

Clinical outcomes of patients lost to follow-up and factors affecting follow-up loss after total knee arthroplasty

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Abstract

Background

The hypotheses were as follows: 1) the clinical outcome of patients lost to follow-up after total knee arthroplasty (TKA) will be different compared to patients with follow-up; 2) follow-up rate will be affected by various social economic factors.

Methods

Patients who underwent TKA between March 2019 and February 2020 were retrospectively included. Patients lost to follow-up were defined as patients who did not undergo follow-up 6 months after TKA; all patients were divided into follow-up and follow-up loss groups. Western Ontario and McMaster Universities Osteoarthritis (WOMAC) and Knee Society Score (KSS) were measured before surgery. After surgery, WOMAC, KSS function, and satisfaction were measured via telephone. Age, sex, unilateral or bilateral TKA, distance from hospital, presence of a family, and insurance were investigated.

Results

A total of 137 patients were included in the study. There were 92 (67.2%) patients that followed up 6 months after TKA, on the other hand, 45 patients (32.8%) were lost to follow-up. There was no difference in clinical outcomes (WOMAC, $p = 0.932$; KSS clinical, $p = 0.450$) and satisfaction (pain: $p = 0.230$, function: $p = 0.300$) between two groups. Age, sex, unilateral or bilateral TKA, distance from hospital, presence of a family, and insurance had no effect on follow-up rates.

Conclusion

The clinical outcomes of patients lost to follow-up after TKA did not show a difference from those who were followed up. Age, sex, unilateral or bilateral TKA, distance from hospital, presence of a family, insurance status, and postoperative clinical symptoms did not affect the follow-up rate.

Introduction

Total knee arthroplasty (TKA) is a treatment option for end-stage knee osteoarthritis. TKA can reduce pain and improve patient function. However, aside from surgery, postoperative rehabilitation such as range of motion and quadriceps muscle exercises can also affect surgical outcomes. Additionally, symptoms may not completely improve even after TKA, with some patients reporting discomfort despite a significant reduction of pain experienced [1]. Early complications are difficult to detect because these are usually asymptomatic. There are also many patients who prefer continuous follow-up. Therefore, continuous outpatient follow-ups after TKA are important.

However, there have been disagreements regarding outpatient follow-ups. In the case of TKA, postoperative management does not change due to the follow-up procedure, and outpatient follow-up is recommended only 3 months after surgery to reduce cost [2, 3]. Other studies have also reported that the threat of complications and the patients' age at the time of TKA were taken into consideration when the specific timing of follow-ups were recommended [4, 5]. However, most orthopedic surgeons prefer outpatient follow-up once every 1–2 years after TKA [6].

The reasons for postoperative follow-up loss are reported differently, depending on the type of surgery and country. In the United States, different follow-up rates have been reported according to sex and race in anterior cruciate ligament reconstruction [7]. In China, age, sex, employment, distance, costs, patient preoperative clinical factors, and physician factors were not associated with follow-up rates after ophthalmologic surgery [8]. In England, age and lower socioeconomic status were associated with a lower follow-up rate [9]. Data from post-arthroplasty patients in the United States have found that distance from hospital and race were associated factors with follow-up rates [10].

Follow-up after TKA is important not only for the patients, but for the surgeon as well because the results of the TKA can be checked and feedback can be given through these sessions. However, the clinical outcomes of patients lost to follow-up are not clearly known. In addition, it is impossible to directly compare the follow-up rate and the factors that affect these due to differences in insurance systems and medical costs in each country. Therefore, in this study, the clinical outcomes of TKA in patients lost to follow-up were compared with those in patients with follow-up as well as investigating the reason for follow-up loss. This study hypothesizes that the clinical outcome of patients with follow-up loss after TKA will be different in patients with follow-up and that follow-up rate will be affected by various factors including age, sex, unilateral or bilateral TKA, distance from hospital, the presence or absence of a family living together, and health insurance stage.

