Osteoarthritis of the Knee: Pill, Needle, or Knife

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Knee Osteoarthritis

- The most common joint disorder in the US
- Effects 10% of US population over age 55yo
- Estimated 52 million Americans suffer from arthritis
KNEE ARTHRITIS

- Arthritis is a degenerative joint disease
- Knee arthritis is one of the most common joints affected
- Results in destruction of cartilage progressing to bone on bone in moderate/severe disease

General Principles

- Knee is composed of three joint compartments
  - Medial, lateral and patellofemoral compartments
- Normal knee functions as a complex hinge allowing
  - Flexion, extension, rotation, and gliding
- Weight distribution across the knee with normal alignment
  - 60% through medial compartment
  - 40% through lateral compartment
Zones of Articular Cartilage

- Superficial (tangential or zone I)
  - Forms the gliding surface
  - Collagen fibers parallel to the articular surface
- Middle (transitional or zone II)
  - Thicker with oblique collagen fibers
  - Constitutes most of the cartilage depth
- Deep (radial or zone III)
  - Collagen fibers perpendicular to the articular surface
- Calcified cartilage (zone IV)
  - Radially aligned collagen fibers

PATHOPHYSIOLOGY
(Degenerative Cascade)

- Articular Cartilage
  - Increase water content, decreased proteoglycans, collagen orientation lost, and loss of chondrocytes
- Meniscus
  - Degeneration of type I collagen
- Synovium
  - Inflammation (increased thickness & vascularity)
    - Type A (phagocytosis)
    - Type B (produce synovial fluid)
    - Type C (multi-potent precursor cells)
PATHOPHYSIOLOGY
(Degenerative Cascade)

• Synovial fluid
  – Decreased level of hyaluronin and lubricin (glycoproteins)
• Cell biology
  – Synoviocytes secrete cytokines (TNF-a, IL-1, IL-6)
  – Increases MMP synthesis
    – Proteolytic enzymes
      ✶ Stromelysin, plasmin, aggrecanase-1
  – Imbalance of MMP and tissue inhibitor of MMPs (TIMPs)
    – TIMPs control MMPs preventing excessive degradation

PATHOPHYSIOLOGY
(Degenerative Cascade)

In summary:
• Articular cartilage degeneration
• Meniscus degeneration
• Synovial inflammation
• Synovial fluid with diminished lubrication
Osteoarthritis

- Older age
- M>F
- Asymmetrical
- Most common joints affected are knees, hips, and lumbar spine
- Cause is unknown

Presentation

- Patients c/o knee pain worse with walking up or down steps
  - This activity causes increased stressors across the joint
- Patients will describe worsening knee pain with change in weather “My knee can tell when it is going to rain”
- Persistent synovitis and effusion will cause capsular stretching leading to pain which varies with barometric pressure
Presentation

- Symptoms may wax & wane often in correlation with recent activities or body stressors (illness)
- Not uncommon for OA exacerbation to occur during hospital admission for unrelated event
  - Surgery, CHF, COPD, pneumonia, viral illness

Physical Examination

- Joint line tenderness to palpation
  - Degenerative compartment will often correlate to overall alignment
  - Varus deformity = medial joint space narrowing
  - Valgus deformity = lateral joint space narrowing
- Effusion
  - Persistent large/tense effusion may represent degenerative meniscus tear (without specific event)
Physical Examination

- McMurray’s test
  - Flex knee & place one hand on medial side of knee
  - Gently externally rotate leg & bring knee into extension
  - Palpable click is a positive test (medial meniscus tear)
- Lachman’s test
  - Most sensitive exam to detect ACL tear
  - Test grading
    - A= firm endpoint, B= no endpoint
    - Grade 1: <5 mm translation
    - Grade 2 A/B: 5-10mm translation
    - Grade 3 A/B: >10mm translation

Physical Examination

- Flexion contracture
  - Persistent synovitis and progressive immobility will lead to tight hamstrings
- Joint widening
  - Osteophyte formation is the body’s attempt to heal the progressive destruction of cartilage
- Crepitus
  - Patella should glide smoothly over femoral trochlea
Radiographs

• AP, lateral, and sunrise (merchant) view
  - Osteophyte formation
  - Sclerotic joint margins & subchondral cysts
  - Joint space narrowing
  - Loose bodies

Radiographs

• A clinical pearl is to always order weight bearing AP radiographs of the knee

• Following images is non-weight bearing X-ray and weight bearing X-ray of the same knee
MRI

