CHAPTER 11
The Knee Joint

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INTRODUCTION
This chapter excludes sport injuries to the knee; these are discussed in Chap. 17.

The goals of reconstructive surgery of the knee in adults are to maintain optimal function, minimize disability, and remove pain. All the joints of the lower extremity participate in locomotion. Pathologic conditions that affect the knee impair normal daily activities and the ability to walk. The broad spectrum of pathologic conditions affecting the knee includes soft tissue injuries to the ligamentous structures that provide stability, meniscal injuries, and arthritic conditions. This chapter focuses mainly on the degenerative arthritic conditions that affect the knee in adults. Ligamentous and meniscal injuries are discussed in the Chap. 17. The number of patients with pain and disability from arthritic conditions of the knees is increasing, as are the expectations of those who wish to maintain active lifestyles. Approximately 300,000 knee replacements are performed each year in the United States. The goal in treating these disorders is to optimize function and mobility while minimizing surgical risks.

ANATOMIC CONSIDERATIONS
Developmental Anatomy
The knee forms between 5 and 7 weeks of gestation. The combined distal femoral and proximal tibial growth plates provide approximately 65 percent of the growth to the lower limb. The proximal tibial physis accounts for 60 percent of the tibial growth. The distal femoral physis contributes to 70 percent of the femoral growth. Limb growth is complete at approximately 13 to 15 years of age in females and 16 to 18 years of age in males.

Gross Anatomy
The knee has a rich anastomotic vascular network. The descending genicular artery branches from the femoral artery before it crosses the adductor hiatus and gives rise to the articular branch (crosses the vastus medialis muscle) and the saphenous branch (travels between the vastus medialis muscle and the sartorius muscle with the saphenous nerve). The superior medial genicular and superior lateral genicular arteries branch from the popliteal artery and pass around the distal femur superficial to the origins of the gastrocnemius muscle. The middle genicular artery branches from the popliteal artery and penetrates the posterior capsule to supply the cruciate ligaments. The inferior medial genicular artery branches from the popliteal artery and courses deep to the hamstring tendons and the medial collateral ligament approximately 2 cm distal to the joint line. The inferior lateral genicular artery travels immediately adjacent to the lateral joint line deep to the lateral collateral ligament. The genicular arteries passing anterior to the knee form a peripatellar anastomosis with additional contributions from the descending branch of the lateral femoral circumflex artery, anterior tibial recurrent artery, and circumflex fibular artery. During a standard medial parapatellar approach to the knee, the superior medial, inferior medial, and inferior lateral genicular arteries are compromised.

The knee has afferent fibers from the tibial nerve, common peroneal nerve, posterior branch of the obturator nerve, and femoral nerve. The posterior articular nerve branches from the tibial nerve, piercing the superior oblique ligament, with the middle genicular artery
supplying the posterior capsule, meniscal structures, and cruciate ligaments. The femoral nerve branches supply the quadriceps muscles and send branches to the superior articular capsule. The common peroneal nerve gives rise to the lateral articular nerve and recurrent peroneal nerve, which innervates the inferolateral capsule/lateral collateral and the anterolateral capsule, respectively. The infrapatellar branch of the saphenous nerve courses along the superior border of the pes anserine to supply the skin over the anteroinferior aspect of the knee. Anesthesia and paresthesia in the distribution of the infrapatellar branch are common after a standard medial parapatellar approach.

The synovial cavity extends approximately 6 to 8 cm above the superior pole of the patella. The collateral ligaments provide coronal plane stability. The medial collateral ligament consists of superficial and deep portions that extend from the medial upper condyle of the distal femur to the subperiosteum of the medial side of the proximal tibia. The semimembranosus contributes to the medial stabilizing complex, as do the tendon insertions of the sartorius, gracilis, and semitendinosus. The lateral-sided structures, provide stability in the coronal plane. The iliotibial band inserts on Gerdes tubercle (lateral to the tibial tubercle) and provides stability in extension. The lateral collateral ligament provides stability in both flexion and extension, and the popliteus muscle contributes to stability, particularly in flexion. The posterolateral corner includes the capsular thickening (arcuate complex) and provides lateral stability, particularly in extension.

