

Technical Report

A BRIEF ANATOMO-SURGICAL DISSECTION GUIDE TO HUMAN LOWER LIMB: RESULTS OF THE COLLABORATION BETWEEN THE UNIVERSITY OF PALERMO AND THE UNIVERSITY OF MALTA

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ABSTRACT

The aim of this article is to show methods for dissection of the lower limb. In the summer 2017 a group of students at the University of Palermo that have already passed the exam of Human Anatomy took a 4 weeks dissection course at the University of Malta. The students were provided with a dissection kit, video recording equipment and cameras for taking pictures. This paper presents the results of the dissection course and a small and simple guide to young students and medical doctors who want to learn the bases of lower limb dissection.

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1. Introduction

Medicine is a science that requires both a practical and a theoretical approach. Unfortunately, the latter is not often valued enough in our University. The study of Anatomy, which is the basis for a doctor's education, exclusively through books and atlases(1-5), is indeed partially lacking the practical approach. That is why a group of students from the University of Palermo have been selected, because of their university career and their knowledge of the English language, to take part in an anatomy dissection course at the University of Malta.

The course took place in the university's dissection hall. The students spent their time dissecting, analysing and separating the various anatomical structures under the supervision of tutors from both universities (6-10). This article focuses on the anatomy of the lower limb.

The dissections were preceded by reviewing the anatomy of the lower limb, using books and atlases for a recognition of the anatomical planes. The aim of this work was to offer a guide to young students and medical doctors who want to learn the bases of lower limb dissection.

2. Material and methods

The students analysed two legs of embalmed cadavers, who died of natural causes. The first leg was taken from a male cadaver of a 80 years old man; the other leg from a female cadaver of a 75 years old woman. The materials used during the course include both anatomical books and atlases, used to compare the theoretical knowledge learned beforehand at the University of Palermo with the body structures studied on the cadavers, and surgical instruments, such as: surgical anatomical forceps, scalpel handle size 4 and blade size 22, scissors and vascular clamps (supplied by the University of Malta). Photos were taken with a Canon EOS 1300D.

3. Results

The cadavers were placed on the anatomy dissection tables with their heads in hyperextension so to help with the dissection process. When working on the lateral regions, the head was slightly tilted to the side.

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A scalpel (blade size 22, scalpel handle size 4) was used to make the first longitudinal incision from the anterior superior iliac spine to the tibial tuberosity, along the lateral margin of the patella.

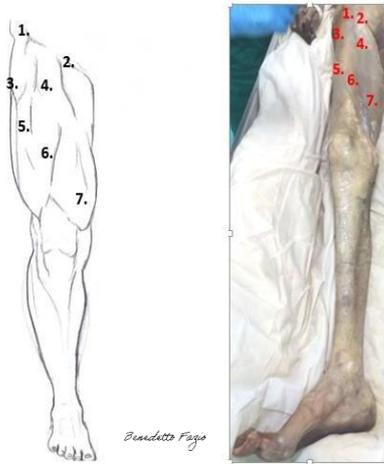


Figure 1. This picture shows superficial musculars structures of lower limb. 1. Iliac Ridge; 2. Inguinal ligament; 3. Tensor Fasciae Latae; 4. Sartorius M.; 5. Vastus lateralis M.; 6. Rectus Femoris M.; 7. Vastus medialis M.

The skin layer was held with the anatomical forceps and a slight pressure was applied moving the scalpel downward and keeping it parallel to the lower surface of the tissue.

The dissection was carried out trying to maintain the anatomical planes and not to damage its contents. At this point in the dissection process, the students were able to notice that the inguinal ligament runs from the anterior superior iliac crest of the ilium to the pubic tubercle of the pubic bone.

The sartorius muscle, which inserts itself into the superomedial surface of the tibia and originates from the anterior superior iliac spine, was isolated, after removing the adipose residues.