- MRI can be useful in the workup for osteoarthritis of the knee if a degenerative meniscus tear is suspected

- Degenerative tears in older patients are most commonly found in the posterior horn of the medial meniscus

- Correlation to physical exam findings and/or mechanical symptoms is critical to confirm diagnosis
MRI

• MRI has been shown to find asymptomatic degenerative meniscus tears in over 60% of patients > 65 yo
• Diagnosis of symptomatic meniscus tear becomes difficult in the setting of concomitant OA
• Articular cartilage destruction may be the root cause of the patients symptoms

MRI

• Adjacent bone marrow lesions can be identified in osteoarthritis
• Representing bone marrow edema of subchondral bone
Nonoperative Treatment

• Weight Loss
  - Indications: symptomatic OA and BMI > 25
  - Improvement in joint pain and function
  - Reducing the risk of progression of OA
  - Each pound of weight loss results in a fourfold reduction in the load exerted on the knee per step during daily activities

Nonoperative Treatment

• Exercise / Physical therapy
  - First line treatment for all patients with symptomatic arthritis
  - Low impact aerobic exercise
    • Swimming
    • Bicycling
  - Improving flexibility and strengthening muscles improve functional outcome and pain scores
Nonoperative Treatment

• Exercise / Physical therapy
  – Quadriceps strengthening
    • Improve stability of joints and lessens pain
  – Hamstring stretching
    • Prevention of flexion contracture
  – Combination of supervised exercises and home program show the best results
  – Benefits often lost after 6 months if exercises are stopped

Nonoperative Treatment

• Viscosupplement intra-articular injections
  – Hyaluronic acid (HA) forms the backbone of aggrecans, the macromolecule that makes up cartilage matrix
  – HA at low load speeds acts as a lubricant and faster movements as a shock absorber
  – In OA the concentration of HA is reduced by half to one third of normal
    • Leads to decreased effectiveness and increased wear rates
Hyaluronic Acid vs Corticosteroid Injections

- Meta-analysis, Randomized trial
- Reported effects of intra-articular hyaluronic acid vs corticosteroids on knee osteoarthritis
- 7 eligible trials included 606 patients
- 0 – 4 weeks:
  - Intraarticular corticosteroids appear to be more effective for pain than intraarticular hyaluronic acid
- 4 – 8 weeks:
  - The 2 approaches have equal efficacy
- > 8 weeks:
  - Hyaluronic acid has greater efficacy

Pharmacologic Treatment

- NSAIDS
  - First line treatment for all patients with symptomatic arthritis
  - Risk factors for adverse reaction
    - Age > 60
    - Multiple medical comorbidities
    - H/o PUD
    - H/o GI bleeding
    - Concurrent corticosteroid use
    - Anticoagulant use
Pharmacologic Treatment

• **NSAIDS**
  - Cox-2 inhibitors limit inflammation without interfering with normal production of protective prostaglandins and thromboxane
    • Decrease the potential gastric toxicity of NSAIDs
  - Cox-2 inhibitors along with all NSAIDs may cause cardiovascular and renal side effects to varying degrees

Pharmacologic Treatment

• Acetaminophen at doses of up to 4 g per day have demonstrated to be superior to placebo in relief of pain resulting from OA
• Acetaminophen less effective than NSAIDs
• Tramadol
  - Strongly recommended by AAOS
Nonoperative Treatment

- Ice application
  - 20 minutes on / 20 minutes off for 2 hours
  - May allow patients to continue exercise programs
- Ambulation aids
  - Use in opposite upper extremity

Nonoperative Treatment

- Intra-articular corticosteroid injection
  - Limits inflammation of the joint
  - Injections given typically no closer than Q3 months
  - Useful in controlling acute exacerbation of OA
  - Often injection given in combination with Lidocaine
Nonoperative Treatment

- Unloader brace
  - Used less frequently
  - Designed to reduce reactive forces in involved compartment
  - Provides 3 point bending force
  - $800-1000

Orthotics

- Padded shoe inserts
  - Decrease in joint impact forces to joints
  - $8-22

- Varus knee deformity
  - Lateral heel wedges
Arthroscopy

- Debridement
  - Synovectomy (plica removal)
  - Removal of loose bodies
  - Chondroplasty
  - Resection of torn/damaged meniscus

