Topics in Sports Medicine:
Physical Examination of the
Knee and Ankle

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Objectives

- Develop a standardized, evidence-based history and physical examination of patients with knee injuries
- Enable health care professionals to accurately diagnose common knee and ankle injuries for patients of all ages.
Components of the assessment include

- Focused history
- Attentive physical examination
- Thoughtfully ordered imaging studies
Focused History Questions

- **Onset of Pain**
  - Acute vs. Chronic
  - Improving or worsening?

- **Location of Pain**
  - *Anterior* – Patellofemoral syndrome, bursitis, Osgood-Schlatter’s disease, patellar tendinitis, patellar fracture
  - *Medial* – meniscus, MCL, DJD, pes anserine bursitis
  - *Lateral* – Meniscus, LCL, DJD, ilirotibial band friction syndrome, fibular head dysfunction
  - *Posterior* – hamstring injury, tear of posterior horn of medial or lateral meniscus, Baker’s cyst, neurovascular injury (popliteal artery or nerve)
Focused History Questions

- **Mechanism of Injury**
  - Contact or noncontact injury?
    - If contact, what part of the knee was contacted?
      - Anterior blow?
      - Valgus force?
      - Varus force?

**Think ACL INJURY any time you have a patient with a significant NON-CONTACT injury with foot planed on the ground (foot planted then knee twisted or body changed direction, felt a pop, immediate swelling, could not continue playing)**
Focused History Questions

- **Injury-Associated Events**
  - **Swelling** after injury (immediate vs delayed)
  - Catching / Locking
  - Buckling / Instability (“giving way”)
  - Pop heard or felt?
Focused History Questions

- **Aggravating Factors**
  - Activities, changing positions, stairs, kneeling

- **Relieving Factors/treatments tried**
  - Ice, medications, crutches

- **History of previous knee injury or surgery**
# Historical Clues to Knee Injury Diagnoses

<table>
<thead>
<tr>
<th>Description</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncontact injury with “pop”</td>
<td>ACL tear</td>
</tr>
<tr>
<td>Contact injury with “pop”</td>
<td>MCL or LCL tear, meniscus tear, fracture</td>
</tr>
<tr>
<td>Acute swelling</td>
<td>ACL tear, PCL tear, fracture, knee dislocation, patellar dislocation</td>
</tr>
<tr>
<td>Lateral blow to the knee</td>
<td>MCL tear</td>
</tr>
<tr>
<td>Medial blow to the knee</td>
<td>LCL tear</td>
</tr>
<tr>
<td>Knee “gave out” or “buckled”</td>
<td>ACL tear, patellar dislocation</td>
</tr>
<tr>
<td>Fall onto a flexed knee</td>
<td>PCL tear</td>
</tr>
</tbody>
</table>
Physical Exam - General

- Develop a standard routine!
  - Helps insure complete examination
  - Put in gown/shorts

**GENERAL STEPS**

1) Inspection
2) Palpation
3) Range of motion
4) Strength testing
5) Special tests
Physical Exam - Exposure

- Adequate exposure - groin to toes bilaterally
- Examine in supine position
- Compare knees
Patient then brings medial aspects of knees and ankles in contact

- Knees – genu valgum (I), genu varum (II)
Observe – Dynamic Alignment

- Pronation/Supination may be enhanced with ambulation

- Antalgic gait indicates significant problem (anti = against, algic = pain)
Inspect Knee

- Evidence of local trauma
  - Abrasions
  - Contusions
  - Lacerations
- Patella position
- Muscle atrophy

- Warmth
- Erythema
- Effusion*
Inspect Knee-Related Muscles

- **Quadriceps atrophy**
  - Long-standing problem

- **Vastus medialis atrophy**
  - After surgery

http://www.neuro.wustl.edu/neuromuscular/pics/people/patients/Hands/ibmquadatrsn.jpg
Surface Anatomy – Anterior*

