Total Knee Arthroplasty Outcome for 129 Knees 80 Years and Older in Chinese Population

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Abstract

Background

Since China is aging rapidly, it is necessary to evaluate the reliability, durability, and satisfaction of total knee arthroplasty (TKA) among patients over 80 years.

Methods

Between February 2009 and December 2017, 98 patients (129 knees) met the inclusion criteria and were postoperatively followed-up ≥ 3 years. TKAs included 67 unilateral TKAs and 31 bilateral TKAs. The indexes included operative time, intraoperative blood loss, tourniquet time, Knee Society Score (KSS), Visual Analogue Scale (VAS), Range of Motion (ROM), “Forgotten Joint” Scale (FJS), crutches usage and patients’ satisfaction.

Results

KSS clinical and functional scores improved significantly from preoperative mean of 33 and 27 to latest follow-up of 87 and 51, respectively (p <0.05). The VAS decreased significantly from preoperative mean scores of 8 to latest follow-up of 0 (p <0.05). The proportion of patients without crutches at last follow-up was 52%, satisfaction rate was 94% and FJS ≥ 50 was 85%. However, ROM did not improve significantly from preoperative mean 89° to latest follow-up 93° (p >0.05). The preoperative hemoglobin and survival proportions between bilateral and unilateral TKAs were not statistically different (p >0.05).

Conclusion

TKA was reliable, durable, and satisfied in patients older than 80 years in Chinese population.

Introduction

Total knee arthroplasty (TKA) is a successful operation to alleviate pain and improve function for patients with advanced arthritis of the knee[1]. The safety of TKA has been improved based on the recent advances in anesthesia, perioperative health care, and surgical techniques, especially for older patients[2]. Moreover, most of the literature on patients 80 years of age and older was published in relation to Western populations. Knee anatomy and exercise habits of the Chinese population are different from Caucasians, with a relatively smaller bone structure and less exercise in the elderly. On the basis of one of the hospitals with the largest number of TKA patients over 80 years old in China, the current study was done to assess the reliability, durability, and satisfaction of TKA in Chinese patients 80 years of age or older with particular attention to perioperative operative time, intraoperative blood loss, knee function, patients’ satisfaction, medical morbidity, mortality, and rate of complications[3], [4], [5].

We asked whether elderly patients over 80 could benefit from TKA, and whether the life span of the patients will be affected after bilateral TKA.

Methods

Study design

Between February 2009 and December 2017, 117 patients (152 knees) received TKA due to osteoarthritis with 80 years of age and older. These TKAs were performed by a senior operator and 98 patients (129 knees) met the inclusion criteria (mean 82 years; range, 80–90 years) (Fig. 1). The patients' mean weight was 68 kg (range, 43–97 kg). The indications for surgery were advanced, symptomatic arthritis of the knee. All patients had a pre-anesthetic medical evaluation by a medical specialist. Sixty-four arthroplasties were done on the left knee. There were 60 women and 38 men, and 8 patients had simultaneous bilateral TKAs under one anesthesia. Sixty-seven patients had a unilateral TKA and 23 patients had staged bilateral TKAs including 6 staged bilateral TKAs during one hospital stay. The preoperative data included patient demographics (Table 1).

The inclusion criteria were as follows: 1) aged 80 years and older; 2) all surgical procedures were conducted by the same surgeon; 3) the indications for surgery were advanced, symptomatic arthritis of the knee; and 4) a minimum follow-up period of 3 years. The exclusion criteria were as follows: 1) a history of rheumatoid or ankylosing spondylitis; 2) any medical disability that limited the ability to walk and would not be considered suitable for a minimum 3-year follow-up period; 3) disabling diseases involving other joints of the lower extremities, and severe deformities (varus angulation, valgus angulation, or flexion contracture of more than 15°); 4) mental diseases; 5) patients participating in other trials were excluded; and 6) Patients lost to follow-up.