Arthroscopy

- Direct Visualization of articular cartilage

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>Normal cartilage</td>
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<tr>
<td>I</td>
<td>Softening and swelling</td>
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<tr>
<td>II</td>
<td>Partial thickness defect, fissures &lt; 1.5cm diameter</td>
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<tr>
<td>III</td>
<td>Fissures down to subchondral bone, diameter &gt; 1.5cm</td>
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<tr>
<td>IV</td>
<td>Exposed subchondral bone</td>
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Evidence Based Medicine for Arthroscopic Debridement of Knee Osteoarthritis

- 180 patients with knee OA who received arthroscopic débridement, arthroscopic lavage, or placebo surgery (skin incisions)
- Outcomes were assessed at multiple points over a 24-month period
  - Use of 5 self-reported scores for pain, function, walking, and stair climbing
- The outcomes after arthroscopic lavage or arthroscopic debridement were no better than those after a placebo procedure

Arthroscopy

- Partial meniscectomy
  - >80% satisfactory function at minimum follow-up
  - Predictors of success
    - Age <40yo, normal alignment, minimal or no arthritis, single tear
- Total meniscectomy
  - 70% have arthritic X-ray changes 3 years after surgery
  - 100% have arthrosis at 20 years
  - Severity of degenerative changes is proportional to percent of the meniscus removed
Unicompartmental Knee Arthroplasty

• Indications
  – Isolated unicompartmental noninflammatory arthritis
  – Deformity of less than 10 degrees
  – Intact anterior cruciate ligament (ACL)
  – Little or no joint subluxation
  – Little or no patellofemoral disease
  – Weight < 90 kg

• Data suggests that only 6% of patients meet the criteria for whom knee arthroplasty is indicated
• Indications for this procedure have been expanded for younger patients
• 10 year survival rates range from 87 to 96%
• 15 year survival rates range from 79 to 90%
  – Survivorship declines rapidly in the second decade
• Late failure
  – Opposite compartment degeneration
  – Component loosening
  – Polyethylene wear
Total Knee Arthroplasty

- **Total Knee Arthroplasty**
  - 600,000 TKA performed each year in the US
  - By 2030 the number of TKA performed is expected to grow to over 3 million annually

- Goals
  - Relief of pain
  - Restoration of function
  - Reestablishment of proper alignment of the lower extremity
  - Achievement of intrinsic stability
  - Creation of a durable reconstruction
Total Knee Arthroplasty

• Indications
  - To Relieve pain caused by severe knee arthritis
    - Osteoarthritis / Inflammatory arthritis
  - Cartilage space loss confirmed on radiographs
  - Severe progressive deformity
  - Exhaustion of nonsurgical treatment

Total Knee Arthroplasty

• Relative Contraindications
  - Current or recent infection
  - Medical instability (severe cardiovascular disease)
  - Incompetent extensor mechanism
  - Recurvatum deformity secondary to muscular weakness
  - Neurologic disruption affecting musculature about the knee
  - Young and active patients (< 55yo)
Total Knee Arthroplasty

• Designs
  – Unconstrained
    • Posterior-cruciate retaining (CR)
    • Posterior-cruciate substituting (PS)
  – Constrained
    • Nonhinged
    • Hinged
  – Fixed vs mobile bearing

Total Knee Arthroplasty

• Survival rates range from 91 to 96% at 15 year follow up
  – Survival rate for cemented CR ranges from 96-97% at 10 year follow up
  – Survival rate for cemented PS ranges is 97% at 10 year follow up and 94% at 13 year follow up
  – Survival rate for cementless TKA ranges from 95 to 97% at 10 to 12 year follow up
Total Knee Arthroplasty

• Complications
  – Symptomatic instability occurs in 1-2%
    • Ligament instability accounts for 6% of revision TKA
  – Patellofemoral maltracking
    • Most common cause of revision TKA (8-35%)
  – Vascular injury (rare)
  – Nerve palsy
    • Incidence of nerve injury reported at 0.3%
  – Infection
    • Incidence of infection reported at 1-2%

TKA Rehabilitation

• Discharge home criteria
  – Medically stable
  – 80-90 degrees AROM knee flexion
  – Ambulate 75-100 feet
  – Ascend or descend stairs
TKA Rehabilitation

• Physical therapy
  – 2-3x per week for at least 2-4 weeks
  – Focus on closed-chain concentric exercises
  – Advance from crutches to cane to unassisted

• Driving recommendations
  – 4 weeks after a right total knee
  – less than 4 weeks after a left total knee

THE END
References


References