The anterior and posterior cruciate ligaments are intraarticular extrasynovial structures, which provide rotational and sagittal plane stability to the knee. The anterior cruciate ligament is the primary structure that resists anterior translation of the tibia and plays a secondary role in resisting external rotation of the tibia. The anterior cruciate ligament (ACL) has free nerve endings and mechanoreceptors that play a role in proprioception (derived from the posterior articular branch from the tibial nerve).

Meniscal structures have a fibrocartilaginous composition with a reasonably good peripheral blood supply, a “watershed” area, and a poor blood supply in the center. Afferent innervation mirrors the distribution of the vascular supply. The medial meniscus is attached to the deep medial collateral ligament and is semilunar in shape. The lateral meniscus is more circular and mobile, with an absence of direct connection with the lateral collateral ligament. The popliteal hiatus, located in the posterolateral aspect of the joint, coincides with an area of the lateral meniscus that has no attachment.

The proximal tibial plateau is relatively flat compared to the distal femur. The lateral tibial plateau is convex and the medial tibial plateau is concave. The meniscal structures act as an interposition between the relatively round femoral condyles and relatively flat tibial condyles to help distribute weight more evenly across the articulation. The mobility of the lateral meniscus accommodates the greater posterior translation of the contact point between the lateral femoral condyle and the lateral tibial plateau as the knee moves from an extended to a flexed position.

**BIOMECHANICS OF THE JOINT**

The axis of motion is not a true hinge. The motion of the knee joint is a combination of rolling and gliding movements, which create an instant center of rotation that changes through a range of motions. The translation between the femur and the tibia is greatest in the lateral compartment compared to the medial compartment as the knee goes from an extended to a flexed position. This posterior translation (“rollback”) of the femur relative to the tibia is important to obtain higher degrees of knee flexion. The posterior translation allows the distal femur to complete terminal flexion without impingement from the posterior tibia. In addition to the translation of the femur on the tibia, there is approximately 10 degrees of rotational change through the range of motion. As the knee goes from 10 to 30 degrees of flexion to full extension, there is an external rotation of the tibia of about 5 degrees. The cruciate ligaments assist in this guided motion. The ACL provides most of the restraint to anterior translation of the tibia with the knee at 30 degrees of flexion. The posterior cruciate ligament (PCL) provides resistance to posterior translation of the tibia in flexion. Normal knee motion is from 2 to 3 degrees of hyperextension to flexion of 140 degrees. During walking, the maximum flexion is usually less than 70 degrees; in climbing stairs, the maximum flexion is approximately 95 degrees.

**ETIOLOGY AND EPIDEMIOLOGY**

Arthritis of the knee joint is defined by loss of the hyaline cartilage at the end of the femur and tibia, leading to contact between the subchondral bones. Arthritis can be primary or secondary. Primary osteoarthritis of the knees is more common in women than men and seems to be associated with obesity. There is a genetic predisposition to primary arthritis, and the typical age of presentation is in the sixth to eighth decades of life.

Secondary osteoarthritis may be due to traumatic conditions (tibial plateau fractures or ligamentous ruptures around the knee), meniscal injuries, previous surgical procedures, pigmented villonodular synovitis, and inflammatory conditions involving the knee (rheumatoid arthritis, lupus, psoriasis, gout, pseudogout). Chondrocalcinosis
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PATHOPHYSIOLOGY

The most common location of primary osteoarthritis of the knee is in the medial compartment. The wear tends to occur initially at the anteromedial aspect of the proximal tibia when the ACL is functioning. The wear pattern is generally posteromedial in patients with a deficient ACL. With the progressive varus deformity that results from loss of articular cartilage in the medial compartment, there is contact between the lateral femoral condyle and the tibial spines, leading to wear patterns in the central portion of the knee joint. This is often associated with changes in the articulation of the patellofemoral joint and subsequent patellofemoral osteoarthritis.

