Total Knee Arthroplasty in the Elderly: Does Age Affect Pain, Function or Complications?

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Abstract

Background TKA is one of the most commonly performed procedures in the elderly, yet whether age influences postoperative pain, function, and complication rates is not fully understood for this group. This is because the current literature has limited followup, small sample sizes, and no comparator group.

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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Questions/purposes We therefore asked if increasing age adversely affects postoperative pain, Knee Society Scores®, and complication rates.

Methods We retrospectively reviewed all 438 patients 80 years or older who underwent primary TKA between 1995 and 2005. We established a comparator group of 2754 patients younger than 80 years. We assessed pain, the Knee Society Score® (KSS), and the Knee Society Function Score® (KSFS). The number and type of complications were recorded and those graded 2 or more using the classification of Dindo et al. were analyzed. Minimum followup was 5 years (mean, 6 years; range, 5–15.5 years).

Results We found no difference in pain scores at 3, 5, and 10 years between the two groups. The KSS was comparable between groups at Year 5, but the KSFS was lower in the octogenarians. Major complications rates were higher in the octogenarian group (19% versus 15%).

Conclusions When compared with younger patients, octogenarians can expect comparable pain relief and KSS but lower function and more complications.

Level of Evidence Level III, therapeutic study. See Instructions for Authors for a complete description of levels of evidence.

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Introduction

With the expected expansion of the elderly population, an understanding of how these patients respond to surgery is important. By 2031, individuals older than 80 years will account for 3.8% of the UK's total population [25]. Total knee arthroplasty (TKA) is one of the most common orthopaedic procedures, with more than 86,000 primary procedures being performed between England and Wales in 2010 alone [19]. Currently 5% of all TKAs are performed in patients 85 years or older [3, 19], but with large expansions in this population group expected [10], it is probable the elderly will account for a greater proportion of cases in future years. Furthermore, with increased awareness of TKA, it can be expected demand will increase [9, 15]. Although TKA reduces pain and improves function in general populations of patients with joint disease [21], such postoperative outcomes as these in the octogenarian population are unclear. In the literature, the elderly have comparable knee scores to those of younger patients in the initial year postoperative [6] but with a lack of longer-term followup, it is difficult to determine how these patients progress. An appreciation of key outcomes such as postoperative pain and function beyond this initial period is crucial, however, and in particular how they compare with outcomes of a younger patient cohort so that we can understand any differences between these groups. In addition, reporting of complication rates is highly variable [12, 16, 26]. In part, this can be attributed to varying methods of complication recording among authors [21], small samples sizes [4, 20], limited followup [12, 16, 20], and the absence of a comparator group [2, 11, 13].

We therefore determined whether increasing age adversely affects postoperative (1) pain level, (2) Knee Society Score[®] (KSS) and Knee Society Function Score[®] (KSFS), and (3) complication rate, by using an adequate sample size, comparator group, and minimum followup of 5 years.

Patients and Methods

We retrospectively analyzed two groups of patients, with a mean age difference of 15 years at surgery, during a 10-year period. Our institution is comprised of three hospitals, and all patients who undergo primary TKA are reviewed by the local arthroplasty audit group. The preoperative baseline information is obtained by independent practitioners, and patients are followed up for life at given intervals. We searched this database to obtain all individuals 80 years or older who underwent primary TKA between 1995 and 2005. We identified 438 patients with a mean age at surgery of 83 years (Table 1). Eighty patients (18% of the total) were

Table 1. Demographics of both groups

Variable	Octogenarians (n = 438)	Control subjects (n = 2754)
Mean age (years)	83	68
Sex ratio (male:female)	1:1.2	1:2.1
Mean BMI	26.8	29.4
Diagnosis	Osteoarthritis: 95.7% Rheumatoid arthritis: 4.3%	Osteoarthritis: 92.3% Rheumatoid arthritis: 7.7%

lost to followup at a mean of 7 years after surgery. As the mean followup for these patients was greater than 5 years, all were included in the analysis. At the time of completion of this study 52% of the octogenarians were deceased. Mean age from surgery to death was 9 years, and a Kaplan-Meier survival curve shows this substantially greater mortality rate (Fig. 1). Minimum followup was 5 years (mean, 6 years; range, 5–15.5 years). No patients were recalled specifically for this study; all data were obtained from medical records and radiographs.

