Rehabilitation Following Total Knee Arthroplasty (TKA)

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Introduction

• “Major salvage procedure of the arthritic knee for both OA and RA.”
• Approximately 130,000 knee replacements performed every year in the United States.
• Partial or total knee replacement.

History

• Continued innovation to try to limit the problems of wear, loosening and loss of range of motion.
• In the 1860s, Fergusson reported performing a resection arthroplasty of the knee for arthritis.
• The first artificial implants were tried in the 1940s as molds fitted to the femoral condyles following similar designs in the hip.
• In the 1950s, tibial replacement was also attempted, but both designs had problems with loosening and persistent pain.

Disclosure

• No relationships to disclose

Introduction

• Surgery consists of replacing diseased or damaged joint surfaces of the knee with metal and plastic components shaped to allow continued motion of the knee.
• OA causes cartilage to become stiff and lose its elasticity, making it more susceptible to damage. Over time, cartilage wears away, decreasing its ability to act as a shock absorber.

History

• Combined femoral and tibial articular surface replacements appeared in the 1950s as simple hinges (L.G.P. Shiers).
• These implants failed to account for the complexities of knee motion and consequently had high failure rates from aseptic loosening. They were also associated with unacceptably high rates of postoperative infection.
• In 1971, Gunston recognized that the knee does not rotate on a single axis like a hinge. His polycentric knee replacement had early success but was ultimately unsuccessful because of inadequate fixation of the prosthesis to bone.
**History**

- Insall, 1973: total condylar prosthesis. Didn’t try to reproduce normal knee motion.
- Later altered to mimic normal kinematics to improve range of motion. At the same time, a prosthesis with more natural kinematics was developed, relying on retained cruciate ligaments to provide knee motion.
- Ranawat et al, 1993: 94% survivorship at 15 yr. f/u.

**Indications for TKA**

- Disabling pain
- Limitations in function
- Radiographic findings
- Failed conservative treatment

**Factors to Consider**

- Age
- Weight
- Activity level
- Past medical history
- Patient goals
- Level of arthritis
- Bone quality
- Joint contractures
- Method of fixation
- Structural deformities (ie. valgus, varus)

**Contraindications**

- Sepsis
- Remote infection
- Dysfunction of extensor mechanism
- Severe vascular disease
- Recurvatum deformity

**Obesity and TKA**

- A recent literature review showed that there is increased risk in complications for morbibly obese patients after going through total knee replacement.
- These patients should be advised to lose weight before surgery and, if medically eligible, would probably benefit from bariatric surgery.

**Nutrition and TKA**

- Glucosamine and chondroitin sulfates are two nutritional supplements currently being studied to determine their usefulness in treating OA.
  - Components of normal cartilage.
  - Available in pharmacies and health food stores without a prescription.
  - Appear to stimulate chondrocytes to make new collagen and proteoglycans.
  - Thought that they may be able to help the body repair cartilage damaged by OA.
  - Most studies done in vitro.
  - Supplements marketed under different names, with different strengths/levels of purity.
Surgical Techniques

- Exposure of anterior knee
  - Detachment of VMO, displacement of patella
- Bones cut to shape
- Articular cartilage, meniscus and ACL are removed
- LCL and MCL are spared, PCL can be spared
- Articular surface of patella can be replaced or spared
- Cemented vs. cement-less fixation
- Removal of PCL shown to reduce maximal force individual can place on knee
- Minimally invasive procedures exist, no long-term benefits proven

Surgical Techniques

- The argument as to whether knee ligaments should be preserved or sacrificed continues to this day.
- Long-term follow-up studies do not show any significant differences, although gait appears to be less abnormal if ligaments are preserved, especially when walking up and down stairs.
- One theoretical way of incorporating normal kinematics and maximal conformity is with mobile tibial bearings. Current midterm follow-up studies of these prostheses have so far shown encouraging results.

Unicompartmental (UKA)

- Partial knee replacement
- Advantages
  - Smaller incision
  - Less post-op pain
  - Greater ROM
  - Shorter hospital stay
  - Easier revision
- TKA more reliable long-term

Pre-operative Care

- Patient education on procedure
- HEP review
- Hip, knee, ankle strengthening
- Balance & proprioception
- ROM/flexibility
- Assistive device training
  - Walker (RW or SW)
  - Crutches
  - QC/SPC

Goals of Rehabilitation

- Objective
  - ROM
  - Strength
  - Joint mobility
  - Effusion
  - Tenderness
  - Flexibility
  - Gait
- Subjective
  - Pain
  - ADL’s
  - Return to work
  - Recreation
Phases of Rehabilitation

- Acute
- Sub acute
- Functional

Acute Phase

- Wound care
  - Type of closure
    - Staples, Adhesives, Suturing
  - Sponge bathe ~2 wks
  - Shower ~24-48 hrs after staples removed
  - Steri-strips ~10 days
  - Keep incision clean and dry
  - No creams or lotions

- Patellar mobility
  - Manual therapy
  - Self-mobilizations

- Control effusion/hemarthrosis
  - Ankle pumps
  - Elevation
  - Cryotherapy
  - Compressive dressings

- Flexibility
  - Calf
  - Hamstring
  - Help to gain TKE
    - Pain
    - Gait
    - Quad function

- Quadriceps function
  - NMES vs. Biofeedback
  - Quad setting
    - Diff angles
  - SLR's
Acute Phase

• NMES Protocol Guidelines
  – Electrodes placed over proximal lateral quadriceps and distal medial quadriceps
  – Parameters: 2500Hz, 75 bursts, 2 second ramp, 12 second on, 50 second off, intensity to maximum tolerable or at least 30% of the maximum volitional isometric contraction (MVIC), 10 contractions per session
  – 3 sessions per week until quadriceps strength MVIC is 70% of uninvolved.
  – Performed isometrically at 60 degrees of knee flexion

• Early motion
  – 0-90 by wk 2
  – CPM
  – Heel slides
  – Wall slides
  – Exercise bike

• RCT by Labraca et al found that commencing early movement in the first 24 hours after surgery allows for early mobilization and discharge from the hospital.

