Therapeutic Approaches to the Knee

Jason Freedman, MD
Therapeutic Approaches to the Knee

No conflicts of interest related to this presentation
Therapeutic Approaches to the Knee

• Anatomy
• Physical examination
• Radiology
• Injection technique
• Clinical cases
Anatomy

• Femur
  • Condyles
• Tibia
  • Plateau
  • Tibial tuberosity
  • Gerdy’s tubercle
• Fibula
  • Head
• Patella
  • Facets
  • Poles
Anatomy

- Ligaments
  - Anterior cruciate
  - Posterior cruciate
  - Medial collateral
  - Lateral collateral
    - Posterolateral corner
- Meniscus
- Articular cartilage
Anatomy

- Muscles/tendon
  - Quadriceps tendon
  - Patella tendon
  - IT band
  - Hamstring
    - Biceps femoris
    - Pes/Medial hamstring
      - Sartorius
      - Gracilis
      - Semitendinosus
Physical Examination

• Inspection
  • Malalignment
  • Effusion
  • Erythema
  • Skin laceration/abrasion

• Squat
Physical Examination

• Range of motion

• Palpation
  • Joint lines
  • Condyles
  • IT band
  • Patella/quad tendon
  • Hamstring tendons
Physical Examination

- Provocative testing
  - Lachman
Physical Examination

- Provocative testing
- Lachman
- Anterior drawer
- Posterior drawer
• Provocative testing
  • Lachman
  • Anterior drawer
  • Posterior drawer
  • Varus/Valgus
Physical Examination

• Provocative testing
  • Lachman
  • Anterior drawer
  • Posterior drawer
  • Varus/Valgus
  • McMurray
    • Medial meniscus flex->ext with valgus/ER
    • Lateral meniscus flex ->ext with varus/IR
Physical Examination

• Provocative testing
  • Lachman
  • Anterior drawer
  • Posterior drawer
  • Varus/Valgus
  • McMurray
  • Patella grind
Physical Examination

- Provocative testing
  - Lachman
  - Anterior drawer
  - Posterior drawer
  - Varus/Valgus
  - McMurray
  - Patella grind
  - Patella inhibition
Physical Examination

- Provocative testing
  - Lachman
  - Anterior drawer
  - Posterior drawer
  - Varus/Valgus
  - McMurray
  - Patella grind
  - Patella inhibition
  - Patella apprehension
Physical Examination

- Provocative testing
  - Lachman
  - Anterior drawer
  - Posterior drawer
  - Varus/Valgus
  - McMurray
  - Patella grind
  - Patella inhibition
  - Patella apprehension
  - Patella tilt
  - J sign
Radiology

• Radiographs
  • Standing bilateral view
  • Tunnel
  • Lateral
  • Sunrise
Radiology

- MRI
  - ACL
  - PCL
  - MCL
  - LCL
  - Meniscus
  - Articular cartilage
  - Patella tendon
  - Quadriceps tendon
Radiology

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Radiology

- MRI
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  - Quadriceps tendon
Clinical Case #1

• 58 yo F with right knee pain
  • 1 year of atraumatic knee pain
  • Medial pain, some anterior
  • Occasional swelling
  • Stiff in morning
  • Worse after prolonged walking, used to be able to walk several miles, now only a few blocks.
  • Difficulty getting in and out of the car
  • No history of trauma, but may have had a high school soccer injury
  • Family history of “bad knees”
  • BMI 35
Clinical Case #1

- 58 yo M with right knee pain
  - Perhaps trace effusion
  - Range of motion 0 - 125°
  - Ligaments stable
  - Tenderness at medial joint line, femoral condyle
  - Medial irritability with McMurray
  - Mild pain with patella grind/inhibition
  - Neurovascularly intact
Clinical Case #1