Methods And Materials

Patient demographics

All patients who underwent TKA by the same surgeon (LSH) between March 2019 and February 2020 were included. The exclusion criteria were as follows: 1) patients who needed secondary operation due to complications such as infection, fracture, and loosening; 2) patients who were hospitalized for a long time in another hospital and were unable to follow up; and 3) patients who died during the follow-up period. Patients who underwent TKA were discharged 2 weeks after surgery, with outpatient follow-up being performed 6 weeks, 3 months, 6 months, and 1 year after TKA. A patient lost to follow-up was defined as a patient who did not undergo outpatient follow-up 6 months after surgery. Institutional Review Board approval was obtained before any analysis was performed (approval number: BOHUN 2021-07-015-002).

Social economic factor & cause of follow-up loss

For all patients included in this study, sex, age, unilateral or bilateral TKA, distance between hospital and residence, national health insurance status (Medicare or medical aid), and the presence or absence of a family living together (living alone or living with family) was investigated by reviewing the patient's chart. Patients were also divided into two groups based on the distance between their residence and the hospital: patients living within 30 km from the hospital and those living in areas farther than 30 km from the hospital. Patients lost to follow-up were asked about the cause of follow-up loss through open-ended questions via telephone.

Clinical outcome measurement

Western Ontario and McMaster Universities Osteoarthritis (WOMAC) and Knee Society Score (KSS) were measured to confirm the patients' clinical symptoms prior to surgery. After surgery, WOMAC and KSS functions were measured via telephone. Satisfaction (%) was divided into pain and function parameters and surveyed by telephone. Since clinical outcomes were measured through a telephone interview, the KSS clinical score, which requires knee range of motion angle measurement, could not be measured.

Statistical Analysis

The differences in clinical score and satisfaction rate between the follow-up loss and non-loss groups were analyzed using an independent t-test. Chi-square analysis was conducted on the categorical data that affect follow-up rate, such as sex, distance from hospital, presence of family in the residence, and medical insurance state. Age, height, weight, clinical outcome, and satisfaction rate were analyzed using logistic regression analysis. All statistical analyses were performed using the SPSS statistical package (version 22.0, IBM Corp., Armonk, NY, USA). Logistic regression analysis was used to analyze PF arthritis and its influencing factors. The difference in clinical score according to PF arthritis and muscle status was analyzed using an independent t-test. Statistical significance was set at $P < 0.05$.

Results

A total of 140 patients underwent TKA, and 137 patients were included in this study, with one periprosthetic fracture case, one case of infection, and one case of hospital admission being excluded based on the set exclusion criteria (Table 1). There were 78 patients who underwent unilateral TKA and 59 patients who underwent bilateral TKA. After TKA, 92 (67.2%) patients were followed up; however, 45 patients (32.8%) were lost to follow-up within 1 year after TKA. The preoperative WOMAC and KSS clinical scores did not differ between the follow-up group and the follow-up loss group; however, the follow-up loss group exhibited statistically significant low KSS function scores. After TKA, both the WOMAC and the KSS function scores improved significantly. Pain satisfaction was $77.7 \pm 18.1\%$, and function satisfaction was $73.6 \pm 19.7\%$ (Table 2).

Table 1
Patients demographics

	No follow-up loss (N = 92)	Follow-up loss (N = 45)	P-value
Age	73.6 ± 5.4	73.7 ± 5.4	0.961
Sex	male: 49 female: 43	male: 25 female: 20	0.290
Height	158.4 ± 8.4	156.8 ± 7.6	0.290
Weight	66.1 ± 10.4	67.4 ± 12.1	0.505
Side	Unilateral: 54 Bilateral: 38	Unilateral: 24 Bilateral: 21	0.585
Insurance	Medicare: 85 Medicaid: 7	Medicare: 39 Medicaid: 6	0.353
Distance from hospital	Within 30km: 52 Over 30km: 40	Within 30km: 20 Over 30km: 25	0.206
Number of families	Live alone: 12 Live with family: 80	Live alone: 38 Live with family: 7	0.793
Preoperative WOMAC	66.2 ± 8.6	68.4 ± 5.8	0.129
Preoperative KSS clinical	49.4 ± 6.7	50.0 ± 2.6	0.595
Preoperative KSS function	45.5 ± 4.3	43.9 ± 4.7	0.048
WOMAC: Western Ontario and McMaster Universities Osteoarthritis, KSS: Knee Society Score			

