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КРАТКАЯ АНАТОМИЯ МЫШЦ ТУЛОВИЩА И КОНЕЧНОСТЕЙ

CONCISE ANATOMY OF MUSCLES OF THE TRUNK AND EXTREMITIES

Учебно-методическое пособие

Минск БГМУ 2017

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Содержит базовые сведения по анатомии мышц туловища и конечностей. Материал представлен без излишней сложности и чрезмерного упрощения, что в сочетании с хорошо подобранными иллюстрациями, выполненными в режиме цветного контрастирования отдельных мышц, выгодно отличает настоящее издание от других аналогичных.

Предназначено для студентов 1–2-го курсов, обучающихся на английском языке по специальности «Стоматология».

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INTRODUCTION

The current standart program for the discipline of “Human Anatomy" for the specialty 1-79 01 07 “Dentistry” is aimed at the optimization of teaching non-core topics and sections. One of these sections is the myology of the trunk and limbs.

One lecture and four hours of classroom seminars are devoted to the study of the topic “Muscles of the trunk and limbs”, which is clearly insufficient for the formation of basic knowledge of the anatomy of muscles. At the same time, this knowledge will be in demand in the process of studying a number of clinical disciplines (surgery, traumatology, orthopedics, neurology, etc.). In practice it is of significant importance for a doctor of any specialty to be able to correctly pinpoint the location of all the elements of the human body, the basis of which are muscles and bones. The ability to correctly determine the projection of organs, vessels, nerves and other topographic and anatomical formations on the surface of the body contributes to the formation of clinical thinking of a future doctor.

The basis of this manual is the principle of maintaining a balance between excessive complexity and excessive simplification of the study material. The clinical direction of the publication is strengthened by a compact description of the superficial anatomy of the trunk and limbs

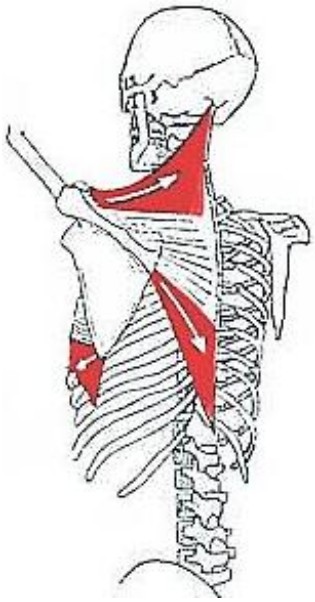
All of the above allowed the authors to shorten and adapt the text of this manual. Well-chosen illustrations, which are in colour, show the difference between separate muscles. This edition will be a good help for junior students.

MUSCLES OF THE BACK

Superficial back muscles are situated underneath the skin and superficial fascia. They originate from the vertebral column and attach to the bones of the shoulder — the clavicle, scapula and humerus. These muscles include trapezius (*m. trapezius*) and latissimus dorsi (*m. latissimus dorsi*) (figure 1). The trapezius originates from the skull, ligamentum nuchae and the spinous processes of C_7–Th_{12}. The fibres attach to the clavicle, acromion and the scapula spine. The upper fibres of the trapezius elevate the scapula and rotate it during abduction of the arm. The middle fibres retract the scapula, and the lower fibres pull the scapula inferiorly. Latissimus dorsi originates from the lower part of the back, where it covers a wide area. It has a broad origin – arising from the spinous processes of T_6–Th_{12}, iliac crest, thoracolumbar fascia and the inferior three ribs. The fibres converge into a tendon that attaches to the humerus: extends, adducts and medially rotates the upper limb.

The intermediate back muscles; these are rhomboid major and rhomboid minor (*mm. rhomboideus major et minor*), serratus posterior superior and serratus posterior inferior *(mm. serratus posterior superior et inferior*), and also levator scapulae (*m. levator scapulae*) (figure 2). The rhomboid muscles originate from the spinous processes of C_7–Th_5 vertebrae, and attaches to the medial border of the scapula. It retracts and rotates the scapula. Serratus posterior superior originates from the lower part of the cervical and thoracic vertebral $C_{6–7}$–$Th_{1–2}$ and attaches to the first 4 ribs, serratus posterior inferior originates from the thoracic and lumbar vertebral $Th_{11–12}$–$L_{1–2}$ and attaches to the last 4 ribs. Serratus posterior superior lifts the ribs and serratus posterior inferior lowers them.

The intrinsic (deep) muscles of the back are well-developed, and collectively extend from the sacrum to the base of the skull. They are associated with the movements of the vertebral column, and the control of posture. They are part of the "muscle corset", which ensures the stability of the spine and the correct position of the internal organs. The muscles form two isolated tracts. The lateral tract is presented by the erector spinae (*m. erector spinae*), which includes the longissimus (*m. longissimus*), ilicostalis (*m. iliocostalis*) and the spinalis muscles (*m. spinalis*) (figure 3). The medial tract includes the transversospinalis muscle (*m. transversospinalis*), fibres of which go through a number of different vertebrae, and the semispinalis muscle (*m. semispinalis*), 5–7 the vertebrae; muscle multifidus (*mm. multifidi*), 2–4 the vertebrae; and muscle rotators (*mm. rotatores*), 1st vertebrae (figure 4).



Lifting up the arms higher than horizontal level, elevation, is carried out with the help of the muscles of the trunk and the girdle of upper limbs attached to the scapula. The upper fibres of the trapezius muscle pull the lateral angle of the scapula upwards and medially, while the lower fibres pull down and medially; the serratus anterior pulls the bottom corner down and laterally, this makes the scapula rotate around the sagittal axis, which goes through its upper corner. As a result of the rotation of the scapula, its joint cavity rises to the top and along with it — the humerus, held in horizontal position by contraction of the deltoid and supraspinous muscles.

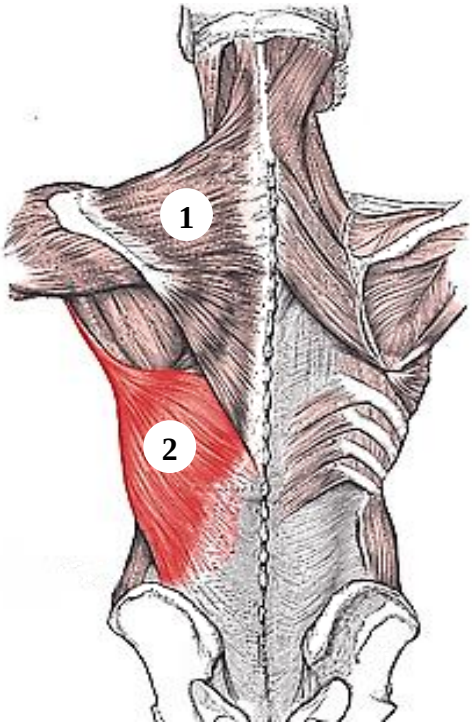


Fig. 1. The superficial back muscles:
1 — trapezius; *2* — latissimus dorsi

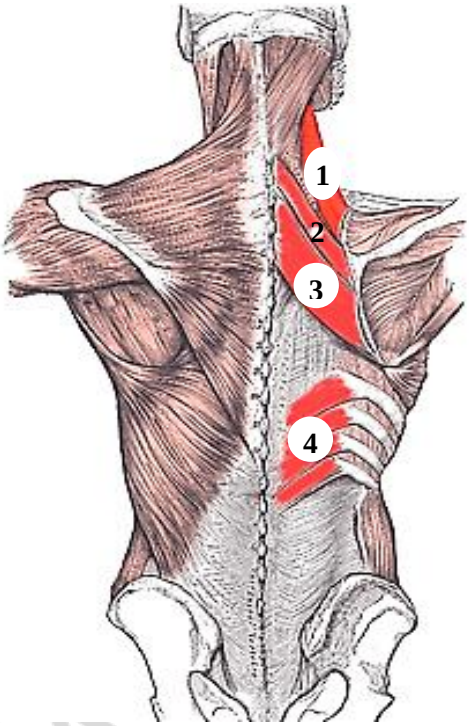


Fig. 2. The intermediate back muscles:
1 — levator scapulae; *2* — rhomboid minor; *3* — rhomboid major; *4* — serrated posterior inferior