The rectus femoris muscle arises by two tendons: the first is the anterior or straight tendon, which moves from the anterior inferior iliac spine; the other is the posterior or reflected tendon, which moves from a groove above the rim of the acetabulum.

The vastus lateralis muscle arises from several areas of the femur, including the upper part of the intertrochanteric line; the lower, anterior borders of the greater trochanter, to the outer border of the gluteal tuberosity, and the upper half of the outer border of the linea aspera.

The vastus medialis muscle originates from the anatomical neck of the femur and then descends along the inner (medial) lip of the linea aspera.

The vastus intermedius arises from the front and lateral surfaces of the body of the femur, sitting under the rectus femoris muscle. The vastus medialis and vastus intermedius appear to be inseparably united. Its fibers end in a superficial aponeurosis, which forms the deep part of the quadriceps femoris tendon.



Figure 2. This picture shows deeps femoral artery and vein, and others structures near the crural canal. 1. Inguinal ligament; 2. Ileo-psoas M.; 3. Femoral artery and vein; 4. Vastus lateralis M.; 5. Rectus Femoris M.; 6. Sartorius M.; 7. Vastus Medialis M.

The patellar ligament is a continuation of the quadriceps tendon. It is composed by the distal portion of the superficial fibers of the common tendon of the quadriceps femoris. It inserts itself into the tibial tuberosity.

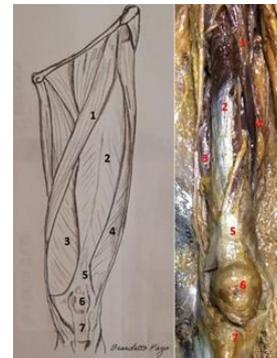


Figure 3. This picture show anteriors musculars of the thigh. 1.Sartorius M.; 2. Rectus Femoris M.; 3. Vastus lateralis M.; 4. Vastus medialis M.; 5. Rectus Femoris Tendon; 6. Patella; 7. Patellar ligament.

The vascular-nervous bundle was identified medially to the visceral compartment. Centrally, it contained the femoral artery; laterally, the femoral vein; and medially the femoral nerve. The components of this vascular-nervous bundle were isolated and carefully cleaned by using a blunt dissection.

The gracilis muscle is the most superficial muscle on the medial side of the thigh. It arises by a thin aponeurosis from the anterior margins of the symphysis pubis and inserts itself into the medial surface of the body of the tibia, below the condyle. For this reason, the muscle is a lower limb adductor. The adductor longus arises from the superior ramus of the pubis and it is inserted into the middle third of the medial lip of the linea aspera.

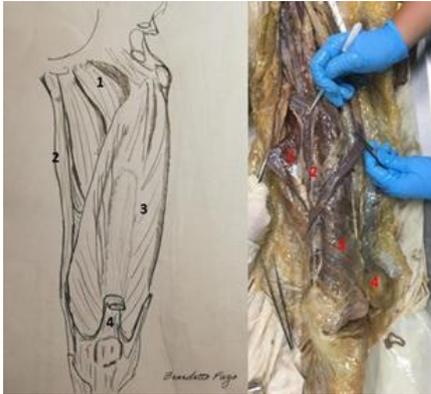


Figure 4. This picture shows lower thigh's laterals and medials muscles. 1. Adductor Longus M.; 2. Gracilis M.; 3. Vastus lateralis M.; 4. Patella.

After isolating the front thigh muscles, we dissected the patellar ligament to overturn the patella and to observe the internal structures by the flexion of the lower limb. In doing so, we can observe the intercondylar fossa of the femur, which appears to be like a deep notch between the surfaces of the medial and lateral epicondyle of the femur, these are two protrusions on the distal end of the femur that join the knee. The condyles are separated from one another by a smooth shallow articular depression called patellar surface, which articulates itself with the posterior surface of the patella. We can see the cruciate ligaments, which are two strong fibrous cords crossing inside the intercondylar fossa. They originate from the anterior and posterior intercondylar areas and are inserted on the internal face of the condyles: in particular, the anterior cruciate ligament originates from the anterior intercondylar area of the tibia and it is inserted into the medial side of the lateral condyle of the femur. The posterior cruciate ligament, instead, is more robust and lies between the posterior intercondylar area of the tibia and the lateral face of the medial condyle of the femur.

