

Total Hip and Knee Arthroplasty in Nonagenarians

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Abstract: Among 25 patients of mean age 91.5 years (range, 90-96 years) who received a total hip or knee arthroplasty at the authors' institution, 8% experienced surgical complications, 56% experienced at least 1 medical complication, and 80% received perioperative blood transfusions. At a mean follow-up of 4.1 years, patients were experiencing pain reduction and somewhat higher functional capacity and had slightly better survival characteristics than age-matched controls. Total hip and knee arthroplasty patients in this cohort should be told that they have a higher likelihood of experiencing perioperative medical complications and of receiving a blood transfusion than younger individuals; at the same time, they can expect pain relief as well as equal or better survival than their age-matched peers. **Key words:** hip arthroplasty, knee arthroplasty, nonagenarian, complication.
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It is well established that the US population is becoming progressively older: between 1990 and 2000, the number of Americans older than 85 years increased by 37%, as compared to 20% for the population at large [1]. Although patients at these advanced ages may benefit from total hip and knee arthroplasties, the risks associated with these procedures in this population have not been clearly delineated. Three studies of total knee arthroplasty in patients 90 years of age and older—by Belmar et al [2], Joshi and Gill [3], and Pagnano et al [4]—found a higher medical complication rate in this cohort than that reported for younger patients undergoing total joint arthroplasty; at the same time, they reported fewer surgical complications.

The 3 studies also reported that gains in functional capacity, as measured by Knee Society scores, were less in this cohort than in younger patients [2]. Not all their findings were unanimous: Belmar et al. observed that presurgical medical conditions were predictive of postsurgical medical complications in the patients they studied [2], whereas Pagano et al. found no such association [4]. It is of interest to note that another study, of patients 90 years of age or older who had undergone either knee or hip arthroplasty, Berend et al. observed that the patients had a higher survival rate than age-matched controls [5].

The purpose of this study was to review our institution's experience with total joint arthroplasty in patients 90 years of age and older for the purpose of determining what measures, if any, can be taken to make total joint arthroplasty in this age group safer.

Materials and Methods

Between January 1, 1998, and December 31, 2004, a total of 25 patients aged 90 years or older underwent total knee or hip arthroplasty at the authors' institution: either primary total knee

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arthroplasty (18 patients), revision total knee arthroplasty (1 patient), primary total hip arthroplasty (5 patients), or conversion of a previously septic total hip arthroplasty from an antibiotic spacer to a total hip arthroplasty (1 patient). Charts were reviewed, and record was made of indications for surgery, type of anesthesia used, preoperative Harris Hip and Knee Society scores, medical history, postoperative surgical and medical complications, transfusion requirements, date of discharge from the hospital, and date of death if applicable.

The decision to transfuse was made by monitoring the hemoglobin level. If the hemoglobin level fell below 10 g/dL, the patient was examined for clinical signs of anemia. If clinical signs such as tachypnea, fatigue, dyspnea, tachycardia, change in mental status, hypotension, and decreased urinary output were found, then transfusion was indicated. Also, if there was a downward trend in hemoglobin level of greater than 2 g/dL in a 24-hour period, then transfusion was indicated.

Social Security Death Index and follow-up surveys were used to determine patients' current status.

Demographics

The study population consisted of 19 female and 6 male patients. The preoperative diagnosis for the 19 total knee arthroplasty patients was osteoarthritis in 18 and aseptic loosening of a prior total knee arthroplasty in 1. Of the 6 total hip arthroplasty patients, 3 had a preoperative diagnosis of osteoarthritis, 1 had an infected total hip that had an antibiotic spacer and completed a course of antibiotics, 1 had a femoral neck fracture, and 1 experienced failed internal fixation after a hip fracture. A cemented femoral component and an uncemented acetabular component were used in 3 of the 6 hip arthroplasties; cemented femoral and acetabular components were used in the other 3. All 19 total knee arthroplasties were cemented.

The mean age of the patients was 91.5 years old (range, 90-96 years). Twenty-three of the 25 patients had significant preoperative medical conditions (Table 1). Nineteen patients (76%) received spinal anesthesia and 6 patients (24%) received general anesthesia.