Table 2
Clinical outcome of TKA patients

	Preoperative	Postoperative	p-value
WOMAC	66.9 ± 7.9	26.3 ± 19.0	P < 0.001
KSS function	45.0 ± 4.5	73.3 ± 23.8	P < 0.001
Pain satisfaction (%)		77.7 ± 18.1	
Function satisfaction (%)		73.6 ± 19.7	
WOMAC: Western Ontario and McMaster Universities Osteoarthritis, KSS: Knee Society Score			

1) Clinical outcome difference between no follow-up loss and follow-up loss group

The postoperative WOMAC score was 25.9 ± 18.5 in the no follow-up loss group and 26.2 ± 20.2 in the follow-up loss group ($p = 0.932$); postoperative KSS function was 74.6 ± 21.8 in the no follow-up loss group and 71.3 ± 27.6 in the follow-up loss group ($p = 0.450$). There was no significant difference between the two groups.

Pain satisfaction (%) was 79.0 ± 17.2 in the no follow-up loss group and 75.0 ± 18.4 in the follow-up loss group ($p = 0.230$), while function satisfaction was 74.8 ± 19.2 in the no follow-up loss group and 71.1 ± 20.6 in the follow-up loss group ($p = 0.300$). In terms of satisfaction, the follow-up loss group tended to be lower; however, this finding was not statistically significant (Table 3).

Table 3
Clinical outcome difference between no follow-up loss and follow-up loss group

	No follow-up loss	Follow-up loss	P-value
Postoperative WOMAC	25.9 ± 18.5	26.2 ± 20.2	0.932
Postoperative KSS function	74.6 ± 21.8	71.3 ± 27.6	0.450
WOMAC improvement	40.3 ± 20.8	39.5 ± 23.3	0.855
KSS function improvement	29.4 ± 22.3	27.0 ± 27.2	0.590
Pain satisfaction (%)	79.0 ± 17.2	75.0 ± 18.4	0.230
Function satisfaction (%)	74.8 ± 19.2	71.1 ± 20.6	0.300

WOMAC: Western Ontario and McMaster Universities Osteoarthritis, KSS: Knee Society Score

2) Factors affecting follow-up rate

No difference was seen between the two groups regarding how sex, unilateral or bilateral TKA, national health insurance status, distance between hospital and residence, and living alone or living with family affected follow-up rates (Table 1). A logistic regression test was performed for other variables, and there was no difference between the two groups in terms of age, height, weight, preoperative WOMAC, and KSS clinical score (Table 4). However, preoperative KSS function was 45.5 ± 4.3 in the no follow-up loss group and 43.9 ± 4.7 in the follow-up loss group, while a statistically significant ($p = 0.048$) low preoperative KSS function score was seen in the follow-up loss group.

