Acute Knee Pain after Fall

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Focused patient history and workup

• 23 year old female
• Twisted her left leg during a fall while skiing, felt a popping sensation in her left knee
• Afterward she tried to ski but her knee felt unstable and was extremely painful
• Left Knee Exam: Minimal swelling, no ecchymosis and no deformity. No tenderness over either of the collateral ligaments or the anterior joint line. Negative patellar apprehension sign. Full range of motion without discomfort. Positive Lachman test. The remaining 3 major ligaments are stable and nontender to exam.
List of imaging studies

• 4 view left knee radiographic series (in ED)
• MRI left knee w/o contrast (outpatient)
No evidence of fracture or dislocation. No lytic or sclerotic bone lesions. No degenerative changes. Soft tissues are unremarkable.
MRI L Knee w/o Contrast – T2 FS Sagittal

Primary signs of ACL tear: edema, increased signal of ACL on T2 weighted image, discontinuity of fibers

Secondary signs of ACL tear: bone marrow edema, fluid in joint from bleeding
ACL tear - Lack of continuity between anteromedial bundle and posterolateral bundle of the ACL. Bone bruising on the lateral femoral condyle
Increased signal and fluid again consistent with an ACL tear
 Increased signal and swelling within the confines of the intracondylar notch
Typical Treatment and Outcome

• ‘RICE’ therapy in immediate setting = rest, ice, compression, elevation

• Nonoperative rehabilitation
  • Associated with recurrent instability and chondral/meniscal injuries in active adults and skeletally immature\textsuperscript{1,2}

• ACL reconstruction vs. ACL repair
  • Reconstruction - ie creating a new ligament with non-ACL tissue - remains the superior treatment option for a vast majority of cases. ACL Repair has poor outcomes.
  • 0% failure rate vs 15% failure rate\textsuperscript{3}
  • Repeat ACL injury after isolated ACL reconstruction is common, occurring in 1 in 3 over 20 years\textsuperscript{3}
Post-Traumatic Knee Pain Imaging Algorithm

**POST TRAUMATIC KNEE PAIN**

Clinical assessment

- **Application of Ottawa Rules**
  - Knee radiographs are indicated when any of the following are present:
  - Age 55 years or older
  - Tenderness at head of the fibula
  - Isolated tenderness of the patella
  - Inability to flex knee to 90 degrees
  - Inability to weight bear 4 steps both immediately and in the Emergency Department

- **Assessment of superficial soft tissue structures; e.g. extensor mechanism**
  - Ultrasound

  - Radiographs not indicated
    - Conservative management
    - Persisting symptoms
      - MRI
    - High suspicion of ligamentous/meniscal pathology
MRI was appropriate for our patient given history of twist and “pop” in addition to positive Lachman’s on exam
Imaging discussion

- Patient history and clinical exam may be sufficient to diagnose an ACL rupture, however misdiagnosis is common
  - ½ of patients with an acute ACL rupture were misdiagnosed as uncomplicated knee sprain in orthopaedic emergency unit
- MRI is diagnostic imaging of choice for knee ligamentous and meniscal injuries
- Diagnostic accuracy of MRI is comparable to that of Lachman test
MRI for Detection of ACL Tear

• In reference to arthroscopy:\(^6\)
  • Sensitivity of 97.46%
  • Specificity of 90.38%
  • Accuracy of 94.4%

• VS. Lachman test (most accurate clinical diagnostic test), reported sensitivity of 85% and specificity of 94%\(^6\)
Classic Imaging Findings for ACL Tear

**Primary signs:** edema, increased signal of ACL on T2 weighted image, discontinuity of fibers, or change in expected course of ACL
Classic Imaging Findings for ACL Tear

Secondary signs: bone marrow edema, additional fractures, MCL injury, or anterior tibial translation >7mm (relative to femur)
Classical Imaging Findings for ACL Tear

**Secondary signs:** bone marrow edema, additional fractures, MCL injury, or anterior tibial translation >7mm (relative to femur)

**Grade I** – mild injury, with minimally torn fibers and no loss of MCL integrity

**Grade II** – moderate injury, with an incomplete tear and increased laxity of the MCL

**Grade III** – severe injury, with a complete tear and gross laxity of the MCL
Classic Imaging Findings for ACL Tear

**Secondary signs:** bone marrow edema, additional fractures, MCL injury, or anterior tibial translation >7mm (relative to femur)

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Draw 2 lines parallel to the cephalocaudal axis of the image: one crossing the posterior most point of the posterolateral tibia plateau and the other crossing the posterior most point of the lateral femoral condyle. Anterior translation is determined by the distance in millimeters between these two lines. A translation of ≥7 mm is considered to be a positive indicator of ACL injury.
Selective use of a short MRI examination saves costs and potentially increases effectiveness in patients with acute knee injury without a fracture on radiography. 

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<thead>
<tr>
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<th>Radiation Exposure</th>
<th>Cost</th>
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<tbody>
<tr>
<td>X-ray knee</td>
<td>0.001 mSv</td>
<td>$36-$580+</td>
</tr>
<tr>
<td>MRI knee w/o contrast</td>
<td>0</td>
<td>$634-$2,935+</td>
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Wrap Up

• Have a high suspicion for ACL injury if patient reports twisting injury or “pop”; and if there is a positive Lachman’s test
• Get MRI to confirm suspicion and assess for other injuries (radiographs not always needed)
• MRI is the best way to evaluate for meniscal tears and ligamentous injury
References


