

Anatomy, Bony Pelvis and Lower Limb, Leg Lateral Compartment

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Introduction

The lateral compartment of the leg is made up of the fibularis brevis and fibularis longus muscles. In old anatomy textbooks, the muscles are referred to as the peroneal brevis and peroneal longus. Both muscles function by evert and plantar flexing the foot, turning the sole outwards. The muscles also play a role in affixing the medial margins of the foot during fast walking or jogging and prevent excessive inversion. They also aid in supporting the transverse and lateral arches of the foot. The superficial fibular nerve, also known as the peroneal nerve, innervates the fibularis muscle. This nerve has root values of L4 to S1.^{[1][2][3]}

Structure and Function

The key function of the fibularis longus and fibularis brevis is eversion and plantar flexion of the foot. These two muscles also support the transverse and lateral arches of the foot.

Embryology

The first hint of a limb is a swelling found on the ventrolateral surface of the 21-day embryo. After the fourth week, a true limb appears which is only a few millimeters. The lower limb bud can be found adjacent to the lumbar and sacral somites. When the embryo is about 5 to 7 mm, the limb bud lengthens and develops a distinct morphology. This morphology reveals a rounded dorsal surface and a flat ventral surface. At about four weeks, three general areas of the lower limb develop, namely the thigh, leg, and foot. An outgrowth of the limb continues for the next several weeks. By week 6 or 7 skeletogenesis or mesenchymal condensation is observable. The development of the foot plate follows, and correct orientation occurs concerning the tibia and fibula. Rotation continues into the seventh week, and one may start to see the digital rays and notching. By the 10th week, the foot can be seen in dorsiflexion at the ankle, and the first metatarsal is obvious. By week 12, the foot pronates, and equinus is no longer present. At the same time, there is tissue differentiation taking place in three stages: mesenchymal, cartilaginous, and osseous. The somites give rise to the myogenic mesodermal cells.

The genes that control the topography and temporal sequence of the lower limb have been identified. They are known as the HOX genes.

Blood Supply and Lymphatics

The lateral compartments receive their blood supply from the fibular and posterior tibial arteries.

Nerves

The superficial fibular nerve is the chief supplier for the lateral compartment of the leg.

Muscles

The fibularis longus is the more superficial and longer of the two muscles. It has its origin from the lateral and superior surface of the head of the fibula and the lateral tibial condyle. At the distal end, the muscle fibers descend to the foot and pass just posterior to the lateral malleolus. The muscle fibers then cross under the foot. After this, the tendon attaches to the base of the metatarsal on the cuneiform bone on the medial side.

The fibularis brevis is located deeper to the fibularis longus and is slightly shorter. The muscle originates from the lateral and inferior surface of the fibular shaft. The short muscle forms a tendon which descends into the foot just posterior to the lateral malleolus. It then passes over the cuboid and calcaneus. The short tendon of the fibularis brevis attaches to the tubercle on the fifth metatarsal. Like the fibularis longus, the brevis plays a role in the eversion of the foot. The superficial fibular nerve also innervates it.^{[4][5]}

Surgical Considerations

The lateral compartment of the leg is also susceptible to developing acute or chronic compartment syndrome. When the pressure inside the lateral compartment increases, the tissue perfusion can be compromised resulting in muscle necrosis. The following conditions may cause lateral compartment syndrome:^{[6][7]}

- Intense exercise
- Seizures
- Burns
- Nephrotic syndrome
- Envenomation
- Bleeding inside the leg
- Drug or alcohol abuse
- Postischemic edema
- Rhabdomyolysis
- Myositis
- Anabolic steroid abuse
- Deep vein thrombosis
- Trauma
- Military anti-shock trousers
- Tight splints
- Prolonged lithotomy position
- Intraosseous infusion
- Malfunction of a sequential compression device

Recognizing compartment syndrome is essential. If left untreated it can lead to ischemia and necrosis of the neurovascular structures and muscle. The upper limit for necrosis is 6 to 7 hours of ischemia. The patient will usually present with swelling of the leg, pain while walking or running, extreme pain to palpation, and abnormal sensations such as tingling or paresthesia.

The physical exam may reveal pain on palpation, tense compartment or even muscle herniation. The arterial pulses may be intact, but the neurological exam will show the weakness of eversion or plantar flexion. Definitive diagnosis requires measurement of compartmental pressures, but this technique is not always available. If the resting compartment pressure is greater than 20 millimeters of mercury, the diagnosis is confirmed. In many cases, the diagnosis is based on history and clinical exam. Several other imaging and invasive tests can be performed. However, since time is of the essence, one should not wait for a thallium scan or an MRI to be done later.

Clinical Significance

During surgery, the common fibular (peroneal) nerve is often difficult to visualize. Thus, surgeons often use the fibularis longus muscle as an anatomical landmark and follow it up to its attachment. Just before the fibularis longus muscle attaches to the fibular head, there is a small thin gap between the head and neck of the muscle. The common fibular nerve penetrates this gap and then divides into the superficial and deep branches. Injury to the common fibular nerve can result in foot drop.

