

## Skeleton of lower extremity – Ossa membri inferioris

Skeleton of lower extremity consists of lower **extremity girdle** (cingulum membri inferioris) created by pelvis bone (os coxae) and **bones of free lower extremity** (pars libera membri inferioris) – basis of the thigh is femur (femur), basis of crus are tibia (tibia) and fibula (fibula), leg skeleton is created by seven tarsal bones (ossa tarsi), five metatarsal bones (ossa metatarsi) and phalanges (phalanges pedis).

### **Pelvic bone – Os coxae**

Os coxae of an adult human is standard flat bone, which in course of development, is created from three originally independent bones (os ilium – iliac, coxal bone, os ischii – ischium, sciatic bone, os pubis – pubis, pubic bone). These three bones fuse together even before the adult age (most often between 16th and 20th year), in joint pit acetabulum (acetabulum) located on the external side of the pelvic bone. The edges between the original bones, which os coxae originates from, are often apparent even on the mature bone. On the external circumference of acetabulum, there is semilunar joint area (facies lunata) for joining with the head of caput femoris (joint pit for iliac joint). Acetabulum is not closed in caudal direction, and a notch is created here – incisura acetabuli. In the middle of acetabulum, there is a deeper pit (fossa acetabuli), which during human life is filled by fibrous tissue with lipoidal pillow. For easier understanding, individual formations for each original bone unit are described separately.

- **Os ilium** (iliac bone, coxal bone). Most of the iliac bone is located over acetabulum, only the body of the iliac bone (**corpus ossis ilii**) is an integral part of iliac pit – acetabulum. A large wing comes off of iliac bone body – **ala ossis ilii**, its inner part is mildly sagging into **fossa iliaca**, which topographically still pertains to abdominal cavity. Lower edge of fossa iliaca is created by arch shaped edge (**linea arcuata**), which is part of borderline between pelvis major and minor. Dorsally from iliac pit, on inner area of iliac bone wing, there is a significantly uneven joint area, for joining with sacral bone (**facies auricularis**) and behind it a tuberosity is protruding (**tuberositas iliaca**) for attachment of a strong ligament. Outer plane of the blade iliac bone is more rough and three lines run here (**linea glutea posterior, anterior et inferior**). Linea glutea posterior is outlined dorsally; linea glutea anterior ventrocranially and linea glutea inferior is located ventrocaudally (over

acetabulum). Internal and external bone planes are meeting together cranially in iliac crest – **crista iliaca**, quite palpable, and on thinner individuals it is outlined on body surface. Crista iliaca has a rough surface – flat abdominal muscles are attached here. Crista iliaca protrudes forwards and backwards as palpable thorns (**spina iliaca anterior superior**, **spina iliaca posterior superior**), serving for attachment of muscles. At frontal edge of a bone, there is another thorn (**spina iliaca anterior inferior**), analogical thorn is found at dorsal edge of the iliac blade (**spina iliaca posterior inferior**). Under it, there is a deep notch on the bone (**incisura ischiadica major**), which though passes over sciatic bone. Under spina iliaca anterior inferior, there is a projection (**eminentia iliopubica**), which is found on the upper arm of pubic bone.

- **Os pubis (pubic bone)** is created by both the body (**corpus ossis pubis**) and by two arms – **ramus superior** and **ramus inferior**. Upper arm of pubic bone continues from the body into symphysis, where within transition into lower arm, it is terminated by rough symphyseal facies (**facies symphyialis**). Above the symphyseal plane (at upper bone edge) there is an apparent tubercle – **tuberculum pubicum**, from which runs big ridge – **pecten ossis pubis** upward and laterally. At lower edge of upper arm pubic bone there is an apparent groove – **sulcus obturatorius**.
- **Os ischii (sciatic bone)** The body of the sciatic bone (**corpus ossis ischii**) is an integral part of acetabulum. At the point where ramus – **ramus ossis ischii** comes off of sciatic bone body in ventrocaudal direction, there is a large **tuber ischiadicum**. Anterior narrowed part of ramus ossis ischii, is connected with lower arm of the pubic bone. At the back edge of sciatic bone, big thorn – **spina ischiadica** protrudes. The above mentioned notch (incisura ischiadica major) is located above it. Under it; the bone edge is deepened into smaller **incisura ischiadica minor**. Sciatic bone and both arms of the pubic bone encircle a great opening together (**foramen obturatum**), blocked filled by fibrous membrane (membrana obturatoria).