The data of the operative data included the operation time, intraoperative blood loss and transfusion, tourniquet time, ASA (American Society of Anesthesiologists Physical Status Classes), prosthesis type, patella replacement and complication (Table 2). Preoperative and postoperative clinical evaluations were performed by two independent orthopedic surgeons according to KSS, VAS, ROM, FJS, Crutch (Table 3,4) and radiographic data[6]. The death causes of patients after TKA were shown in Table 5. Data regarding the intraoperative and immediate postoperative complications were noted immediately. Revision for any reason was documented. Data results are cross-checked by the other two independent orthopedic surgeons.

Patients' satisfaction is classified as Very good if they have no other uncomfortable feelings; Good if they have few special feelings; General if they could accept some uncomfortable feelings; Not good if they could not accept the uncomfortable feelings[7].

All medical records were approved by patients. All participants signed informed consent, and the study was approved by the clinical research Ethics Committee of Chinese PLA General Hospital, Beijing, China. All methods were performed in accordance with the relevant guidelines and regulations.

Operation procedures

All patients received TKA (Depuy PFC, Depuy RPF, Gemini CR). The surgeries were performed by one senior physician under tourniquet control using a medial parapatellar approach[8]. Twenty-six patellar resurfacing was applied for 13 left and 13 right knees[7]. We commonly aim to accurately reproduce the preoperative thickness of the patella, as measured by callipers after osteotomy of the tibia and femur. When resurfacing was not performed, the patella should be repaired by removing the osteophytes and smoothing the fibrillated cartilage. Patellofemoral tracking was assessed by the “no thumb test” after inserting the implants.

All patients were managed with the same perioperative regimen[5]. Patients received antibiotic prophylaxis with intravenous Ceftriaxone Sodium (2g, 30 minutes before the operation followed by 2g for the next day). If the operation time exceeds 3 hours or the blood loss is greater than 1500ml, a second dose could be given during the operation. The postoperative regimen included: intravenous and oral analgesia (oral until 6 weeks after TKA), prophylaxis against venous thrombosis and knee extension training immediately. Progressive resistance exercises, gravity-assisted regaining of flexion and walking with support were started on the first day after TKA[5]. All patients used walkers for 6 weeks postoperatively and were taught by the same experienced rehabilitation doctor.

Statistical analysis

SPSS 24.0 (SPSS Inc) was used for statistical analysis by an independent orthopedic surgeon. Clinical data was described using means ± standard deviations. The level of statistical significance was defined as $p < 0.05$. Paired t-tests were performed to determine the difference in ROM, KSS, and VAS between before and after TKA. Chi-square test or Fisher exact test were performed to determine the difference in FJS, Crutch and Satisfaction. The Kaplan-Meier was used for survival analysis.

Results

There were no elderly patients over 80 years of age in our hospital who underwent revision surgery after TKA (Table 1). The patients were followed up until death or for a minimum of 3 years (range, 3–11 years). The preoperative hemoglobin of patients with bilateral TKAs in one stage was not statistically significant than that of patients with one knee in one stage, 127.50 ± 9.67 g/L and 125.65 ± 15.33 g/L respectively ($p > 0.05$) (Table 1). One patient died after a pulmonary embolism on postoperative Day 6. One patient was transferred to Intensive Care Unit after the operation due to intraoperative hypovolemia. One patient had an allergic reaction to blood transfusion during the operation. There was one patient with two stiff knees at 0°after primary TKA (Table 1). The imaging results of all review patients are normal.

The surgical time of patients with two knees in one stage was significantly longer than that of patients with one knee in one stage, 167.63 ± 67.62 min and 112.26 ± 27.03 min respectively ($p < 0.05$). The blood transfusion of patients with two knees in one stage was significantly higher than that of patients with one knee in one stage (1478.75 ± 912.57 mL and 772.56 ± 375.66 mL respectively) ($p < 0.05$). And the blood loss between the two groups was not statistically significant (350.00 ± 141.42 and 225.04 ± 152.10, respectively) ($p > 0.05$). The tourniquet mean time was 61.32 ± 20.80min. The distribution of ASA,

prosthesis, patella replacement and surgical complication was not statistically significant ($p > 0.05$) (Table 2).