- 58 yo M with right knee pain
  - Radiographs
Clinical Case #1

• 58 yo M with right knee pain
  • What is the diagnosis?
    • Crystalline arthropathy (gout)
    • Osteoarthritis
    • Rheumatoid arthritis
    • Post traumatic arthritis
    • Septic arthritis
Clinical Case #1

• 58 yo M with right knee pain
  • What is the diagnosis?
    • Crystalline arthropathy
  • **Osteoarthritis**
    • Rheumatoid arthritis
    • Post traumatic arthritis
    • Septic arthritis
Osteoarthritis of the Knee

• Clinical and radiographic manifestations of joint degradation
• Symptoms of pain, swelling, stiffness
• Incidence of new knee OA 240 persons per 100,000 per year
• Prevalence: symptomatic 17% >45 ys; radiographic 37% > 60yrs
• More common in women, African Americans
• Risk factors: obesity, age, trauma, occupation, lifestyle activities
Osteoarthritis of the Knee

• Examination findings
  • Malalignment – varus, valgus
  • Effusion
  • Limited motion
  • Crepitus
  • Medial/lateral compartment tenderness
  • Pain with patella grind/inhibition
Osteoarthritis of the Knee

• Radiographic findings
  • Joint space narrowing
  • Osteophyte
  • Subchondral sclerosis and cysts
  • Deformity

• No benefit for MRI imaging *
Osteoarthritis of the Knee

- Treatment
  - Exercise
  - Weight loss
  - Ice
  - NSAIDs, topical diclofenac
  - Unloader bracing
Osteoarthritis of the Knee

• Treatment
  • Injections – Corticosteroid
    • Anti-inflammatory and anti-nociceptive
  • Last weeks to months
  • Can be given at 3-4 month intervals
Osteoarthritis of the Knee

• Treatment
  • Injections – Corticosteroid
  • Patient sits edge of table with knee flexed over side at 90°
    • Sterile gloves
    • 22g 1 ½ inch needle
    • Pre-filled syringe with corticosteroid and lidocaine/bupivacaine
    • Chlorhexidine or betadine prep
    • Gauze
    • Bandage

Anteromedial or anterolateral approach
Osteoarthritis of the Knee

• Treatment
  • Injections – Viscosupplementation
    • Hyaluronic Acid
      • Glycosaminoglycan found in synovial fluid and cartilage
      • Acts as lubricant and shock absorber
      • May have anti-inflammatory effects
    • Various commercial preparations and injection protocols
    • Meta-analysis of best evidence trials showed no clinically important improvement in pain or other outcomes (Jevesevar *JBJS* 2015)
  • Some patients with mild/moderate OA do see relief
Osteoarthritis of the Knee

• Treatment
  • Injections – Platelet Rich Plasma (PRP)
    • Autologous whole blood derivative
    • High concentration of growth factors: TGF-β, ILGF, PDGF, FGF, VEGF
    • Positive effect on chondrogenesis and stem cell proliferation
    • Increase anti-inflammatory and decrease pro-inflammatory factors
    • Demonstrates clinically significant improvement in patients with symptomatic knee OA up to 12 months (Meheux J Arthros 2016)
Osteoarthritis of the Knee

• Treatment
  • Surgery
    • Arthroscopy
      • No benefit for lavage and debridement
      • May be indicated if unstable flap articular cartilage or meniscus tear in patient with mechanical symptoms
Osteoarthritis of the Knee

- Treatment
  - Surgery
    - Osteotomy
      - Correct mechanical alignment to shift weight bearing axis to non-arthritic compartment
      - Indicated in younger, active patients
      - Can delay need for arthroplasty
Osteoarthritis of the Knee

• Treatment
  • Surgery
    • Arthroplasty
Clinical Case #2

- 43 yo F atraumatic right anterior knee pain
  - Noted anterior knee pain 3 months ago when doing lunges, step climber at gym
  - Recently started working with a new trainer for Cross Fit
  - Now anterior knee pain with stairs, getting out of the chair, running
  - No specific injury
  - No swelling
  - Feels the knee will sometimes give out
Clinical Case #2

• 43 yo F atraumatic anterior knee pain
  • Physical examination
    • Full range of motion
    • No effusion
    • Stable ligaments
    • Non specific anteromedial/lateral tenderness
    • Mild pain with patella grind and inhibition
    • Negative patella apprehension, normal tilt test
    • Neurovascularly intact
Clinical Case #2

• 43 yo F atraumatic anterior knee pain
  • Radiographs?
  • Ottawa Rules?