- Patella
- Hollow

Indented
Surface Anatomy - Anterior, Flexed

- Patella
- Head Of Fibula
- Tibial Tuberosity
Palpation – Anterior*

Patella:
Lateral and Medial Patellar Facets

Superior And Inferior Patellar Facets
Lateral Fat Pad
Patellar Tendon**

Medial Fat Pat
Surface Anatomy - Medial

- Tibial Tuberosity
- Patella
- Medial Femoral Condyle
- Medial Tibial Condyle
- Joint Line
Palpation - Medial

- Medial Collateral Ligament (MCL)*
- Pes anserine bursa**
- Medial joint line
Palpation – Lateral

Lateral Collateral Ligament (LCL)**

Lateral joint line
Palpation - Posterior

- Popliteal fossa*

- Abnormal bulges
  - Popliteal artery aneurysm
  - Popliteal thrombophlebitis
  - Baker’s cyst
Range Of Motion Testing

- Extension \(0^\circ\) \(
\rightarrow\)
Flexion \(135^\circ\)

- Describe loss of degrees of extension
  - Example: “lacks 5 degrees of extension”

- Locking* = patient unable to fully extend or flex knee due to a mechanical blockage in the knee (i.e., loose body, bucket-handle meniscus tear)
Strength Testing

- Test knee extensors (quadriceps) and knee flexors (hamstrings)
  - Can test both with patient in seated position, knees bent over edge of table
  - Ask patient to extend/straighten knee against your resistance
  - Then ask patient to flex/bend knee against your resistance

- Compare to unaffected knee
Special Tests – Anterior Knee Pain

- **Patellar apprehension test**

  (http://www.sportsdoc.umn.edu/Clinical_Folder/Knee_Folder/Knee_Exam/lateral%20patellar%20apprehension.htm)

- **Patellofemoral grind test**
Assess stability of 4 knee ligaments via applied stresses*
Stress Testing of Ligaments

- Use a standard exam routine
  - Direct, gentle pressure
  - No sudden forces

- Abnormal test
  1. Excessive motion = laxity
  2. Soft/mushy end point**
Collateral Ligament Assessment

Patient and Examiner Position*
Valgus Stress Test for MCL

Note Direction Of Forces
Varus Stress Test for LCL*

Note direction of forces
Lachman Test*

- Patient Position
- Physician hand placement
Anterior Drawer Test for ACL

- Physician Position & Movements*
- Patient Position

*Note direction of forces
Pivot Shift Test for ACL

- Start with knee extended and internally rotates
- Examiner applies inward (valgus force) on lateral knee with one hand
- Examiner holds foot with other hand and flexes affected knee
**Review of Evidence – ACL**

**Table 3. Comparison of 3 Clinical Examination Techniques for Diagnosing Anterior Cruciate Ligament Tears**

<table>
<thead>
<tr>
<th>Study (Reference)</th>
<th>Lachman Test</th>
<th>Anterior Drawer Test</th>
<th>Pivot Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sensitivity</td>
<td>Specificity</td>
<td>Sensitivity</td>
</tr>
<tr>
<td>Boeree and Ackroyd (14)</td>
<td>0.63</td>
<td>0.90</td>
<td>0.56</td>
</tr>
<tr>
<td>Hardaker et al. (40)</td>
<td>0.74</td>
<td>NA</td>
<td>0.18</td>
</tr>
<tr>
<td>Donaldson et al. (41)</td>
<td>0.99</td>
<td>NA</td>
<td>0.35</td>
</tr>
<tr>
<td>Jonsson et al. (42)</td>
<td>0.87</td>
<td>NA</td>
<td>0.33</td>
</tr>
<tr>
<td>Liu et al. (43)</td>
<td>0.95</td>
<td>NA</td>
<td>0.61</td>
</tr>
<tr>
<td>Braunstein (59)</td>
<td>0.91</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Torg et al. (71)</td>
<td>0.95</td>
<td>NA</td>
<td>0.61</td>
</tr>
<tr>
<td>Katz and Fingeroth (75)</td>
<td>0.89</td>
<td>NA</td>
<td>0.41</td>
</tr>
<tr>
<td>Noyes et al. (76)</td>
<td>0.89</td>
<td>NA</td>
<td>0.56</td>
</tr>
<tr>
<td>Lee et al. (79)</td>
<td>0.89</td>
<td>NA</td>
<td>0.78</td>
</tr>
<tr>
<td>Hughston et al. (81)</td>
<td>0.58</td>
<td>0.23</td>
<td>0.48 (0.38–0.59)</td>
</tr>
<tr>
<td><strong>Summary statistic (95% CI)</strong></td>
<td><strong>0.87 (0.76–0.98)</strong></td>
<td><strong>0.93 (0.83–0.96)</strong></td>
<td><strong>0.48 (0.38–0.59)</strong></td>
</tr>
</tbody>
</table>

