Orthopaedics for the primary care provider
Acute knee injuries
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2 Background
• Incidence of knee injuries has increased over the last 2 decades
  • ↑ activity levels in adults
  • ↑ sports participation at all ages

3 History
• Key factors in making diagnosis
  • Mechanism of injury
  • Onset of swelling
  • Ability to bear weight
  • Mechanical symptoms
  • Instability
  • Pre-existing conditions

4 Physical Examination
• Inspection
  • Lacerations/Contusions
  • Alignment/Deformity
  • Effusion/Hemarthrosis
  • Gait
• Palpation
  • Joint line pain
  • meniscus tear
  • Palpable defects
    • Quadriceps tendon tear, Patella ligament tear, Patella fracture

5 Physical Examination
• ROM
  • Knee (0° - 140°)
• Strength
  • Quadriceps
    • Straight leg raise
    • Extensor lag
  • Hamstrings
• Neurovascular
  • Compartment syndrome

6 Physical Examination
• Ligaments

7 Physical Examination
• Ligaments
  • Grading
Ligaments
Grading
• 0 → normal
• I → 1 to 4 mm, firm end point
• II → 5 to 9 mm, firm end point
• III → 10 to 15 mm, soft end point

Physical Examination
Special tests
• Meniscus
  • Squat test
  • Steinmann test
  • McMurray test
  • Apley compression/distraction
• Patella-femoral
  • Grind
  • Lateral apprehension
  • Q-angle

Hip
• SCFE

Imaging
Radiographs
• AP, lateral, sunrise
• 45° flexion PA weight-bearing view
• Arthritis
• Stress X-rays (peds)
Indications
• Ottawa knee rules
• Traumatic hemarthrosis
• Deformity

Identify
• Fractures
• Dislocations
• Arthritis
• Specific bony signs for ligament injury
  • Tibial spine fracture (ACL)
  • Segond fracture (ACL)
  • Pellegrini-Stieda (MCL)

MRI
• When to order?
  • If suspect
    • Meniscus tears
• If suspect
  • Meniscus tears
  • Ligament tears
    • 90-98% sensitive for ACL tears
  • Articular cartilage injury
    • Osteochondral fractures
  • Occult fractures
• Physical exam is limited
  • Pain
  • Swelling

12 Differential Diagnosis
  • Acute hemarthrosis
    • Peripheral meniscus tear
    • ACL/PCL tear
    • Dislocation
      • Patella, knee
    • Fractures
    • Bleeding disorders
      • Coumadin
      • PVNS

13 Meniscal Injuries
  • Anatomy
    • Medial meniscus
    • Lateral Meniscus

14 Meniscal Injuries
  • History
    • Among most common knee injury
    • Twisting injury while weight bearing
  • Patients c/o
    • Joint line pain
    • Swelling
    • Clicking
    • Locking

15 Meniscal Injuries
  • Examination
    • Effusion/Hemarthrosis
    • Tender to palpation along joint line
    • McMurray test
    • Apley test
    • Squat test
    •

16 Meniscal Injuries
  • Imaging
Meniscal Injuries

- Imaging
  - Radiographs
    - PA 45° flexion (weight-bearing), lateral and sunrise views
  - MRI
    - Accurate method to confirm diagnosis
- Diagnosis can be made 90% of time with careful history and physical examination

Meniscal Injuries

- Treatment
  - Non-operative
    - Ice, elevation, NSAIDS, PT
  - Surgical
    - Partial meniscectomy
    - Meniscal repair
    - Meniscal allograft

Meniscal Injuries

- Partial meniscectomy
  - Good results through 20 years

Meniscal Injuries

- Meniscal repair

Meniscal injuries

- Repair
  - 80% success with ACLR
  - 60% for isolated repair
  - Inside-out highest success
- Rehab
  - Weight bear as tolerated with crutches for a month
  - Slow with deep flexion and twisting
  - Return to activities 4-6 months

Meniscal injuries

- Meniscal allograft
  - Pain after subtotal meniscectomy
  - Minimal osteoarthritis
  - 80% success rate (pain)
  - 10 year survival 70%
  - Does not prevent osteoarthritis
- Future trends
  - Meniscal scaffolds
• Future trends
  • Meniscal scaffolds
  • Biologics

22 Ligament injuries
• Anatomy

23 Ligament Injuries - ACL
• > 200,000 new ACL injuries per year
• History
  • Non-contact injury with knee in extension
  • Hemarthrosis within a few hours
  • Audible pop in > 50%
  • More common in females

