Hip and Knee Arthroplasty in the Geriatric Population

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Growth of the geriatric population and the role of total joint replacement

Senior citizens are the fastest growing subset of the American population. In 2000, there were 35 million people over age 65 [1]. It is estimated that by the year 2030 the geriatric population will represent approximately 20\% of the American population or approximately 70 million people [1]. The rapid and persistent increase in the elderly population will affect the use and costs of health care in the United States significantly [2]. This will be most apparent in the treatment of disease and injuries of the musculoskeletal system. The latter is because more than 80\% of the geriatric population has musculoskeletal complaints requiring a physician encounter and some form of treatment [3,4]. In particular, severe progressive osteoarthritis (OA) of the hip and knee accounts for approximately 40\% to 60\% of musculoskeletal complaints in the elderly [3,4]. Further, hip fractures and tumor metastasis to proximal and distal femur or proximal tibia frequently are seen in older people. Severe end-stage OA of the hip and knee, femoral neck fractures, and pathologic conditions affecting proximal and distal femur and the proximal tibia usually result in joint replacement surgery. Approximately 68\% of total hip arthroplasties (THA) and 74\% of total knee arthroplasties (TKA) are performed on people over age 65 [3]. With the current growth rate of the geriatric
population, by the year 2030, there will be an approximate 40% to 80% increase in total joint replacement surgery performed in older patients [1,4].

Since their introduction in the late 1960s in the United Kingdom as high-risk, last-resort procedures, hip and knee arthroplasty procedures have undergone a rapid evolution. In 1996, more than 607,000 knee and hip replacements were performed in the United States [2]. Patients who have knee or hip joint arthroplasty attain improved mobility and significant improvements in quality of life, with postoperative quality of life often equal to or exceeding the population norm. This translates into retained independence and self-care and decreased health care costs [5]. THA and TKA surgeries are among the most successful interventions available to the geriatric population, as measured by the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) in terms of improvement in quality-of-life years gained [6].

**Osteoarthritis of the hip and knee joints**

OA is a chronic widespread form of arthritis that affects all joint structures and commonly is manifested in hip and knee. Except for traumatic arthritis, which can occur at any age after an injury, the prevalence of OA increases with age. OA is slightly more common in knees compared with hips. Its onset is insidious but progressive, resulting in significant pain and disability, often leading to deterioration in function and loss of independence. OA of the hip and knee is among the top causes of pain and physical disability in community-dwelling adults [7]. Further, OA is a disease of aging cartilage. Although the exact pathophysiology of OA is yet to be delineated completely, the etiology of OA likely is multifactorial, including risk factors, such as genetic origins, microtrauma, increased cytokine activity, lack of nutrients (eg, antioxidants), and obesity.

The diagnosis of OA of the knee and hip is made clinically and radiographically. Clinically, patients who have OA have symptoms of pain-related activity that decrease with rest. In knee OA, other signs and symptoms include knee swelling secondary to effusion, crepitation and subjective locking and sensation of unsteadiness, and angular deformity of the hip and knee that invariably results in gait abnormality secondary to decreased quadriceps strength and joint flexibility [8–10]. The latter frequently is seen in severe end-stage OA. Older patients commonly require walking assist devices for ambulation or sometimes are wheelchair dependent. The ultimate and sometimes devastating end result of OA is debilitating pain and loss of independent functioning (ie, low SF-36 scores [11]), manifested by an inability to carry out activities of daily living.

The psychologic secondary morbidity resulting from functional impairment is substantial. In one study, 200 patients completed a questionnaire about functional disability related to OA and mood (anxiety and depression). There was an 8.3% prevalence of depression in this population and
a 24.4% prevalence of anxiety. Additionally, it was found that after surgery, the level of independent living, without assistance, greatly improved the psychologic well-being of these patients [12].