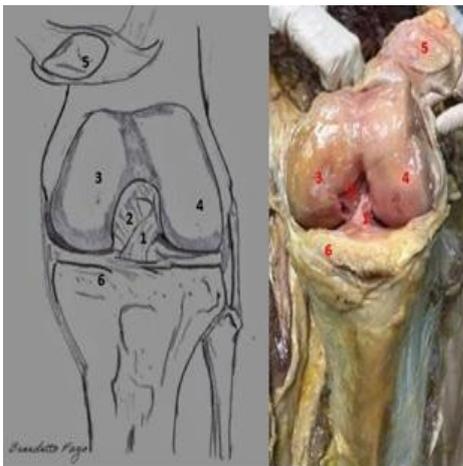


Figure 5. This picture shows articular structure of the knee. 1. ACL; 2. PCL; 3. Medial Condyle; 4. Lateral Condyle; 5. Kneecap; 6. Tibial Plateau.

Starting from the knee, we made the second longitudinal incision along the tibial tuberosity down to the retinacula, which is formed by band of connective tissue that allow the tendons to exert force across the angle between the leg and the foot. Continuing on the ankle and following the lateral margin of the foot, we carried on the incision down to the metatarsal bone. By doing so, the incision shows the extensor tendons of the foot. Starting from the anterior surfaces, we observed and dissected the tibialis anterior muscle that originates in the upper two-thirds of the lateral surface of the tibia and inserts itself into the medial cuneiform and first metatarsal bones of the foot. It arises from the upper two-thirds of the lateral surface of the body of the fibula and ends in a long tendon, which runs behind the lateral malleolus, in a groove, which is shared both by the tibialis anterior tendon and the tendon of the peroneus brevis. In its turn the tibialis anterior tendon is inserted into the lateral side of the base of the first metatarsal bone and the lateral side of the medial cuneiform bone. The long extensor muscle of the fingers arises from the lateral condyle of the tibia, from the upper three-quarters of the anterior surface of the body of the fibula, from the interosseous membrane and from the deep surface of the fascia.



Figure 6. This picture shows the tendon-muscular structures of the leg. 1. Tibialis anterior M.; 2. Long Peroneal M.; 3. Achille's Tendon; 4. Lower Retinaculum of the extensor muscles; 5. Short Peroneal M.

This muscle divides into four slips and each tendon inserts itself into its own phalanx (from the second to the fifth). The gastrocnemius muscle is located with the soleus in the posterior (back) part of the leg.



Figure 7. This picture shows tendon-muscular structures of the foot. 1. Lower Retinaculum of the extensor muscles; 2. Tendons of the Long Extensor of the fingers; 3. Tendons of the Extensor Hallucis Longus; 4. Tendon expansion of Short Peroneal M.; 5. Short Extensor of the fingers M.

The lateral head originates from the lateral condyle of the femur, while the medial head originates from the medial condyle of the femur. Its other end forms a common tendon with the soleus muscle; this tendon is known as the calcaneal tendon or Achilles Tendon and inserts itself into the posterior surface of the calcaneus.

4. Discussion and conclusions

International elective experience among Italian medical students and residents are strongly encouraged (11, 12). This course of anatomical dissection has allowed the students to diverge from a simplified and two-dimensional image offered by atlases and anatomy books to a more real approach and understanding of three-dimensional anatomy. Despite the preparation offered by the university course of study, it was initially difficult for the students to identify the anatomical structures on the cadavers, previously studied in books and atlases only. Thus, only after practice and experience spent in anatomical dissection, they have been able to acquire a certain degree of awareness. In our opinion, this opportunity should be given to a high number of students.

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