General arthrology
Joints of the spine, thorax, head and the hyoid bone

SKELETAL JUNCTIONS (juncturae ossium)

1. SYNARTHROSIS:

- The bones are connected by a layer of connective tissue
- The articulare surface are missing,minimal movements
- Differentiation according the type of connective tissue

a) **ART. FIBROSA- SYNDESMOSIS**
b) **ART. CARTILAGINEA – SYNCHONDROSIS (SYMPHYSIS)**
c) **SYNOSTOSIS**

2. DIARTHROSIS: articulatio synovialis

- Joint connection with contact

a) ART. FIBROSA- SYNDESMOSIS

Connection using fibrous tissue

wedging (gomphosis):

• it helps the tooth being inserted into dental alveolus of the jaw

suture (sutura):

• connection of skull bones

smooth- plana

serrated- serrata

squamous- squamosa

ligament (ligamentum):

• band of collagen fibrous tissue, (like a rope, ribbon or flat membrane)

b) ART. CARTILAGINEA

SYNCHONDROSIS

- Connection using **hyaline** cartilage (connection of ribs and sternum, between bones of the skull base- in child)

SYMPHYSIS

- connection using **fibrous** cartilage (intervertebral discs, connection of the coxal bones with symphysis pubica)

c) SYNOSTOSIS

- Connection of the bones using the bone tissue, the result is growing of two or more bones
- Exapmles: sacral bone, coccygeal bone, coxal bone, some skull bones
- In adulthood: synostosis of skull sutures - physiological, pathological

2. DIARTHROSIS

- Joint connection– **articulatio**, usually movable

DESCRIPTION OF THE JOINT

- Contact articular surfaces - **facies articulares**
- Joint cavity - **cavitas articularis**
- Joint capsule - **capsula articularis**
- Special joint apparatus

a) <u>Articular surface (facies articularis):</u>

- surface, with is in connection with the other bone
- is covered by a layer of joint cartilage (hyaline)
- different shape, articular head (caput)- convex, articular fovea (fossa)- concave
- shape of the articular surfaces determines the possibility of movement in the joint

b) Articular capsule (capsula articularis):

- **fibrous covering** of the joint

-**stratum fibrosum-** external layer from firm collagenous fibrous tissue, it has to protect the joint

- **stratum synoviale**- thin internal layer from fine fibrous tissue with vessels and nerves, it forms folds - **plicae synoviales**, and villi- **villi synoviales**, it produces a synovium- **synovia** (it has nutritive and mechanical functions)

c) Articular cavity (cavum articulare):

- cavity (fissure) between articular surfaces and articular capsule, it is filled by synovia

d) Special joint apparatus:

- Only in some joints
- They participate in ensuring of their better function

Joint ligaments (**ligamenta articularia**):

- (intraarticular ligaments, extraarticular ligaments)

Cartilaginous plates (**disci et menisci**):

- Fibrous cartilage, intraarticular, in joints with incongruental joint surfaces
- discus articularis- completely septates the joint cavity and divides ii into two separated cavities
- meniscus articularis- it sepatates incompletely the joint cavity

Articular labra(**labra articularia**):

- Bands of cartilaginous tissue, they enlarge and deepen te joint pits

Synovial bursae (**bursae synoviales**):

- pouches around the joint, derivatives of the joint capsule, in the places, where tendons and muscle lie directly on the joint

Ankylosis

Types of the joints

A. Classification of joints according to the shape of articular surfaces:

- Tough joint with irregular surfaces- **AMPHIARTROSIS**
- Flat joint - **ART. PLANA**
- Spherical joint - **ART. SPHAEROIDEA**
  - Free - **ARTHRODIA**
  - Restricted - **ENARTHROSIS**
- Cylindrical joint - **ART. CYLINDROIDEA**
  - **GINGLYMUS**- the axe of movement is in the right angle to the longitudinal axe of bone
  - Wheel joint - **TROCHOIDEA**- the axe of movement is parallel with the longitudinal axe of bone
- Elipsoidal jonit- **ART. ELLIPSOIDEA**
- Sellar joint - **ART. SELLARIS**
- Trochlear joint- **ART. TROCHLEARIS**

AMPHIARTROSIS

ART. PLANA

ART. SPHAEROIDAE

ARTHRODIA

ENARTHROSIS

ART. CYLINDROIDEA:

