MUSCLES IN THE BODY

24. 10.2014

Kaan Yücel
M.D., Ph.D.
http://mdp120.org

A TOTAL OF 35 FIGURES EMBEDDED IN THE TEXT

READABILITY SCORE
53 %
1. INTRODUCTION TO MYOLOGY

The muscular system consists of all the muscles of the body. The discipline related to the study of muscles is myology. Musculus (muscle) is derived from the word mus-mouse; musculus- little mouse. All skeletal muscles are composed of one specific type of muscle tissue. These muscles move the skeleton. Therefore they move the body parts.

1.1. TYPES OF MUSCLES

There are three muscle types: skeletal, cardiac and smooth muscles.

• **Skeletal striated muscle** is voluntary somatic muscle. It makes up the gross skeletal muscles that compose the muscular system. The skeletal muscles move or stabilize bones and other structures (e.g., the eyeballs). Striated muscles are innervated by the somatic nervous system.

• **Cardiac striated muscle** is involuntary visceral muscle. It forms most of the walls of the heart and adjacent parts of the great vessels, such as the aorta. The cardiac muscle pumps blood.

• **Smooth muscle (unstriated muscle)** is involuntary visceral muscle. It forms part of the walls of most vessels and hollow organs (viscera). It moves substances through them by coordinated sequential contractions (pulsations or peristaltic contractions). Non-striated and cardiac muscles are innervated by the autonomic nervous system.

All skeletal muscles are commonly referred to simply as “muscles”. They have fleshy, reddish, contractile portions (one or more heads or bellies). Some muscles are fleshy throughout. Most muscles also have white non-contractile portions (tendons). The tendons are made mainly by organized collagen bundles. The tendons provide a means of attachment. When referring to the length of a muscle, both the belly and the tendons are included. In other words, a muscle’s length is the distance between its attachments.

Most skeletal muscles are attached directly or indirectly to bones. Not only to bones, but some are also attached to cartilages, ligaments, or fascias. Some are attached to some combination of these structures. Some muscles are attached to organs (the eyeball, for example), skin (such as facial muscles), and mucous membranes (intrinsic tongue muscles). Muscles are organs of locomotion (movement). They also provide static support. They give form to the body. The muscles also provide heat.

The architecture and shape of muscles vary. The tendons of some muscles form flat sheets, or aponeuroses, that anchor the muscle to the skeleton (usually a ridge or a series of spinous processes) and/or to deep fascia (such as the latissimus dorsi muscle of the back), or to the aponeurosis of another muscle (such as the oblique muscles of the anterolateral abdominal wall).

1.2. MUSCLE TERMINOLOGY

Many terms provide information about the muscle’s shape, size, location, or function. It may also be related to the resemblance of the muscle. Muscles may be described or classified according to their shape. This classification also helps to name the muscle.

• **Flat muscles**: have parallel fibers often with an aponeurosis. An example: External oblique muscle (broad flat muscle). The *sartorius* is a narrow flat muscle with parallel fibers.

• **Pennate muscles**: are feather-like (L. pennatus, feather) in the arrangement of their fascicles. These muscles may be unipennate, bipennate, or multi-pennate. Examples: Extensor digitorum longus (unipennate), *rectus femoris* (bipennate), and *deltoid* (multi-pennate).

• **Fusiform muscles**: are spindle shaped with a round, thick belly (or bellies). They have tapered ends. An example: biceps brachii.

• **Convergent muscles**: arise from a broad area and converge to form a single tendon. An example: Pectoralis major.

• **Quadrate muscles**: have four equal sides (L. quadratus, square). An example: Rectus abdominis, between its tendinous intersections.

• **Circular or sphincteral muscles**: surround a body opening or orifice. They constrict it when contracted. An example: Orbicularis oculi. This muscle closes the eyelids.
1.3. CONTRACTION OF MUSCLES

Skeletal muscles function by contracting. They pull and never push. When a muscle contracts and shortens, one of its attachments usually remains fixed. The other (more mobile) attachment is pulled toward it, often resulting in movement. Attachments of muscles are commonly described as the origin and insertion. The origin is usually the proximal end of the muscle. The origin remains fixed during muscular contraction. The insertion is usually the distal end of the muscle. The insertion is movable. However, this is not always the case.

Some muscles can act in both directions under different circumstances. The structural unit of a muscle is a skeletal striated muscle fiber. The functional unit of a muscle is a motor unit. It has a motor neuron and the muscle fibers it controls. When a motor neuron in the spinal cord is stimulated, it initiates an impulse. This impulse causes all the muscle fibers supplied by that motor unit to contract simultaneously.

1.4. FUNCTIONS OF MUSCLES

Muscles serve specific functions in moving and positioning the body.
A prime mover (agonist) is the main muscle responsible for producing a specific movement of the body. It contracts concentrically to produce the desired movement. The prime mover does most of the work (expending most of the energy) required. A fixator steadies the proximal parts of a limb through isometric contraction while movements are occurring in distal parts. A synergist complements the action of a prime mover. An antagonist is a muscle that opposes the action of another muscle. The same muscle may act as a prime mover, antagonist, synergist, or fixator under different conditions.