- **Lachman Test**  
  Sensitivity 87%  
  Specificity 93%

- **Anterior Drawer**  
  Sensitivity 48%  
  Specificity 87%

- **Pivot Shift Test**  
  Sensitivity 61%  
  Specificity 97%
Posterior Drawer Testing - PCL*

Note direction of forces
Assess Meniscus

- **Joint line tenderness**
  - Flexion of the knee enhances palpation of the anterior half of each meniscus

- McMurray Test
Posterior Sag Sign for PCL

- Have the patient in a position of 45 degrees hip flexion and 90 degrees of knee flexion.
- Examiner observes for an asymmetric sagging as the tibial plateau sinks below level of the patella.
Review of Evidence - Meniscus

Table 4. Comparison of 2 Common Physical Examination Tests for Meniscal Pathology*

<table>
<thead>
<tr>
<th>Study (Reference)</th>
<th>Joint Line Tenderness</th>
<th></th>
<th>McMurray Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sensitivity</td>
<td>Specificity</td>
<td>Sensitivity</td>
</tr>
<tr>
<td>Anderson and Lipscomb (38)</td>
<td>NA</td>
<td>NA</td>
<td>0.58</td>
</tr>
<tr>
<td>Noble and East (39)</td>
<td>0.67</td>
<td>0.13</td>
<td>0.63</td>
</tr>
<tr>
<td>Fowler and Lubliner (63)</td>
<td>0.85</td>
<td>0.29</td>
<td>0.29</td>
</tr>
<tr>
<td>Barry et al. (83)</td>
<td>0.76</td>
<td>0.43</td>
<td>0.56</td>
</tr>
<tr>
<td>Summary statistic (95% CI)</td>
<td>0.76 (0.65–0.87)</td>
<td>0.29 (0.10–0.46)</td>
<td>0.52 (0.35–0.68)</td>
</tr>
</tbody>
</table>

* NA = not assessed.

- Joint Line Tenderness: Sens 76% Spec 29%
- McMurray Test: Sens 52% Spec 97%
Ankle Examination
General

- Inspection
- Palpation
- Range of Motion
- Strength Testing
- Special Tests
Medial Aspect

- Deltoid ligament
- Posterior tibiotalar ligament
- Tibiocalcaneal ligament
- Anterior tibiotalar ligament
- Tibionavicular ligament
- Medial malleolus
- Posterior talocalcaneal ligament
- Plantar calcaneonavicular ligament
Medial Tendons

- Posterior tibialis tendon
- Flexor digitorum longus tendon
- Posterior tibial artery
- Posterior tibial nerve
- Flexor hallucis longus tendon
- Flexor retinaculum
- Tibia
- Calcaneus
Lateral Malleolus & Attached Ligaments

Anterior tibiofibular ligament
Anterior talofibular ligament
Posterior tibiofibular ligament
Posterior talofibular ligament
Lateral malleolus
Calcaneofibular ligament
Lateral talocalcaneal ligament
Peroneus Longus and Peroneus Brevis Tendons
Ligamentous Instability

- **Ligaments**
  - Anterior and posterior talofibular, anterior tibiofibular, and deltoid ligaments.

- If any of these ligaments are torn, the tibia can separate from the fibula and the talus may become unstable.

