

Osteoarthritis of the Knee: Pill, Needle, or Knife

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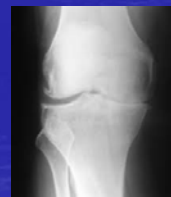
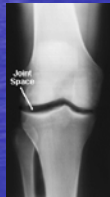
Knee Osteoarthritis

- 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 effected
- Results in destruction of cartilage progressing to bone on bone in moderate/severe disease



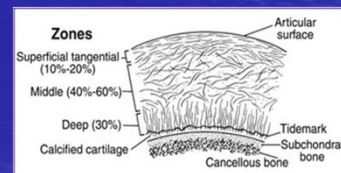
General Principles

- 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- α , 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 effected 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

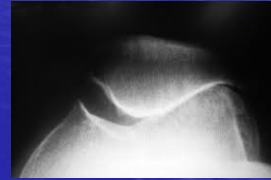
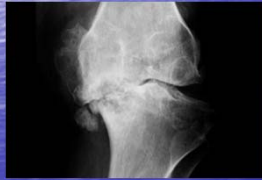
- McMurray's test
 - Flex knee & place one hand on medial side of knee
 - Gently externally rotate leg & bring knee into extension
 - Palpable click is a positive test (medial meniscus tear)
- Lachman's test
 - Most sensitive exam to detect ACL tear
 - Test grading
 - A= firm endpoint, B= no endpoint
 - 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

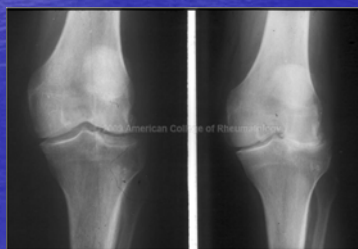
Radiographs

- 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



MRI

- 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



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

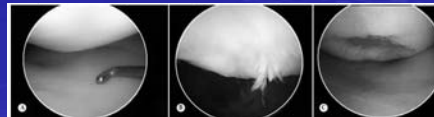
- Debridement
 - Synovectomy (plica removal)
 - Removal of loose bodies
 - Chondroplasty
 - Resection of torn/damaged meniscus



Arthroscopy

- Direct Visualization of articular cartilage

Outerbridge Arthroscopic Grading System	
Grade 0	Normal cartilage
Grade I	Softening and swelling
Grade II	Partial thickness defect, fissures < 1.5cm diameter
Grade III	Fissures down to subchondral bone, diameter > 1.5cm
Grade IV	Exposed subchondral bone



Evidence Based Medicine for Arthroscopic Debridement of Knee Osteoarthritis

- Study published in New England Journal of Med (2002)
- 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



Unicompartmental Knee Arthroplasty

- 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



Total Knee Arthroplasty

- **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

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