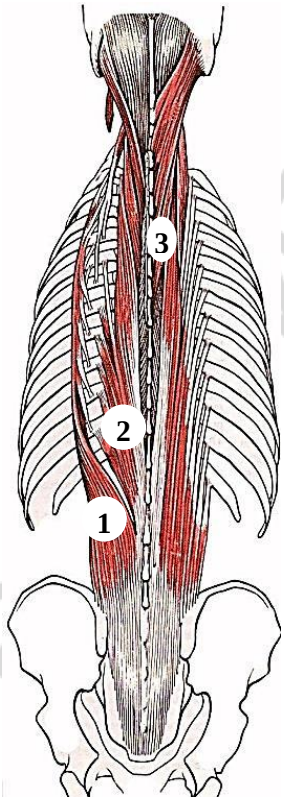


Fig. 3. Deep muscles of the back. Lateral tract:
1 — ilicostalis; *2* — longissimus; *3* — spinalis

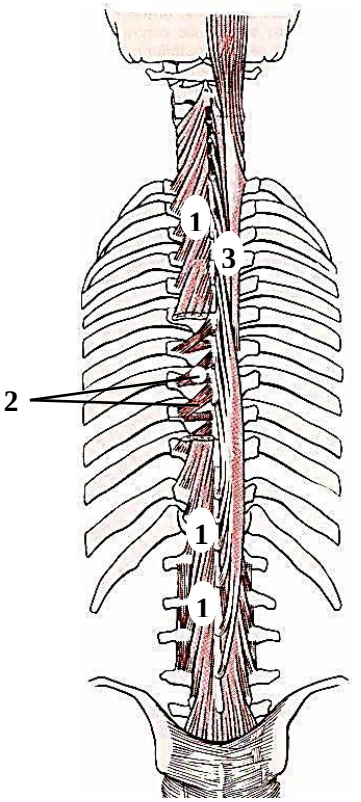


Fig. 4. Deep muscles of the back. Medial tract:
1 — multifidus; *2* — rotatores; *3* — semispinalis

CHEST MUSCLES

The muscles of the chest are presented by superficial and deep muscles of the chest. The superficial muscles include: pectoralis major and minor, serratus anterior and the subclavius muscle. They attach to the upper limbs and bring them in motion (figure 5).

Pectoralis major (*m. pectoralis major*) originates from the first 6 ribs, the sternum and the clavicle, it attaches to the humerus, flexes and extends the arm, rotates the arm medially. Pectoralis minor (*m. pectoralis minor*) originates from the third to fifth ribs, and inserts on the coracoid process of the scapula; it pulls the scapula anteriorly and inferiorly toward the ribs. Serratus anterior (*m. serratus anterior*) is located on the anterior lateral surface of the chest. Its point of origine is near the latissimus dorsi. It originates on the anterior side of the first 8 ribs, goes under the rib surface of the clavicle, and attaches to the medial border of the scapula drawing the scapula forward and upward, abducting and rotating it.

The deep muscles of the chest include: internal and external intercostal muscles (*mm. intercostales externi et interni*). Each rib is connected to the rib below it by both an external and internal intercostal muscle. The twelfth rib is the exception as it is the most inferior rib (figure 6). Their origins are along the inferior borders of the first 11 ribs and their insertions are along the superior borders of the rib below. The fibers of the external intercostals run obliquely inferior and anterior to the origin. Contraction of the external intercostal muscles elevates the ribs and spreads them apart. The internal intercostal muscles are the deeper set of intercostal muscles. Their origins form along the superior border of the second through twelfth ribs and their insertions form along the inferior borders of the rib above. The fibers of the internal intercostals run obliquely superior and posterior at the right angle to those of the external intercostals. Contraction of the internal intercostal muscles depresses the ribs and pulls them closer together. The external muscles aid inhalation, the internal aid exhalation.

When we inhale as deep as we can, the accessory muscles that lift the ribs with a fixed shoulder girdle are: pectoralis major and minor, serratus anterior, trapezius muscles, rhomboid, levator scapulae.

Diaphragm

Diaphragm (*diaphragma*) is the dome-shaped sheet of muscle and tendon that serves as the main muscle of respiration and plays a vital role in the breathing process. It separates the thorax (chest) from the abdomen. The origins of the diaphragm are found along the lumbar vertebrae of the spine and the inferior border of the ribs and sternum. Openings in the diaphragm allow the esophagus, descending aorta, and inferior vena cava to pass between the thoracic and abdominal cavities. It has the following parts: the lumbar part, the costal part and the sternal part. To the right of the diaphragm there is an opening for the vena cava. The lumbar region has its origins on the lumbar vertebra by way of two pillars of tendon called the left and right musculotendinous crura. The aorta and the thoracic duct pass through the first opening, and the esophagus and vagus nerve pass through the second opening (figure 7).

The static function of the diaphragm is to maintain a difference in pressure between the thorax and the abdomen. The dynamic function of the diaphragm is to aid breathing, flow of venous blood to the heart, flow of lymph, the act of defecation, etc.

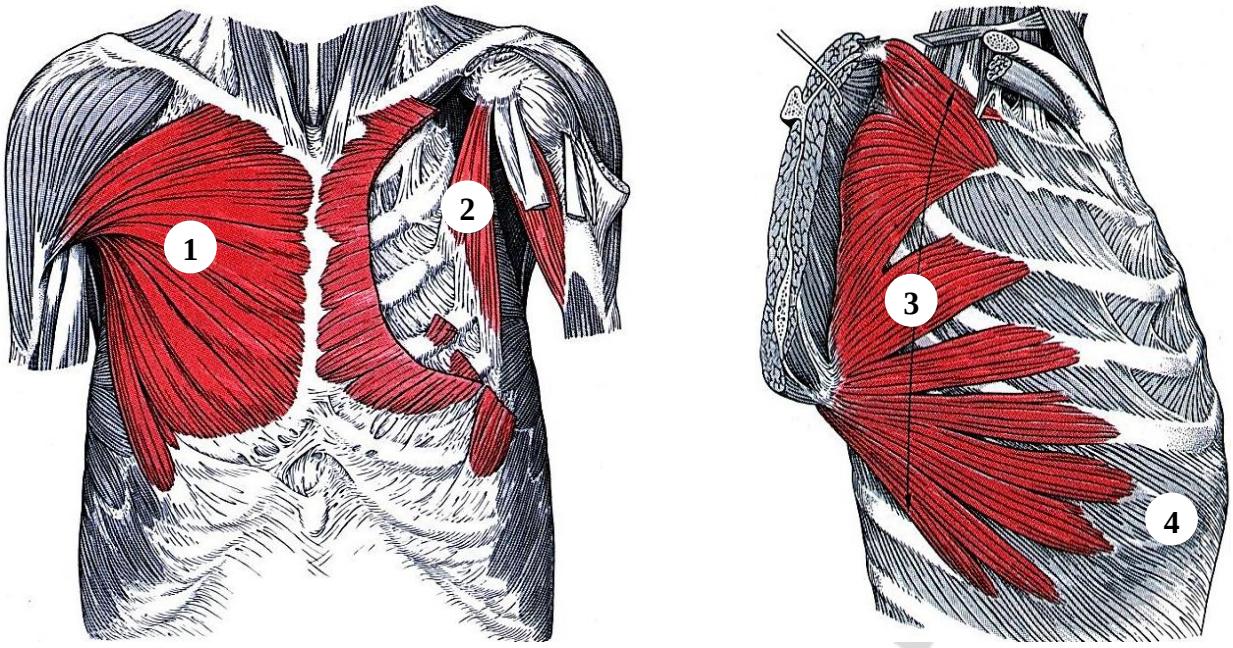


Fig. 5. Muscles of the ches:
A — the front view; *B* — the right side view: *1* — pectoralis major; *2* — pectoralis minor; *3* — serratus anterior; *4* — obliquus externus abdominis