Postoperatively, all patients received deep venous thrombosis prophylaxis (16 patients received low-molecular-weight heparin, 6 coumadin, and 3 aspirin and mechanical compression devices) and prophylactic antibiotics. Six patients received Foley catheters postoperatively that were removed between postoperative days 2 and 7.

Results

The mean length of stay was 10.1 days (range, 4-38 days). Fourteen (56%) of the 25 patients, including 1 who died in hospital, experienced a total of 27 complications (Table 2); 6 of the 14 experienced more than 1 complication. There did not appear to be a link between any 2 specific complications. The organ systems most commonly affected were the cardiovascular and the genitourinary, with 7 and 9 complications, respectively. There were only 2 surgical complications: 1 case of persistent wound drainage and 1 case of a total hip periprosthetic infection.

Cardiovascular complications included 2 new-onset cases of atrial fibrillation, 2 episodes of hypotension, 1 case of syncope, 1 episode of hypertensive emergency, 1 new-onset case of atrial flutter, 1 sinus pause, and 1 episode of bradycardia. Three patients experienced urinary incontinence; 2 patients experienced urinary retention, and

Table 1. Preoperative Medical Conditions Among 25 Patients 90 Years of Age or Older Undergoing Total Knee or Hip Arthroplasty, 1998 to 2004

Condition	No. of Patients
Cardiovascular	
Hypertension	16
Atrial fibrillation	5
History of myocardial infarction	4
Hypercholesterolemia	4
Atrial flutter	3
Mitral stenosis	2
Stable angina	2
Rheumatic heart disease	1
Complete heart block	1
Congestive heart failure	1
Genitourinary	
Benign prostate hypertrophy	1
Prostate cancer	1
Pulmonary	
Chronic obstructive pulmonary disease	3
Asthma	3
Neurologic	
Cerebrovascular accident	1
Parkinsonism	1
Epilepsy	1
Psychiatric	
Depression	1
Gastrointestinal	
Peptic ulcer disease	3
Gastroesophageal reflux disease	2
Hepatitis	1
History of colon cancer	1
History of cholecystectomy	1
Endocrinologic	
Diabetes	2
Hypothyroidism	2
Hematologic	
Anemia	2

Table 2. Postoperative Medical Complications Among 25 Patients 90 Years of Age or Older Undergoing Total Knee Or Hip Arthroplasty, 1998 to 2004

Complication	No. of Patients
Cardiovascular	
New-onset atrial fibrillation	2 (POD 2 and POD 4)
Hypotension	2
Brief hypotension crisis	1
New-onset atrial flutter	1 (POD 4)
Sinus pause	1
Bradycardia	1 (POD 2)
Syncope	1
Genitourinary	
Urinary incontinence	3
Urinary retention	2
Urinary tract infection	3
Acute renal failure	1
Pulmonary	
Pleural effusions	3
Pneumonia	1
Neurologic	
Confusion	4
Gastrointestinal	
Acute ileus	1
Mortality	1

POD indicates postoperative day.

3 experienced a urinary tract infection. Pulmonary complications included 3 episodes of pleural effusions and 1 case of pneumonia. There was 1 case of acute renal failure. Four patients experienced postoperative confusion. There was 1 case of acute ileus.

The mean preoperative hematocrit was 37.3, and the lowest mean postoperative hematocrit occurred on postoperative day 3 at 28.3. Twenty patients required at least 1 blood transfusion; 4 patients received autologous blood and the remainder received allogenic units. The median number of

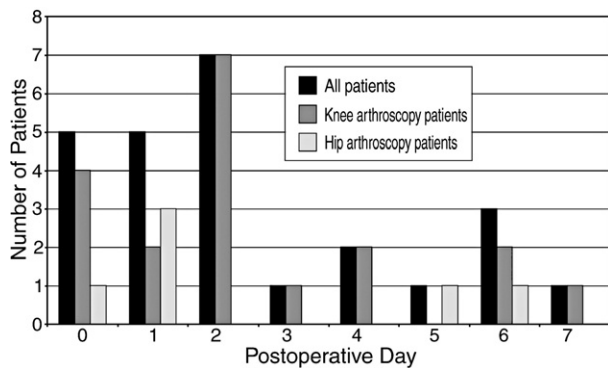


Fig. 1. Number of hip or knee arthroplasty patients 90 years of age or older who were administered transfusions in the authors' institution, 1998 to 2004, by postoperative day.

transfusions was 3 U of packed red blood cells (range, 0-7 U), although most patients received 2 U. The majority of transfusions were administered in the first 72 hours postoperatively and tailed off thereafter (Fig. 1). There were no adverse transfusion reactions.