Sub-acute Phase

• Flexibility
  – Static stretching
  – Active stretching
  – PNF/manual techniques
  – Self-myofascial release (SMR)
    • Foam roller
    • Rolling stick
    • Can allow what the joint won’t
  – Quad, ITB, hip flexor

• ROM
  – 0-120 by wk 6
  – Passive stretch
    • Prone/seated hang w/ BF
  – Manual stretch
  – Hydraulic/pneumatic flexion and/or extension devices
  – Tibio-femoral joint mobilizations
  – Scar massage (distal 1/3)
  – Retro-walking

• Advanced quad strengthening
  – Resisted SLR/SAQ
  – Chair squats
  – Wall squats
  – Closed chain TKE
  – Lunges
Sub-acute Phase

- Hip and core strengthening
  - Abs, glutes, hip rotators, hip flexors
  - Isometrics
  - 4-way SLR
  - Bridges
  - TA isometrics
  - Resistance band

Sub-acute Phase

- Balance & proprioception
  - Weight shifting
  - SLB
  - Tiltboard
  - Multi-plane balance
  - Lateral stepping
  - Perturbations

Sub-acute Phase

- Aerobic conditioning
  - Walking
  - Incline walking
  - Exercise bike
  - Elliptical
  - Aquatic therapy

Functional Phase

- ADL/Functional training
  - Sit-stands
  - Stair negotiation (eccentric)
  - Sport specific exercise

Long-term Outcomes

- Recommended activities
  - Golfing
  - Bowling
  - Walking
  - Rowing
  - Cross-country skiing
  - Bicycling

- Rock climbing/hiking
- Downhill skiing
- Dancing
- Aerobics

Long-term Outcomes

- Activities to avoid
  - Football
  - Basketball
  - Baseball/softball
  - Tennis
  - Racquetball
  - Jogging
  - Volleyball

- Possible activities
  - Horseback riding
  - Ice/inline skating
### Long-term Outcomes

- Long-term studies confirm satisfactory functional scores and show a 91-96% prosthesis survival rate at 14-15 years of follow-up.
- No difference appears to exist between posterior cruciate ligament (PCL)-retaining and PCL-substituting designs.
- Cementless designs do not have the same length of follow-up, but studies at 10-12 years report a 95% prosthesis survival rate.

### Complications

- Thromboembolism
- Periprosthetic fractures
- Patellofemoral complications
- Neurovascular complications
- Aseptic loosening
- Arthrofibrosis
- Infections

### DVT

- Overall incidence of DVT following total knee replacement without any prophylaxis has been reported at 40-88%.
- Most of these are calf thromboses.
- The risk of fatal PE, however, is the important figure and varies from 0.1-1%.

### Wells CPR for DVT

<table>
<thead>
<tr>
<th>Factor</th>
<th>Wells Score</th>
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<tbody>
<tr>
<td>Active cancer (treatment ongoing, within previous 6 mo, or palliative)</td>
<td>+1</td>
</tr>
<tr>
<td>Paralysis, paresis, or recent plaster immobilization of the lower extremities</td>
<td>+1</td>
</tr>
<tr>
<td>Recently bedridden &gt;3 days or major surgery within 12 wk requiring general or regional anesthesia</td>
<td>+1</td>
</tr>
<tr>
<td>Localized tenderness along the distribution of the deep venous system</td>
<td>+1</td>
</tr>
<tr>
<td>Entire leg swelling</td>
<td>+1</td>
</tr>
<tr>
<td>Calf swelling &gt;3 cm larger than the asymptomatic side (measured 19 cm below the tibial tuberosity)</td>
<td>+1</td>
</tr>
<tr>
<td>Pitting edema confined to the symptomatic leg</td>
<td>+1</td>
</tr>
<tr>
<td>Collateral superficial veins (inversion)</td>
<td>+1</td>
</tr>
<tr>
<td>Alternative diagnosis at least as likely as deep vein thrombosis</td>
<td>-1</td>
</tr>
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### Fractures

- Supracondylar fractures of the femur are not common following TKA (ie, 0.2-1%).
- Treatment is with internal fixation or revision TKA.
- Tibial fractures are uncommonly observed.

### Aseptic Loosening

- Loosening leads to the ultimate failure of the prosthesis and occurs in approximately 5-10% of patients at 10-15 years.
- Once a component is loose, it becomes mechanically unstable with worsening osteolysis.
- Treatment is revision with bone grafting.
Arthrofibrosis

- Excessive scar tissue causing restriction of knee movement.
- Occurs in less than 1% of patients.
- Conservative management includes anti-inflammatory medication, physiotherapy.
- Aggressive treatment includes manipulation under anesthetic with CPM therapy and excision of scar tissue.

Infection

- While it is relatively rare, periprosthetic infection is one of the most challenging complications of TKA.
- A detailed clinical history and physical examination are the most reliable tools to recognize infection.
- Fever, chills, painful joint, and a draining sinus may be present.
- Aspiration of the joint has the highest specificity for confirming infection.

Thank you!

References