Evaluation of the Painful Knee

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Introduction

- Knee pain
  - Accounts for 1/3 of musculoskeletal problems seen in the primary care setting.
  - Source of significant disability, limiting the ability to exercise, work and perform activities of daily living.
Introduction

- Knee pain
  - Differential diagnosis:
    - extensive
    - narrowed with a detailed history, focused physical exam, and appropriate imaging and laboratory studies
History

- Chief Complaint
  - pain, instability, swelling, deformity, stiffness, etc.

- Characterize pain
  - duration: recent or remote
  - etiology: traumatic or atraumatic (insidious)
  - location: anterior, posterior, medial, lateral
  - frequency: constant or intermittent
  - severity: scale 1-10
  - quality: sharp, dull, aching, etc.
  - aggravating and alleviating factors
  - night pain?
History

- **Acute Traumatic Injury**
  - contact vs. noncontact
  - mechanism of injury
    - twisting, hyperextension, pivoting, valgus stress, etc.
  - pop? able to continue playing?
  - able to bear weight?
- swelling
  - localized or diffuse
  - onset: rapid vs. delayed
- ecchymosis, redness
History

- Mechanical Symptoms
  - locking, catching, giving way, instability

- Limitations
  - daily activity, work, exercise, etc.

- Athlete
  - sport (position), season, time table for return

- Treatment
  - ice, medications, bracing, therapy, injections
  - response?
History

- Allergies
- Medications (steroids, quinolone)
- PMH
  - previous knee problems, prior surgery, other joint complaints, etc.
  - medical co-morbidities, systemic symptoms, etc.
- SH (smoking, drugs, etc.)
- FH
- ROS
3 Common Diagnostic Categories

- Acute knee pain following trauma
- Acute or chronic knee pain with overuse
- Knee pain without trauma or overuse, possibly associated with systemic symptoms.
Acute Knee Pain Following Trauma

Common:
- MCL tear
- ACL tear
- Patellar dislocation
- Meniscal tear
- Fracture

Images:
- Medial meniscus tear
- Patellar dislocation
- Tibial plateau fx
- ACL tear

Images:
- MCL sprain
Acute Knee Pain Following Trauma

- Less common:
  - PCL tear
  - LCL/PLC tear
  - Knee dislocation
  - Extensor mechanism disruption
Acute or Chronic Knee Pain from Overuse

- PF pain syndrome
- Medial plica syndrome
- Osteoarthritis
- Deg. meniscal tear
- Baker’s cyst
Acute or Chronic Knee Pain from Overuse

- Stress fractures
- IT band syndrome
- Tendonitis/Bursitis
  - PT, QT, pes anserine
- Apophysitis
  - Osgood Schlatter
  - Sinding Larsen Johansson

Tibial stress fx
Knee Pain Without Trauma or Overuse

- **Rheumatologic Disorders**
  - Systemic autoimmune disease
    - RA, SLE
  - Seronegative Spondyloarthropathy
    - Reiter’s, psoriatic, ankylosing spondylitis, inflammatory bowel disease
    - Acute rheumatic fever, post streptococcal reactive arthritis
  - Crystalline induced arthropathy
    - Gout (monosodium urate crystals)
    - Pseudogout (calcium pyrophosphate dihydrate crystals)
Knee Pain Without Trauma or Overuse

- Infection (septic arthritis)
  - most common - staph aureus
  - sexually active - neisseria gonorrhea
  - shoulder surgery - p. acnes
  - sickle cell - salmonella, strep pneumonia
  - HIV - bartonella henselae
  - IV drug - pseudomonas aeruginosa
  - cat bite - pasteurella multocida
  - human bite - eikenella corrodens
  - immunocompromised - fungal/candida
  - spirochete (syphilis, lyme’s disease)
  - atypical mycobacteria
Knee Pain Without Trauma or Overuse

- DVT
- 1° Musculoskeletal tumors
  - Benign
  - Malignant
- Metastatic lesions
- Luekemia/Lymphoma
- Clotting Disorders
  - Factor Deficiency
  - Anticoagulation therapy
- Vasculitis
- Referred pain
Physical Exam