Patients received either lovenox alone, coumadin alone, or a combination of aspirin and pneumatic compression for deep venous thrombosis prophylaxis. The 16 patients receiving lovenox alone had a mean transfusion rate of 2.3 U per patient. The 6 patients receiving coumadin had a mean transfusion rate of 3 U per patient. The 3 patients receiving aspirin and pneumatic compression had a transfusion rate of less than 1 U per patient. Unfortunately the number of patients in each group was too small to show any statistically significant difference.

Of the 14 patients still alive at the time of the study, the authors were able to contact either the patient or a family member in 12 instances. At a mean follow-up of 4.1 years (range, 1.8-8.1 years), 9 of the 12 were active and 3 were demented and bed-bound. The Harris Hip Score of the sole surviving hip patient had improved from 28 preoperatively to 62 at 6.5 years postoperatively. Among the 8 surviving total knee arthroplasty patients who were still mentally alert, at a mean follow-up duration of 3.6 years, mean Knee Society clinical scores had improved from 41 preoperatively to 93, and mean Knee Society function scores from 27 preoperatively to 42.

A Kaplan-Meier survival curve of the patients in our study was compared to that of an aged-matched control group obtained from the United

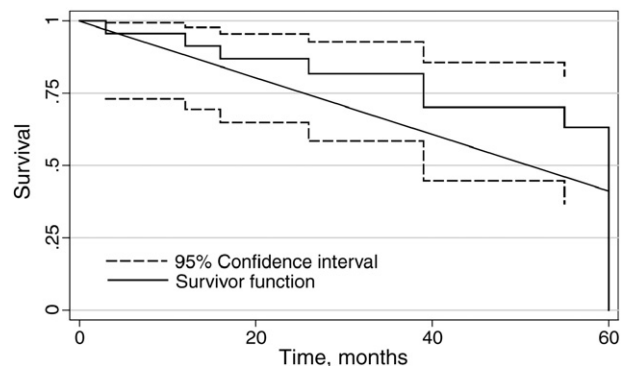


Fig. 2. Kaplan-Meier survival curve of patients 90 years of age or older after total joint arthroplasty. Solid stepped line indicates survival in the study population; dashed lines, upper and lower 95% confidence intervals. Straight line indicates expected survival from the United States Life Tables, 2002 [6].

States Life Tables (2002) [6] (Fig. 2). Five-year survival was used because of insufficient observations past this endpoint. Our curve shows that the nonagenarians in our series had slightly better 5-year survival rates than did the control group. The curve for the control group is located within the lower 95%.

Discussion

Our results suggest several recommendations concerning total joint arthroplasty in patients 90 years of age and older. Twenty-seven medical complications in 25 patients in combination with a high median number of transfusions support the view that the surgeon should treat this cohort differently than younger, healthier total joint arthroplasty patients. To begin with, we believe that the surgeon should explain to the arthroplasty candidate who is 90 years of age or older the high likelihood of medical complications and of multiple transfusions. The surgeon should also emphasize to these patients that, although they can expect pain relief in the affected joint, the immediate postoperative course may be more difficult than in younger patients. In addition, the surgeon should consider the following interventions for these patients: cardiac telemetry for the first 4 days after surgery, urologic prophylaxis, and the institution of environmental changes during hospitalization (eg, brighter surroundings, decreased noise levels, regular schedule) to decrease the likelihood of postoperative delirium.

The relatively high number of medical complications and the relatively low number of surgical complications in our series (2) are similar to those in previous series on total joint arthroplasty in patients 90 years of age or older [2,3], although in our series the rate of medical complications was higher. In patients 90 years of age or older undergoing total knee arthroplasty, Belmar et al [2] noted 11 medical complications in 12 patients, Joshi and Gill [3] noted 5 medical complications in 19 patients, and Pagnano et al [4] noted 15 medical complications in 41 patients. The foregoing studies support our contention that patients 90 years of age or older should be counseled concerning the high rate of medical complications.