Clinically, the main presentation of OA is pain. Depending on the severity of the disease, effusion, crepititation, and angular deformity of the affected joints are not uncommon. As a result, patients typically present with an antalgic gait. The clinical manifestations of OA of the hip correlate closely with its radiographic findings. The plain radiograph remains the primary objective diagnostic modality (Fig. 1). There are five cardinal findings of OA on radiograph: asymmetric loss of cartilage resulting in joint space narrowing, subchondral bone cysts, osteophytosis, bony eburnation, and subchondral bone sclerosis. The plain films also can be used to grade the severity of OA. It is widely accepted that there are four stages or grades of OA, graded 1 to 4, ranging from less to more severe. Grade 1 is mild OA of hip or knee with preservation of joint space. At the other extreme, grade 4 is OA with bone on bone articulation. At this stage, valgus or varus angular deformity is not uncommon. Finally, the severity of OA dictates its medical and or surgical management.

Nonsurgical or medical management of OA is geared at pain relief. Initially, the most conservative treatment is a low dose of acetaminophen usually combined with a trial of physiotherapy [13]. The latter increases bone density and muscle strength [14,15]. Second-line analgesia involves nonsteroidal anti-inflammatory drugs (NSAIDs), which are used either continuously or on an as-needed basis. NSAIDs used in the elderly must be monitored closely, however, because of the associated high morbidity and potential mortality profile of these drugs. It is reported that 20% to 30% of all hospitalizations and deaths secondary to peptic ulcer disease in the elderly are indirectly or directly related to NSAIDs use [16]. Alternatively, selective cyclooxygenase-2-specific inhibitors can be used if there are

![Fig. 1.](image)
significant risk factors for upper-gastrointestinal complications. Intra-articular therapies, including steroids and hyaluronic acid–like products, are used if pain relief is inadequate and there are effusions or obvious inflammatory signs [16,17]. Attention also must be paid to nonpharmacologic measures, such as patient education, weight loss, and exercise [18]. Because of the progressive and destructive natural course of OA, however, most affected individuals require surgery, usually in the form of joint replacement, for definitive pain control and functional restoration.

History of the surgical management of joint disorders

The crippling effects of joint arthritides have been present in humans since they evolved to walking upright. The biomechanical stresses placed on the skeletal framework by an upright posture, weight bearing, and gait are evident in skeletal remains unearthed at excavations dating to medieval Saxon and Roman times. The evidence of articular disease is etched clearly into these remains. Just as the human race has evolved and developed these diseases of the joints, so has the field of orthopedics evolved to develop and implement ways to correct these arthritides.

The first large-scale advance in treating joint arthritides came in the early 1800s. These operative advances were made possible because of discoveries in basic physiology. Through anatomic dissection of cadavers and application of the their findings to human models, early surgeons began to understand fully the physiology of skeletal tissues and how these tissues effected the biomechanical processes taking place in skeletal support and ambulation.

The initial paradigm shift in dealing with joint disease took place in Liverpool, England, in the early 1800s. Henry Park was the first surgeon to move from the norm of amputation for injury and joint disease to total joint excision with pseudarthrosis formation. Dr. Park’s method of joint correction was slow to gain acceptance because of several factors taking place across Europe and the Americas. The first was the wars taking place in Europe that produced patients for whom amputation was the fastest means of providing life-saving care. Surgeons of this time were valued for their surgical speed as much as for their surgical prowess, and Dr. Parks’ joint excision was not a fast surgery compared with amputation. The other daunting obstacle was that Dr. Park was practicing in the preanesthesia era.

The next leap forward in joint disease came toward the end of the 1800s. In 1885 in Lyon, France, Leopold Ollier, whom many have labeled, “The Father of Orthopedic Surgery,” described the concept of interpositional arthroplasty. His initial attempts at remedying arthritides used adipose tissue interposed between the offending bones. The downfall to his procedure was that he did not affix the adipose to the subjacent bone, so it often did not stay in place and provide the cushioning it was intended to. Despite this procedure largely being ineffective, it opened the door of belief that materials might be inserted into the joint space to provide relief. After
Dr. Ollier’s initial attempts, surgeons all over Europe began experimenting with different interpositional materials, none more than Czech surgeon, Vitezslav Chlumsky, who tried muscle, celluloid, silver plates, rubber struts, magnesium, zinc, glass, pyres, decalcified bone, and wax, all without much success.