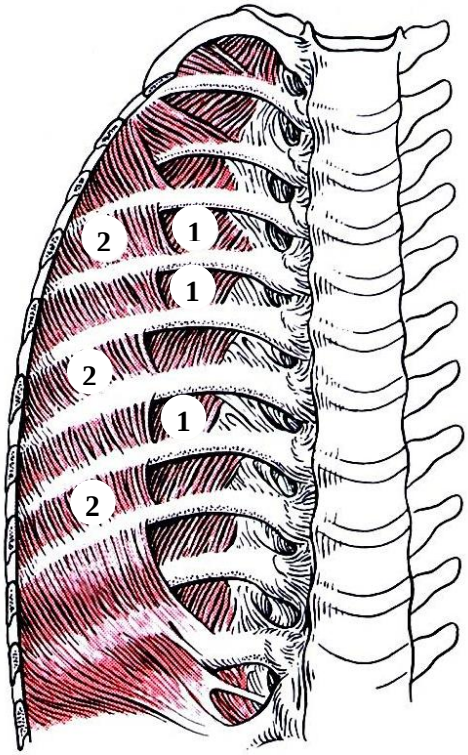


Fig. 6. Intercostal muscle:
1 — external intercostal; *2* — internal intercostal

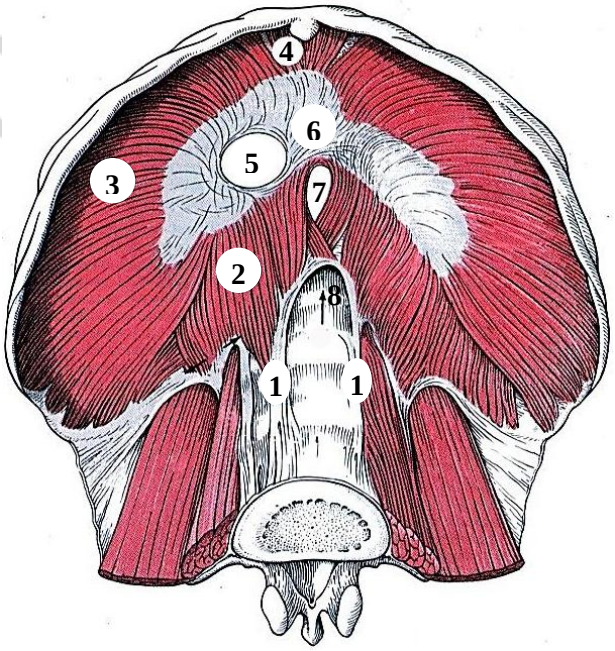


Fig. 7. Diaphragm:
1 — left and right crus of diaphragm; *2* — lumbar part of the diaphragm; *3* — ribcage part of diaphragm; *4* — xiphoid process of sternum; *5* — foramen for inferior vena cava; *6* — central tendon of diaphragm; *7* — foramen for esophagus; *8* — foramen for aorta

ABDOMINAL MUSCLES

The muscles of the abdomen are: external and internal oblique, transversus abdominis (transverse abdominal) and the rectus abdominis (figure 8); in the posterior abdominal wall lays the quadratus lumborum muscle. Muscles of the abdomen form the walls of the abdominal cavity; they play a critical role in protecting the delicate vital organs within the cavity as well as help with defecation. These muscles contract to flex, laterally bend, and rotate the torso and lower the ribcage.

External oblique (*m. obliquus externus abdominis*) covers the external intercostal muscles. The muscle originates from the lower 8 ribs, inserts into the linea alba of the abdomen, the pubis, and attaches to the iliac crest of the hip bones with the inguinal ligament. Internal oblique (*m. obliquus internus abdominis*), originates from the lateral 2/3 of the inguinal ligament and the thoracolumbar fascia, which goes upwards laterally and attaches to the three lower ribs. Transversus abdominis (*m. transversus abdominis*) lays deeper than the internal oblique; however has a similar origin and attachment. Rectus abdominis (*m. rectus abdominis*) lays to the sides of linea alba, stretches from the 5th to the 7th rib (origin) and attaches to the pubic bone. Each muscle consists of a string of four fleshy muscular bodies connected by narrow bands of tendon, which are covered by the rectus sheath.

Between the rectus abdominis muscles is a thick mass of white fibrous connective tissue called the linea alba that unites the abdominal muscles of the left and right sides. Linea alba stretches from the xiphoid process of the sternum to the pubic symphysis, in the top part it can be as wide as 2.5 cm, it narrows towards the bottom (0.4 cm), however it grows thicker in the sagittal plane. Linea alba is very firm and has poor blood supply, which makes it ideal for surgeries to get inside the abdominal cavity. Approximately in the middle of the linea alba the umbilical region (bellybutton) is located. It is only covered by skin and fascia. During prenatal development the umbilical cord is attached there. The umbilical cord contains three vessels: two arteries, which carry blood from the baby to the placenta, and one vein, which carries blood back to the baby. The vessels connect the baby to the mother and form a placental blood circulation.

Inside the abdominal cavity constant pressure is being maintained by abdominal muscle and internal organs. When pressure rises, this creates the opportunity for a hernia to occur. Hernia is protrusion of an organ which pushes through a “weak part” of the muscle or tissue that holds it in place.

Nearly all walls of the abdomen have “weak parts”. On the back wall these are the inferior lumbar triangles, on the upper wall — it’s the oesophageal hiatus of the diaphragm, as … lumbocostal and sternocostal triangles, on the bottom wall — femoral canal. Most of the “weak parts” are located on the front wall including linea alba, umbilical ring and inguinal canal.

Inguinal canal (*canalis inguinalis*) (figure 9) goes through the anterior abdominal wall from the top, down and medially. The lower wall of the inguinal canal is formed by the inguinal ligament, the front wall is limited by the aponeurosis of the external oblique muscles of the abdomen; the upper wall is represented by the lower edges of the internal oblique muscle and transverse muscle of the abdomen, the back wall consists of a cross-fascia belly. In men the spermatic cord passes through the inguinal canal, in women —

round ligament of the uterus. If the back wall of the canal is weak, inguinal hernias occur, which make up to 80 % of all abdominal hernias in adults and 95 % in children.

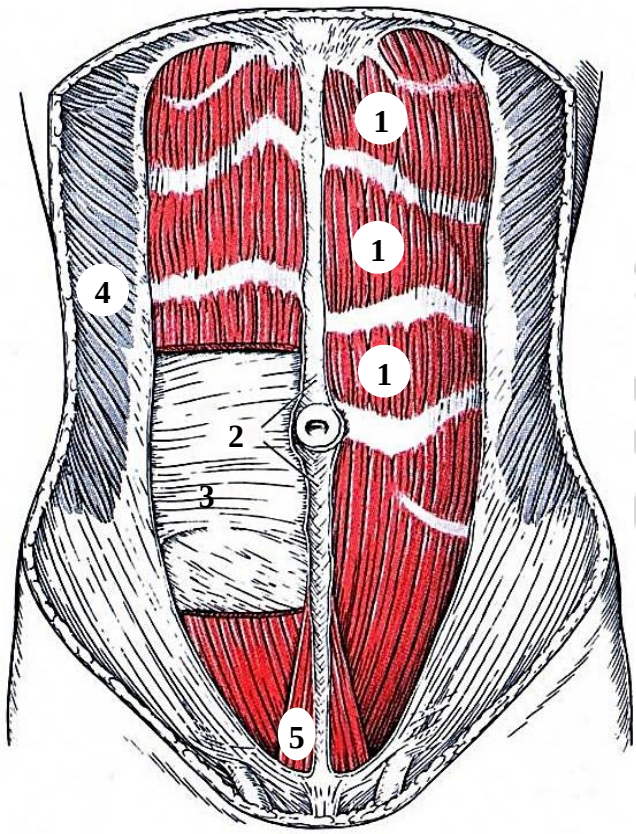


Fig. 8. Abdominal muscles:
1 — rectus abdominalis; *2* — linea alba; *3* — rectus sheath, posterior layer; *4* — body of sternum; *5* — pyramidalis