- Inspection
- Palpation
- ROM
- NV Testing
- Special Tests

ALWAYS COMPARE TO OPPOSITE SIDE
Physical Exam: Inspection

- gait - antalgic, stride length, assistive devices, etc.
- skin - scars, erythema, ecchymosis
- swelling - intra-articular (effusion), soft tissue
- alignment - neutral, varus, valgus
- muscular atrophy
- deformity/asymmetry
Physical Exam: Palpation

- Anterior
  - Extensor mechanism: quad, quad tendon, patella, retinaculum, trochlea, patellar tendon, tibial tubercle

- Posterior
  - Popliteal fossa, popliteal artery, hamstrings, gastrocnemius, posterior horn menisci
Physical Exam: Palpation

- **Medial**
  - MFC, medial epicondyle, adductor tubercle, MCL, medial meniscus, pes anserine, tibial plateau

- **Lateral**
  - LFC, lateral epicondyle, LCL, lateral meniscus, tibial plateau, fibular head, peroneal nerve, IT band, Gerdy’s tubercle
Physical Exam: ROM

- Normal: 0° - 135°
  - check active and passive motion
  - hyperextension (GLL)
  - contracture
  - extensor lag
Physical Exam: NV Exam

- Sensation
  - Dermatomes
Physical Exam: NV Exam

- **Sensation**
  - **Peripheral Nerves**
  - Medial thigh: obturator
  - Anterior thigh: femoral
  - Posterolateral calf: sciatic
  - Dorsal foot: superficial peroneal
  - 1st web space: deep peroneal
  - Plantar foot: tibial
Physical Exam: NV Exam

Motor

- Hip flexion - iliopsoas: femoral n., L1,2,3
- Hip extension - gluteus maximus: inferior gluteal n., S1
- Hip abduction - gluteus medius: superior gluteal n., L5
- Hip adduction - adductor longus: obturator n., L2,3,4
- Knee flexion - hamstrings: sciatic n., L5, S1
- Knee extension - quadriceps: femoral n., L2,3,4
Physical Exam: NV Exam

Motor

- Ankle DF
  - TA: deep peroneal n., L4,5
  - EHL: deep peroneal n., L5
  - EDL: deep peroneal n., L5

- Ankle PF
  - Gastroc/soleus: tibial n., S1,2
  - Peroneus longus and brevis: superficial peroneal n., S1
  - FHL: tibial n., L5
  - FDL: tibial n., L5
  - TP: tibial n., L5
Physical Exam: NV Exam

Motor

- Ankle Inversion
  - TP: tibial n., L5
  - TA: deep peroneal n., L4,5
- Ankle Eversion
  - Peroneus longus and brevis: superficial peroneal n., S1
Physical Exam: NV Exam

- Reflexes
  - Disc L3–L4: Root L4, Reflex Patellar reflex, Muscles Anterior tibialis, Sensation Medial leg and medial foot
  - Disc L4–L5: Root L5, Reflex None, Muscles Extensor hallucis longus, Sensation Lateral leg & dorsum of foot
  - Disc L5–S1: Root S1, Reflex Achilles reflex, Muscles Peroneus longus & brevis, Sensation Lateral foot

- Vascular
  - Pulses - popliteal, DP, PT
  - Normal ABI >0.9
Physical Exam: Special Tests

- **Effusion**
  - fluid wave
  - ballot patella
  - milking maneuver
Physical Exam: Special Tests

- Patellofemoral joint
  - crepitus
  - compression test (grind)
  - tracking: J sign
  - patellar tilt
  - patellar glide
  - patellar apprehension
  - Q angle
  - patella alta/baja
  - palpable plica
  - Ober test
Physical Exam: Special Tests

- **Patellofemoral Joint - Pearls**
  - **Anterior Knee Pain Syndrome**
    - PF forces: 3xBW stairs, 6-8xBW full squatting
    - common in adolescent females
    - not a surgical problem
    - evaluate biomechanics
    - address the entire kinetic chain
    - CMP reserved for documented cartilage pathology
Physical Exam: Special Tests