The clinical scores of KSS postoperatively at year 3 was higher than that preoperatively (87.15 ± 13.29 and 33.09 ± 17.74, respectively) ($p < 0.05$) (Table 3). The functional scores of KSS postoperatively at year 3 was higher than that preoperatively (51.05 ± 22.13 and 27.33 ± 19.39, respectively) ($p < 0.05$) (Table 3). The postoperative VAS mean point was 0.45 ± 1.10 at year 3 was significantly lower than that before surgery (7.78 ± 0.92) ($p < 0.05$). However, the postoperative ROM in patients were not statistically significant than that before TKA (92.83 ± 23.53°and 88.81 ± 24.48°, respectively) ($p > 0.05$) (Table 3).

The proportion of FJS 50 points or more was 85%. We observed no difference between two genders in FJS at year 3 ($p > 0.05$) (Table 4). The proportion of patients who did not use crutches at last follow-up was 52% ($p > 0.05$) (Table 4). Other patients with crutches or wheelchairs after TKA mainly complained of lower limb weakness. The patients' satisfaction rate was 94% ($p > 0.05$) (Table 4).

Of the 24 patients who died after TKA, 15 met the minimum three-year follow-up time requirement. The death causes of patients after TKA were shown in Table 5. Heart failure and cancer were most common. The survival proportions between bilateral and unilateral TKAs were not statistically significant in 80 years and older patients ($p > 0.05$) (Fig. 2,3).

Discussion

A growing subset of patients had a TKA with greater life expectancy after reaching age 80[9]. This study was done to address the TKA outcome, the rate of complication, patients' satisfaction, and mortality after primary TKA in patients age 80 years and older.

The 80 years and older patients frequently had several preoperative medical comorbidities. A history of hypertension and cardiac disease was most common. Belmar et al1 showed that postoperative medical complications often could be linked with preoperative medical conditions. A high rate of complications had been reported in several series of primary and revision TKA in elderly patients[10], [11], [12]. Hosick et al[13] reported that a large number of comorbid conditions were present in patients older than 80 years who had a TKA. In that study, the rate of postoperative medical complications was 7%. In each of these studies, the medical complications were typically transient and rarely compromised the ultimate outcome of the TKA. Then preoperative detailed information obtained from patients and their family members about medical history as well as optimal perioperative patient care is required[14], [15]. However, we could not link the postoperative medical complications to the preoperative medical comorbidities. In our study, the rate of postoperative medical complications was 5%. The preoperative hemoglobin of patients between bilateral TKAs in one stage and unilateral TKAs were not statistic significant ($p > 0.05$), which showed that the preoperative hemoglobin was not the most important factor in deciding bilateral TKAs in one stage[16].

In the present study, the period of bilateral TKAs hospital stay (23.07 ± 9.20) was longer than the young bilateral TKAs patients[11]. In China, the postoperative self-physical therapy of old adult patients is usually continued until the patients' ability to walk becomes steady. The delayed postoperative rehabilitation schedule in old adult patients is due to their decreased physical strength and cognitive function.

The KSS clinical and functional scores improved significantly for patients 80 years of age and older from preoperative mean scores of 33 and 27 to latest follow-up scores of 87 and 51 respectively ($p < 0.05$). No knees have required revision subsequently. The VAS improved significantly from preoperative mean scores of 8 to latest follow-up scores of 0 ($p < 0.05$). At least a follow-up time of 3 years after surgery, all but one patient had substantial relief of pain after TKA. The data were similar to studies which were reported by several authors showing that TKA provides predictable relief of pain and improvement in function in the octogenarian populations[17].

However, the ROM did not improve significantly from preoperative mean 89°to latest follow-up 93°($p > 0.05$). They benefited mainly from pain relief and function improvement after TKA, but limited from squatting and other large knee flexion activities. To sit in a chair without using one's hands requires 93° knee flexion on average, and tying one's shoes while seated requires 106° flexion on average. Most elderly patients said that their knee function after TKA was adequate for daily life and could ensure basic self-care[18].