• I take x-rays of everyone! Why?
• 34 yo M 1 yr knee pain started knee pain after doing 10K. Still gets some knee pain after exercising
Clinical Case #2

- 43 yo F atraumatic anterior knee pain
  - Radiographs
Clinical Case #2

• 43 yo F atraumatic anterior knee pain
  • What is the diagnosis
    • Patella instability
    • Osteoarthritis
    • Meniscus tear
    • Patellofemoral pain syndrome
    • IT band syndrome
Clinical Case #2

• 43 yo F atraumatic anterior knee pain
  • What is the diagnosis
    • Patella instability
    • Osteoarthritis
    • Meniscus tear

• Patellofemoral pain syndrome
  • IT band syndrome
Clinical Case #2

- **Patellofemoral Pain Syndrome**
  - Most common cause anterior knee pain
  - Pain around patella and retinaculum, with other pathology excluded
  - Associated with malalignment, muscle imbalance (weak VMO), weak hip abductors
  - Small subset will also have patella chondromalacia
  - May also see maltracking
  - Often associated with overuse, changes in activity or athletic training
Clinical Case #2

• Patellofemoral Pain Syndrome
  • Pain behind and/or around patella
  • Worse after prolonged sitting, stairs, running.
  • Feel popping or grinding under patella
  • Feel like knee will give out – inhibition of quadriceps due to pain

• Decreased quadriceps bulk/tone
• Pain with patella grind and inhibition
• Maltracking – J sign, patella tilt
Clinical Case #2

• **Patellofemoral Pain Syndrome - Treatment**
  • Relative rest
    • Reduce loading to the joint and peripatellar tissues
  • Correct training errors
    • Focus on lifting/running form, training program
  • Physical therapy
    • Flexibility, strengthening
  • Bracing / Taping
Clinical Case #2

- IT band syndrome/tendonitis
  - IT band rubs across lateral femoral condyle with motion
  - Tenderness along IT band, Gerdy’s tubercle, where crosses LFC
- Ober test
- Commonly have hip abductor weakness (gluteus medius stabilizes IT band)
- Stretching, foam rolling, icing
- Correct training errors
Clinical Case #3

- 30 yo M left knee pain
  - Slipped coming down stairs carrying a box three weeks ago
  - Missed a step and fell, twisting the knee as he landed
  - Immediate pain but able to bear weight
  - Had some swelling that has improved after icing the knee
  - Notes medial sided pain
  - Feels something stuck or catches when he tries to bend the knee or twist
  - Normally active, running and cycling, but has had difficulty returning
  - No previous knee symptoms
Clinical Case #3

• 30 yo M left knee pain
  • Physical examination
    • Small effusion
    • Motion 20-125°, but can be passively extending to 10°
    • Tender over medial joint line and compartment, pes anserinus
    • Stable to varus and valgus stressing, but pain with valgus stress
    • Negative Lachman, anterior and posterior drawer
    • Irritability medially with McMurray test
    • No pain with patella grind or inhibition
    • Neurovascularly intact
Clinical Case #3

• 30 yo M left knee pain
  • Radiographs
Clinical Case #3

• 30 yo M left knee pain
  • What is the diagnosis?
    • Capsular strain
    • Meniscus tear
    • MCL sprain
    • Pes bursitis
    • ACL tear
Clinical Case #3