- Patellofemoral Joint - Pearls
  - Subluxations/Dislocations
    - >90% lateral
    - Usually tear MPFL
    - often spontaneously reduce
    - may present similar to ACL tear
Physical Exam: Special Tests

Meniscus

Functions
- load transmission
- shock absorption
- stability
- lubrication
- proprioception

Normal medial meniscus

Normal lateral meniscus
Physical Exam: Special Tests

- Meniscus
  - symptoms
    - joint line tenderness,
    - worse twisting, pivoting, squatting
    - +/- giving way
  - provocative tests:
    - McMurray
    - Apley compression
    - Thessaly
Physical Exam: Special Tests

Meniscus – Pearls

- Not all meniscal tears require surgery.
- Beware the MRI with a degenerative meniscal tear that does not correlate with the patient's history and physical exam.
Physical Exam: Special Tests

- **Ligaments:**
  - ACL
  - PCL
  - MCL
  - LCL
  - PLC
Ligament Injuries

- **Grading:**
  - **A**=firm endpoint, **B**=no endpoint
  - **Grade I**
    - <5mm translation
  - **Grade II**
    - 5 – 10mm translation
  - **Grade III**
    - >10mm translation
Physical Exam: Special Tests

- **ACL**
  - Primary restraint to anterior translation and IR of tibia on femur
  - **Lachman’s test**
    - Most sensitive
  - **Pivot shift**
    - Extension to flexion
    - Reduces at 20° - 30° (IT band)
    - Correlates with functional instability
  - **Anterior drawer**
Physical Exam: Special Tests

- ACL - Pearls
  - Most are non-contact deceleration twisting or pivoting injuries.
  - pop, acute pain and swelling, difficulty bearing weight, unable to continue playing
  - swelling within hrs.
  - 4-6x increased incidence in woman
Physical Exam: Special Tests

- ACL - Pearls
  - relaxed patient is the key to accurate Lachman’s test
    - externally rotate hip, support thigh
      - helps relax the hamstrings
  - feel for amount of tibial translation and quality of endpoint
  - always compare to opposite side
  - beware the PCL deficient knee
    - false + Lachman/ant. drawer

ACL Tear

Hamstring ACL reconstruction
Physical Exam: Special Tests

- **PCL**
  - Primary restraint to posterior translation of the tibia on the femur
  - *posterior drawer*
    - Most sensitive
  - posterior sag sign
  - quadriceps active test

- Posterior drawer
Physical Exam: Special Tests

- **PCL - Pearls**
  - common mechanism
    - dashboard
    - hyperextension
    - fall on front of knee with foot plantar-flexed
  - less effusion than ACL
  - causes more disability than instability
Physical Exam: Special Tests

- PCL - Pearls
  - false (+) anterior drawer: know your starting point (medial tibial plateau 1 cm anterior to MFC)
  - non op treatment
    - Isolated grade I-II PCL tear
  - surgery
    - Failure of conservative tx
    - Grade III PCL tears
    - Combined ligament injuries
  - grade III PCL tear - beware the missed PLC injury
Physical Exam: Special Tests

- **MCL**
  - Primary restraint to valgus stress
  - **Valgus stress test**
    - most sensitive
    - Laxity 30° only
    - isolated MCL
    - Laxity 0° and 30°
    - combined MCL and cruciate ligament
Physical Exam: Special Tests

- **MCL - Pearls**
  - non-op treatment
    - most isolated injuries
  - surgery
    - combined ligament injuries
    - failure of non-op treatment
    - complete tibial avulsions (primary repair)

- Valgus stress

- primary repair MCL
Physical Exam: Special Tests

- **LCL**
  - Primary restraint to varus stress
  - **varus stress test**
    - most sensitive
    - Laxity 30° only:
      - isolated LCL
    - Laxity 0° and 30°:
      - combined LCL and cruciate ligament
    - Laxity 30° and increased external rotation at 30°
      - combined LCL and PLC
Physical Exam: Special Tests

