Functional Anatomy of the Knee and Leg

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Anatomy and Dissection Sources

- [www.primalpictures.com](http://www.primalpictures.com)  
  - Interactive Knee  
  - Interactive Functional Anatomy  

- Mary Lloyd Ireland, MD
Lower Limb model: Lateral View

www.primalpictures.com
Lower Limb model: Medial View

www.primalpictures.com
Lower Limb model: Anterior View

www.primalpictures.com
Internal/External Rotation of Knee
Flexion/Extension of Knee

www.primalpictures.com
Fig. 63–8. Muscular anatomy of the anterior aspect of the knee.
Knee model: Anterior View

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Left Knee Joint, Ligaments, from above
Knee joint and menisci, from above
Tibial plateau and menisci, from above
Screw home mechanism (Smillie) tibial externally rotates in terminal knee extension
Joint line palpation with knee flexed should produce pain if meniscus is torn

Externally rotate tibia for medial meniscus tears, Internally rotate for lateral meniscus tears
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Knee Joint

Lateral view
- Iliotibial tract
- Biceps brachii m., long head, short head
- Bursa under iliotibial tract
- Fibular collateral ligament and bursa
- Plantaris m.
- Biceps brachii tendon and bursa
- Common peroneal n.
- Head of fibula
- Gastrocnemius m.
- Solus m.
- Peroneus longus m.
- Tibialis anterior m.
- Vastus lateralis m.
- Vastus medialis m.
- Rectus femoris tendon
- Patella
- Lateral patellar retinaculum
- Medial patellar retinaculum
- Joint capsule
- Patellar ligament
- Tuberosity of tibia

Medial view
- Sartorius m.
- Gracilis m.
- Semitendinosus m.
- Semimembranosus m.
- Adductor magnus tendon
- Tibial collateral ligament, parallel fibers, oblique fibers
- Bursa under semimembranosus tendon
- Anserine bursa under semitendinosus, gracilis, and sartorius tendons
- Gastrocnemius m.
- Popliteus m.

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Knee model: Medial View

www.primalpictures.com
OKU 10: “Soft Tissue Injuries About the Knee,” Kaar et. al., p. 455. Fig. 1A.

- Posteromedial corner:
  - Medial collateral ligament
  - Superficial and deep layers
  - Meniscotibial and meniscofemoral ligaments
  - Posterior Oblique ligament
    - Runs posterior to superficial MCL
    - Multiple bands attaching to posteromedial capsule, semimembranosus, and proximal tibia
Knee model: Lateral View

www.primalpictures.com
OKU 10: “Soft Tissue Injuries About the Knee,” Kaar et. al., p. 455, Fig. 1B.

- Posterolateral corner: Static stabilizers
  - Fibular collateral ligament
  - Popliteofibular ligament
  - Posterolateral capsule
  - Popliteus serves as dynamic and static stabilizer
    - Popliteus femoral attachment in anterior popliteal sulcus, 2cm. anterior and distal to FCL attachment
  - Upside down muscle: origin distal, insertion proximal
Knee Instabilities

Bird’s-Eye view of Tibia

- Anterior cruciate ligament (ACL)
- Lateral meniscus
- Medial meniscus
- Lateral collateral ligament (LCL)
- Posteromedial complex (PMC)
- Superficial medial collateral ligament (SMCL)
- Posterior cruciate ligament (PCL)
- Ligament of Humphrey
- Ligament of Wrisberg
- Popliteus
- PosteroLateral complex (PLC)
Anatomic Sources of Leg Pain

• Bone
  - A continuum of bone trauma exists from bone strain to stress reaction to stress fracture

• Periosteum
  - Inflammation occurs at muscular insertions particular of tibialis posterior and soleus.

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Anatomic Sources of Leg Pain

- **Muscles and Compartments**
  - 4-5 muscle compartments
  - Chronic strains and tendinopathy can occur

- **Nerves**
  - Proximal nerve entrapment can cause radicular pain
  - Systemic diseases can lead to neuropathy
Anatomic Sources of Leg Pain

- **Arteries and Veins**
  - Atherosclerosis can lead to claudication
  - Venous phlebitis or thrombosis can occur
  - Popliteal artery entrapment and arterial endofibrosis has been described in younger population.

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Differential Dx of Chronic Leg Pain in Athletes

- CECS
- Muscle herniation
- Stress fractures
- Medial tibial periostitis (shin splints)
- Chronic muscle strain
- Popliteal artery entrapment
- Referred from spine

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Compartment Syndromes

**Traumatic**
- Secondary to fracture, crush, and reperfusion injuries
- Surgical emergency
- Skin and fascia may both contribute to compartmental restriction and increased pressure
- Non-physiologic swelling secondary to trauma

**Exertional**
- Consistently exercise-induced
- Generally endurance athletes
- No pain at rest, pain consistently relieved with cessation of sport
- Attributed to restriction of muscle swelling secondary to tight fascial compartments
- Diagnosed with pre and post exercise pressure measurements
History and Physical: Clinical Pearls in Athletic Leg Pain

- Pain with initial impact
  - Stress fracture
  - Periostitis
  - Muscle strains and tendinitis

- Focal bone pain
  - Stress fracture
  - Diffuse medial bone pain
    - Medial tibial periostitis
  - Focal muscle pain
    - Strain or Hernia
History and Physical: Clinical Pearls in Athletic Leg Pain

- Pain with resisted motion
  - Muscle strains and periostitis
- Pain with vibration
  - Stress fractures
- Pain at night
  - Tumors
- Pain with exertion
  - CECS, Popliteal artery entrapment
  
- Paresthesias at rest
  - Nerve entrapment
- Paresthesias with exertion
  - CECS
- Electrical shooting pain
  - Radicular pain from back
History and Physical: Clinical Pearls in Athletic Leg Pain

- Diffuse swelling
  - DVT
  - CECS
  - Muscle ruptures

- Focal swelling
  - Muscle herniation
  - Ganglion
  - Tumor

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80% of CECS involve the anterior or lateral compartments (Cross-section just above middle of leg)

- Extensor digitorum longus m.
- Tibialis Posterior m.
- Flexor digitorum longus m.
- Gastrocnemius m. (medial head)
- Gastrocnemius m. (lateral head)
- Peroneus longus m.
- Peroneus brevis m.
- Flexor hallucis longus m.
- Soleus m.

Nerves (Cross-section just above middle of leg)

- Superficial Peroneal n.
- Anterior tibial a. and v. and deep peroneal n.
- Posterior tibial a. and vv. and tibial n.
- Lateral sural Cutaneous n.
- Medial sural Cutaneous n.
Anterior and Lateral Compartments

- Extensor digitorum longus m.
- Tibialis anterior m.
- Intermuscular septum
- Extensor hallucis longus m.
- Peroneus longus m.
- Peroneus brevis m.
Posterior Compartments: Deep and Superficial

- Tibialis Posterior m.
- Flexor digitorum longus m.
- Flexor hallucis longus m.
- Soleus m.
- Gastrocnemius m. (lateral head)
- Gastrocnemius m. (medial head)
Know the anatomy before performing compartment testing or surgical releases.
The End . . . Thank You!

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