GINGLYMUS

TROCHOIDEA

ART. ELLIPSOIDEA

ART. SELLARIS

ART. TROCHLEARIS

B. Classification of joints according to the level of moveability and number of axis of movements.:

Joints with minimal movement:

- With irregular surfaces - **amphiartrosis**

Joints with sliding movements:

- Flat joints - **articulatio plana**

Joints with rotational movements:

- Joint surfaces alloow rotation along one to three axis
- **One-axis joints (art. cylindroidea and art. trochlearis)**
- **Two-axis joints (art. ellipsoidea** and **art. sellaris)**
- **Triaxial joints (art. sphaeroidea)**

C. Classification of joints according to the number of connecting bones:

Simple joint - art. simplex- two bones are connecting

Composed joint - art. composita- two or more bone are connecting, or two bones with discus or meniscus

Junctions of the spine and thorax

Junctions of the spine

Spine (columna vertebralis)

We can observe all types of junctiones on the spine
Synartroses and diarthroses as well

Synarthrosis

- syndesmosis- ligaments
- synchondrosis- disci intervertebrales
- synchondrosis sacrococcygea
- synostosis- os sacrum, os coccygis

Diarthrosis- articulationes intervertebrales

Spojení mezi obratli

1. **Junctiones of vertebral bodies**
   – disci intervertebrales: altogether 23, cartilaginous (symphysis) connection (anulus fibrosus – hyaline and fibrous cartilae, nucleus pulposus – fibrous tissue)

Articulatio uncovertebralis

2. <u>Junctions of vertebral arches</u>

- elastic liaments**– ligamenta flava (interarcualia)**

3. Junctions of articular processes of vertebrae

- **articulationes intervertebrales**

  sliding movements

  - short ligaments - **ligg. intertransversaria**
  - **ligg. interspinalia**
  - **lig. supraspinale** (cervical area) –

  as sagitally oriented **ligamentum nuchae** which is going to the occipital bone

4. <u>Junctions common for all vertebrae</u>

a) lig. longitudinale anterius

b) lig. longitudinale posterius

- They continue also to the sacral and coccygeal bone

Synostosis

- Coonection using the bone tissue
- Sacral bone: fusion of five sacral vertebrae
- Coccygeal bone: fusion of 3 - 5 coccygeal vertebrae

Curvature of vertebral column

1. In the sagittal plane

- double S-shaped:

lordosis: curvature forwards, cervical C4-5 and lumbar L3-4

kyphosis*:* curvature backwards, thoracic Th6-7 and sacral

2. Curvature in frontal plane

- Skoliosis, mild skoliosis is physiological and it is present in all people – in most mild right, in some mild left (if you are right or left-handed)

SHAPE AND MOVEMENTS OF THE SPINE

- 35% of body height

Movements

- **anteflexion, retroflexion,** 90° cervical, 23° lumbar, most stressed and vulnerable is part of the lower cervical vertebrae, Th11-12, L4-S1
- **lateroflexion**, 30° cervical, 35° lumbar
- Rotation and torzion, 60-70° cervical, 25-35° thoracic
- Springing movements

Mobility of the vertebral column

– depends on the size of intervertebral disc
– te mobility is rectricted by: ligaments, articular capsules and muscles

Junctiones of thoracic cage

1. Art. costovertebrales

a) art. capitis costae

b) art. costotransversarium

2. Juncturae sternocostales

a) artt. sternocostales (2nd-5th)

b) synchondrosis (1st, 6th, 7th)

3. Juncturae intercostales

a) artt. interchondrales (6th-9th)

b) membrana intercostalis externa, interna

A. Articulationes costovertebrales

1. Articulationes capitis costae

Articular surfaces: facies articularis capitis costae and foveae costales on thoracic vertebrae

articular capsule: firm and it is attached to the margins of articular surfaces

special apparatus: lig. capitis costae radiatum, at 2nd – 10th rib: lig. capitis costae intraarticulare

movements: along axis parallel with the neck of the rib

2. Articulationes costotransversariae

articular surfaces: foveae costales transversales and art. surface on tuberculum costae

articular capsule: margins of the articular surfaces

special apparatus: lig. costotransversaria, between collum costae and transversal procces of the vertebra