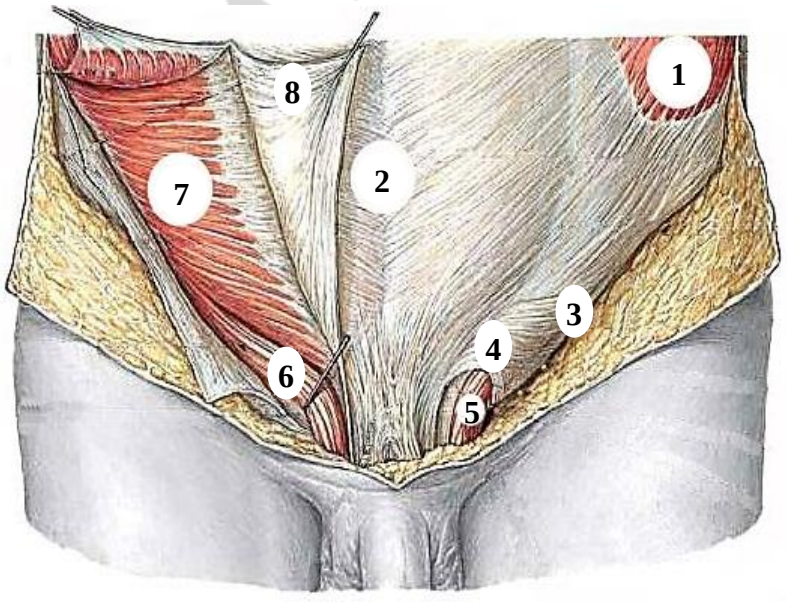


Fig. 9. Inguinal canal:
1 — external oblique; *2* — linea alba; *3* — inguinal ligament; *4* — superficial inguinal ring; *5* — spermatic cord; *6* — cremaster; *7* — internal oblique; *8* — external oblique; aponeurosis

MUSCLES OF THE GIRDLE OF THE UPPER LIMBS

Muscles of the upper limb girdle

The muscles of the upper limb girdle, start on the scapula and collarbone, and attach to the humerus. This group of muscles is made up of the deltoid muscle and muscles of the scapula (figure 10).

The deltoid (*m. deltoideus*) surrounds the front, top and back of the shoulder joint. The muscle starts from the scapula and collarbone, is attached to the same tuberosity of the humerus, and when it contracts, it flexes, extends and diverts the shoulder.

The supraspinatus muscle (*m. supraspinatus*), *infraspinatus* (*m. infraspinatus*), teres minor and teres major (*mm. teres major et minor*) lay on the back surface of the scapula, from where they originate. The first three muscles terminate on the large tubercle of the humerus and are the supinators. The teres major muscle, due to its attachment to the crest of the small tubercle, functions as a pronator of the shoulder.

The same function is carried out by the subscapularis (*m. subscapularis*), which transfers from the costal surface of the scapula to the large tubercle of the humerus.

Muscles of the upper extremity are categorised into muscles of the arm, forearm and wrist.

The shoulder has front and back muscles (figure 10). The front group of muscles consists of the biceps, coracobrachialis, and the brachialis muscle. Biceps (*m. biceps brachii*) together with the coracobrachialis (*m. coracobrachialis*) originate on the scapula; the brachialis attaches to the radius, coracobrachialis to the humerus. Brachialis (*m. brachialis*) originates from the distal end of the humerus and attaches to the ulna.

The bicep muscle goes over the shoulder and elbow joints, and makes the elbow joint bend inwards. Coracobrachialis bends the arm in the shoulder joint, brachialis — in the elbow joint.

The back surface of the shoulder is composed of triceps (*m. triceps brachii*) and anconeus (*m. anconeus*).One bundle of the tricep muscle originates from the scapula, the other two from the humerus. Both of these muscles are attached to the ulna. When the posterior muscles of the arm contract, this extends the elbow joint (straightening of the arm).

Muscle of the forearm

The anterior muscles of the forearm consist of seven extensors of the wrist and fingers and two flexors (figure 11). The majority of extensor muscles originate from the medial epicondyle of the shoulder; pronators go from the radius to the ulna. On the surface of the radius and ulna lays the flexor capri radialis muscle (*mm. flexoris carpi radialis et ulnaris*), the Palmaris longus muscle separates the radius and ulna (*m. palmaris longus*). Flexor carpi radialis attaches to the II metacarpal, the flexor carpi ulnaris attaches to the V metacarpal. The pronator teres muscle (*m. pronator teres*) goes across the named muscles in their top third part.

In the middle layer of the forearm there are flexor digitorum superficialis and profundus muscle (*mm. flexoris digitorum superficialis et profundus*). They originate from the medial epicondyle of the shoulder and both bones of the forearm, they attach to the medial (surface) and distal (deep) phalanges of II–V fingers.

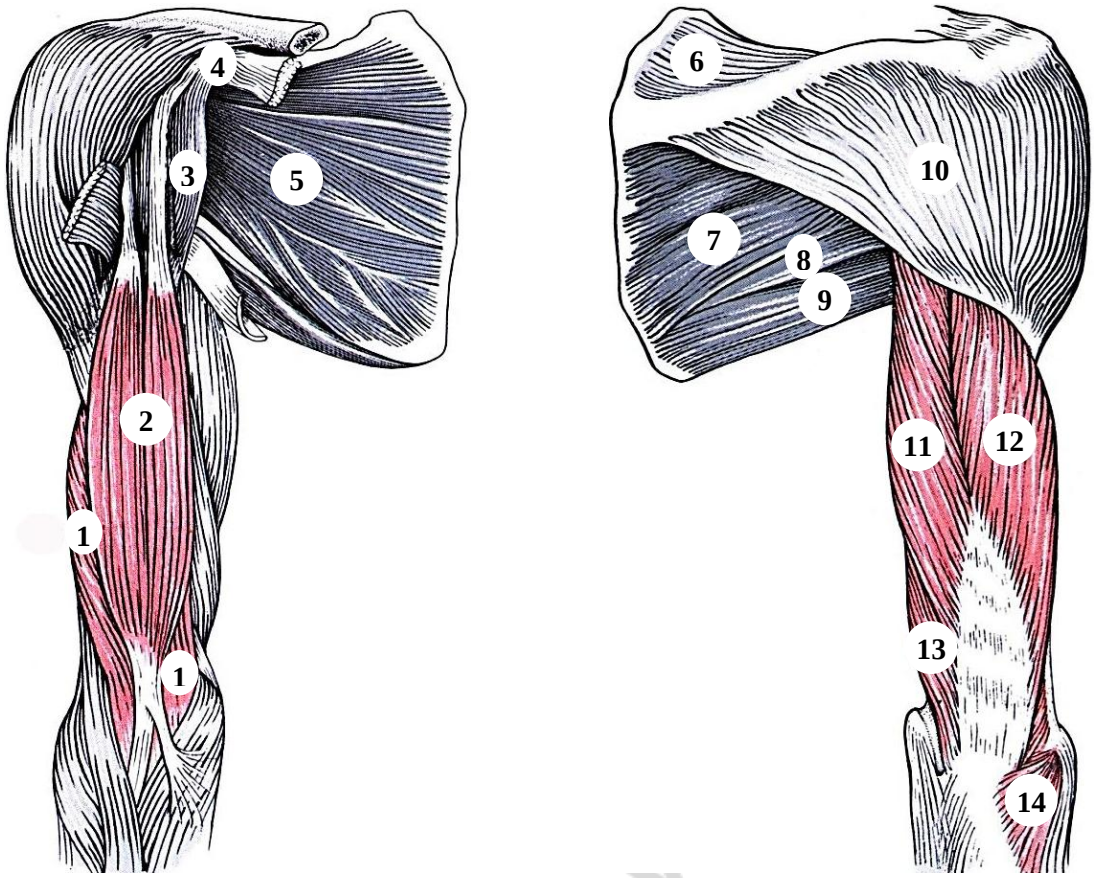


Fig. 10. Muscle of the shoulder and arm.
A — anterior; *B* — posterior: *1* — brachialis; *2* — biceps brachii; *3* — coracobrachialis; *4* — scapula; *5* — subscapularis; *6* — supraspinatus; *7* — infraspinatus; *8* — teres minor; *9* — teres major; *10* — deltoid; *11*, *12*, *13* — triceps brachii long, lateral and medial head; *14* — anconeus

Along the radial edge of the deep flexor of the fingers passes the flexor policis longus muscle (*m. flexor policis longus*), which goes all the way to the distal phalange.