Rarely, when there is an inversion injury to the ankle, lateral compartment syndrome can occur. The torn muscles can lead to bleeding within the tissues leading to elevated compartmental pressure. The diagnosis should be considered following an inversion injury of the ankle, especially if there is any tightness of the lateral compartment. Neurovascular compression is a late finding. Immediate fasciotomy can be limb-saving.

Other Issues

Complications of fasciotomy include:

- Hemorrhage
- Injury to the fibular nerve
- Infection
- Damage to the venous and arterial structures
- Deep vein thrombosis
- Skin breakdown
- Nerve entrapment
- Chronic pain

Athletes should be warned that recurrence of acute compartment syndrome is possible. Recurrence rates between 5% and 15% have been reported. Recurrence may also result from an incomplete fascial release, excessive scarring, or inadequate rehabilitation. A second-time fasciotomy should always be open and more extensive than the first one.

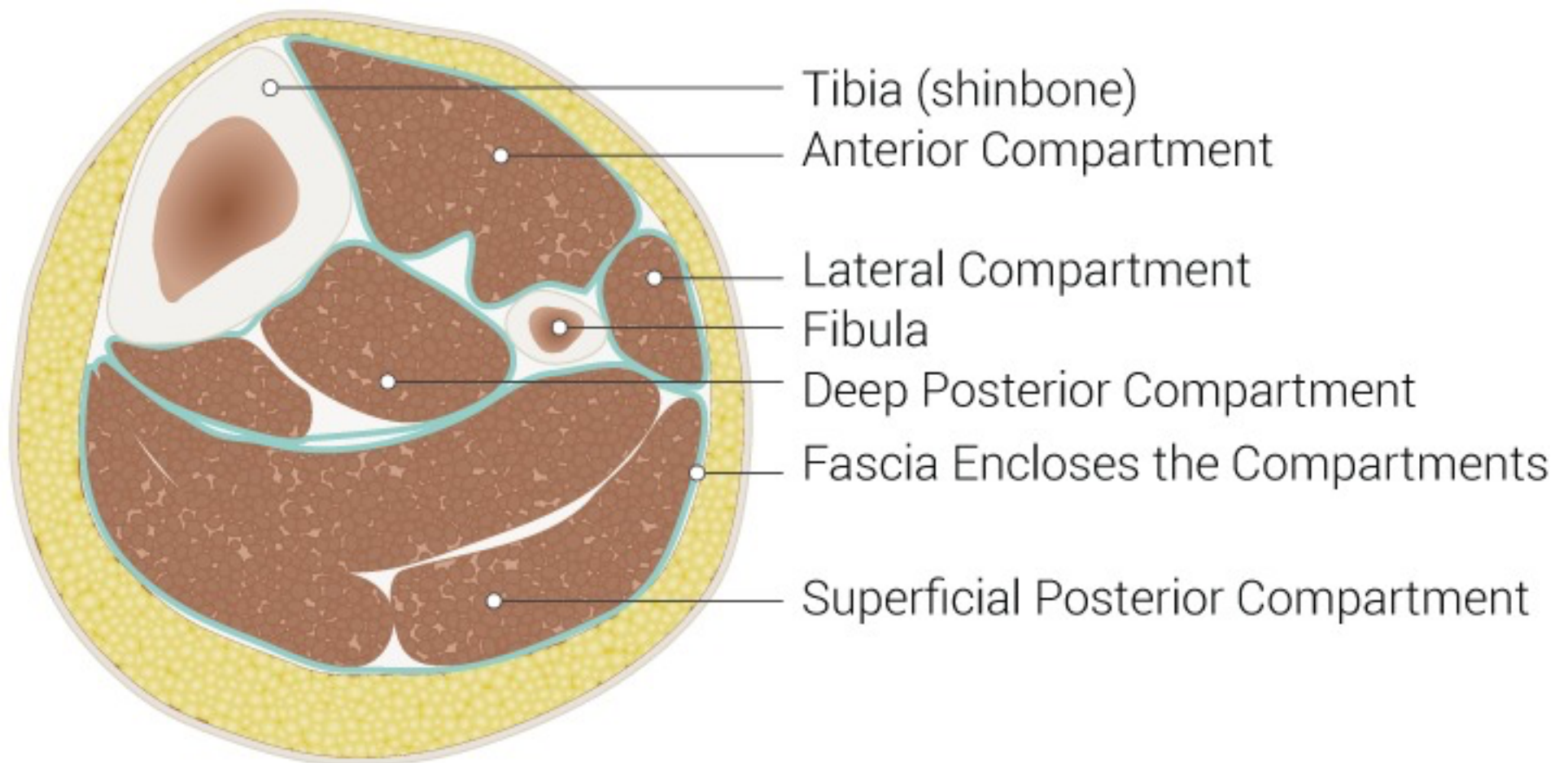
Questions

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Leg Compartments



The leg is divided in 3 compartments by the interosseous membrane between the interosseous borders of the tibia and fibula and the anterior and posterior intermuscular septa.

Lateral - contains the perineal group of muscles

Anterior - contains the extensor group of muscles

Posterior - contains the flexor group of muscles

Leg Compartments, Tibia (shinbone), Anterior Compartment, Lateral Compartment, Fibula, Deep Posterior Compartment, Fascia Encloses the Compartments, Superficial Posterior Compartment. Contributed Illustration by Beckie Palmer

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