Movements: along axis which is parallel with collum costae

B. Juncturae sternocostales

- Connections between costal cartilages and sternum

1. Synchondrosis sternocostalis: cartilaginous connection with incisura costalis sterni, regularly at 1st often at 6th and 7th rib

2. Artt. sternocostales:
between 2nd to 5th rib and sternum
Articular surfaces: sternal end of costal cartilage, incisura costalis sterni
Articular capsule: to the margins of the articular surfaces
Special apparatus: ligg. sternocostalia radiata – they form membrana sterni externa and interna

C. Junctions of adjacent ribs

1. Articulationes interchondrales

joint connection between costal cartilages of 5th to 9th rib, covered by short articular capsule

2. Membranae intercostales – fibrous membranes connecting ajacent ribs

Membrana intercostalis externa

Membrana intercostalis interna

Cest cage shape and movements

- **Shape of truncated cone**
- base **(apertura thoracis inferior)**
- apex **(apertura thoracis superior)**
- walls **– frontal, dorsal, lateral**

cavitas thoracis

spatia intercostalia

arcus costarum

angulus infrasternalis

Movements

- in costovertebral connections, axis runs parallel with collum costae
- Upward rotation - inspirium
  downward rotation- exspirium

Junctions of skull

Craniovetebral junctions, syndesmoses, synchondroses, temporomandibular joint and hyoid junctions

I. Craniovertebral junctiones

- Connection of the skull with the 1st and 2nd cervical vertebra

1. Articulatio atlantooccipitalis

- Paired joint

Articular surfaces:
condyli occipitales and
foveae articulares superiores
of atlas
Articular capsule:
Is attached to the margins of
the articular surfaces

Special apparatus:
membrana atlantooccipitalis anterior* and *posterior
(between arches of atlas and occipital bone)
membrana tectoria
(cranial continuation of ***lig. longitudinale posterius*****,** it reaches to *clivus)*
Type of joint: elipsoidal with possibility of flexion and extension of the head and there are also possible smaller movements sideways

2. *Articulatio atlantoaxialis*

a) articulatio atlantoaxialis lateralis

•Paired joint

Articular surfaces:

facies articulares inferiores of atlas

facies articulares superiores of axis

b) *articulatio atlantoaxialis mediana*

•Unpaired joint

Articular surfaces:

facies articularis anterior on frontal side of *dens axis* with ***fovea dentis*** of atlas

a *facies articularis posterior* on dorsal side of *dens axis* with ***lig. transversum atlantis***

Articular capsule: is common and is attached to the margins of the articular surfaces

Special apparatus:
lig. apicis dentis, ligg. alaria,
lig. cruciforme atlantis, formed by
lig. transversum atlantis and vertical ibrous bands going from axis to occipital bone ***(fasciculi longitudinales)***
Type of joint: both joints form one mechanical unit, atlas is rotating along *dens axis* in range of 60°

II. Skull syndesmoses

Present sutures ***(suturae)***, between the margins of the bones, there is a layer of fibrous tissue

III. Skull synchondroses

s. sphenopetrosa+s. petrooccipitalis
s.interoccipitalis- anterior et posterior
s.intersphenoidalis, s.sphenooccipitalis
synchrondrosis sphenooccipitalis

IV. Temporomandibular joint
(articulatio temporomandibularis)

Articular surfaces: ***caput mandibulae*** connects with ***fossa mandibularis*** **and** ***tuberculum articulare*** of temporal bone

Articular capsule: is attached to the margins of the articular surfaces, its medial part is very strong, it rows together wit *discus articularis*

Type of joint: gynglimus

Elevation – closing of the mouth

Depresion – opening of the mouth

protraction - shifting od the chin forwards

Retraction - shifting od the chin backwards

Special apparatus:

discus articularis (fibrous cartilage) – its middle part is thiner and the margins are thicker, it grows together with articular capsule, it divides articular cavity into ***pars discotemporalis*** and ***discomandibularis.***

Articular capsule: on lateral side: ***lig. laterale*****,** around the joint: ***lig. sphenomandibulare*** and ***lig. stylomandibulare***

V. Hyoid junctions

The skull and hyoid bone connects using muscle and ***lig. stylohyoideum***

X-ray picture of skull of Maxmilián the 2nd with good visible processus styloideus elongatus, 7 cm long

Thank you for your attention!!

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