The deep layer is represented by the pronator quadratus muscle (*m. pronator quadratus*), which lays in the lower third of the forearm and goes from the radius to the ulna.

The anterior muscles of the forearm are divided from the posterior muscles of the forearm by the brachioradialis (*m. brachioradialis*), which goes from the humerus to the radius. When these muscles contract, the arm is held in the middle position between supination and pronation.

Muscles of the posterior forearm are categorised into superficial and deep. The superficial originate from the lateral supracondylar ridge of humerus, the deep ones — from radius and ulna (figure 12).

Beside the brachioradialis lay the extensor carpi radialis longus and brevis (*mm. extensoris carpi radialis longus et brevis*), which attach to metacarpal bones II and III. Along the edge of the ulna lays the extensor carpi ulnaris (*m. extensor carpi ulnaris*), which attaches to the V metacarpal bone. Between the extensor carpi radialis and extensor carpi ulnaris lay the extensor digitorum and extensor digiti minimi (*m. extensor digitorum*, *m. extensor digiti minimi*). The extensor digitorum and extensor digiti minimi attach to the middle and distal phalanges (II–V fingers).

The deep layers of muscles of the posterior forearm on the radial side consist of abductor pollicis longus *(m. abductor pollicis longus*) *extensor* pollicis longus and brevis (*m.extensor pollicis longus et brevis*), extensor indicis (*m. extensor indicis*) and supinator (*m. supinator*). All the above mentioned muscles originate from the radius and ulna and attach to the phalanges. The supinator muscle curves around the upper third of the radius.

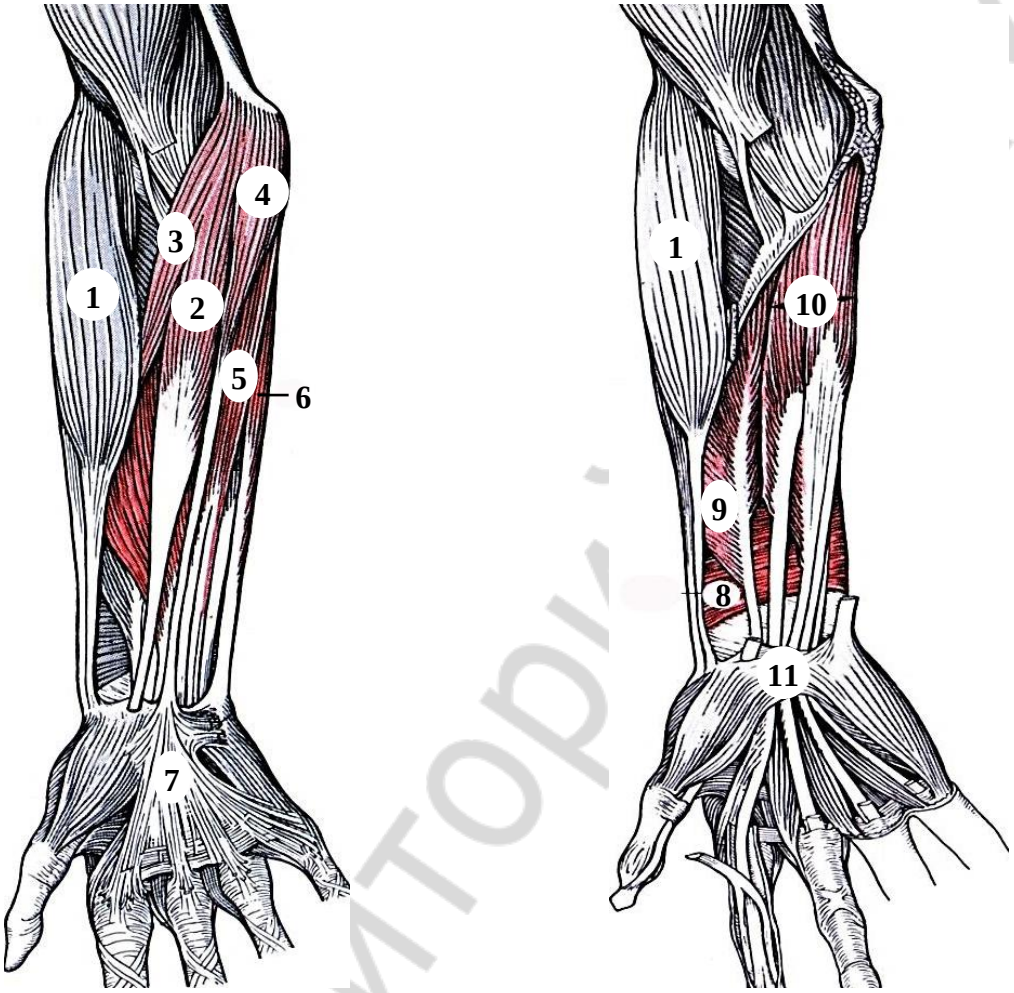


Fig. 11. Muscle of the forearm, anterior view:
1 — brachioradialis; *2* — flexor carpi radialis; *3* — pronator teres; *4* — Palmaris longus; *5* — flexor digitorum superficialis; *6* — flexor carpi radialis; *7* — palmar aponeurosis; *8* — pronator quadratus; *9* — flexor pollicis longus; *10* — flexor digitorum profundus; *11* — flexor retinaculum

Muscles of the wrist are divided into three groups: thenar (*thenar*); hypothenar (*hypothenar*), and palm muscles (figure 13, 14).

The thenar group consists of the following muscles: flexor pollicis brevis (*m. flexor pollicis brevis*), abductor policis brevis (*m. abductor pollicis brevis*), adductor pollicis (*m. adductor pollicis*) and opponens pollicis (*m. opponens pollicis*).

Muscles that have the same function, except the adductor policis, are also part of the hypothenar group.

The intrinsic muscles are: lumbricales (*mm. lumbricales*), palmar interossei and dorsal interossei (*mm. interossei palmares et dorsales*), they flex the fingers, separately and bring them together.

The muscles of the shoulder girdle and the upper limb have interesting anatomical formations, in which large vessels and nerves pass, which is of great practical importance. In the axilla and cubital fossa a lot of blood vessels and nerves are located, carpal tunnel contains tendons, that flexors covered by sheaths. The axilla can be seen best if we extend the shoulder to the maximum capacity. There we can see cavum axillare with all its blood vessels, nerve endings and lymph nodes