Primary osteoarthritis of the knee can also occur in the lateral compartment and is often associated with hypoplasia of the lateral femoral condyle. Valgus deformities are often associated with lateral tracking of the patella, increased femoral anteversion, and tibial torsion. In varus osteoarthritis, the ligamentous structures of the opposite compartment have normal tension and length; whereas in valgus osteoarthritis, the medial collateral ligament of the opposite medial compartment usually becomes lax as the deformity worsens. Laxity of the medial structures can be a source of pain preoperatively and makes the surgical treatment more difficult.

SURGICAL PROCEDURE

Arthroplasty

Patient Selection/Indications

Arthroplasty of the knee includes procedures that resurface the distal femur and proximal tibia to prevent pain generated by bone-on-bone articulation. The options for resurfacing the knee joint include unicompartment knee arthroplasty and total knee arthroplasty. Total knee replacements retain the PCL, sacrifice the PCL, or replace it with an implant. All total knee replacements remove the ACL if it is still present.

The decision for knee arthroplasty should be made before the decision for a total or partial arthroplasty. Knee replacements are generally undertaken when the cartilage in at least one compartment is absent and the radiographs show bone-on-bone contact. When these criteria are met, decisions to proceed with surgical treatment are based on the patient’s disability and pain. Great care must be taken in evaluating knee pain. Other sources of knee pain may be soft tissue instability, patellofemoral pain, hip pathology, lower back pathology, fibromyalgia, and other myofascial pain syndromes. If an arthroplasty is performed prematurely in the course of a disease or for an indication other than loss of articular cartilage, patients may be potentially worse off than before surgery. Some authors have described this condition as the “imperfect knee syndrome.”

Unicondylar knee arthroplasties involve resurfacing the most involved compartment of the knee joint; this may be an option in a small subset of patients with isolated compartment arthritis without inflammatory disease. The ideal candidate for a unicompartment knee arthroplasty is generally a low-demand, older person of normal weight with single-compartment arthritic symptoms and an otherwise well-functioning knee with good range of motion and mild to moderate deformity. These operations can be performed for medial and lateral compartment disease, but they are more commonly performed for medial compartment disease owing to its higher frequency overall.

The advantages of a unicompartment knee arthroplasty are the retention of both cruciate ligaments, leaving a knee that functions with more normal kinematics. In addition, less invasive exposures are required during placement and the range of motion is generally higher after a unicompartment compared to a total knee replacement. Disadvantages are the potential for mechanical loosening and disease progression in the other compartments, leading to a less durable outcome than with total replacement.

Although controversial, mainstream indications include unicompartmental disease without contralateral tibiofemoral disease in a patient with good range of motion, focal symptoms in the involved compartment, and functioning cruciate ligaments. Relative contraindications to unicompartment knee arthroplasty are significant patellofemoral symptoms, ACL deficiency, knee flexion contracture of more than 5 degrees, subluxation, a highly active patient, and obesity.

There has been increased use of unicompartment knee arthroplasties for a subset of the population who are younger and more active. Many authors have doubts about the use of these devices in this patient population. The use of these arthroplasties in a younger patient population may be thought of as a bridge to delay a total knee replacement. High tibial osteotomy should be considered in younger patients with higher activity levels.

Early Treatment for Arthritis

Early treatments for knee arthritis include activity modification, orthotic devices to alter the mechanics of the
weight-bearing axis through the knee, anti-inflammatory medications, acetaminophen, and occasionally intraarticular injections. When these conservative treatments have been exhausted and the patient's disability and pain have increased, an arthroplasty procedure may be indicated.

Surgical Technique

**Positioning and Tourniquet**

The patient is usually positioned supine on the operating table. A tourniquet is commonly used during the procedure to minimize intraoperative blood loss, but some controversy exists as to the potential consequences, particularly in patients with risk for neuropathic pain, as in diabetes and vascular disease. Many surgeons choose to perform a knee arthroplasty without a tourniquet in patients with neuropathic pain or radiographic evidence of vascular calcifications. The duration and pressure of the tourniquet correlate with a potential for neurologic injury.