For comparison, a comparator group was established. We again used the local arthroplasty group database, and we reviewed all patients younger than 80 years who underwent primary TKA between 1995 and 2005 with the same preoperative diagnoses. This produced a cohort of 2754 patients with a mean age at surgery of 68 years (Table 1). Minimum followup was 5 years (mean, 9 years; range, 5–17.7 years). Nine percent of the younger cohort withdrew from followup at a mean of 8 years postoperatively.

We assessed pain, KSS, and KSFS preoperatively and postoperatively at Years 1, 3, 5, and 10 in both groups. Pain scores were assessed using The Knee Society scoring

Fig. 1 A graph shows Kaplan-Meier survival analysis for both groups. The octogenarian group had a higher ($p < 0.001$) mortality rate.

criteria, which categorizes pain under the following descriptors: none; mild/occasional; mild (stairs only); mild (walking and stairs); moderate-occasional; moderate-continual; and severe. The KSS considers pain, ROM, stability, and implant alignment, and the KSFS considers walking distance, ability to use stairs, and the use of walking aids. Both have a maximum score of 100. AP and lateral radiographs were taken at these assessments to review the prosthesis. Medical and surgical complications deemed attributable to undergoing TKA were documented. Documentation in the database was rigorous, and we therefore only presented complications graded 2 and above based on the classification of Dindo et al. [8], which excluded any problems able to be treated with antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy.

We computed mean and median calculations for all continuous variables at each stage of assessment. We used generalized estimating equations methods to estimate the effects of age (80 years or older, younger than 80 years), sex (male, female), and diagnosis (osteoarthritis, rheumatoid arthritis) on the KSS and KSFS. The odds ratios of independent variables (BMI, sex, diagnosis) on overall complication rates were determined using binary logistic

regression. Independent t-tests were used to compare BMI (< 25, 25–29, 30–40) by age, sex, and diagnosis. We used SPSS® v19.0 (SPSS Inc, Chicago, IL, USA) for all analyses.

Results

Pain was reduced ($p < 0.001$) postoperatively in both groups with no difference between the groups at Years 3, 5, and 10. Seventy-one percent of the octogenarians and 72.9% of the control subjects were pain free at Year 5. The octogenarian group was more likely ($p = 0.05$) to report improved pain levels at Year 1. Pain scores for the octogenarian group (Fig. 2) and comparator group (Fig. 3) at each stage of followup are provided.

The KSSs were comparable in both groups preoperatively (29 in octogenarians versus 30 in the comparator group) however the KSFS was lower ($p < 0.001$) in the octogenarian group (45 versus 50). At Year 5, the median KSSs again were comparable ($p = 0.995$) between the groups (Fig. 4); however, the median KSFS was lower ($p < 0.001$) in the octogenarian group (45 versus 65)

Fig. 2 A graph shows pain scores preoperatively in the octogenarian group at Years 1, 3, 5 and 10 postoperatively. These scores were comparable to those for the comparator group at Years 3, 5 and 10.

Fig. 3 A graph shows pain scores preoperatively in the comparator group at Years 1, 3, 5 and 10 postoperatively. This group was less likely to be pain free at Year 1 compared with the octogenarians.

Fig. 4 A graph shows the median KSS for both groups preoperatively and at Years 1, 3, 5, and 10 postoperatively. These scores were comparable at all times.