LCL - Pearls

- isolated LCL injuries rare
- often combined with PLC injury +/- cruciate ligament injury
- LCL best palpated with knee in figure 4 position
Physical Exam: Special Tests

- LCL - Pearls
  - less intrinsic healing ability than MCL
  - often require surgery
  - non-op treatment
    - isolated LCL injury with minimal laxity
  - surgery
    - reconstruction +/- repair
    - isolated high grade injuries
    - combined ligament injuries
Physical Exam: Special Tests

- PLC
  - Static structures
    - LCL popliteus tendon, popliteofibular ligament, lateral capsule
  - Dynamic structures
    - biceps femoris, popliteus muscle, IT tract, lateral gastroc.
  - primary restraint to ER tibia on femur
Physical Exam: Special Tests

- **PLC**
  - **Dial test (external rotation)**
    - most sensitive
    - $>10^\circ$ ER asymmetry at $30^\circ$ only
    - Isolated PLC injury
    - $>10^\circ$ ER asymmetry at $30^\circ$ & $90^\circ$
    - PCL and PLC injury

Prone dial test
Physical Exam: Special Tests

- PLC
  - Reverse pivot shift
    - Knee 90° flexion, ER and valgus stress on tibia
    - As knee is extended, tibia reduces at 20° - 30° from a posterior subluxed position
  - Posterolateral drawer test
  - External rotation recurvatum test
Physical Exam: Special Tests

- **PLC - Pearls**
  - abnormal gait
    - varus or hyperextension thrust
  - isolated PLC injuries rare, usually combined with LCL and/or ACL/PCL injuries
  - missed PLC injury -
    - cause of ACL reconstruction failure
  - non-operative
    - isolated low grade injuries
  - surgery
    - high grade and combined lig. injuries
    - repair/reconstruction of all injured structures
Physical Exam: Special Tests

- PLC - Pearls
  - high association of peroneal nerve injuries
    - ↓ sensation on dorsum foot
    - weak ankle dorsiflexion and eversion
  - consider possibility of knee dislocation with spontaneous reduction in multi-ligament knee injury
    - Check NV status including ABI’S

peroneal n.
Physical Exam: Special Test

- Referred pain – Pearls
  - spine/hip
    - Spine and/or hip pathology may refer pain to the knee, with knee pain as the only presenting symptom.
    - Don’t forget to examine the lumbar spine and hips, particularly when the knee findings do not correlate with the severity of symptoms.
Imaging Studies

- Radiographs
  - skeletally mature
    - BIL WB PA, lateral, sunrise
  - open physes:
    - AP, lateral, oblique, notch, sunrise
- indications
  - Trauma
    - Ottawa rules
  - Pain, swelling deformity, etc
  - Orthopaedic surgeon

Ottawa knee rules

Answer: --

Answer questions, then click "Compute" button below

Unable to bear weight immediately and in ED?
- True
- False
Tender on patella?
- True
- False
Tender on fibular head?
- True
- False
Age over 55?
- True
- False
Unable to flex more than 90 degrees?
- True
- False

NOTES:
Decision rule for ordering knee x-rays in adults after acute trauma. Any "True" answer result in "Do x-ray"
Imaging Studies: Radiographs

- Identify:
  - arthritis
  - fractures/dislocations
  - OCD lesions
  - PF joint
    - patellar tilt/subluxation
    - patella height
    - trochlear dysplasia
Imaging Studies: Radiographs

- Identify:
  - fractures associated with ligament injuries:
    - Segond fx (ACL)
    - Tibial spine fx (ACL)
    - Arcuate fx (LCL)
  - alignment (hip to ankle)
  - skeletal maturity
  - tumors
Imaging Studies: MRI

- When to order?
  - If you suspect:
    - meniscal tear
    - ligament tear
    - articular cartilage injury
    - occult fracture
  - Physical exam limited:
    - pain or swelling
  - Failure to improve with appropriate conservative treatment.
Arthrocentesis

