Knee Contusions and Stress Injuries

Laura W. Bancroft, M.D.
Objectives

• Review 5 types of contusion patterns
  – Pivot shift
  – Dashboard
  – Hyperextension
  – Clip
  – Lateral patellar dislocation

• Demonstrate various stress injuries, including patellofemoral stress syndrome
Pivot Shift

- Knee valgus, femur internally rotated
- Deceleration-rotational-valgus stress
- ACL rupture
- Impaction of lateral femoral condyle against posterolateral tibial plateau
- Location of femoral condylar edema depends on degree of flexion

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Children
Tibial Eminence Fractures

• 90% - subchondral bone contusions
  – Lateral femoral condyle – 80%
  – Lateral tibial plateau – 80%
  – Medial femoral condyle – 60%
  – Medial tibial plateau – 30%

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Children

• May have intact ACL with typical pivot shift bone contusions
  – 28% of cases
  – Ligamentous laxity

Dashboard Injury

- Force applied to anterior proximal tibia while knee in flexed position
- Disruption of PCL and posterior capsule

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Subacute Dashboard Injury
Hyperextension

- Direct force is applied to anterior tibia while foot is planted
- Indirect force - forceful kicking
- Direct injury (car bumper hitting anterior tibia of pedestrian)

Hyperextension

- Anterior aspect of tibial plateau strikes anterior femoral condyle
- “Kissing” contusion
- +/- ACL, PCL or meniscal injury
- Dislocation + popliteal neurovascular injury

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Clip Injury

- Contact injury
- Pure valgus stress applied to knee while knee is mildly flexed
- American football players

Clip Injury

- **Bone marrow edema**
  - Most prominent in lateral femoral condyle - direct blow
  - Second smaller area of edema in the medial femoral condyle - avulsive stress to the MCL

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• +/- MCL sprain or disruption
  – Most common – proximal ligament near femoral attachment

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Lateral Patellar Dislocation

- Most common mechanism of first-time patellar dislocation
  - Flexed, internally rotated knee
  - Planted foot
  - Valgus component

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Acute Traumatic Patellar Dislocation

- **Contusions**
  - 100% - lateral femoral condyle
  - 96% - patella
  - 30% - medial femoral condyle

- 12 month follow-up
  - 22% - femoral condylar contusion
  - 39% - patellar contusion

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PDRS – patellofemoral ligament rupture
PDRS – cartilage sheared
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PDRS – osteochondral fragment
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Stress Injuries
Stress changes throughout medullary canal
Stress fracture – excessive jump roping
Avulsive injury at MCL origin – valgus stress
Stress fracture
Stress fracture
Insufficiency fracture
Insufficiency fracture
Patellofemoral Stress Injuries - Children

- Sinding-Larsen-Johannson disease
- Osgood-Schlatter
- Patellar sleeve avulsion
- Tibial Tuberosity Avulsion
Sinding-Larsen-Johannson Disease

- Umbrella term for syndrome that causes pain at inferior pole of patella
- Fragmentation or calcification of inferior pole

Osgood-Schlatter Disease

- Traction apophysitis
- Strong forces from quadriceps mechanism
- Insertion of patellar tendon on tibial tuberosity

Osgood-Schlatter Disease

- Common causes of anterior knee pain
- 12-15 y/o boys
- 8-12 y/o girls
- Repeated jumping/squatting
- Local pain, swelling and tenderness at tuberosity

Osgood-Schlatter Disease

- T2 - High signal within and surrounding tendon
- Deep infrapatellar bursitis
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Patellar Sleeve Avulsion

- Acute counterpart to Sinding-Larsen Johannson
- Acute jumping injury
- 8-12 y/o

Patellar Sleeve Avulsion

- Anterior soft tissue swelling
- Small fragment of bone avulsed from inferior tip or anterior inferior patella

Patellar Sleeve Avulsion

- Osseous fragments - tip of the iceberg
- Much larger cartilage fragment unseen on radiographs
- MR – identify size of cartilage fragment

Patellar Sleeve Avulsion

- Adolescent boy jumpers near skeletal maturity
- Sharp fragments are visible and elevated on radiographs

Tibial Tuberosity Avulsion
Tibial Tuberosity Avulsion
Conclusion

- **Pivot shift injury** is caused by deceleration-rotational-valgus stress, has associated ACL rupture, and impaction contusions of lateral femoral condyle and posterolateral tibial plateau.

- **Dashboard** injuries are caused by forces applied to the anterior proximal tibia while knee is in flexed position, and leads to disruption of the PCL and posterior capsule.
Conclusion

• **Hyperextension** injuries are caused by the anterior tibial plateau striking the anterior femoral condyle, leading to “kissing” contusions, with or without ACL, PCL and meniscal injury.

• **Clip** injuries result from pure valgus stress applied to mildly flexed knee, resulting in large lateral femoral condylar contusion and smaller medial femoral condylar avulsive injury.
Conclusion

- **Lateral patellar dislocation** occurs when valgus force is applied to the flexed, internally rotated knee when the foot is planted. Lateral femoral condylar and medial patellacontusions occur, often in conjunction with patellofemoral ligament sprain or tear.
Conclusion

• Linear stress and insufficiency fractures occur commonly in the proximal tibia, fibula or subchondral femur.

• Patellofemoral stress syndrome (Sinding-Larsen-Johannson disease, Osgood-Schlatter disease, patellar sleeve avulsion and tibial tuberosity avulsion) is the most common cause of chronic anterior knee pain in adolescents.