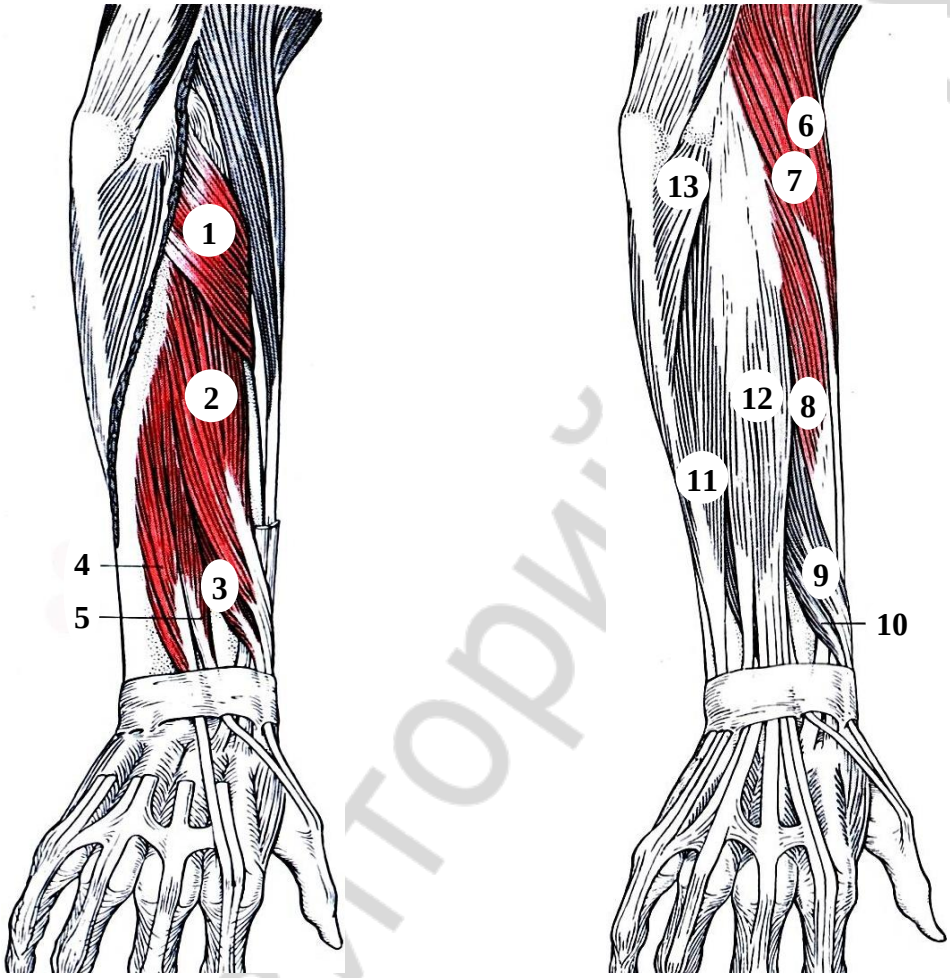


Fig. 12. Muscles of the forearm, posterior view:
1 — supinator; *2* — abductor pollicis longus; *3* — abductor pollicis brevis; *4* — extensor pollicis longus; *5* — extensor indicis; *6* — brachioradialis; *7* — extensor carpi radialis; *8* — extensor carpi radialis brevis; *9* — abductor pollicis longus; *10* — extensor pollicis brevis; *11* — extensor carpi ulnaris; *12* — extensor digitorum; *13* — anconeus muscle

Tendinous sheaths of the wrist

The wrist contains many synovial sheaths of tendons of the arm that are attached to the wrist. The synovial sheath helps tendons glide when work is being carried out.

On the dorsum lay canals containing sheaths that aid with extension.

On the palm surface (figure 15) there are canals containing tendons that aid flex the wrist and fingers. These flexor tendons, the superficial and the deep, lay in the same sheath, which stretches to the middle of the palm and reaches the distal phalanx of the little finger. The tendon that flexes the thumb is located in an isolated sheath. Synovial sheaths of the 2nd -4th the fingers are also isolated. Inflammation of the synovial sheath can be caused by doing the same motion for a long period of time (people in specific jobs, athletes).

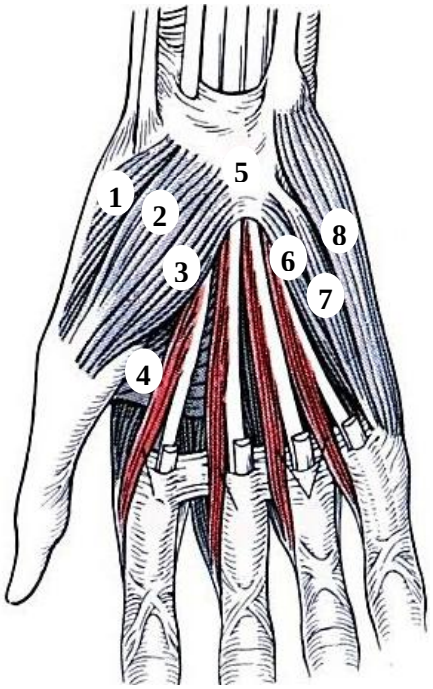


Fig. 13. Muscles of the wrist. Palm:
1 — opponens pollicis; *2* — abductor pollicis brevis; *3* — flexor pollicis brevis; *4* — adductor pollicis; *5* — flexor retinaculum; *6* — opponens digiti minimi; *7* — flexor digiti minimi brevis; *8* — abductor digiti minimi

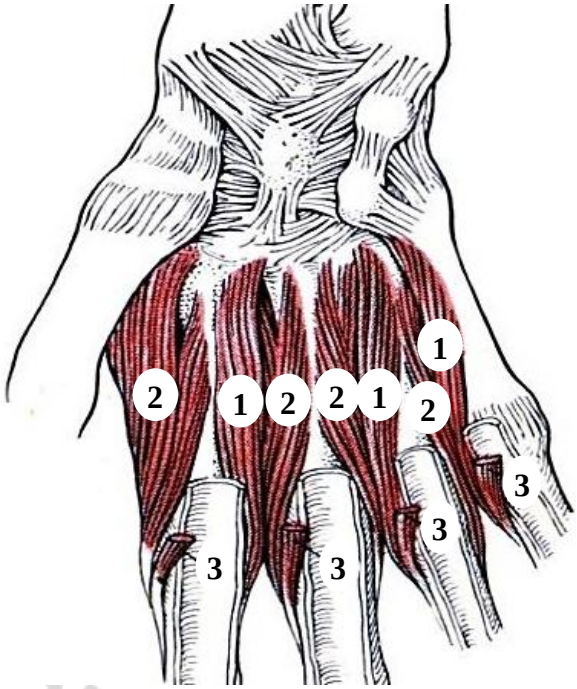


Fig. 14. Muscles of the wrist. Middle layer:
1 — palmar interossei; *2* — dorsal interossei; *3* — lumbrical

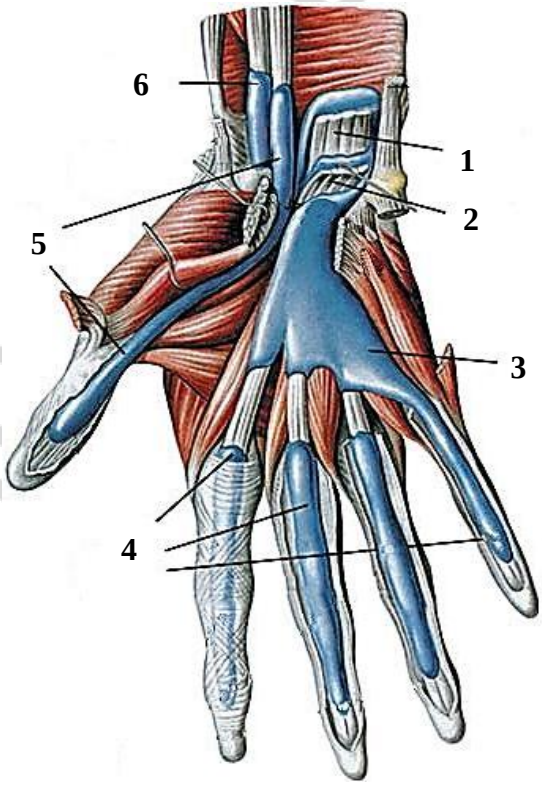


Fig. 15. Synovial sheath of the tendons of the hand muscles (palm surface):
1 — flexor digitorum profundus; *2* — flexor digitorum superficialis; *3* — a common tendon sheath of fingers; *4* — tendon sheath fingers; *5* — sheath of the long flexor tendons of the thumb; *6* — radial flexor tendon sheath wrist

APPENDICULAR MUSCLES OF THE PELVIC GIRDLE AND LOWER LIMBS

Muscles of the pelvic girdle surround the hip joint and bring the femur into motion.

Intrinsic muscles of the hip

Iliopsoas (*m. iliopsoas*) — attaches to the femur and has the ability to laterally rotate the thigh at the hip.

Piriformis (*m. piriformis*), obturator internus (*m. obturatorius internus*), superior and inferior gemellus muscle (*mm. gemelli superior et inferior*) originate from the inner surface of the hip bone, goe out of its cavity and attach to the femur. When the muscle contracts, it rotates the hip outwards (figure 16).

Extrinsic muscles of the hip

Gluteus maximus, gluteus medius and gluteus minimus (*mm. glutei maximus, medius et minimus*) originate from the outer surface of the iliac, and attach to the femur; they flex and rotate the hip outwards. Under the above named muscles there are the quadratus femoris (*m. quadratus femoris*) and the external obturator muscle (*m. obturatorius externus*), which also rotate the hip outwards (figure 16).