The proportion of patients who did not use crutches at last follow-up was 52%. Other patients with crutch or wheelchair after TKA mainly complained of lower limb weakness. The exercise of muscle strength of the lower limbs of elderly patients over 80 years was very important for postoperative recovery, and it was also difficult among Chinese population to keep at home[19].

The proportion of patients' satisfaction rate was 94%, and the 50 points or more rate of "Forgotten Joint" Scale (FJS) was 85%. This result indicated that "relieving the pain and keeping basic functions" the main purpose of TKA was achieved[20], [21].

Our study has several limitations. The primary limitation is that the study lacked adequate power to compare the results of TKAs with two knees in one stage with two knees in two stages. The other limitation is that several prostheses were used during the study, and comparison of results based on the implant used also would be prone to inadequate power. Third, the minimum 3-year follow-up period is still short, which may have impacted the results. We will continue to follow up the patients for 5 to 15 years, as the patients are currently aged above 80.

Conclusion

TKA was reliable, durable, and satisfied in patients older than 80 years in Chinese population. We recommend TKA for patients 80 years of age and older based on the surgical indications.

Abbreviations

TKA, total knee arthroplasty; KSS, knee society score; BMI, body mass index; ROM, range of motion; VAS, visual analogue scale; FJS, “Forgotten Joint” scale; ASA, American Society of Anesthesiologists Physical Status Classes.

Declarations

Funding

None.

Conflict of interest

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

We do not wish to share our data, because some of the patient’s data regarding individual privacy, and according to the policy of our hospital, the data could not be shared with others without permission.

Code availability

Not applicable.

Ethics approval and consent to participate

All medical records were approved by patients. All participants signed informed consent, and the study was approved by the clinical research Ethics Committee of Chinese PLA General Hospital, Beijing, China.

Consent for publication

Not applicable.

Authors’ contributions

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Contributors	Roles
CJ	Manuscript writing; Data collection; Data analysis; Study conceive; Participated in the design of the study; Data interpretation; Project coordination
ZZ	Data collection; Data analysis; Study conceive; Participated in the design of the study; Data interpretation; Project coordination
YW	Data collection; Data analysis; Study conceive; Participated in the design of the study; Data interpretation; Project coordination
JF	Data curation; Investigation; Methodology; Validation; Writing - review & editing
CX	Data curation; Investigation; Methodology; Validation; Writing - review & editing
JC	Project administration; Supervision; Writing - review & editing
XZ	Project administration; Supervision; Writing - review & editing

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Tables

Table.1 Patient Demographic Parameters.

Parameters	Male (N=38, 48 knees)	Female (N=60, 81 knees)	Overall (N=98, 129 knees)	Statistic
Age† (yr)	82.53±2.14	81.50±1.85	81.90±2.02	*p =0.433*
Height†(cm)	167.61±7.93	156.10±5.66	160.56±8.67	*p =0.12*
Weight† (kg)	76.12±11.21	63.48±8.20	68.38±11.28	*p =0.015**
BMI† (kg/m^2)	27.05±3.31	26.06±3.16	26.44±3.23	*p =0.834*
Hemoglobin† (g/L)				
Bilateral TKAs (one stage)	132.00±6.00	124.80±11.01	127.50±9.67	*p =0.16*
Unilateral TKAs (one stage)	133.52±15.59	121.00±13.22	125.65±15.33	*p =0.172*
Knee (no.[%])			129	*p =0.127*
Left Knee	28	36	64	
Right Knee	20	45	65	
TKA (no.[%])			129	*p =0.368*
Bilateral TKAs	10	21	31	
One stage	3	5	8	
Two stage (one hospital stay)	2	4	6	
Two stage (two hospital stay)	5	12	17	
Unilateral TKAs	28	39	67	
Inpatient Days† (d)				*p =0.00**
Bilateral TKAs (one hospital stay)			23.07±9.20	
Unilateral TKA (one hospital stay)			12.33±3.75	
Follow-up† (mo)	75.48±25.11	73.85±27.56	74.46±28.59	*p =0.191*
Revision knee (no.[%])	0	0	0	

BMI: body mass index; TKA: Total Knee Arthroplasty.