## **Femur – Femur**

Femur is the biggest and longest bone in the human body.

**Proximal epiphysis** has caput femoris with fovea capitis femoris. Femoral head is connected with the diaphysis by its narrowed bone part – femoral neck (collum femoris). On the interface between collum and corpus femoris two tubers protrude – greater trochanter

(trochanter major) and lesser trochanter (trochanter minor). Medial side of trochanter major is deepened into an apparent pit (fossa trochanterica). The edge – linea pectinea distally descend from lesser trochanter. All mentioned structures serve as sites of origin or insertion of many muscles.

**Femoral diaphysis:** at the back side of the bone body, there is linea aspera with labium mediale and labium laterale. Labium laterale lineae asperae proceeds proximally as tuberositas glutea. Proximally linea pectinea is separated from labium mediale lineae asperae. Distally both labia lineae asperae are divided in such way, that a flat field of triangular shape (planum popliteum) is created.

**Distal epiphysis** is terminated with two condyles – condylus femoris medialis et lateralis, epicondylus medialis and epicondylus lateralis are located on condyles. Ventrally, there is a smooth flat surface – facies patellaris for articulation with patella, dorsally there is a big pit – fossa intercondylaris between both condyles, proximally bordered by edge – linea intercondylaris.

### **Knee-cap – Patella**

Patella is the biggest sesamoideal bone in the human body. Patella has a triangular shape with the basis (**basis patellae**) inverted proximally and with the apex (**apex patellae**) directing distally. Anterior facies is separated from posterior facies by lateral and medial edge. Ventral patellar plane (facies anterior), is roughed up and is included into tendo of m. quadriceps femoris. Dorsal joint area (**facies articularis**) is usually divided into larger lateral and smaller medial facette.

### **Shin bone – Tibia**

Tibia is located on the thumb side of lower extremity crus. It is the stronger bone of the framework of both crural bones, and it is joined with femur, fibula and talus.

**Proximal epiphysis** has two condyles – condylus medialis and condylus lateralis. Proximal tibial area, facies articularis superior is interrupted by a projection – eminentia intercondylaris and this way is divided into facies articularis superior medialis and facies articularis superior lateralis for joining with both femoral condyles. The projection is divided into tuberculum intercondylare mediale and tuberculum intercondylare laterale. In front of eminentia and behind it there is an area intercondylaris anterior and area intercondylaris posterior. On the dorsal side of condylus lateralis, there is facies articularis fibularis in distolateral direction,

designed for joining with capitulum fibulae.

**Diaphysis** has sharp anterior edge (margo anterior), which starts proximally as tuberositas tibiae (attachment lig. patellae of quadriceps femoris), distally it is flattened. Another edge (margo interosseus) separates lateral plane from dorsal plane, and margo medialis separate dorsal plane from medial plane. A rough line – linea musculi solei (for spacing of m. soleus) is running from proximolateral into distomedial side in proximal part of the dorsal side of diaphysis.

**Distal epiphysis** has an inner angle (malleolus medialis) on its medial side. Facies articularis inferior tibiae is joined with talus. On the lateral side of distal tibial end there is incisura fibularis for fibrous connection with fibula.

### **Fibula – Fibula**

Fibula is long slim bone, located on crus, laterally from tibia.

**Proximal epiphysis** creates a capitulum (caput fibulae) for joining with tibia – facies articularis capitis fibulae.

**Diaphysis:** in the cross-section - the corpus of fibulae is of quadrangular shape, with margo anterior, medialis et posterior. Between margo anterior and margo medialis an edge (margo interosseus) for attachment of interosseal membrane is running.

**Distal epiphysis** runs into an external malleolus (malleolus lateralis), joint plane on its inner side (facies articularis malleoli lateralis).

### **Tarsal bones – Ossa tarsi**

Ossa tarsi are represented by: *talus*, *calcaneus*, *os naviculare*, *os cuneiforme mediale*, *os cuneiforme intermedium*, *os cuneiforme laterale* and *os cuboideum*. All of these bones are ranked as the bones of short type.