Fig. 5 A graph shows the median KSFS for both groups preoperatively and at Years 1, 3, 5, and 10 postoperatively. This score was lower ($p < 0.001$) in the octogenarian group than in the younger group (45 versus 65) at Year 5.

(Fig. 5), showing no difference from the preoperative score. Independent factors aside from age (BMI, diagnosis, sex) had an effect on KSFS ($p < 0.001$, $p = 0.002$, $p < 0.001$, respectively) but not on the KSS in the octogenarians (Table 2).

The complication rate was higher ($p = 0.035$) in the octogenarian group (19%) than in the younger group (15%). The only independent variable that affected complications was diagnosis in the comparator group (odds ratio, 1.54; 95% CI, 1.03–2.30; $p = 0.037$) (Table 3).

Table 2. Knee Society Knee and Function Scores[®] for the octogenarian group by independent factors

Variable	Knee Society Score [®]		Knee Society Function Score [®]	
	median	p value	median	p value
BMI				
< 25	87	0.905	50	< 0.001
≥ 25 to < 29	86		50	
≥ 30 to < 40	83		45	
Diagnosis				
Osteoarthritis	86	0.134	45	0.002
Rheumatoid arthritis	62		45	
Gender				
Female	86	0.447	45	< 0.001
Male	84		55	

Table 3. Complications in both groups

Factor	OR	95% CI	p Value
Octogenarians			
BMI (continuous variable)	1.00	0.98–1.02	0.338
Gender: male vs female	1.31	0.82–2.10	0.265
Diagnosis: OA vs RA	1.04	0.31–3.49	0.949
Control subjects			
BMI (continuous variable)	0.97	0.92–1.03	0.909
Gender: male vs female	1.18	0.98–1.42	0.085
Diagnosis: OA vs RA	1.54	1.03–2.30	0.037

OA = osteoarthritis; RA = rheumatoid arthritis.

The complications incurred with their corresponding frequencies are presented (Table 4).

Discussion

Given the substantial growth of the elderly population [10], it is necessary to evaluate the effectiveness of interventions in this demographic. We compared postoperative pain, KSS, KSFS, and satisfaction and complication rates between patients 80 years or older and a younger cohort who underwent TKAs. Currently, these outcomes are uncertain in the literature owing to small sample sizes [4, 20], limited followup [12, 16, 20], and the absence of comparator groups [2, 11, 13]. We therefore determined whether increasing age adversely affects postoperative (1) pain level, (2) KSS and KSFS, and (3) complication rate.

We recognize limitations to our study. First, we lost numerous octogenarian patients to followup. This relates not only to higher anticipated death rates in the elderly but also likely because many patients were in their late 80s and 90s and traveling to the hospital for followup could be

Table 4. Complications for both groups*

Complication	Octogenarians (%)	Control subjects (%)
Acute renal failure	0.2	0.3
Cerebrovascular accident	0.7	0.1
Deep infection	0.9	1.3
Deep venous thrombosis	1.6	1.5
Implant loosening	0.0	1.0
Myocardial infarction	0.7	0.3
Periprosthetic fracture	0.9	0.2
Prolonged wound drainage	2.7	1.5
Pulmonary embolism	0.9	1.0
Superficial infection	1.4	2.8
Tibiofemoral dislocation	0.5	0.1

* These are the most commonly encountered and clinically significant complications. Other less significant complications included urinary tract infections and confusion.