**Exposure**

Exposure of the knee for an arthroplasty is an anterior longitudinal incision over the knee exposing the extensor mechanism (Fig. 11-1). It is important to maintain the blood supply of the anterior skin flaps by minimizing dissection between the deep fascial plane and the overlying skin. Elevation of these flaps deep to the fascia will help maintain the viability of the skin flaps. This is particularly important when patients have had several previous knee operations. Every effort should be made to incorporate previous incisions so as to avoid skin necrosis.

The knee joint can be exposed through a quadriceps-splitting approach, the mid-vastus muscle-splitting approach, or a subvastus approach. Each of these exposures has advantages and disadvantages. The advantage of the quadriceps-splitting approach is a relatively atraumatic plane within the quadriceps tendon, allowing excellent exposure of the knee joint. This is historically the most commonly utilized knee exposure. There have been proponents of midvastus exposure, which extends from the medial side of the tibial tubercle along the medial side of the patella and veers in a medial superior direction through the midportion of the vastus medialis muscle. The potential advantage of this approach is to maintain the integrity of the quadriceps tendon. Disadvantages to this approach include muscle splitting and potential denervation of a portion of the vastus medialis muscle. A subvastus approach is one that elevates the entire quadriceps mechanism from the medial border of the vastus medialis muscle. The disadvantage of this approach is increased blood loss and limited exposure.

All of the medial exposures compromise the vascular supply to the patella from the superior medial geniculate and inferior geniculate arteries. Once the arthrotomy is performed through the medial side of the patella, the soft tissue structures on the medial proximal tibia are elevated in a subperiosteal plane to allow anterior translation and external rotation of the tibia relative to the femur, thus providing improved exposure. The medial release is larger in a varus knee than a valgus knee, which helps balance the tight medial structures at the completion of the arthroplasty. Traditionally, a portion of the infrapatellar fat pad is excised to allow adequate exposure of the knee joint. The patella may or may not be resurfaced (in the United States, the patella is most often resurfaced). The patella has traditionally been everted to provide access to the medial and lateral compartments of the tibiofemoral joint. Some surgeons have proposed avoiding a patellar eversion in order to minimize soft tissue tension within the extensor mechanism and thus improve short-term recovery.

A lateral parapatellar approach can be used for a valgus knee. The advantages of the lateral approach are that it minimizes release of the medial stabilizing structures and that it releases the lateral patellar retinaculum of the patella as part of the exposure. The disadvantages of the
lateral approach are an inability to subluxate the tibia for exposure, difficulty closing the capsule following arthroplasty, the occasional need for a tibial tubercle osteotomy to improve exposure, and difficulty of a revision procedure through the same approach. Most surgeons choose a medial exposure for all joint replacements.

There has been a trend toward promotion of minimally invasive techniques and exposures for total knee replacement. Various authors have suggested that modifications of these traditional approaches are less intrusive in the suprapatellar cavity and less traumatic to the extensor mechanism.

**Bone Preparation and Implantation**

The sequence of bone cuts varies according to the surgeon’s preferences. The goals of the surgery are to create a joint line that is parallel to the floor; thus, the tibia is cut parallel to the axis of the tibial shaft. This axis lies medial to the midpoint between the lateral and medial malleoli such that, on a radiograph, the axis passes through the center of the talus. The level of the resection of the proximal tibia is determined by the anticipated restoration of the composite tibial component. (For example, a composite tibial component of 10 mm would require a resection of the proximal tibia in the uninvolved compartment of approximately 10 mm.) The distal femur is resected such that the resection is perpendicular to the mechanical axis of the femur, which extends from the center of the femoral head rotation to the center of the distal femur. The combination of a tibial cut parallel to the floor and perpendicular to the mechanical axis of the femur results in a limb alignment that is mechanically neutral.