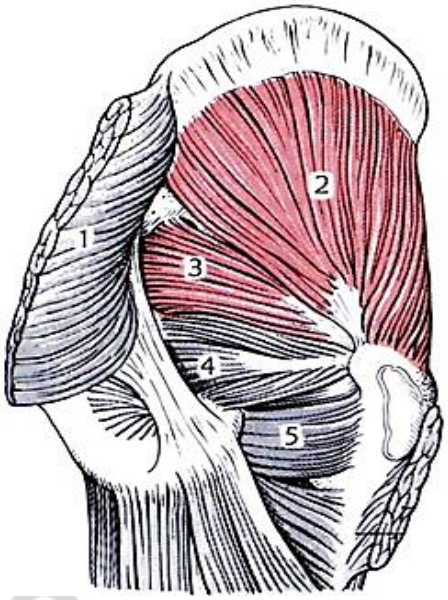


Fig. 16. Muscles of the hip. View from the back:
1 — gluteus maximus; *2* — gluteus medius; *3* — piriformis; *4* — obturator internus; *5* — quadratus femoris

Muscles of the lower limbs

Muscles of the thigh can be divided into anterior, medial and posterior (figure 17).

The anterior group consists of quadriceps femoris (*m. quadriceps femoris*) and sartorius (*m. sartorius*). They flex the lower limb at the hip joint and assist in lateral rotation. Three heads originate from the femur, the fourth head from the iliac bone; they attach to the tuberosity of the tibia. The sartorius muscle originates from the iliac bone, runs across the thigh in inferomedial direction and attaches to the superior, medial surface of the tibia. It is a flexor, abductor and lateral rotator.

The back muscles of the thigh consist of the biceps femoris (*m. biceps femoris*) (laterally), semitendinosus (*m. semitendinosus*) and the semimembranosus

(*m. semimembranosus)* (medially) muscles. They originate from the ischial tuberosity and the femur, and attach to the tibia and fibula; when they contract, they flex the shin, and extend the thigh.

The medial group consists of the adductor brevis, adductor longus and adductor magnus (*mm. adductor brevis, longus, magnus*), gracilis (*m. gracilis*) and pectinatus (*m. pectinatus*) muscle. The muscles originate from the pubis and attach to the femur, pectinatus — to the tibia. When they contract, they bring the limb to the midline.

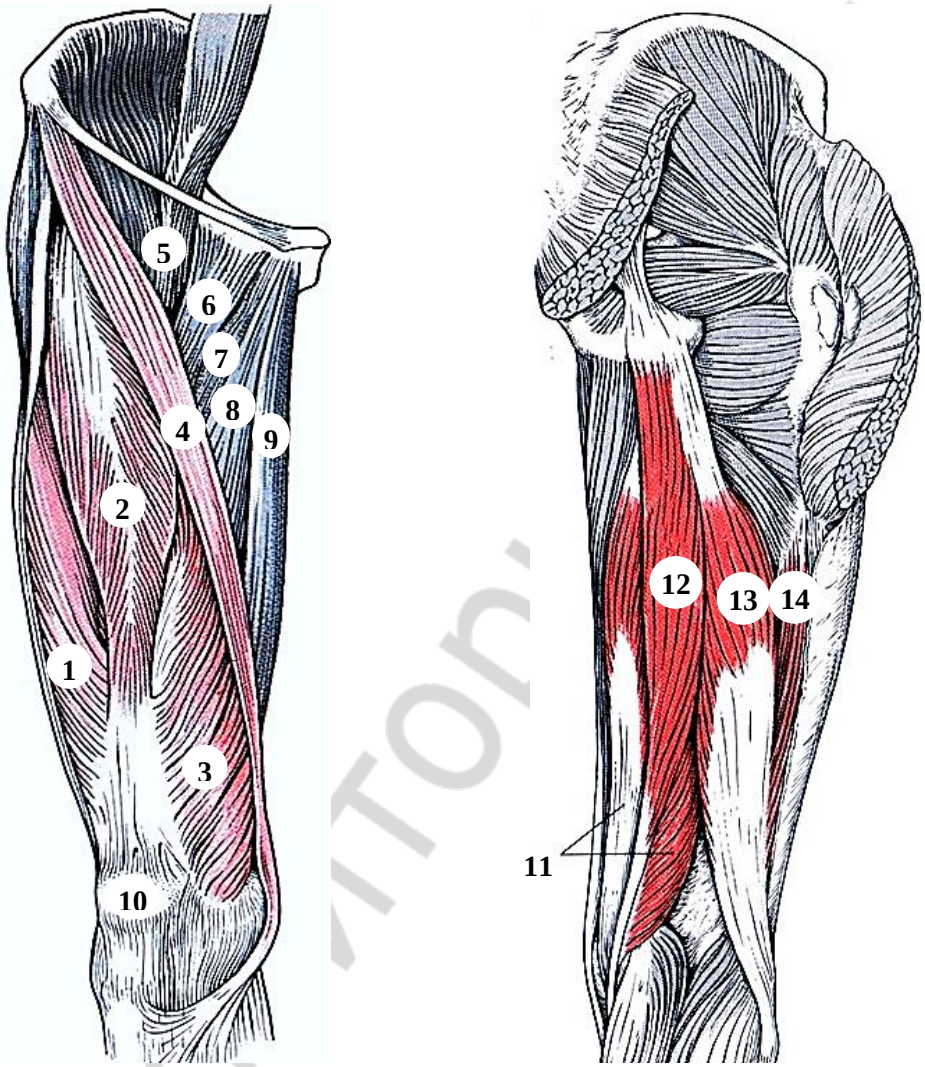


Fig. 17. Thigh muscle:
A — front view, *B* — back view: *1* — vastus lateralis; *2* — rectus femoris; *3* — vastus medialis; *4* — sartorius; *5* — iliopsoas; *6* — pectineus; *7* — adductor brevis; *8* — adductor longus; *9* — gracilis; *10* — patella; *11* — semimembranosus; *12* — semitendinosus; *13* — biceps femoris, long head; *14* — biceps femoris, short head

Muscle of the shin

They can be divided into anterior, posterior and lateral muscles. The anterior group consists of tibialis anterior (*m. tibialis anterior*), extensor digitorum longus (*m. extensor digitorum longus*) and the extensor hallucis longus (*m. extensor hallucis longus*), which originate from the tibia and fibula and attach to the base of the foot, extending it (figure 18).

The posterior group of muscles consists of the triceps surae (*m. triceps surae*) (surface layer), popliteus (*m. popliteus*), tibialis posterior (*m. tibialis posterior*), flexor digitorum

longus (*m. flexor digitorum longus*) and the flexor hallucis longus (*m. flexor hallucis longus*) (deep layer). Triceps surae originates at the upper fibula, tibia and the tendinous arch of soleus which stretches between the tibia and fibula. It then becomes the Achilles tendon and consists of the gastrocneminus muscle (lays superficially) and the soleus muscle which is located closer to the bones of the shin (figure 19).