Interpositional arthroplasty experimentation continued into the 1900s but never provided great success until the 1910s, when Sir Robert Jones showed in a 21-year follow-up report that several of his patients in whom he had placed gold foil over the reconstructed femoral heads retained effective motion and stability. This finding provided support that interpositional arthroplasty was feasible and helped boost joint surgery to its next phase.

In 1932, American surgeon, Marius Smith-Petersen, described the first mold prosthesis interposition through a new anterior approach to the hip. Smith-Petersen designed a glass mold that was placed between the femoral head and the acetabulum. His reasoning was that this mold would facilitate healing of the disrupted and destroyed joint membrane by providing a surface for new membrane to adhere to. Many of the molds broke and, despite finding evidence of new membrane formation on the glass during revision surgery, patient complaints about continued pain caused Smith-Petersen to abandon the glass mold. Smith-Petersen went on to try many other possible materials but it was not until 1937 when a material was found that enabled orthopedists to achieve the first long-term predictable results in interpositional hip arthroplasty. This material, Vitallium, had the ability to withstand wear, stay in a more fixed position, not break, and not cause patients pain and discomfort.

At the same time that interpositional arthroplasty was striding forward with various experimental materials, prosthetic hip arthroplasty also was taking shape and gaining more notoriety. The first to really pioneer this surgery were the Judet brothers from Paris, France. Initially, they used an acrylic prosthesis, in 1948, which failed miserably because of a high wear rate but ushered in a new idea of belief that the offending joint could be removed and replaced. Many orthopedists began experimenting with different approaches to the hip, different materials and constructs, and different designs. Notable surgeons, such as Girdlestone, Thompson, and Austin Moore, designed prostheses that met with variable success and duration of use. The stage was set, however, for Sir John Charnley to make his revolutionary advances and usher in the age of THA [19].

Charnley began his refinement of hip arthroplasty with a better understanding of the hip. He delved more deeply into its function, its attachments, and its biomechanics. His research and understanding led to the establishment of low-friction arthroplasty. This technique contributed multiple advancements that had not been seen until this time. The name of the technique comes from Charnley’s replacing the arthritic hip socket with a better wearing, high-density polyethylene cup and replacing the femoral head with a Moore-Thompson–type metal prosthesis with a smaller head diameter, thus reducing the friction present in the metal-on-metal implants. He introduced the bone cement, methylmethacrylate, to stabilize the prostheses
in the bone, thereby lessening the risk for implant loosening, which had been the main reason for hip replacement failure. He introduced clean-air operating techniques to reduce bacteriologic contamination during surgery, reducing infection rates. His advances in biomechanics, materials, instrumentation, and procedures garnered Charnley the highest accolades [20].

**Joint replacement surgery for osteoarthritis of the hip and knee**

A large majority of older patients who have severe symptomatic OA choose to undergo THA or TKA for long-term pain relief, improvement of function, and quality of life. This decision is supported by many studies that show excellent outcomes after joint replacement surgery. Currently, there is a general trend in THA and TKA to be less invasive with the surgical approaches, thereby minimizing soft tissue trauma, blood loss, and operative time. Patients who were at least 75 years old at the time of surgery improved their preoperative scores on the SF-36 to levels comparable to an age-matched nonsurgical group [6]. Another study demonstrates that elective THA and TKA in patients at least 80 years old had markedly improved postoperative knee and hip scores comparable to younger patients [21]. Therefore, age alone is not a barrier to hip and knee arthroplasty surgery in the elderly, because postoperative outcomes mostly are correlated with preoperative comorbidities [4]. Thus, preoperative planning becomes an important and integral part of the planning for THA and TKA surgery.