- **Talus (talus)** The main segment of talus – corpus (**corpus tali**) is carrying proximally trochlear joining area for joining with crural bones tibia and fibula – trochlea tali. Processus posterior tali runs dorsally from the body of talus. On the plantar side of talus, there are three joining areas for joining with calcaneus (facies articularis calcanea anterior, media et posterior). Oblique fissure – sulcus tali runs between middle and back joint area.

Fibular side of bone protrudes into processus lateralis tali, the body proceeds ventrally through short neck – **collum tali** into head – **caput tali**. On the head there is facies articularis navicularis for joining of talus with navicula.

- **Calcaneus (calcaneus)** Calcaneus is the largest metatarsal bone. It is jointly connected with talus and cuboid bone. Dorsal plane carries three facies articulares talaris – anterior, media et posterior for joining with talus. Between frontal and middle joint facies there is sulcus calcanei, which together with sulcus tali creates sinus tarsi. On the medial side, an apparent projection protrudes – sustentaculum tali, which supports talus. Dorsal edge of calcaneus creates tuber calcanei. On plantar side, tuber calcanei is divided into two projections – processus medialis and processus lateralis tuberis calcanei. Distal end of the bone has sellary shaped sagged joint area – facies articularis cuboidea for joining with cuboidal bone.
- **Os naviculare (navicula)**. Os naviculare is proximally articulated with caput tali, distally it has three plane facettes for connecting with cuneiform bones. On medial side it protrudes into a tuberosity – tuberositas ossis navicularis.
- **Ossa cuneiformia (cuneiform bones)**. Medial cuneiform bone (**os cuneiforme mediale**) is the biggest cuneiform bone, with its sharp margin facing towards dorsum pedis. Proximally it has joint area for os naviculare, distally for thumb metatarsus. Middle cuneiform bone (**os cuneiforme intermedium**) is the smallest (shortest) cuneiform bone, set more deeply between both remaining ossa cuneiformia. Blade of its wedge is running in plantar direction. Proximal joint area is for joining with os naviculare, distal joint area is joining with II. metatarsus. Lateral cuneiform bone (**os cuneiforme laterale**) is running in plantar direction. Dorsally, there is a rectangular rough base. Proximal joint area serves for joining with os naviculare, distal for III. metatarsus.
- **Os cuboideum (cuboideal bone)**. Os cuboideum is proximally joining with calcaneus, medially with lateral cuneiform bone and os naviculare, distally with IV. and V. metatarsus. On lateral side of bone, there is a beginning of a groove, which runs on plantar side of the bone in distomedial direction.

### **Metatarsal bones – Ossa metatarsi**

Similar to metacarpal bones, five metatarsal bones are joined by their distally located heads (**caput ossis metatarsi**) with bases of proximal phalanges. The middle part of the first

metatarsal bone (**corpus ossis metatarsi**) is quite bulky, in other bones it's relatively slim, it is mild convex towards the dorsum of pedis. Metatarses also consist of proximally located basis (**basis ossis metatarsi**), that are in contact with metatarsal bones. With the exception of I. and V. metatarsus, medially and laterally sides have basis of joint facies for joining with neighbouring metatarsal bones. I. metatarsus has joint area for contact with II. metatarsus on lateral side, V. metatarsus for joining with IV. metatarsus on medial side. Os metatarsi II. is the longest bone, its base is inserted directly into bifurcation of cuneiform bones. Sesamoid bones are constantly bilaterally on the plantar side of the head of thumb metatarsus and intermittently are found below the capitulum of the metatarsus V., or as well as of the II. metatarsus.

### **Phalanges of feet fingers – Phalanges digitorum pedis**

Phalanges digitorum pedis are three on each finger (phalanx proximalis, media et distalis), only the thumb has two (phalanx proximalis et distalis). Each article proximally has a **basis**, proceeding into **corpus**, and distally is terminated with a middle head – **caput phalangis**. almost trochlear shape. Therefore they are of analogical structure to the phalanges of hand fingers, but because they don't have grasp function, and serve only to help support standing and walking, they are shortened (especially middle phalanges). The forth and fifth finger have a tendency to grow together (most often middle and distal phalanx – biphalangia). On the distal end of the terminal phalanx, there is a tuberosity – tuberositas phalangis distalis.