†The values are given as the mean and the standard deviation. * *p0.05.*

Table.2 Operative Data between two genders.

Operative Data	Male (N=38, 48 knees)	Female (N=60, 81 knees)	Overall (N=98, 129 knees)	Statistic
Surgical time† (minutes)				*p =0.000**
One knee in one stage	114.31±26.96	111.04±27.19	112.26±27.03	
Two knees in one stage	137.00±67.58	186.00±67.77	167.63±67.62	
Tourniquet time† (minutes)	64.17±22.34	59.63±19.78	61.32±20.80	*p =0.649*
Blood loss† (mL)				*p =0.847*
One knee in one stage	248.33±175.57	211.27±135.80	225.04±152.10	
Two knees in one stage	433.33±57.74	300.00±158.11	350.00±141.42	
Blood transfusion† (mL)				*p =0.000**
One knee in one stage	827.02±431.54	739.86±337.42	772.26±375.66	
Two knees in one stage	1540.00±1384.05	1442.00±703.61	1478.75±912.57	
ASA (no. [%])				
I	0	2	2	*p =0.061*
II	21	41	62	
III	16	17	33	
IV	1	0	1	
Prosthesis (no. [%])				*p =0.847*
Gemini CR	23	25	48	
Depuy PFC	19	22	41	
Depuy RPF	21	19	40	
Patella replacement (no. [%])	12	14	26	*p =0.291*
Left Knee	7	6		
Right Kne	5	8		
Complication (no. [%])			5	*p =0.80*
Low blood volume	0	1	1	

Pulmonary thrombosis	1	0	1
Allergic reaction to blood	1	0	1
Knee stiff at 0°	0	2	2

†The values are given as the mean and the standard deviation. * *p0.05.*

Table.3 Comparison of KSS, VAS and ROM before TKA and at Year 3 after TKA.

Clinical Factor	Preoperative	Postoperative at year 3	Statistic
KSS Clinical score †	33.09±17.74	87.15±13.29	*p =0.00**
KSS Functional score †	27.33±19.39	51.05±22.13	*p =0.00**
VAS†	7.78±0.92	0.45±1.10	*p =0.00**
ROM†	88.81±24.48	92.83±23.53	*p =0.12*

KSS: Knee Society Score; VAS: Visual Analogue Scale; ROM: Range of Motion.

†The values are given as the mean and the standard deviation. * *p0.05.*

Table.4 Distribution of FJS, Crutch and satisfaction between two genders at Year 3 after TKA (No. [%]).

Parameters	Male (N=38, 48 knees)	Female (N=60, 81 knees)	Proportion [%]	Statistic
“Forgotten Joint” Scale(no.[%])				*p =0.166*
0	1	3	3%	
25	4	11	12%	
50	15	19	26%	
75	17	40	44%	
100	11	8	15%	
Crutch (no.[%])				*p =0.96*
Without Crutch	20	31	52%	
With Crutch	15	25	41%	
With Wheelchair	3	4	7%	
Satisfaction(no.[%])				*p =0.728*
Very good†	40	68	84%	
Good†	4	2	5%	
General†	3	4	5%	
Not good†	2	6	6%	

FJS: “Forgotten Joint” Scale.

†These indexes of the patients’ satisfaction are classified as Very Good if they have no other uncomfortable feelings; Good if they have few special feelings; General if they could accept some uncomfortable feelings; Not Good if they could not accept the uncomfortable feelings. * *p0.05.*

Table.5 The Death Cause of Patient after TKA.