The alignment of these cutting jigs to the bones can be made with extramedullary or intramedullary alignment. The most common alignment for the femur is intramedullary and the most common alignment for the tibia is extramedullary. The advantage of intramedullary alignment on the femur is more accurate placement due to limitations in identifying landmarks intraoperatively. The disadvantages of intramedullary alignment relate to increased risk of fat embolism and its systemic effects. On the tibial side, extramedullary alignment is more easily achieved because these anatomic landmarks are readily palpable intraoperatively.

The remaining distal femoral cuts are based on the implant dimensions and the choice of sacrificing a retaining knee arthroplasty. Retention or substitution of the PCL is very controversial; excellent short- and long-term outcomes have been shown with both techniques. Those who support retention of the PCL argue that less bone is resected from the intercondylar notch, more normal movement is retained, and there is potential retention of afferent proprioception from the retained ligament. In general, a knee replacement that retains the PCL is less tolerant to changes in the level of the reconstructed joint line, and studies have shown paradoxical anterior translation of the femur relative to the tibia with flexion. Surgeons who remove the PCL believe that substitution for the function of the PCL with the implant is more predictable and minor changes in the joint line location are better tolerated.

**Revision**

The concepts in revision knee arthroplasty are similar to those in primary knee replacement. However, in the former, intramedullary stems are generally utilized as part of the reconstruction. Therefore both the femoral and tibial cuts are often based on intramedullary alignment. The goals of creating neutral mechanical alignment are the same in primary and revision operations. Most revision operations utilize metal augment to replace lost bone. The stem extensions into the metadiaphyseal regions of the tibia and femur may be cemented or uncemented.

Exposure for revision operations is more complex and often requires supplemental techniques to improve exposure when motion is limited and/or periarticular scars are excessive. Most of these exposure issues relate to management of the extensor mechanism. Options include extending the incision into the quadriceps tendon superior and lateral “quadriceps snip”, extending the incision into the quadriceps tendon in a V-shaped fashion toward the lateral inferior aspect of the extensor mechanism (“quadriceps turn-down”), or a tibial tubercle osteotomy. In revision operations, various degrees of ligamentous insufficiency may be encountered. To cope with this, there is a graduated level of constraints in implants based on different specifications by the manufacturers. These may vary from a semiconstrained to a fully constrained hinge implant.

**Comorbidities**

As with total hip arthroplasty, patients with end-stage osteoarthritis of the knee often have comorbidities that must be addressed in the perioperative period so as to reduce complications. Comorbidities include cardiopulmonary disease, diabetes, hypertension, and obesity (see Chap. 10). Many patients with arthritis have been treated with anti-inflammatory drugs and may have gastrointestinal or renal side effects because of this. Patients with inflammatory conditions, particularly rheumatoid arthritis, must be treated with particular care owing to involvement of other musculoskeletal areas. As with operations on any patient with rheumatoid arthritis, the cervical spine should be examined to ensure absence of significant instability or canal compromise (see Chap. 8).

**Prophylaxis**

**Thromboprophylaxis**

Thromboprophylaxis of some form is generally recommended for total knee replacements, just as they are with total hip replacements (see Chap. 4). The risk of fatal
pulmonary embolism is lower in a total knee replacement than in a total hip replacement (see Chap. 10). The incidence of proximal thigh clots is lower with total knee replacements than with total hip replacements. Thromboprophylaxis protocols differ between surgeons and are based on experience and the level of concern. Early mobilization, compression stockings, venous compressive devices such as foot pumps, or sequential compression devices are often utilized. Some authors have recommended chemical prophylaxis with aspirin, warfarin, or low-molecular-weight heparin.

**Antibiotic Prophylaxis**

Antibiotic prophylaxis has been shown to be associated with decreased infection rates (see Chap. 3). When antibiotics are administered, it should be done 30 to 60 min before placing a tourniquet, so that the antibiotic concentrations in tissue at the surgical site are optimal.

