of humerus?
 - Know diagrams (fig 7.27 a and b)
- Upper limb
 - Scapula is part of the upper limb
 - Ulna is medial and radius is lateral
 - 14 phalanges in each hand because only 2 in the thumb instead of 3 like the other fingers
 - Humerus:
 - **Surgical neck:** need to surgery to fix fracture of bone here
 - **Anatomical neck:** between head and lesser and greater tubercle
- Hand
 - Have to know names of all bones
- Have to know pelvic girdle diagram 7.31
- Need to know differences between female and male pelvis bones composition

Topic 3: Anatomy and Physiology of the Joints

Classification of Joints:

- Structure and function
 - Structure:
 - Fibrous joints
 - Junction between bone and cartilage
 - Joints is usually join 2 or more than 2 bones
 - Little to no movement: synostose
 - Syndesmosis: limited movement
 - Gomphoses: nail (ex. Tooth in bone socket)
 - Just connective tissue
 - Cartilaginous joints
 - No joint cavity
 - Immovable joints
 - sometimes may change
 - synchondroses : areas of growth between rib 1-7 ribs and sternum
 - Part is hyaline and the other part fibrosis
 - Symphysis: articular surfaces covered with hyaline cartilage
 - Linking plate
 - Synovial (most abundant)
 - Articular cartilage: cushioning
 - Joint cavity: fluid filled cavity
 - Articular capsule: double layered
 - Synovial fluid: Reduces friction between 2 bones
 - Reinforcing ligaments: restrict movement
 - Nerve and blood vessels
 - Bursae and tendon sheath
 - Bags of lubricant = reduce friction
 - Bursa sac lined with synovial membrane
 - Tendon sheath = elongated bursa around tendon
 - Factors that influence stability
 - Articular surface
 - Shape does not help stability
 - Deep ball and socket joints have good shape for stability
 - Ligaments
 - More ligaments = more strength
 - Stretch stays stretched
 - Muscle tone
 - Book says 4 but many ppl have 5
 - Most important in stabilizing
 - Movement: Angular movements

- Flexion move forward up (shoulder)
- Extension backwards down (shoulder)
- For knee its the opposite
- Move outward from body abduction
- Move toward body is adduction
- Whip is internal rotation (shoulder)
- Whip is external rotation (shoulder)
- Circumduction only for shoulder
- When thumb touches to other fingers its opposition
- Plate of foot at medial side of body
- Opposite is eversion
- Function
 - Synarthroses
 - amphiarthrosis
 - Diarthroses
- Will be diagrams from this ppt on midterm
- Diagram slide 21 and 22 REALLY IMPORTANT!!! Need to know all structures, names that in red
- The rotator cuff muscles stabilize the shoulder

MIDTERM

52 mcq

3 on topic 1

31 on topic 2

7 on topic 3

11 diagram questions total

Topic 4: Anatomy and Physiology of the Muscular System

Attachment can be direct or indirect

Origin: attachment to immovable bone

Insertion: attachment to movable bone

Convergent all fascicles go to one ligament in triangular shape

The muscle that crosses the anterior side of the flexion so pect major responsible for movement of shoulder

Deltoid: It can perform three actions because it has the 3 origins

Slide 8 (opposite for knee only for flexion and extension) - posterior knee is flexion

No muscles on skull cos dont want to move it

Facial expression muscles

Must know what it's attached to but not more detail (For diagram on slide 11 only need to know muscles talked about on other slides in the powerpoint)

Lacunae is same meaning in bone and cartilage

Know difference between cartilage and bone

Functions of bone

Words in red are very important

Particularity for intramembranous ossification is for long bone