1.5. NERVES AND ARTERIES TO MUSCLES

Variation in the nerve supply of muscles is rare; it is a nearly constant relationship. In the limb, muscles of similar actions are generally contained within a common fascial compartment and share innervation by the same nerves. The blood supply of muscles is not as constant as the nerve supply and is usually multiple. Arteries generally supply the structures they contact.

2. MUSCLES OF THE FACE & SCALP

The facial muscles (muscles of facial expression) move the skin. By doing so, they change facial expressions to express mood. Most muscles attach to bone or fascia. They produce their effects by pulling the skin.

The occipitofrontalis is a flat digastic muscle. It elevates the eyebrows. It also produces transverse wrinkles across the forehead. This gives the face a surprised look.

Several muscles change the shape of the mouth and lips during speaking as well as activities such as singing, whistling, and mimicry. The shape of the mouth and lips is controlled by a complex group of muscular slips, which include the following:

- Elevators, retractors, and evertors of the upper lip.
- Depressors, retractors, and evertors of the lower lip.
- The orbicularis oris, the sphincter around the mouth.
- The buccinator in the cheek.

The platysma (G. flat plate) is a broad, thin sheet of muscle in the subcutaneous tissue of the neck. It helps depress the mandible. It draws the corners of the mouth inferiorly.

Cutaneous (sensory) innervation of the face and anterosuperior part of the scalp is provided primarily by the trigeminal nerve (CN V). The motor innervation to the facial muscles is provided by the facial nerve (CN VII).

3. MUSCLES OF THE NECK

The sternocleidomastoid (SCM) muscle is a broad, strap-like muscle. It has 2 heads. One head attaches on the sternum. The other one attaches on the clavicle. Bilateral contractions of the SCMs will cause extension of the elevating the chin. Acting unilaterally, the SCM laterally flexes the neck (bends the neck sideways). It also rotates the head. The ear approaches the shoulder of the ipsilateral (same) side as a result.

http://www.youtube.com/yeditepeanatomy
Trapezius is a large, flat triangular muscle. It covers the posterior aspect of the neck. It also is located at the superior half of the trunk. The trapezius provides a direct attachment of the pectoral girdle to the trunk. It was given its name because the muscles of the two sides form a trapezium (G. irregular four-sided figure). The trapezius assists in suspending the upper limb.

4. MUSCLES OF THE PECTORAL & SCAPULAR REGIONS

4 anterior axioappendicular muscles (pectoral muscles) move the pectoral girdle. Pectoralis major is the biggest of these 4. The pectoralis major is a large, fan-shaped muscle. It covers the superior part of the thorax. It produces powerful adduction and medial rotation of the arm.

The superficial and intermediate groups of extrinsic back muscles attach the the upper limb to the axial skeleton (trunk). The posterior shoulder muscles are divided into three groups:
- Superficial extrinsic shoulder muscles: trapezius and latissimus dorsi.
- Deep extrinsic shoulder muscles: two muscles
- Intrinsic shoulder muscles: deltoid, teres major, and the four rotator cuff muscles.

Four muscles are named as rotator cuff muscles. They help the head of humerus stay in the glenoid cavity like a cuff in the shoulder joint. These uscles are teres minor, supraspinatus, infraspinatus and subscapularis.

The name latissimus dorsi (L. widest of back) was well chosen because the muscle covers a wide area of the back. It passes from the trunk to the humerus. It acts directly on the shoulder joint. It also indirectly acts on the pectoral girdle. The latissimus dorsi extends, retracts, and rotates the humerus medially. We do that when folding the arms behind the back. It is a movement for scratching the skin over the opposite scapula.

The deltoid is a thick, powerful, coarse-textured muscle. It covers the shoulder. It forms its rounded contour. As its name indicates, the deltoid is shaped like the inverted Greek letter delta (Δ). The deltoid abducts the arm.

Muscles of the chest and abdomen

5. MUSCLES OF THE ARM, FOREARM & HAND

There are 4 arm muscles. 3 of them are flexors. The flexor arm muscles are: biceps brachii, brachialis, and coracobrachialis. They are in the anterior (flexor) compartment. The nerve of the 3 muscles is the musculocutaneous nerve. The one extensor muscles is the triceps brachii. It is in the posterior part of the arm. Its nerve is the radial nerve.

The biceps brachii is the flexor of the arm. The brachialis lies deeper in the arm. It is the main flexor of the forearm. The triceps brachii is the main extensor of the forearm.

There are 17 muscles crossing the elbow joint. Some of these muscles act on the elbow joint exclusively. Others act at the wrist and fingers.

The flexor muscles of the forearm are in the anterior (flexor-pronator) compartment. They are separated from the extensor muscles of the forearm by the radius and ulna and, in the distal 2/3 of the forearm, by the interosseous membrane that connects them. They flex the wrist and do pronation. They are mostly innervated by the median nerve. The ulnar nerve also innervates some of them.