Serial Number	Age	Number of Knees	Gender	Time to Death after TKA (mo)	The Cause of Death
1	80	1	M	36	Heart Failure
2	88	1	F	36	Heart Failure
3	84	1	M	83	Heart Failure
4	82	1	M	72	Lung Cancer
5	83	1	M	90	Heart Failure
6	80	1	M	99	Urinary System Tumor
7	80	1	M	74	Digestive System Tumor
8	82	1	M	41	Lung Cancer
9	90	1	M	84	Respiratory Failure
10	80	1	F	92	Lung Infection
11	83	1	M	70	Multiple Organ Dysfunction Syndrome
12	82	1	M	63	Heart Failure
13	84	2	F	41	Cerebral Atrophy
14	82	2	F	36	Heart Failure
15	81	1	F	13	Heart Failure
16	84	1	F	12	Lung Cancer
17	81	1	M	48	Heart Failure
18	80	1	F	30	Lung Infection
19	81	1	M	36	Urinary System Tumor
20	80	1	F	56	Cerebral Hemorrhage
21	84	1	M	0.2	Pulmonary Thrombosis
22	83	2	M	36	Heart Failure
23	84	2	F	3	Heart Failure
24	85	2	F	110	Cerebral Infarction
24	82.63±2.02†	29		52.55±31.04†	

M: Male; F: Female.

†The values are given as the mean and the standard deviation.