Preoperative assessment for patients scheduled to undergo THA and TKA surgery determines patient comorbidities and risk assessment profile. The general goal is to identify and treat any conditions previously undiagnosed and to optimize known medical problems to reduce preoperative risk. Even with thorough preoperative optimization, there remain several absolute contraindications to THA and TKA. These include active systemic and skin infection, open wounds, neuropathic joints, and documented adverse reaction to anesthesia. During this process, consent for the procedure usually is obtained. The risks, benefits, and alternatives to surgery are discussed in great detail with the patients and families (especially in cases where patients cannot give consent because of cognitive impairment), with specific mention made of the incidence of the known and documented perioperative complications. Some of these complications include deep periprosthetic infection, early and late dislocation, deep vein thrombosis (DVT), pulmonary embolus, and death. For patients over 80 years old, the added risks of myocardial infarctions and stroke are emphasized [22].

**Total hip arthroplasty**

THA was developed in the 1960s for the treatment of hip OA in elderly patients. Since then, THA has progressed greatly and now is considered the standard of care for severe end-stage OA of the hip in elderly patients. THA
alleviates pain and improves physical activity significantly, at the same time re-establishing independence and a heightened quality of life [4].

THA typically takes approximately 1.5 hours to complete and involves fixation of the acetabular and femoral components. The actual technique used to fix the components may vary depending on the bone quality, training of the surgeons, and implant designs. Similarly, the surgical approach is heavily surgeon dependent. Cemented and cementless fixation techniques are used for THA components fixation. Although there are many studies that show good to excellent outcomes in older patients when cementing techniques are used for component fixation [23,24], recently there is a trend toward cementless fixation technique for the acetabular and femoral components using porous coated implants, reducing the adverse effects of cemented fixation. The cementless fixation relies on bony ingrowth, which is of sufficient quantity in the elderly to provide stable long-term fixation. This is supported by clinical and cadaveric investigations. Lester and colleagues demonstrate in an autopsy study that cementless femoral component were well fixed and stable for an average of 22 months in elderly patients [25]. Konstantoulakis and coworkers show that uncemented hip arthroplasties in patients ages 65 and older had no signs of discernable subsidence or osteolysis after 4 years of follow-up [26].

There are several different bearing surfaces used in older patients undergoing THA. The most widely used is highly cross-linked polyethylene with a metal femoral head. The longevity of this construct depends on the wear rate of the polyethylene [27]. In geriatric low-demand patients, this hybrid-bearing surface is quite successful [28,29]. Another bearing surface making a resurgence is metal on metal. The newer generation metal-on-metal bearing surface has a significantly better wear profile compared with conventional metal-on-polyethylene surface [30,31]. This surface commonly is used in older patients who lead a relatively more physically active lifestyle. Lastly, ceramic-on-ceramic or ceramic-on-polyethylene rarely is used in older patients in the United States and commonly is reserved for younger, high-demand patients. Despite the actual technique or the articulating surface used in THA, this remains a successful operation for elderly patients who have severe OA of the hip. Survival analysis suggests that 95% of traditional THA interventions last for 15 years and 85% to 90% for more than 20 years [23,24].

**Total knee arthroplasty**

The development of TKA for the treatment of knee pathology lagged behind that of THA and was considered an unsuccessful operation with many complications in the 1970s and early 1980s. With newer model designs paying strict adherence to knee kinematics, however, TKA has become a successful operation, with survivorship of 91% at 10 years, 84% at 15 years, and 78% at 20 years [32]. It is embraced as the treatment of choice in patients over age 55 who have progressive and painful OA and who have failed
nonsurgical and less invasive treatments. The benefits after TKA are marked improvement in all facets of health, including mobility; well-being and emotional status; less social isolation; and reliable pain relief [33]. The benefits are noticeable in patients over 70 years of age. Birdsall and colleagues show that after TKA, patients 80 years and older had improved pain, emotional status, sleep, and physical mobility [34]. Another study demonstrates that patients over age 85 had similar outcomes [35].