24 Ligament Injuries - ACL
• Examination
  • Hemarthrosis
  • On field examination
    • Less guarding, swelling
    • Compare to contra-lateral side
  • Positive Lachman
  • Pivot Shift
    • Must be relaxed

25 ACL
• "Rule of 70"  
  • 70% of ACL tears non-contact
  • 70% of ACL tears are sports related
  • 70% of acute hemarthrosis are ACL tears
  • 70% of ACL tear patients feel a "pop"
  • 2-4 times more common in females

26 Ligament Injuries - ACL
• Imaging
  • Radiographs
    • Segund fracture
    • Tibial Spine avulsion

27 Ligament Injuries - ACL
• MRI
  • Sensitivity 90% - 98%
  • Specificity 50%
    • (partial v complete)
  • Accuracy 90%
  • Bone bruises > 90%

28
Ligament Injuries - ACL

1. Treatment
   - Non-operative
   - PT
   - Bracing
   - Activity modification
   - Surgical
     - Repair
       - Avulsions
     - Reconstruction
       - Autograft
       - Allograft

29  Ligament Injuries - ACL

   • Reconstruction

30  ACL

   • Rehab
     - CPM – no benefit
     - Avoid open chain quad work from 0-45 early post-op
     - Early motion
     - Early weight bearing
     - Return to sport
       - 1st year 6x risk of peers
       - Risk normalizes after 2 years

31  ACL

   1. Bracing
      - Post-operative
      - Functional
      - ACL deficient knee
   2. Prevention
      - Braces
      - Neuromuscular training program
      - Retear 6% overall
        • Higher in young, cutting sports
• Higher in young, cutting sports

32  **Ligament Injuries - MCL**
   • Most common isolated ligament injury
   • Commonly associated with ACL injury
   • History
     • Valgus force
     • Medial sided knee pain

33  **Ligament Injuries - MCL**
   • Examination
     • Pain with palpation of MCL
     • No effusion/hemarthrosis
     • Valgus instability at 30° (0 ° ? ACL)

34  **Ligament Injuries - MCL**
   • Imaging
     • Radiographs
       • Fractures
         ➢ Lateral tibial plateau
         ➢ Physeal injuries
         ➢ Pellegrini-Stieda
     • MRI
       • Associated Injuries

35  **Ligament Injuries - MCL**
   • Treatment
     • Non-surgical for all grades is well established
     • Early quadriceps and hamstring strengthening
     • Functional brace for early return to sports
     • Time Line

36  **Ligament Injuries - PCL**
   • Instability less common than with ACL
   • Long term association with arthritis
     • Medial and patellofemoral
   • Associated injuries common
     • PLC (60%)
   • History
• PLC (60%)
• History
  • Posterior force to proximal tibia of flexed knee
  • Knee hyperextension
  • Usually no history of pop or tear

37 □ Ligament Injuries - PCL
• Examination
  • Hemarthrosis
  • Posterior drawer
  • Quadriceps active test
• Imaging
  • Radiographs
  • Posterior tibial subluxation
  • Avulsion fracture off tibia
  • MRI

38 □ Ligament Injuries - PCL
• Treatment
  • Non-operative
    • Isolated tears usually do not require surgery
    • Quadriceps rehabilitation
    • Bracing
  • Operative
    • Repair
      ➢ Tibial avulsions
    • Reconstruction
      ➢ Associated injuries
      ➢ Grade III laxity

39 □ Ligament Injuries - PLC
• Anatomy
  • Popliteus tendon
  • Popliteofibular ligament
  • LCL

40 □ Ligament Injuries - PLC
• History
  • Associated with PCL injuries and knee dislocations
  • Anteromedial blow to tibia or external rotation force on extended knee

41 □ Ligament Injuries - PLC
• Examination
  • Varus laxity at 30°
  • ↑ ER and posterolateral drawer at 30° → PLC
  • ↑ ER and posterolateral drawer at 90° → PLC + PCL
  • ER recurvatum test
• ↑ ER and posterolateral drawer at 90° → PLC + PCL
• ER recurvatum test
• Neurovascular exam
  • Peroneal nerve injury (>10%)

42 Ligament Injuries - PLC
  • Imaging
    • Radiographs
      • Fibular head fractures
      • Medial tibial plateau
    • MRI
  • Treatment
    • Non-operative
    • Poor results
    • Operative
      • Acute (< 3 weeks)
        ➢ Direct primary repair
      • Chronic (> 3 weeks)
        ➢ Reconstruction