Figures

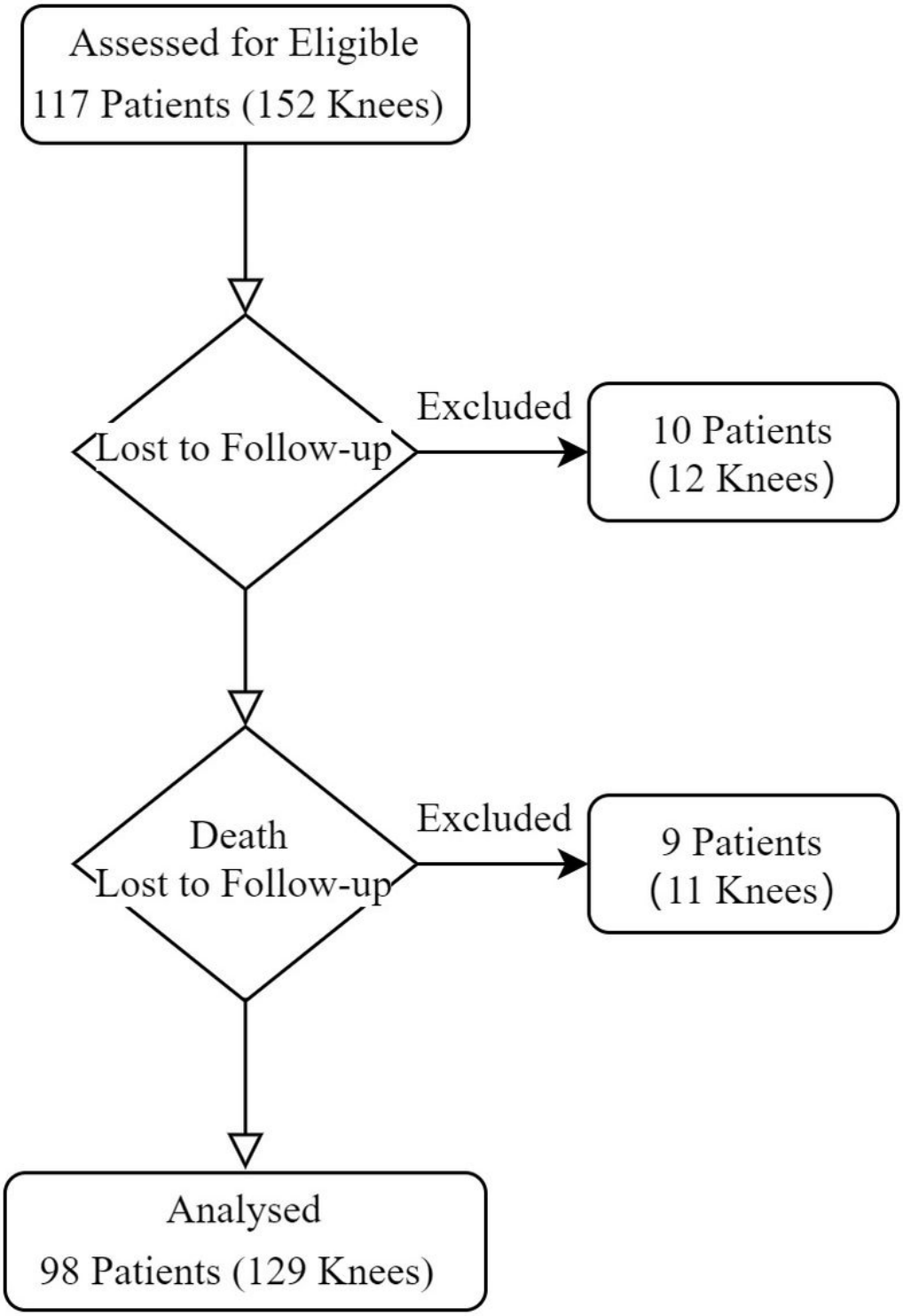

Figure 1

Flow Diagram

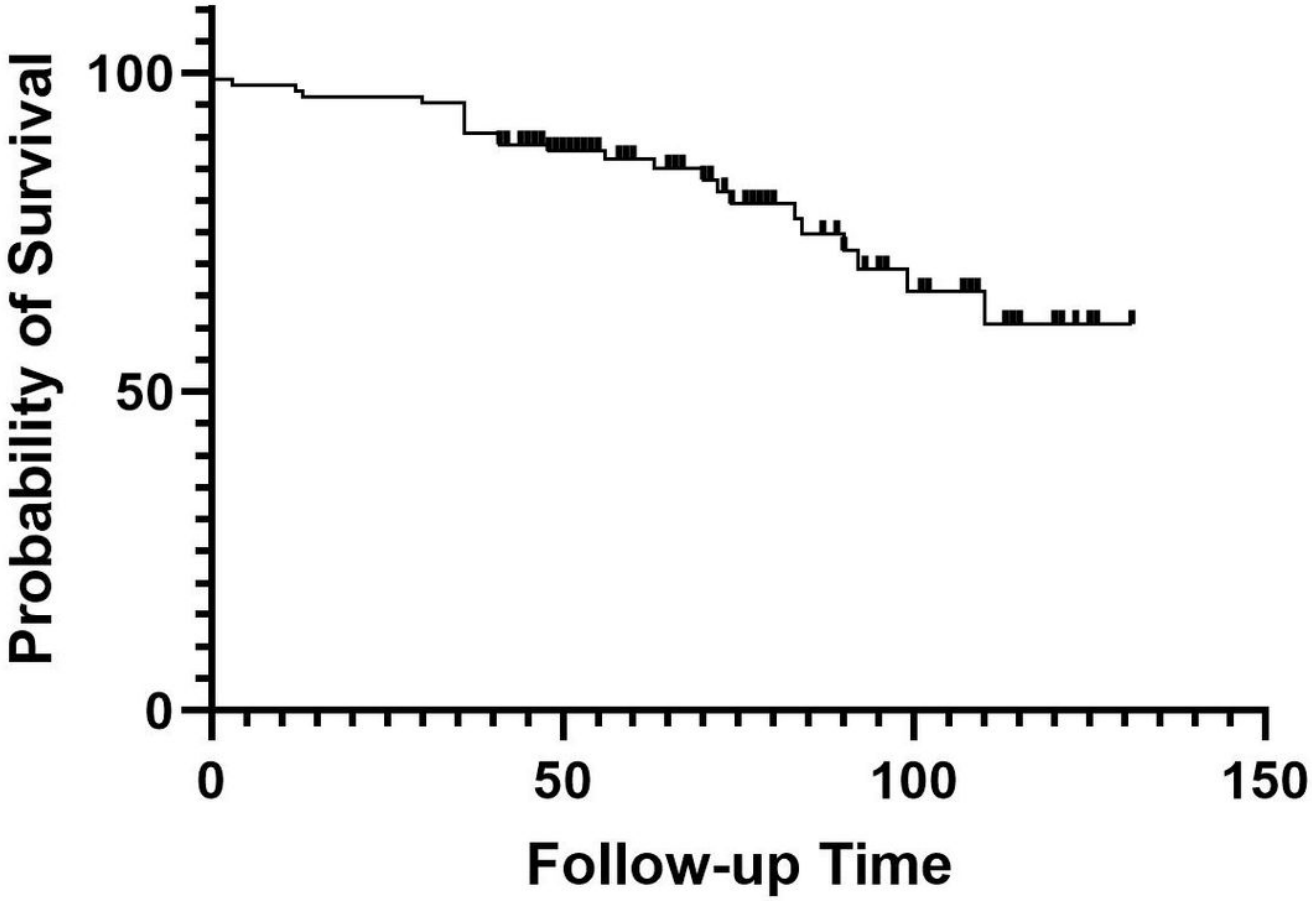

Figure 2

Survival Proportions in 