The surgical goals of TKA are to create a kinematically stable, solidly fixed, and well functioning knee. This is achieved by good fixation techniques, soft tissue balancing, and restoration of the mechanical axis. Lack of attention to any aspect of these three important steps leads to an imperfect knee that may require revision. Although cementless fixation techniques using porous coated pegs, stems, or screws are used, methylmethacrylate cement for component fixation is used most commonly in elderly patients. It is debatable whether or not retention, sacrifice, or substitution of the posterior cruciate ligament leads to better outcomes of primary TKA [36]. At the authors’ institution, most surgeons retain the posterior cruciate ligament if it is intact at the time of surgery. It remains controversial whether or not the patella should be resurfaced during TKA [37]. Only recently has it become routine by most surgeons in the United States to resurface it as part of the initial TKA procedure. A few studies demonstrate increased incidence of anterior knee pain after TKA in patients who have unresurfaced patellae, which are alleviated with second-stage resurfacing [37]. Alternatively, there is demonstrable adverse impact on resurfaced patellae as it pertains to patella fracture or component loosening [38]. Additionally, the benefits of patellar resurfacing are manifested in better stair-climbing ability and improved overall function [37,38]. At the authors’ institution, it is common practice to resurface the patella during the primary TKA procedure.

Complications of hip and knee arthroplasty surgery

Despite the best efforts in component design, patient selection, and preoperative and postoperative precautions in TKA and THA, complications occur. Intraoperative complications during routine THA and TKA are rare. Such occurrences include fat embolism, nerve injury (sciatic or common peroneal nerve) with resultant foot drop, vascular injury, and fractures. Complications that primary care providers typically encounter after total hip and knee surgery are infections, dislocation, and thromboembolism, whereas more severe complications, such as periprosthetic fractures, usually find their way to the emergency department.

Infection

Deep periprosthetic infection remains a challenging and potentially devastating complication of THA and TKA surgery. It is one of the leading
causes of reoperation after joint arthroplasty. Management of deep peri-
prosthetic infections relies heavily on prevention. Prophylactic antibiotic
given within 1 hour of skin incision and continued for 24 hours after surgery
has reduced the incidence of infection greatly in primary joint replacements
to 1% to 4% [39–41]. Other preventative measures taken to reduce the in-
cidence of deep periprosthetic infections include reconstructing operating
rooms with clean laminar airflow system, draping with iodine adhesive pro-
tective plastic, thorough cleaning of the operative sites with iodine or provi-
dine and alcohol, effective sterilization of instruments and proper conduct
with strictest adherence of operating room etiquette by all personnel [41].

The main bacterium responsible for deep periprosthetic infection is *Staph-
ylococcus aureus*, which may be a result of direct inoculation or hematoge-
nous seeding [41]. Patients commonly present with a brief history of pain,
swelling, and erythema of the surgical wound. Successful treatment of deep
periprosthetic infections is a work in progress but involves comprehensive
antibiotic coverage and débridement, prosthesis revision with 1- or 2-staged
reimplantation, or resection arthroplasty with or without concomitant
arthrodesis [42,43]. Antibiotic treatment alone rarely is recommended for
deep-seeded sepsis around the prosthesis and typically is reserved for supra-
fascial wound infections with susceptible organisms. It is now accepted widely
in the United States that deep periprosthetic infection within 2 to 4 weeks of
initial joint arthroplasty or signs of acute infection in joint arthroplasty
performed several years ago without prior infection can be treated with
débridement plus polyethylene exchange coupled with a 6-week course of in-
travenous antibiotic therapy [42,44]. The success of this approach depends
on several factors, which include susceptibility of the isolated organisms, sta-
bility of the implants, patient age and comorbidities, and the extent of soft-
tissue injury. More than 70% of deep periprosthetic infections can be treated
using this approach [42]. The effectiveness of these techniques in older
patients has not been established. Most surgeons in the authors’ institution
favor the 2-staged approach with implantation of a temporary antibiotic im-
regnated spacer for 6 weeks along with intravenous antibiotic before bring-
ing patients back for definitive reimplantation of a new prosthesis (Fig. 2).
Finally, in rare instances, leg amputation after failed multiple knee revision
surgeries for chronic recalcitrant infection is reported in the literature [45].