43 Articular Cartilage Injuries
  • Osteochondral fractures
    • History
      • Associated with patella dislocations
    • Examination
      • Hemarthrosis
      • Locking
    • Imaging
      • Radiographs
      • MRI
  • Treatment
    • Large fragments
      ➢ Replaced and fixed
    • Small Fragments
      ➢ Excised

44 Extensor Mechanism Injuries
  • Anatomy
    • Quadriceps muscle → quadriceps tendon → patella → patella tendon

45 Extensor Mechanism Injuries - rupture
  • Commonly misdiagnosed
  • History
    • Patella tendon
      • Younger patient
      • Athletics
    • Quadriceps tendon
• Athletics
• Quadriceps tendon
  • Older patient
  • Systemic disease
• Vigorous eccentric quadriceps contraction
• Unable to straighten leg
• Quinolone

46 Extensor Mechanism Injuries - rupture
• Examination
  • Palpable defect
  • Unable to do straight leg raise
    • Extensor lag
  • Hemarthrosis
• Imaging
  • Radiographs
    • Patella alta,
    • Peds - Sleeve fracture, Tibial tubercle
  • MRI/Ultrasound

47 Extensor Mechanism Injuries - rupture
• Treatment
  • Early surgical repair

48 Extensor Mechanism Injuries - tendinopathy
• Overuse in athletic population
• Hamstring and quadriceps tightness predisposing factor
• Repetitive microtrauma in an area of poor blood supply leads to degeneration not inflammation

49 Extensor Mechanism Injuries - tendinopathy
• History
  • Anterior knee pain
  • Gradual onset
  • Associated with running or jumping
  • Overuse
• Examination
  • Pain to Palpation
  • Pain with resisted extension or passive flexion


50 • **Extensor Mechanism Injuries - tendinopathy**
- Imaging
  - X-rays
    - Osgood Schlatters disease
  - MRI
- Treatment
  - Rest
  - Chopat strap
  - Physical therapy
    - Eccentric strength
    - NTG patch

51 • **Patella femoral pain syndrome**
- Constellation of problems with multifactorial etiology
- Typically related to overloading of the patella femoral joints
- History
  - Young females
  - Dull aching pain behind patella
  - Worse with knee flexion
  - No injury

52 • **Patella femoral pain syndrome**
- Examination
  - Palpate anterior knee
  - Patella femoral tracking (lateral, crepitus)
  - Leg alignment
  - Patella compression
- Imaging
  - X-rays (axial or sunrise view)
  - MRI
    - Usually not helpful

53 • **Patella femoral pain syndrome**
- Treatment
  - Most improve non-operatively
  - Education, stretching and strengthening
  - Activity helps

54 • **Dislocation - PF**
- History
  - More common in females
  - Twisting injury with knee in extension
  - Previous dislocation/subluxation
• Twisting injury with knee in extension
• Previous dislocation/subluxation
  • Recurrence rate 40%
• Examination
  • Obvious deformity
  • Hemarthrosis
  • Patella located laterally
  • Tender over medial retinaculum
  • Q-angle

55 **Dislocation - PF**
• Imaging
  • Radiographs
    • Sunrise view
    • Osteochondral fractures
  • MRI
    • Suspect loose body
• Treatment
  • Reduction
    • Hip flexion, knee extension
  • Temporary immobilization
  • Functional rehabilitation

56 **Dislocation - Knee**
• History
  • Multi-ligaments injury
  • Severe injury
• Examination
  • Deformity
  • Hemarthrosis
  • Ligament instability
  • Neurovascular
    • Peroneal nerve (50%)
    • Pulses (25%)
      ➢ Posterior tibial
      ➢ Dorsalis Pedis

57 **Dislocation - Knee**
• Imaging
  • Radiographs
  • Angiography
    • Suspect vascular injury
  • MRI
• Treatment
  • Emergent reduction
• Treatment
  • Emergent reduction
  • 24-48 hour observation
    • Vascular compromise
    • Compartment syndrome
  • Confirm concentric reduction
  • Early repair/reconstruction

58 When to refer to Orthopaedics
  • Significant traumatic injury
  • Effusion/hemarthrosis
  • Instability
  • Failure to improve with RICE
  • Symptoms > 6 weeks with no improvement

59 Summary
  • Knee injuries are very common injuries
  • Accurate diagnosis and treatment can lead to successful outcomes