80 Years and Older TKAs

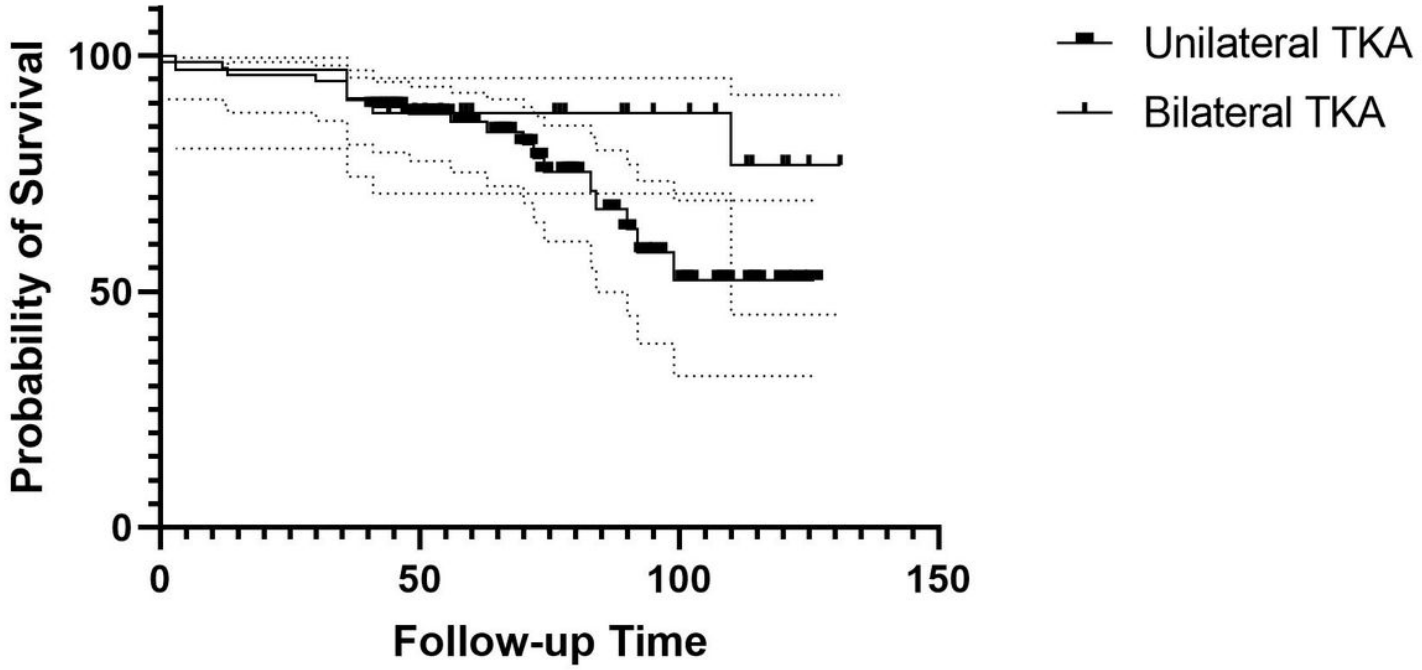

Figure 3

Comparison of Survival Proportions between Unilateral and Bilateral TKAs