• 30 yo M left knee pain
  • Indications for MRI
    • Acute injury with large effusion
    • Ligamentous instability on examination
    • Mechanical symptoms with positive McMurray
    • Pain for several months despite conservative modalities
Clinical Case #3

- 30 yo M left knee pain
  - MRI
Clinical Case #3

• 30 yo M left knee pain
  • What is the diagnosis?
    • Capsular strain
  • **Meniscus tear**
    • MCL sprain
    • Pes bursitis
    • ACL tear
Clinical Case #3

• 30 yo M left knee pain
  • Conservative treatment for degenerative tear, atraumatic, no mechanical symptoms
  • Consider surgery for younger patients, acute tears, mechanical symptoms
  • Once tear occurs, does not function properly as shock absorber
  • Tears may remain stable in size, but often will get larger

• Goals of surgery to relieve pain/mechanical symptoms, preserve shock absorbing tissue, prevent tear propagation
Clinical Case #3

• 30 yo M left knee pain
  • Arthroscopic knee surgery
    • Attempt to repair torn meniscus
      • Only outer ¼ - ⅓ has blood supply
      • Better to repair than debride, better to debride than leave tear
Clinical Case #3

- 30 yo M left knee pain
  - Arthroscopic knee surgery
Clinical Case #3

• 30 yo M left knee pain
  • Arthroscopic knee surgery
Clinical case #4

• 37 yo M one month of knee swelling
  • No traumatic injury
  • Runs and swims a few times a week, few flights of stairs at work
  • Feels tight, pain worse with flexion
  • Pain anteromedial and anterolateral
  • No redness
  • No other pertinent medical or family history
Clinical case #4

• 37 yo M one month of knee swelling
  • Examination demonstrates large effusion, no erythema
  • Knee motion 0-115°, stable ligaments
  • Non specific anterior tenderness
  • Radiographs
Clinical case #4

- 37 yo M one month of knee swelling
  - Knee aspiration performed
  - Patient supine with knee extended

- Sterile gloves and drape
- 18g spinal needle
- Large syringe(s)
- Hemostat
- Syringe with 1-2cc’s 1% lidocaine or 0.25% bupivacaine with 25g needle
- Pre-filled syringe with corticosteroid and lidocaine/bupivacaine
- Chlorhexidine or betadine prep
- Gauze
- Bandage
- Syringe cap

Superolateral patella approach
Clinical case #4

- Fluid analysis
  - Cell count – RBC: 3000, nucleated cells: 17,719
  - Crystals – negative
Clinical case #4

• What is your diagnosis?
  • Lyme disease
  • Gout
  • Rheumatoid arthritis
  • Septic arthritis
  • Osteoarthritis
Clinical case #4

Synovial fluid Western Blot Lyme Ab test

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Serum Western Blot Lyme Ab test

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<tr>
<td>LYME AB TOTAL IMMUNOLOBULINS</td>
<td>3.48</td>
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Comment:
Negative <0.91
Equivalent 0.91 - 1.99
Positive >1.99

LYME DISEASE AB QUANT IGM | 0.84 | (A) | 0.00 - 0.79 |

Comment:
Negative <0.80
Equivalent 0.80 - 1.19
Positive >1.19

IgM levels may peak at 3-6 weeks post infection, then gradually decline.

Performed at: RH - LabCorp Raritan
69 First Avenue, Raritan, NJ 08869-1200
Lab Director: Annette S Reyes MD, Phannel 804318280

LYME IGG WB INTERP | Positive | (A) |

Comment:
Positive: 5 of the following Borrelia-specific bands: 12, 23, 24, 30, 39, 41, 45, 59, 66, and 93.
Negative: No bands or bending patterns which do not meet positive criteria.