► **ANESTHETIC CONSIDERATIONS**

**Preoperative Measures**

Patients presenting for knee arthroplasty often fall into the older age groups; therefore comorbidities associated with advanced age, rheumatoid arthritis, and obesity should be considered (see Chaps. 7, 8, and 12).

**Surgical Requirements for Anesthesia**

Optimal anesthetic techniques for lower extremity joint arthroplasty are those that provide analgesia of the operated extremity, adequate relaxation for retraction, the ability to monitor nerve function postoperatively, and avoidance of additional risks. The experience of the anesthesiologist and the hospital environment may dictate the safest and most effective anesthetic technique.

Techniques that minimize central “hangovers” are optimal for recovery and initiation of physical therapy. Preemptive pain control (oral narcotics and COX-II nonsteroidal anti-inflammatory agents) and antiemesis measures may be desirable.

Various forms of anesthesia are suitable for knee arthroplasty: general, regional, and neuraxial anesthesia. Most primary total knee replacements are performed in a timely manner, which makes them amenable to these techniques. Epidural and regional anesthetics have been shown to decrease the recovery period for these patients and to pose fewer risks than general anesthesia; they may also assist in postoperative analgesia.

**Nerve Block**

Unilateral nerve blocks for major proximal lower limb surgery are generally not optimal, since the nonoperated leg can become very uncomfortable for the patient—hence the patient may move it and thus distract the surgeon. Our choice for knee arthroplasty is to place a continuous femoral nerve block preoperatively (see Chap. 26), followed by a subarachnoid block (see Chap. 30) for the surgery. The femoral nerve block can also be done postoperatively, but not being able to observe patellar movements because of the bandaging may make this difficult. However, one can feel for contractions of the sartorius muscle (which originates from the superior anterior iliac spine). If there are clear anterior motor responses without sartorius contractions, it can only be the quadriceps muscles contracting. To place blocks postoperatively can be very painful for the patient, so it is advisable to place the block just before the spinal anesthesia loses all its effect or to make liberal use of potent analgesics, such as remifentanil. The catheters are left in place for 1 to 5 days, depending on the preference of the anesthesiologist and the surgeon; quadriceps function may be an important consideration. Low infusion rates and low concentrations of a drug such as ropivacaine usually preserve quadriceps muscle function. The patient can top this up by patient-controlled bolus injections whenever the quadriceps muscle function is not needed, as at night while the patient is sleeping (see Chap. 21).

Intraoperatively, the type and amount of sedation depends on the patient’s requirements. Continuous infusion of propofol is often used at various infusion rates, although this sometimes disinhibits the patient; we prefer to use midazolam in varying dosages with or without small doses of meperidine, depending on the patient’s requirements. We also provide patients with noise-cancellation headphones and music of their choice.

A common anesthetic technique is, however, still general anesthesia, although it is not optimal. Its use depends on the choice of the patient, the experience of the anesthesiologist, the choice of anticoagulation agent, and its timing (see Chaps. 4 and 30).

One of the disadvantages of femoral nerve catheters in the postoperative period is a slower return of quadriceps function. This may increase the risk of a fall while the patient is in the hospital; therefore measures to prevent this must be taken. Sciatic nerve blocks are a concern, particularly in valgus knee deformities, owing to the importance of early detection of sciatic and peroneal nerve palsies. These deficits can develop after the initial postoperative evaluation, within the first 24 h. They can be due to postoperative hematoma as well as positioning problems. Oral pain management is essential to provide optimal physical therapy in the recovery period following a total knee replacement. Multimodality pain control often allows the patient to optimize his or her pain control without the central effects of heavy narcotic use.

Because a tourniquet controls bleeding, the assistance of the anesthesiologist is not usually required. However,
the use of tourniquets is becoming more and more controversial, and anesthesiologists may well in the near future be called on to help control bleeding in the surgical field. The principles are described in Chap. 10.