**Dislocation after total hip arthroplasty**

After implant loosening, dislocation is the second leading cause of revision
hip surgery and is a common early complication of THA [46]. The incidence
of hip dislocation ranges from 0.6% to 7% [47]. The cumulative risk for any
dislocation is reported as 2.2% at 1 year, 3.8% at 10 years, and 6% at 10 years
[48]. Many factors are associated with increased rate of dislocation, including
surgeon experience, implant design and positioning, surgical approach, tro-
chanteric nonunion, obesity, alcoholism, and previous revision surgery [47].
During the past few years, more emphasis has been placed on implant design and positioning because of its impact on reducing the rate of dislocation. The end goal is to increase range of motion within patient physiologic arc of motion without causing impingement, which can result in instability and increase dislocation rate. Computer-generated data prove that the optimal cup position should be 45° to 55° abduction and 10° to 20° anteversion to reduce the risk for impingement and dislocation [49]. Surgical approach also influences the dislocation rate. In one study, Morrey reports that the posterior approach had the highest dislocation rate, 5.8%, compared with anterior 2.3% and lateral 3.1% [50].

Treatment of the first dislocation is done predominantly via closed reduction under anesthesia in either the emergency department or the operating room setting. Revision hip arthroplasty for dislocation is performed mainly after multiple dislocations and after the first dislocation, only if the components are malpositioned significantly, resulting in instability after closed reduction (Fig 3).

Periprosthetic fractures after total hip and knee arthroplasty

The timing of periprosthetic fracture around the hip and knee is unpredictable and may occur either intraoperatively with insertion of the prosthesis or many years later. The incidence of periprosthetic fractures after THA and TKA is 2.5% and less than 2%, respectively [51]. The two main causes of periprosthetic fractures after THA and TKA are due to either trauma or loosening secondary to wear debris–induced osteolysis or osteoporosis [51–53]. Fortunately, intraoperative periprosthetic fractures are rare, although
the incidence is more common among cementless versus cemented hip and knee prosthetic components [53].

Treatment of periprosthetic fractures around the hip depends on the location of the fracture, the stability of the fixed components, and the quality of bone stock. For proximal fractures with well-fixed components (for example, greater trochanteric fractures), cerclage cables with cage usually are performed. Management of distal fractures beyond the lesser trochanter invariably is with open reduction and internal fixation. The specific construct used (cable plate fixation; cerclage cables with strut allografts with component retention; or femoral component revision with longer stem after reduction of the fracture with cerclage cables, cable plate, or strut allografts) depends on whether or not the stem is well fixed or loose [54].

Periprosthetic fracture after TKA occurs primarily around the femoral component [55]. Treatment is a balance between maximizing alignment and stability while restoring early range of motion to reduce stiffness. Depending on the fracture location and degree of displacement, bone quality, and stability of the fixed components, many treatment options are available to the surgeon. Poor surgical candidates who have fractures around the knee after TKA may be treated conservatively with knowledge that the outcome will be a malaligned and stiff knee [56]. Open reduction and internal fixation is performed on patients who are acceptable surgical candidates who have displaced fractures but stably fixed components. These are reduced either with fixed-angle devices, such as locked condylar plates, especially in patients who have osteoporotic bone, or retrograde intramedullary nailing via transarticular approach through the implant that has an open intercondylar notch. In cases of implants that are not well fixed, revision arthroplasty is the treatment of choice with bone defects reconstructed with either allograft or augmenting metal wedges [55,56].