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Clinical case #4

• What is your diagnosis?
  • **Lyme disease**
  • Gout
  • Rheumatoid arthritis
  • Septic arthritis
  • Osteoarthritis
Clinical case #4

• Lyme disease
  • Most common tick borne illness
    • Northeast, Great Lakes region of Midwest, Pacific Northwest
    • (93% of cases occur in MA, MD, MN, NJ, NY, PA, WI, CT, DE, RI)
  • Spirochete *Borrelia burgdorferi*, carried in *Ixodes* tick
  • Following bite of infected tick, transmission takes 48-72 hours
  • Erythema migrans rash occurs 2-30 days after bite
Clinical case #4

• Lyme arthritis
  • Develops months after exposure
  • 60% of untreated Lyme disease
  • Induces inflammatory response in synovial tissue
  • Slowly progression in contrast to bacterial septic arthritis
  • Large effusion disproportionate to patient symptoms
  • Diagnosis based on serologic testing
  • Treated with 4 week course doxycycline (amoxicillin and cefuroxime)
Clinical case #4

• Septic arthritis
  • Acute presentation of pain, swelling, redness
  • Difficulty bearing weight, bending knee
  • Constitutional symptoms
  • Examination shows effusion, limited motion, pain with passive motion
  • Elevated WBC, ESR, CRP
  • Synovial fluid >50,000 nucleated cells, >75% PMNs
  • **Positive gram stain**
  • Surgical emergency for I&D followed by antibiotics
Clinical case #5

- 20 yo M soccer player right knee pain
  - Running to cut off the ball, pivoted quickly to change directions
  - Felt ‘pop’ and knee gave out
  - Developed swelling, diffuse pain and needed to be helped off the field
  - Rested next two days, iced the knee, took some ibuprofen
  - Able to walk with a limp
  - Feels some catching, like knee will give out
Clinical case #5

• 20 yo M soccer player
  • Examination
    • Antalgic gait
    • Large effusion
    • Motion 15-60°
    • TTP along medial joint line, lateral femoral condyle
    • Ligament testing difficult due to patient guarding
Clinical case #5

- 20 yo M soccer player
  - Xrays
Clinical case #5

• 20 yo M soccer player
  • Knee aspiration for therapeutic purposes

• Order MRI
Clinical case #5

- 20 yo M soccer player
- What is the diagnosis
  - Patella tendon rupture
  - Meniscus tear
  - Tibial plateau fracture
  - ACL tear
  - PCL tear
Clinical case #5

- 20 yo M soccer player
  - Re-examination 10 days later after MRI
    - Small effusion
    - Motion 0-115°
    - Minimal tenderness along lateral plateau
    - Stable to varus and valgus stressing
    - Positive Lachman and anterior drawer
Clinical case #5

- 20 yo M soccer player
  - What is the diagnosis
    - Patella tendon rupture
    - Meniscus tear
    - Tibial plateau fracture
  - **ACL tear**
    - PCL tear
Clinical case #5

• ACL tear
Clinical case #5

- ACL tear
  - **Segond sign**
    - Avulsion fracture of lateral capular ligaments
    - Pathognomonic for ACL tear
Clinical case #5

• ACL tear
  • Conservative vs surgical treatment
    • Consider non-operative management in lower demand patient without clinical instability
  • Non-operative management associated with higher likelihood (hazard ratio HR) of
    • Meniscus tear, HR 5.4
    • Arthritis, HR 6.0
    • Undergoing total knee replacement, HR 16.7
  • Early surgery better than delayed (more than 12 months)
    • Meniscus tear, HR 3.9 and arthritis, HR 6.2, with delayed reconstruction

Sanders AJSM 2016
Clinical case #5

• ACL tear
  • Surgery
    • Graft options
      • Autograft: bone-patella tendon-bone, hamstring, quadriceps
      • Allograft: patella tendon, Achilles tendon, tibialis anterior
    • Return to sports 9-12 months
Therapeutic Approaches to the Knee
Conclusions

• Most knee problems/injuries can be treated conservatively
• A good patient history and physical examination will diagnose most disorders
• Arthrocentesis useful for therapeutic and diagnostic purposes
• Orthopaedic referral and surgical consideration for specified conditions