difficult. These are natural expectations when studying older patients and our value of 18% is comparable to those of other studies; Pavone et al. [21] lost 16% and Alfonso et al. [1] lost 14% of patients to followup. Furthermore, Alfonso et al. [1] reported, in their series of 25 patients, that three of the 12 not lost to followup were bed bound with dementia, highlighting the challenges of following up patients in this age group. Given that the mean followup for the patients who withdrew in our study was greater than 6 years however, we believe they contributed a substantial amount of data in the form of three postoperative assessments in addition to complication rates. Furthermore, they allowed us to use a larger patient study group than if they were rejected from the analysis. Finally, it is helpful to highlight that older patients may not be sufficiently able to undergo postoperative assessments for the duration of their lifetime and so additional resources, such as hospital transport, may be required for complete followup. It is difficult to determine what effect this missing information could have on the obtained results. However, we had a large sample size. Second, we did not review the socioeconomic factors implicated in TKA. These could highlight disparities in factors such as complication rates, function, and access to joint arthroplasty, but assessing socioeconomic factors was beyond the scope of this study and has been reviewed by others [7, 9, 14]. Third, multiple surgeons performed the procedures, which also can influence the findings, but we think make them more generalizable.

We found pain scores were comparable between groups at Year 5, which is particularly important given this is the main indication for TKA in the elderly [4, 24].

Similarly, the KSSs were comparable at all stages of review, which concurs with other evidence presented in the literature [4, 13]. The KSFSs were lower in the octogenarian

group, however. This is likely to be a consequence of the different information gathered by the KSS and the KSFS. The KSS considers pain, ROM, stability, and alignment whereas the KSFS considers walking distance, ability to use stairs, and the use of walking aids. As such, the KSS is unlikely to be affected by patients' other comorbidities such as cardiorespiratory disease, whereas the KSFS could be reduced substantially by such factors. It therefore is likely that this is the cause of the disparity between the KSS and KSFS, thus implying the knee arthroplasty is more comparable between the octogenarian group and younger comparator group than the KSFS at first implies. These results are consistent with those of other authors studying elderly patients [1, 13, 20]. The database we used does not collect data for preoperative comorbidities however, and so their effect could not be clarified in this study. In addition to comorbidities, the octogenarian group had a lower mean preoperative KSFS which could inhibit progression to greater function.

Complication rates were higher in the octogenarian group than in the younger comparator group (19% versus 15%), which differs from the data presented by Joshi et al. [13] who reported a 4.5% incidence of complications. This is lower, however, than the results of Berend et al. (22%) [5], Alfonso et al. (56%) [1], Pagnano et al. (41%) [20], and Stroh et al. (25%) [23]. It is possible this disparity represents the thoroughness to which complications are documented, and our rates represent only major complications as defined by Dindo et al. [8]. Furthermore, what is defined as a complication may vary among authors. For example, Pavone et al. [21] reported a complication rate of 16%, however this does not include patients who underwent manipulation under anesthesia which was performed in 27% of cases. Equally, Joshi et al. [13] only documented surgical complications and did not comment on medical complications. However, the importance is that the figure was higher than for the control subjects and as such suggests the elderly are more prone to having postoperative problems develop. However, the elderly group was less likely to have some major complications develop, including joint infection and pulmonary embolism. The cause of this difference is not apparent, however it may be a result of more thorough infection and deep venous thrombosis and pulmonary embolism prophylaxis for this group if they are believed to be high-risk candidates. A comparison between this study and the literature is presented (Table 5).

Patients with higher BMIs were not any more likely to develop complications. This information differs from that of several other studies [17, 18, 22] and suggests obese patients should not be denied treatment based on potential complication rates alone.

We believe our observations constitute evidence to justify performing TKA in elderly patients. Given the advancing age of the population, more patients will require

Table 5. Comparison of studies

Study	Pain	KSS	KSFS	Total complications	Mean followup
Berend et al. [5]		83		22%	3 years
Alfonso et al. [1]		93	42	56%	4 years
Joshi et al. [13]	72% pain free	86	51	4.5%	8 years
Pagnano et al. [20]		86	33	41%	4 years
Current study	71% pain free	92	45	19%	6 years

KSS = Knee Society Score[®]; KSFS = Knee Society Function Score[®].

joint arthroplasty and may outlive their prostheses. Our observations showed that during an extended period of postoperative assessment, individuals older than 80 years can experience comparable pain relief and KSSs to younger patients, and as such should not be denied treatment based on age alone.

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