The extensor muscles of the forearm are in the posterior (extensor-supinator) compartment. They are all innervated by branches of the radial nerve. The intrinsic muscles of the hand are located in five compartments.

6. MUSCLES OF THE GLUTEAL REGION & LOWER LIMB

The gluteus maximus is the most superficial gluteal muscle. It is the largest, heaviest, and most coarsely fibered muscle of the body. The main actions of the gluteus maximus are extension and lateral rotation of the thigh. The smaller gluteal muscles are gluteus medius and gluteus minimus. They are fan shaped and their fibers converge in the same manner. Gluteal region muscles

The large anterior compartment of the thigh contains the anterior thigh muscles. The anterior thigh muscles are the flexors of the hip and extensors of the knee. The sartorius is called the “tailor's muscle”. It passes lateral to medial across the superoanterior part of the thigh. The sartorius is the longest muscle in the body. It flexes the hip joint and participates in flexion of the knee joint. It also weakly abducts the thigh and
laterally rotates it. The actions of both sartorius muscles bring the lower limbs into the cross-legged sitting position.

The **quadriceps femoris** (L., four-headed femoral muscle) forms the main bulk of the anterior thigh muscles. It is one of the largest and most powerful muscles in the body. It is formed by four muscles. They are rectus femoris, vastus lateralis, vastus medialis and vastus intermedius. The quadriceps femoris is the great extensor of the leg. The femoral nerve innervates the quadriceps femoris.

The muscles of the medial compartment of the thigh comprise the adductor group. They adduct the thigh. They are innervated by the obturator nerve.

The **posterior thigh muscles** include the **hamstring muscles**. The hamstrings play a crucial role in many daily activities, such as, walking, running, jumping, and controlling some movement in the trunk. In walking, they are most important as an antagonist to the quadriceps in the deceleration of knee extension. The hamstring muscles are long head of biceps femoris, semitendinosus and semimembranosus muscles.

There are 4 muscles in the anterior compartment of the leg. These muscles are dorsiflexors of the ankle joint. They elevate the forefoot and depress the heel. The lateral compartment of the leg is the smallest (narrowest) of the leg compartments. The lateral compartment contains the **fibularis longus and brevis muscles**. Both muscles are evertors of the foot. They elevate the lateral margin of the foot.

The posterior compartment of the leg (plantarflexor compartment) is the largest of the three leg compartments. Muscles in the posterior (plantarflexor) compartment of leg are organized into two groups: superficial and deep, by the transverse intermuscular septum. Generally, the muscles mainly plantarflex and invert the foot and flex the toes. The superficial group of calf muscles (muscles forming prominence of “calf” of posterior leg) includes the **gastrocnemius, soleus, and plantaris**. The gastrocnemius and soleus share a common tendon, the **calcaneal tendon**. This tendon attaches to the calcaneus. The calcaneal tendon (L. tendo calcaneus, Achilles tendon) is the most powerful (thickest and strongest) tendon in the body. These muscles raise heel during walking. They flex the leg at the knee joint. 4 muscles make up the deep group in the posterior compartment of the leg.

The largest peripheral nerve of the body is sciatic nerve. It divides into two branches. They are tibial nerve and common peroneal nerve. The common peroneal nerve later divides into superficial and deep peroneal nerves. The tibial nerve innervates the hamstring muscles, posterior leg muscles. The superficial peroneal nerve innervates the muscles of the lateral compartment of the leg. The deep peroneal (fibular) nerve is the nerve of muscles in the anterior compartment of the leg.

Of the 20 individual muscles of the foot, 14 are located on the plantar aspect, 2 are on the dorsal aspect, and 4 are intermediate in position.

## 7. Muscles of the Abdominal Wall

The six **muscles** of the anterior abdominal wall affect body posture. The deeper the muscle is located (closer to the spine), the more powerful effect it will have. So the muscle will have greater capacity for creating and maintaining a healthy spine. From deep to superficial the abdominal muscles are: transverse abdominal, internal and external (abdominal) oblique muscles and rectus abdominis.

The **transverse abdominis muscle** is the deepest one. The **rectus abdominis** is the most superficial one. It is covered by the **aponeurosis of external oblique**. The rectus abdominis has tendineous intersections. The muscles of the anterolateral abdominal wall:

- Form a strong expandable support for the anterolateral abdominal wall.
- Support the abdominal viscera and protect them from most injuries.
- Compress the abdominal contents to maintain or increase the intra-abdominal pressure and, in so doing, oppose the diaphragm (increased intra-abdominal pressure facilitates expulsion).
- Move the trunk and help to maintain posture.

The main paired muscles in the posterior abdominal wall are the: **iliopsoas muscle** (chief flexor of thigh) and **quadratus lumborum** by the vertebral column. The latter extends the lumbar part of the spine.

http://www.youtube.com/yeditepeanatomy