- **Common mechanism of injury is a supination or inversion force.**
Ligamentous Instability

- The foot turns under the ankle after walking or running on uneven surfaces or when landing on an inverted foot after a jump.
- The most common injured ligament is the anterior talofibular ligament.
- Ligament laxity can lead to chronic ankle sprains.
Ligamentous Instability

- **Clinical Signs and Symptoms**
  - Ankle swelling
  - Static ankle pain
  - Pain on passive motion
  - Tenderness over affected ligament
Ligaments
Drawer’s Foot Sign

- **Procedure:** Patient supine. Stabilize ankle with one hand. Press posterior on tibia with the other hand. Next, grasp anterior aspect of the foot with one hand and the posterior aspect of the tibia with the other. Pull anterior.

- **Rationale:**
  - Gapping with posterior push – tear anterior talofibular
  - Gapping with anterior pull – tear posterior talofibular
Inspection

- Alignment (neutral? valgus? varus?)
- Foot shape: Pes Planus/Cavus
- Toe shape: Clawed, Hammer, Mallet toes?
- Swelling/ Masses
- Discoloration
- Scars / Cuts / Abrasions
- Ulcers
Palpation of Ankle

- ATFL
- CFL
- Distal tibiofibular
- Syndesmosis
- Deltoid ligament
- Lateral malleolus
- Medial malleolus
- Base 5\textsuperscript{th} metatarsal
Range of Motion
Strength Testing

ANKLE DORSIFLEXION
- Tibialis Anterior
- EHL
- EDL
Strength Testing

• INVERSION
  - Posterior Tibialis
  - Flexor Digitorum Longus
  - Flexor Hallucis Longus
Strength Testing

- **EVERSION**
  - Peroneus Longus
  - Peroneus Brevis
Strength Testing

- **PLANTAR FLEXION**
  - Gastrocnemius
  - Soleus
  - Heel Rise
Drawer’s Foot Sign

Posterior talofibular ligament
Anterior talofibular ligament
Lateral Stability

- **Procedure**: Patient supine. Passively invert foot.
- **Rationale**: Gapping secondary to trauma. Suspect tear of anterior talofibular ligament or calcaneofibular ligament.
Lateral Stability

Anterior tibiofibular ligament
Anterior talofibular ligament
Posterior tibiofibular ligament
Posterior talofibular ligament
Calcaneofibular ligament
Lateral talocalcaneal ligament
Medial Stability

- **Procedure:** Patient supine. Passively evert foot.
- **Rationale:** Gapping secondary to trauma. Suspect tear of deltoid ligament.
Medial Stability
Medial Stability

- Deltoid ligament
  - Posterior tibiofibular ligament
  - Tibiocalcaneal ligament
  - Anterior tibiotalar ligament
  - Tibionaviclar ligament

- Plantar calcaneonavicular ligament
- Posterior talocalcaneal ligament
Syndesmosis

The squeeze test: A provocative test for syndesmotic injury. The examiner compresses the tibia and fibula above the ankle. Pain in the region of the distal syndesmosis (area of pain indicated by the tip of the arrow) confirms distal syndesmotic injury. Courtesy of Karen Maughan, MD.
Tarsal Tunnel

- Flexor digitorum longus tendon
- Posterior tibial artery
- Posterior tibial nerve
- Flexor hallucis longus tendon
- Flexor retinaculum
- Calcaneus
Tinel’s Foot Sign

- **Procedure:** Tap over the posterior tibial nerve with a neurological reflex hammer.
- **Rationale:** Paresthesias radiating to the foot indicate irritation of the posterior tibial nerve that may be caused by constriction at the tarsal tunnel.
Tinel’s Foot Sign
Thompson’s Test

- **Procedure:** Patient prone. Flex knee. Squeeze the calf muscles against the tibia and fibula.

- **Rationale:** The gastrocnemius and soleus muscles are squeezed, they mechanically contract. They are attached to the Achilles tendon, which plantar-flexes the foot. If the tendon is ruptured, contraction of the gastrocnemius and soleus muscles will NOT plantar-flex the foot.
Thompson Test