In our study, the majority of complications involved the cardiovascular or genitourinary system. Cardiovascular complications included 2 episodes of new-onset atrial fibrillation, 1 episode of new-onset atrial flutter, and 1 case of bradycardia. Belmar et al [2] also found a high rate of

cardiovascular complications. As these arrhythmias can be found with cardiac telemetry, we recommend that all patients 90 years of age or older receive postoperative cardiac monitoring. As 2 of the 4 arrhythmias in our study occurred on postoperative day 4 (Table 2), we recommend cardiac telemetry for 4 days postoperatively.

Our patient population also had a high rate of genitourinary complications: 3 cases of urinary incontinence, 2 cases of urinary retention, and 3 cases of urinary tract infection. The importance of urinary retention is that it increases the likelihood of urinary tract infection, which in turn can lead to bacteremia that can predispose the patient to a periprosthetic infection. Petersen et al [7] found that urinary tract infections developed in 20% of patients with urinary retention and only 3% of patients without urinary retention. Wroblewski and del Sel [8], studying urinary tract infections in hip arthroplasty patients, reported subsequent deep infection of the implant in 6.2% of cases. Because of the high rate of urinary complications, prophylactic treatment for urinary tract infections should be considered for patients 90 years of age or older.

There were 4 cases of postoperative delirium (16%) in our series. In such cases, the etiology of the neurologic changes must be determined; pulmonary embolism, fat embolism, and stroke must be ruled out. A study by Inouye et al [9] found that changes to the environment can make postoperative delirium less likely: prevention of impairment from visual and hearing handicaps, sleep deprivation, immobility, and dehydration decreased the rate of delirium from 15% to 9.9%. We believe that these interventions should be implemented for patients 90 years of age or older.

In our series, 80% of patients received at least 1 U of packed red blood cells. In contrast, in the series of 9482 patients of mean age 66.6 years who underwent total hip or total knee arthroplasty studied by Bierbaum et al [10], 4409 (46%) received a blood transfusion in the perioperative period. In light of this disparity, as well as the fact that the median number of transfused units (among those who received transfusions) in our series was 3, we believe that patients should be informed that if they do receive a transfusion, there is a high likelihood that they will need multiple transfusions.

There appeared to be no association between preoperative medical comorbidities and postoperative complications in our series. Only 6 postoperative medical complications could be linked to preoperative medical comorbidities.

Because of the small number of patients undergoing total hip arthroplasty, no significant conclusions could be reached concerning this group taken separately. Among the 8 patients who underwent total knee arthroplasty and were still alive and mentally alert at 4-year follow-up, the mean Knee Society clinical score improved from 41 to 93 and the mean function score improved from 27 to 42. The greater increase in mean clinical score, which has also been found by other authors studying this age group [2-4], is due, we believe, to other limiting conditions, such as impaired vision and poor balance, that tend to affect patients 90 years of age or older.

Kaplan-Meier analysis demonstrated that the survival rate of patients undergoing total hip or knee arthroplasty is greater than that of age-matched controls, a seemingly paradoxical result that is probably due to a selection bias: a patient 90 years of age or older who is selected to undergo surgery is more likely healthier than the average individual of the same age. Berend et al [5] found a similar high survival rate among the extremely elderly undergoing total hip arthroplasty. This higher survival rate, we believe, supports the appropriateness of recommending total joint arthroplasty to carefully chosen candidates. In our cohort of the 12 patients who were still alive and not lost to follow-up, 3 were bedbound for dementia and 9 were still able to function relatively free from joint pain. It can be hypothesized that total joint arthroplasty in nonagenarians may allow patients to be more pain free, more active, and, thus, healthier.

In conclusion, when considering joint arthroplasty in the nonagenarian, it is important for the surgeon and the patient to be aware of the many medical complications that can arise. The surgeon must consider prophylactic treatments to prevent some of the more common complications. It is also

important that surgeons inform patients of the likelihood that they will require a blood transfusion in the perioperative period. Finally, the surgeon should be particularly alert during the perioperative period to quickly address problems if they arise.

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