Indications

- ↓ pain, ↑ ROM, accelerate rehabilitation
- facilitates physical exam
- diagnostic tool
  - clear yellow fluid –
    - OA, meniscal tear, cartilage lesion
  - cloudy fluid - inflammatory, infectious
  - bloody (hemarthrosis/lipo-hemarthrosis)
    - ACL tear, patellar dislocation, occult fracture, peripheral meniscal tear, bleeding tendency (anticoagulant, factor deficiency, PVNS, etc.)
Suspected Inflammatory/Infectious Process

- Synovial fluid for:
  - gram stain
  - cell count with diff.
  - protein/glucose
  - crystals
  - cultures
    - aerobic
    - anaerobic
    - AFB
    - fungal

Septic arthritis
Suspected Inflammatory/Infectious Process

- Blood for:
  - CBC with diff.
  - ESR, CRP
  - CMP
  - Rheumatoid factor
  - anti-ccp
  - ANA
  - HLA B-27
  - Lupus prep
  - Lymes titer
  - Blood cultures
Common Causes of Knee Pain by Age Group

- **Children and Adolescents**
  - Overuse
    - tibial apophysitis (Osgood-Schlatter)
    - jumper’s knee (patellar tendonitis)
    - Patellofemoral pain syndrome
    - OCD
  - Acute Trauma
    - patellar subluxation
    - growth plate fractures
    - ligament injury/meniscal tear
  - Inflammatory arthritis – JRA
  - Infection
  - Referred pain (SCFE)/Tumors

Osgood-Schlatter
Common Causes of Knee Pain by Age Group

- **Young Adults**
  - Overuse
    - patellofemoral pain syndrome
    - medial plica syndrome
    - bursitis/tendonitis
    - IT band syndrome
    - stress fractures
  - **Acute Trauma**
    - ligament injuries (ACL/MCL)
    - meniscal tears
    - Fractures (bone/acute chondral lesion)
  - Inflammatory Arthritis - RA, Reiter’s syndrome
  - Infection
Common Causes of Knee Pain by Age Group

- **Older Adults**
  - Overuse
    - osteoarthritis
    - deg. meniscal tears
    - Baker’s cyst
  - Acute Trauma
    - fractures
    - patellar/quad tendon ruptures
  - Crystal Induced Inflammatory Arthritis
    - gout, pseudo-gout
  - Infection
  - DVT
  - Referred pain (arthritis hip/L-spine)/Tumors
Common Causes of Knee Pain by Anatomic Site

- **Anterior Knee Pain**
  - Overuse
    - tibial apophysitis
    - tendonitis/Jumper’s knee
    - patellofemoral pain syndrome
    - patellofemoral arthritis
    - bursitis
  - Acute Trauma
    - patellar subluxation/dislocation
    - anterior fractures
    - tendon rupture (patella/quad)
Common Causes of Knee Pain by Anatomic Site

- **Medial Knee Pain**
  - Overuse
    - medial compartment arthritis
    - medial plica syndrome
    - pes anserine bursitis
    - stress fracture
  - Acute Trauma
    - medial meniscus tear
    - MCL sprain
    - medial fractures
    - MPFL tear
- **Referred Pain**

Medial meniscus tear
Common Causes of Knee Pain by Anatomic Site

- Lateral Knee Pain
  - Overuse
    - Lateral compartment arthritis
    - IT band syndrome
    - Lateral patellar compression syndrome
  - Acute Trauma
    - Lateral meniscal tear
    - Patellar subluxation/dislocation
    - LCL/PLC sprain
    - Lateral fractures
Common Causes of Knee Pain by Anatomic Site

- Posterior knee pain
  - Overuse
    - Baker’s cyst
    - posterior loose bodies
    - tendonitis
      - popliteus/hamstring
  - Acute Trauma
    - gastroc strain
    - PCL sprain
  - DVT

PCL injury mechanism

Loose body posterior

Baker’s cyst
Evaluation of the Painful Knee

- A comprehensive history, physical examination, and appropriate imaging and laboratory studies can facilitate the accurate diagnosis and treatment of the painful knee.
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THANK YOU