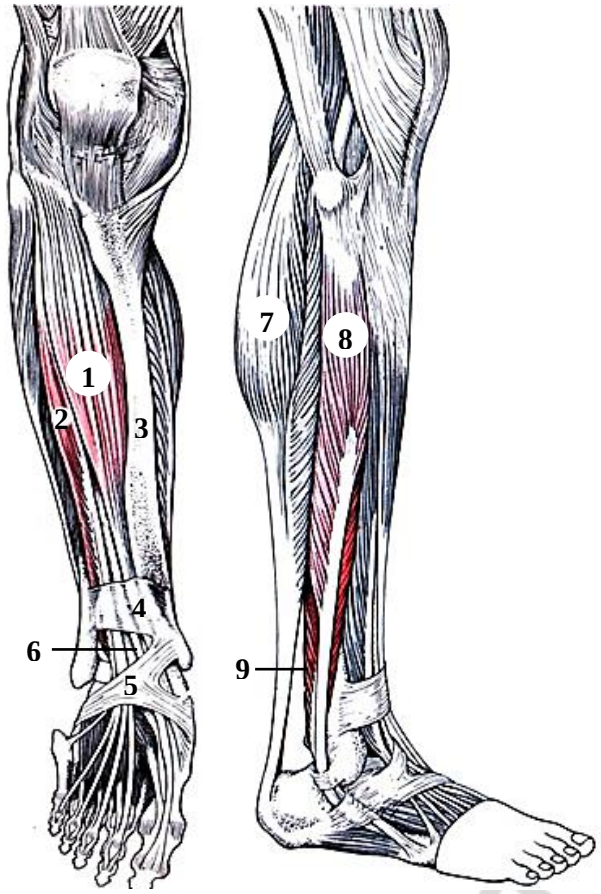


Fig. 18. Muscle of the shin:
1 — tibialis anterior; *2* — extensor digitorum longus; *3* — tibia; *4, 5* — inferior extensor retinaculum; *6* — extensor hallucis longus; *7* — gastrocneminus; *8* — fibularis longus; *9* — fibularis brevis

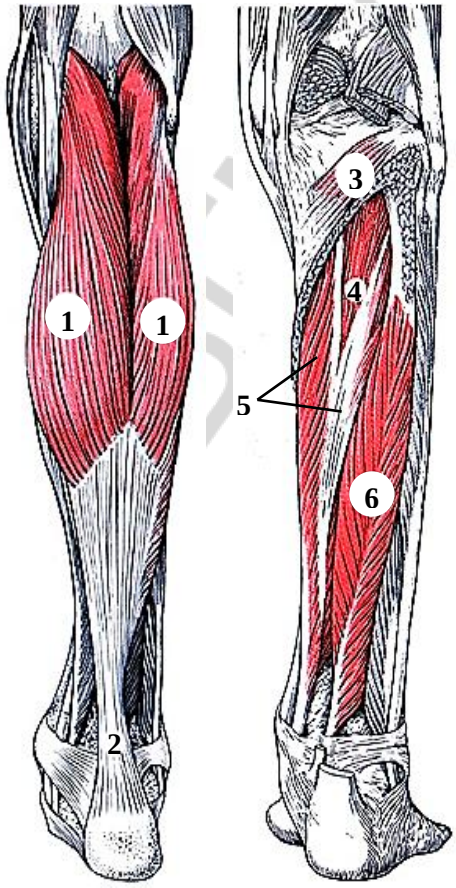


Fig. 19. Muscle of the shin; back view:
1 — gastrocneminus; *2* — calcaneal tendon; *3* — popliteus; *4* — tibialis posterior; *5* — flexor digitorum longus; *6* — flexor hallucis longus

Achilles tendon lifts the heel when a person takes a step and lowers the front part of the foot after the heel is on the ground again.

Tearing the Achilles tendon is a common injury. During this time a person cannot bend their heel or go on their tippy toes.

Deep muscles go from the bones of the shin to the distal phalanges of the toes. The posterior muscles flex the heel, which enables us to walk.

The lateral group of muscles includes the fibularis longus and brevis (*mm. fibularis longus et brevis*), which go all the way to the foot, to the medial edge (longus) and the lateral edge (brevis). They are the pronators of the foot (figure 18).

Muscles of the foot

Like in the wrist, the foot also has medial, lateral and middle groups of muscles. (figure 20). The medial group of muscles consists of flexor hallucis brevis (*m. flexor*

hallucis brevis), abductor hallucis (*m. abductor hallucis*) and the adductor hallucis (*m. adductor hallucis*) muscles. The lateral group of muscles consists of flexor digiti minimi brevis (*m. flexor digiti minimi brevis*) and abductor digiti minimi (*m. abductor digiti minimi*).The middle groups of muscle consists of interossei dorsales and plantaris (*mm. interossei dorsales et plantaris*) and the lumbricales (*mm. lumbricales*), *flexor digitorum brevis* (*m. flexor digitorum brevis*) and quadratus plantae (*m. quadratus plantae*).

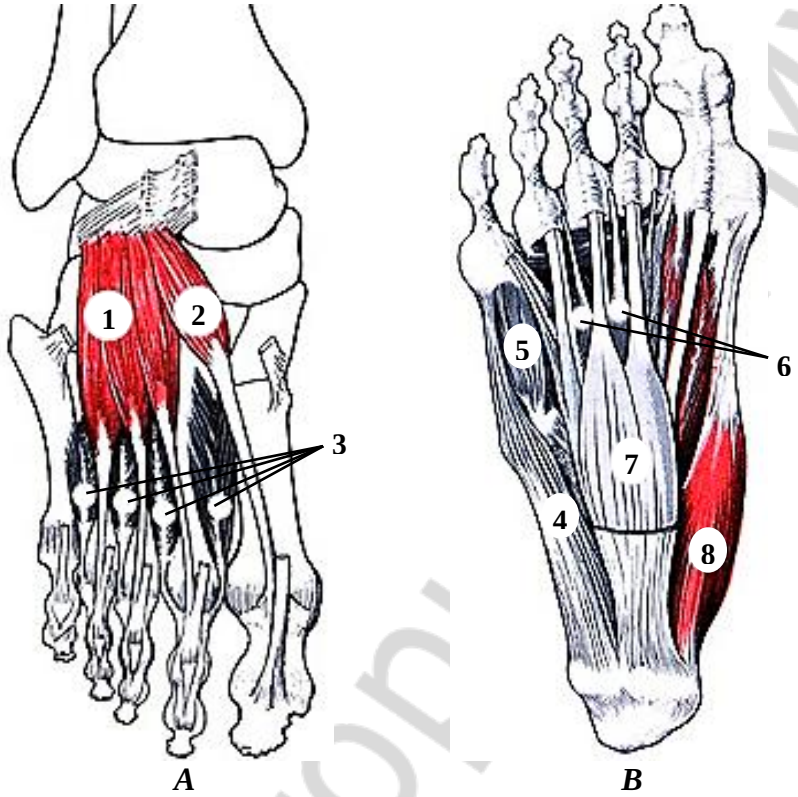


Fig. 20. Muscles of the foot:
A — dorsal surface; *B* — sole of the foot: *1* — extensor digitorum brevis; *2* — extensor hallucis brevis; *3* — dorsal interossei; *4* — abductor digiti minimi; *5* — flexor hallucis brevis; *6* — lumbricals; *7* — flexor digitorum brevis; *8* — abductor halluces

The foot has a vaulted structure and shock-absorbing qualities. Because of 5 parallel and 1 perpendicular joint, this enables equal pressure all over the foot and less damage caused during physical activity (figure 21). In maintaining the height of the arches ligaments, fascia and muscles play a vital role. When the load of the foot is too high the muscle contracts, which increases the height of its arches.

When the pressure is too high, the arch gets wider because of its parallel and perpendicular joints. Flat feet is a foot deformity by flattening of the arches.

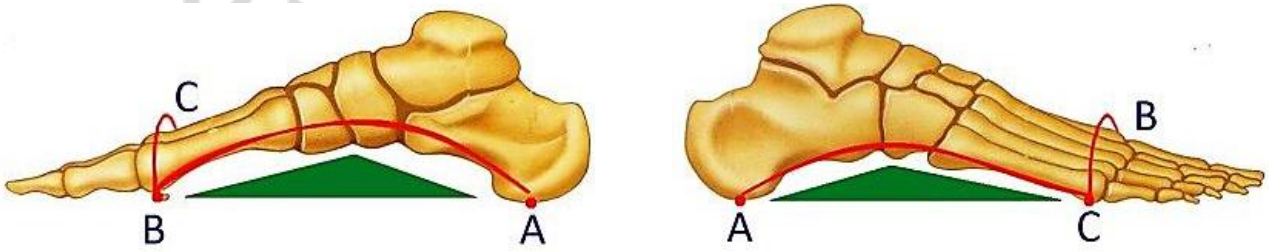


Fig. 21. Arch of the foot:
AB — 1st (medial arch); BC — parallel arch; AC — 5th (lateral perpendicular arch)

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