**POSTOPERATIVE PROTOCOL**

The majority of total knee replacements in the United States are cemented arthroplasties (see Chap. 33). There are, however, proponents of uncemented femoral components, and there has been a resurgence of interest in uncemented tibial and femoral components. The postoperative protocol may vary based on the choice of an implant. With cemented total knee replacements, weight bearing is generally allowed as tolerated. Physical therapy is usually initiated on the day of surgery or first postoperative day. This therapy includes ambulation, generally with assistive devices, and exercises to restore early range of motion and quadriceps strength. Occasionally, knee immobilizers are used for a patient’s safety in walking until quadriceps strength returns. During the recovery period, caution with extreme flexion is necessary to prevent extensor mechanism problems. Continuous passive motion is utilized to improve motion and may provide a psychological benefit to the patient in terms of visualization of a knee that moves as well as providing some early pain relief. Concerns about continuous passive range of motion are the possible contributions to limitation in terminal extension and potential compression of the peroneal nerve when the patient’s mobility is decreased.

**POTENTIAL COMPLICATIONS**

Postoperative complications include arthrofibrosis, nerve traction injuries, vascular insufficiency, extensor mechanism problems, or skin problems. Arthrofibrosis is related to many different factors including poor balancing, preoperative limited motion and scar formation from previous operations, aggressive scar formation during the recovery period, and insufficient or poor physical therapy during the postoperative period. Inadequate pain control may contribute to a patient’s unwillingness to participate in physical therapy and range-of-motion exercises.

**Peroneal Nerve Injury**

Nerve injuries are rare. However, they are more common in a valgus knee with a flexion contracture than in varus knee deformities preoperatively. With the restoration of a normal mechanical axis, a valgus knee deformity tends to stretch the peroneal nerve as it crosses on the lateral side of the knee just distal to the fibular head. In combination with a flexion deformity, this risk is increased, since the nerve passes posterior to the axis of the knee joint. Peroneal nerve injuries in the varus knee preoperatively are rare but can be related to tourniquet problems, postoperative pressure palsies from the patient’s limited mobility, inadequate protection of the peroneal nerve, or excessively tight dressings. Postoperative hematomas can contribute to the development of postoperative nerve palsies. When a postoperative nerve injury is detected, the dressings should be removed and the possibility of an expanding hematoma examined. Compartment syndrome is rare but should be ruled out. Generally the knee is placed into flexion with no pressure on its lateral side to assist reversible changes in the peroneal nerve.

**Extensor Mechanism**

Extensor mechanism failure can occur intraoperatively or postoperatively with aggressive physical therapy and/or postoperative trauma due to quadriceps weakness. Extensor mechanism complications must be avoided and care taken to protect the patient during and after the operation. Education, aids for walking, and/or knee immobilizers can help to prevent these problems.

**Skin Complications**

Skin complications are devastating around total knee replacements, particularly at the inferior aspect of the wound, where there is minimal subcutaneous tissue over the proximal tibia. The blood supply to the anterior skin flaps is at risk if large undermining is performed. These flaps are at greater risk if previous incisions are not accounted for in planning surgical incisions. If a skin complication is encountered, aggressive soft tissue coverage should be instituted.

**KNEE ARTHRODESIS**

Knee arthrodesis is rarely indicated before knee arthroplasty. Indications are septic arthritis or failure of an extensor mechanism due to neuromuscular disease. The most common indication for a knee arthrodesis is in patients with failed knee arthroplasty in the setting of an absent extensor mechanism or recurrent infection. Techniques for knee revision surgery include intramedullary nailing, plate fixation, and external fixation. An intramedullary nail tends to be the most desirable implant due to its load sharing capacity and immediate weight-bearing potential for the patient. The risks of intramedullary nailing are greatest in patients with sepsis, because of recurrent infection around the intramedullary nail. Other alternatives for knee fusion include external fixation, which is desirable...
in a complicated postinfectious case. However, the risk of nonunion is higher with external fixation than with intramedullary nailing. In addition, postoperative management is more complicated with external fixation than with intramedullary nailing.

**SUGGESTED FURTHER READING**


