

Total knee replacement

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Total knee replacement in some form has been practiced for over 50 years. The complexities of the knee joint only began to be understood 30 years ago. Because of this, total knee replacement initially was not as successful as Sir John Charnley's artificial hip. However, over the last 20 years, dramatic advancements in the knowledge of knee mechanics have led to design modifications that appear to be durable. Significant advances have occurred in the type and quality of the metals, polyethylene, and more recently, ceramics used in the prosthesis manufacturing process, leading to improved longevity. As with most techniques in modern medicine, more and more patients are receiving the benefits of total knee arthroplasty (TKA).

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.

Problem: Patients with painful, deformed, and unstable knees secondary to degenerative or inflammatory conditions need a prosthesis that provides reproducible pain relief and improvement in function. The morbidity and complications from the procedure should be minimal. The complexities of a normal knee joint, however, are not reproducible with modern techniques, and patients should understand that they will not have a normal knee. The prosthesis should be durable, requiring patients to undergo only one definitive procedure in their lifetime, although this may simply be unrealistic in younger patients.

Etiology: Osteoarthritic destruction of the knee is the most common reason for total knee replacement. This is a disease of synovial joints, characterized by degenerative and reparative processes, and is observed in 40% of 40-year-old patients on radiographic examination. However, only 50% of these patients are symptomatic. Osteoarthritis may be primary or secondary. Mechanical derangements (eg, previous meniscal or cruciate ligament damage), pyogenic infection, ligamentous instability, fracture into a joint [see Image 2]) are among the common causes of the secondary type. Other causes of cartilage destruction include rheumatoid arthritis, hemophilia, seronegative arthritides, crystal deposition diseases, pigmented villonodular synovitis, idiopathic or steroid-induced avascular necrosis, and rare bone dysplasias.

Recent studies into risk factors for severe osteoarthritis of the hip and knee have revealed that siblings of individuals undergoing joint replacement are 3-5 times more likely to require similar surgery than age-matched controls. This means that genes contribute around 30% of the overall risk for severe osteoarthritis. Laboratory-based studies have shown that chromosome 11 is linked to severe osteoarthritis of the hip and chromosome 2 to severe osteoarthritis of the knee.

Pathophysiology: The exact cause of the degenerative process in primary osteoarthritis is unknown. It may represent a defect in cellular (chondrocyte) repair processes. Osteoarthritic cartilage contains increased amounts of water; alterations in the type of proteoglycan; type II collagen abnormalities; and increased levels of cathepsins, metalloproteinase, interleukin-1, and others as a complex cascade of enzymatic process. Changes in the synovium include synoviocyte hyperplasia, an increased leukocyte population in the membrane and fluid, occasional giant cells, neovascularization with increased vessel permeability, and altered matrix and cellular cytokine formation.

Clinical: Clinical history in a patient with arthritis of the knee is dominated by pain. This predominantly occurs on weightbearing but in the end stages may be constant and unrelieved by rest. Night pain is a particularly disabling symptom that demands urgent attention. The pain may be localized to one compartment or may be diffuse. Other symptoms include stiffness, swelling, locking, and giving way. The level of pain is quantified on a simple scale (eg, mild, moderate, severe; numerical scale of 1-10) and an assessment of how the patient's activities of daily living (ADL) are affected is made. The patient is asked about maximum walking distance, recreational sporting ability and aspirations, stair climbing (which often gives clues about patellofemoral disease), the need for walking aids, the ability to dress and perform self-care, and the ability to perform activities that require knee flexion. Some patients may have considerable interference with social interaction, sexual function, and sleep and may experience exhaustion and even depression from their disease.

Various structured outcome evaluations can be used to try to quantify disability from dysfunction of the knee and are useful as research tools in follow-up studies of total knee replacement. These include general health status measures (eg, Medical Outcomes Short Form 36 [SF 36]) or specific knee scoring systems.

The overall mortality rate from a total knee replacement is less than 1%, but this figure increases with age, male sex, and the number of preexisting medical conditions. Identification and optimization of such conditions prior to surgery is important to reduce perioperative complications.

An assessment of the patient's social circumstances is important for organization of postoperative rehabilitation and placement.

Examination should include assessment of scars or soft tissue defects around the knee. A plastic surgeon consultation is required if wound healing is predicted

to be a problem. Similarly an accurate assessment of the vascular status to the limb is important. Chronic local or systemic infection should be identified and treated.

INDICATIONS

The primary indication for TKA is to relieve pain caused by severe arthritis. The pain should be significant and disabling. Night pain is particularly distressing. If dysfunction of the knee is causing significant reduction in the patient's quality of life, this should be taken into account. Correction of significant deformity is an important indication but is rarely used as the primary indication for surgery. Roentgenographic findings must correlate with a clear clinical impression of knee arthritis. Patients who do not have significant loss of joint space tend to be less satisfied with their clinical result following TKA. Exhaust all conservative treatment measures before considering surgery.

Knee replacement has a finite expected survival that is adversely affected by activity level. It is indicated in older patients with more modest activities but also in younger patients who have limited function because of systemic arthritis with multiple joint involvement. Young patients requesting knee replacement, especially those with posttraumatic arthritis, are not excluded by age but must be significantly disabled and must understand the inherent longevity of joint replacement. Rarely, severe patellofemoral arthritis may justify arthroplasty because the expected outcome of arthroplasty is superior to patellectomy. Isolated patellofemoral replacement has good mid-term results.

Deformity can sometimes become the principal indication for knee replacement in patients with moderate arthritis when flexion contracture or varus or valgus laxity is significant. In such cases, often a more constrained prosthesis is required, leading to greater technical difficulty in surgery and more uncertain long-term survival.

Contraindications: Absolute contraindications to total knee replacement include knee sepsis, a remote source of ongoing infection, extensor mechanism dysfunction, severe vascular disease, recurvatum deformity secondary to muscular weakness, and the presence of a well-functioning knee arthrodesis. Relative contraindications include medical conditions that preclude safe anesthesia and the demands of surgery and rehabilitation. Other relative contraindications include skin conditions within the field of surgery (eg, psoriasis), a past history of osteomyelitis around the knee, a neuropathic joint, and obesity. end