The recognition of risk factors for periprosthetic fractures is vitally important for its prevention and relies on surgeon and patient. Factors that can be controlled by surgeons include adequate surgical exposure during
the procedure; careful and precise preparation of the bone surfaces with the goal of alleviating maneuvers that create stress risers; careful and controlled insertions of cementless implants, especially in patients who have poor bone stock; and performing revision surgeries electively on patients who have radiographic evidence of failed implants. Alternatively, patients must be highly motivated and are obligated to be compliant with timely follow-up appointments; must refrain from risky activities after hip and knee arthroplasty; and must continue medical treatments for underlying comorbidities that may put them at an increased risk for periprosthetic fractures.

**Thromboembolism**

Venous thromboembolism—DVT and pulmonary embolism (PE)—is perhaps the most common complication after THA and TKA. Without effective postoperative prophylaxis, thromboembolism is reported to occur in more than 50% of patients who undergo THA or TKA. It is approximately 3 times more likely in patients who have TKA compared with THA [57]. Patients who are obese and 65 years or older particularly are at risk for having adverse thromboembolic events after THA, with a mortality rate of 1.7% [58]. Similarly, the risk for fatal PE after TKA without thromboprophylaxis is 0.4% [59]. DVT alone causes significant morbidity in older patients as it leads to chronic venous insufficiency or post-thrombotic syndrome. There is a high incidence of post-thrombotic syndrome in patients after THA and TKA, approaching almost 100% at 10 years after the first DVT [60].

The literature supports the effectiveness of thromboprophylaxis in reducing the incidence of DVT and fatal PE. Although uncertainty surrounds the choice of the optimal agents used to prevent and treat existing thromboembolism, the prevalence of DVTs after treatment ranges from 15% to 25% after THA and 35% to 50% after TKA [57] and is reduced by preventive treatments. Modalities used to reduce the prevalence of thromboembolism fall in two major categories—mechanical and pharmacologic. The predominant mechanical modality used is the external pneumatic compression devices, which increase venous return, decrease stasis, and enhance fibrinolysis [61]. Used alone, mechanical devices are not shown more effective than chemical modalities and, therefore, are used best in combination with pharmacoprophylaxis [61].

The pharmacologic agents currently used in the thromboprophylaxis include aspirin, warfarin, low molecular weight heparin, and fondaparinux. Aspirin is shown to reduce PE by 43% and symptomatic DVT by 29% in doses of 160 mg and 375 mg daily [62]. Warfarin is the pharmacoprophylactic agent used most commonly in patients after THA and TKA. Its effectiveness is demonstrated in many studies [61,62]. One such study shows that warfarin in combination with external pneumatic compression devices reduces the prevalence of DVT to 5% and bleeding complications to 0.9% [61]. Enoxaparin, a low molecular weight heparin, is used commonly for prophylaxis
against thromboembolism after joint replacement surgery. After THA and TKA, 30-mg doses of enoxaparin are given twice daily, typically 10 to 12 hours postoperatively. Enoxaparin is a highly effective thromboprophylaxis agent, but its widespread use is limited by the documented increase incidence of bleeding complications [63]. Its use is limited by coexistent renal insufficiency, which is common in elderly surgical patients. Fondaparinux, a synthetic and specific inhibitor of activated factor X, has a long half and once-a-day administration that makes it attractive; however, its effectiveness and its safety in older patients has not been investigated adequately.

