Total Knee Arthroplasty

Disclaimer: This background information is not intended to be a comprehensive scientific discussion of the topic, but rather an attempt to provide a baseline level of information for anyone unfamiliar with the subject matter.

Background:

Total Knee Arthroplasty

Knee replacement, or knee arthroplasty, is a common surgical procedure most often performed to relieve the pain and disability from degenerative arthritis, most commonly osteoarthritis, but other arthritides as well. Major causes of debilitating pain include meniscus tears, osteoarthritis, cartilage defects, and ligament tears.

Knee replacement surgery can be performed as a partial or a total knee replacement. In general, the surgery consists of replacing the diseased or damaged joint surfaces of the knee with metal and plastic components shaped to allow continued motion of the knee.

Technique

The surgery involves exposure of the front of the knee, with detachment of part of the quadriceps muscle from the patella. The patella is displaced to one side of the joint allowing exposure of the distal end of the femur and the proximal end of the tibia. The ends of these bones are then accurately cut to shape using cutting guides oriented to the long axis of the bones. The cartilages and the anterior cruciate ligament are removed; the posterior cruciate ligament may also be removed but the collateral ligaments are preserved. Metal components are then impacted onto the bone or fixed using polymethylmethacrylate (PMMA) cement. A round-ended implant is used for the femur, mimicking the natural shape of the bone. On the tibia the component is flat, although it often has a stem which goes down inside the bone for further stability. A flattened or slightly dished high-density polyethylene surface is then inserted onto the tibial component so that the weight is transferred metal to plastic not metal to metal. During the operation any deformities must be corrected, and the ligaments balanced so that the knee has a good range of movement and is stable. In some cases the articular surface of the patella is also removed and replaced by a polyethylene button cemented to the posterior
surface of the patella. In other cases, the patella is replaced unaltered.

Variations

There are many different implant manufacturers and all require slightly different instrumentation and technique. No consensus has emerged over which design of knee replacement is the best. Clinical studies are very difficult to perform requiring large numbers of cases followed over many years. The most significant variations are between cemented and uncemented components, between operations which spare or sacrifice the posterior cruciate ligament and between resurfacing the patella or not. Some also study patient satisfaction data associated with pain.

Minimally invasive procedures have been developed that do not require dramatic cuts to and through the quadriceps femoris muscle, reducing post-operative pain and disability. This type of less invasive procedure is done by using gender-specific or patient-specific knee implants that fit the knee better and more precisely, and have better long-term affects on the patient.

Partial knee replacement

Unicompartmental arthroplasty (UKA), also called partial knee replacement, is an option for some patients. The knee is generally divided into three "compartments": medial (the inside part of the knee), lateral (the outside), and patellofemoral (the joint between the kneecap and the thighbone). Most patients with arthritis severe enough to consider knee replacement have significant wear in two or more of the above compartments and are best treated with total knee replacement. Some patients have wear confined primarily to one compartment, usually the medial, and may be candidates for unicompartmental knee replacement. Advantages of UKA compared to total knee replacement (TKA) include smaller incision, easier post-op rehabilitation, shorter hospital stay, less blood loss, lower risk of infection, stiffness, and blood clots, and easier revision if necessary.

Pre-operative preparation

Before the surgery is performed, pre-operative tests are done: usually a complete blood
count, electrolytes, APTT and PT to measure blood clotting, chest X-rays, ECG, and blood cross-matching for possible transfusion. Accurate X-rays of the affected knee are needed to measure the size of components which will be needed. Medications such as warfarin and aspirin will be stopped some days before surgery to reduce the amount of bleeding. Patients may be admitted on the day of surgery if the pre-op work-up is completed in advance.

**Post-operative rehabilitation**

Protected weight bearing on crutches or a walker is required until the quadriceps muscle has healed and recovered its strength. Continuous Passive Motion is commonly used postoperatively. Hospitalization varies depending on the health status of the patient and the amount of support available outside the hospital setting. Usually full range of motion is recovered over the first two weeks. At approximately six weeks patients have usually progressed to full weight bearing with a cane. Complete recovery from the operation involving return to full normal function may take three months and some patients notice a gradual improvement lasting many months longer than that.

**Risks and complications**

According to the American Academy of Orthopedic Surgeons, blood clots in the leg veins are the most common complication of knee replacement surgery. A prevention program is usually implemented, which may include periodic elevation of legs, lower leg exercises to increase circulation, support stockings and medication to thin the blood.

Periprosthetic fractures can occur with the aging patient population either intraoperatively or postoperatively.

The knee at times may not recover its normal range of motion (0 - 135 degrees usually) after total knee replacement. Much of this is dependent on pre-operative function. Most patients can achieve 0 - 110 degrees, but stiffness of the joint can occur. In some situations, manipulation of the knee under anesthetic is used to improve postoperative stiffness.

In some patients, the kneecap is unstable post-surgery and dislocates to the outer side of
the knee. This is painful and usually needs to be treated by surgery to realign the kneecap; however, this is quite rare.

In the past, there was a considerable risk of the implant components loosening over time as a result of wear. As medical technology has improved however, this risk has fallen considerably. Knee replacement implants can last up to 20 years in many patients; whether or not they actually last that long depends largely in part upon how active the patient is after surgery.

**Infection**

While it is relatively rare, periprosthetic infection remains one of the most challenging complications of joint arthroplasty.

**Supporting Evidence:**


B. Institute for Clinical Systems Improvement Health Care Order Set: Preoperative Total Hip and Total Knee Arthroplasty, 2006. An evidence based order set, which covers the preoperative care of adults for elective total hip and total knee arthroplasty beginning at hospital admission prior to surgery and does not include preoperative and screening orders from the physician office.

C. Institute for Clinical Systems Improvement Health Care Order Set: Postoperative Total Hip and Total Knee Arthroplasty, 2006. An evidence based order set, which covers the postoperative care of adults for total hip and total knee arthroplasty and does not include discharge orders.

D. Institute for Clinical Systems Improvement Protocol: Perioperative Protocol, 2009. An evidence based protocol, which describes the steps performed throughout the perioperative period that are necessary to prevent wrong site, wrong patient, or wrong procedure as well as to prevent surgical site infection and prevent the unintentional retention of a foreign object.

E. Institute for Clinical Systems Improvement Protocol: Venous Thromboembolism Prophylaxis. An evidence based guideline, which addresses
risk assessment for venous thromboembolism, risk assessment for bleeding, and mechanical and pharmacologic therapies to reduce the occurrence of venous thromboembolism in adult hospitalized patients.


H. Steps to reduce surgical risk. In: I guidelines for perioperative evaluation. Brazilian Society of Cardiology. 2007. 7 pages. NGC:006322. Guideline with objectives 1) To refine and unify the terminology used by the entire multidisciplinary team, including the patients and their family and 2) To establish new routines, change indication for surgery according to the information obtained during the perioperative evaluation.


Areas of Current Clinical Review and Discussion:

- Anticoagulation management postoperatively
- Surgical technique selection
- Prosthesis selection

Basket of Care Scope samples:

- Adults with first-time elective unilateral total knee arthroplasty including preoperative screening, hospital care, and postoperative rehabilitation.
- Adults, without other co-morbid conditions, with first-time unilateral elective total knee arthroplasty including preoperative screening, hospital care and postoperative rehabilitation for 90 days.