Rehabilitation after hip and knee arthroplasty

There is an old adage in total joint arthroplasty surgery that states that successful outcomes of THA and TKA are equally dependent on the surgeon and patient. The surgeon is responsible for performing the best operation possible for the patient, whereas the patient’s responsibility commences almost immediately after surgery in the form of rehabilitation, beginning in the hospital and continuing at home or skilled rehabilitation facility. Currently, there is no evidence to support the effectiveness of inpatient physiotherapy on the eventual long-term outcomes of THA and TKA. Therefore, the generally accepted rehabilitation protocol in the United States usually is 1 or 2 days of physical and occupational therapy in the hospital setting with subsequent referral to a rehabilitation facility to continue functional restoration. Patients initially use walkers and then advance to canes as muscle strength returns, which often is seen between 4 and 6 weeks postoperatively. Patient education plays an important role in the rehabilitation process, particularly in THA, where participation in risky activities can lead to hip dislocation. For example, patients are told to refrain from using low chairs or low beds or sitting in low baths and should sleep on their backs. Patients can expect to return to their usual activities, such as work, driving, and permissible recreational sports, 6 weeks post surgery. This generally is true for patients over age 65 whose usual activities mean simply house or community ambulation. Full functional restoration also depends on patients’ other underling comorbidities. Given the goals of the surgery, however, it is not unreasonable to expect the desire outcomes (described in the previous statement), especially in motivated patients.

Future directions of hip and knee arthroplasty

Minimally invasive surgery and its role and effects on outcomes

Despite the success of TKA procedures, surgical techniques continually strive to improve patient outcomes. This process often includes improvements in instrumentation and technique. Throughout surgical subspecialties, minimally invasive surgery (MIS) techniques have been the recent...
trend. This trend is powered by goals of decreased patient pain, decreased hospital stay and costs, and quicker return to patient goals and functional levels. Standard approach to TKA traditionally has involved an 8- to 14-inch midline skin incision down to the extensor mechanism with a para-medial arthrotomy, violating the medial aspect of the quadriceps tendon. Subsequent eversion and dislocation of the patella gains access to the articular surface and entire tibiofemoral articulation. This approach allows unmatched visualization for appropriate component placement and ligament balancing, leading to proved clinical outcomes.

MIS TKA, as the name implies, involves using a limited incision (4–7 in) (Fig. 4). Subsequent subcutaneous dissection and arthrotomy then are completed in a more limited fashion. Arthrotomy is undertaken through a mid-vastus, subvastus, parapatellar capsular, or lateral approach, depending on surgeon preference. The key to the arthrotomy is to preserve as much continuity of the quadriceps mechanism as possible. Along with incision length and dealing differently with the extensor mechanism, other differences include patellar mobilization. MIS approaches limit patellar eversion, thus limiting tension on the quadriceps mechanism and preventing any subsequent extension of the arthrotomy. Additionally, tibiofemoral dislocation time is decreased and limited only to tibial implantation, as necessary. Management of the soft tissue, more so than incision length, is hypothesized as the major contributing factor for improved early results. Early retrospective results from other centers indicate positive results with these techniques [64,65].

The goals of MIS for total joint arthroplasty include decreased pain and quicker return to function without sacrificing component alignment and patient safety. Patient concerns with MIS include long-term outcome and postoperative pain and length of recovery [66]. This issue is underscored by many surgeons who advise patients that full functional recovery may take up to 1 year. Evaluating these results will help the orthopedic community to advance the ultimate goal of improved techniques and patient outcomes.

Fig. 4. Photograph of patient 4 weeks after bilateral minimally invasive TKA. Linear scar length of approximately 4.5 in.
Computer-assisted navigation for hip and knee arthroplasty

The success of TKA is dependent on the proper alignment of the implanted components. Computer-assisted navigation for TKA recently has become an area of intense investigation and recently has been reported to increase the accuracy of implantation \[67,68\] along with its reliability and reproducibility \[69\]. This increased precision may lead to improved outcomes and faster return to normal functions (Figs. 5 and 6).

Summary

OA is the leading cause of hip and knee pathology in the geriatric population. Hip and knee arthroplasty are the definitive interventions to alleviate pain and restore physical functioning. Complications related to these
procedures occur: the most common of these are infection, thromboembolism, dislocations, and periprosthetic fractures. New improvements related to minimally invasive and computer-assisted navigation surgery techniques are promising and already show excellent outcomes in patients exposed to joint arthroplasty.

References


Fig. 6. Postoperative films showing bilateral lower extremities with normalized mechanical axes, using computer-assisted surgery. The joint lines are perpendicular to the mechanical axes and parallel to the floor.