Table 4
Logistic regression analysis of factors that affect follow-up loss

	B	S.E.	OR	95% CI	p-value
Age	-0.005	0.037	0.995	(0.926–1.069)	0.889
Height	-0.057	0.031	0.944	(0.888–1.004)	0.067
Weight	0.44	0.023	1.045	(0.998–1.093)	0.059
WOMAC	0.037	0.033	1.038	(0.973–1.107)	0.259
KSS_clinical	0.042	0.042	1.043	(0.960–1.133)	0.316
KSS_function	-0.082	0.046	0.921	(0.842–1.008)	0.075
Postoperative WOMAC	-0.013	0.016	0.987	(0.956–1.019)	0.416
Postoperative KSS_function	-0.002	0.012	0.998	(0.975–1.022)	0.893
Pain satisfaction (%)	-0.006	0.024	0.994	(0.948–1.042)	0.803
Function satisfaction (%)	-0.013	0.023	0.987	(0.943–1.032)	0.561
-2LL = 157.057, Nagelkerke R ² = 0.132, Hosmer & Lemeshow test: $\chi^2 = 3.677$ (p = 0.885)					
WOMAC: Western Ontario and McMaster Universities Osteoarthritis, KSS: Knee Society Score					

The reasons for follow-up loss were as follows: 1) there was no pain, so patients did not feel the need for follow-up (26 patients, 57.8%), 2) due to management of other diseases, (6 patients, 13.3%), 3) due to the distance from the hospital (5 patients, 11.1%), 4) due to dissatisfaction (3 patients, 6.7%), and 5) due to other social factors such as COVID-19. (5 patients, 11.1%) (Table 5).

Table 5
Reasons for follow-up loss

	Number	%
Satisfaction with no pain	26	57.8%
To treat of other diseases	6	13.3%
Far from hospital	5	11.1%
Dissatisfaction with pain	3	6.7%
Other social conditions such as COVID-19	5	11.1%

Discussion

The principal findings of this study were as follows: 1) There was no difference in clinical outcome between the no follow-up loss group and the follow-up loss group, and 2) age, sex, height, weight, unilateral or bilateral, national health insurance status, distance from hospital, and number of families had no effect on follow-up.

Currently, there is a difference in opinion regarding the period and duration of follow-up after TKA. Some studies have reported that continuous outpatient follow-up after TKA is not necessary from an economic perspective [2, 3, 11, 12]. Another study reported the appropriate follow-up timing by calculating the complication probability [4]. Alternatively, follow-up was recommended only if the age at the time of surgery was under 70 years of age or if there were symptoms [5]. However, many orthopedic surgeons recommend annual or biennial follow-up for clinical or radiologic signs of failure [6]. Through this follow-up process, patients can feel relieved by checking their condition, and patients can receive quick additional treatment if necessary. In addition, the surgeon could get their surgical outcome feedback by checking the patient's condition. If follow-up was not performed after surgery, the operator could only check the outcomes of the patients who do follow-up, and thus, overestimation or underestimation of the surgical outcomes is possible.

The one-year follow-up rate in this study was 67%. This was similar to the 60–70% of other studies that reported 1 year follow-up rates in TKA [10, 13]. However, direct comparison was difficult because the rate of outpatient follow-up after surgery may vary according to each country's medical insurance system. In a previous study, it was reported that patients who did not follow up were associated with worse clinical outcomes in arthroplasty [14]. It was also reported that the clinical outcome of patients who did not follow up was poor even in other surgeries such as ophthalmology or bariatric surgery [8, 15, 16].

However, in this study, there was no statistically significant difference in clinical outcome and satisfaction between the two groups, but the average value showed a low trend in the follow-up loss group. This seems to be the effect of the relatively small sample size, and there was only KSS clinical as a directly comparable clinical score, and satisfaction was also subjective, so it was difficult to compare it with other studies.

Factors that could affect outpatient follow-up, such as age, sex, unilateral or bilateral surgery, presence or absence of family, and distance from hospital did not affect outpatient follow-up. It has been reported that the follow-up loss rate was high in younger age groups in arthroplasty, and there was no relationship between age and follow-up rate [13]. It is thought that this is not a problem of age itself, but rather the presence or absence of a job according to age, and age acted as a compounding factor. The existence of a job according to age may differ in each country, and this difference is thought to have occurred.

In South Korea, where this study was conducted, a national health insurance system was implemented. All nations are classified as targets for Medicare, and only approximately 3% of the economically weak are classified as eligible for Medicaid [17]. This study showed that postoperative outpatient follow-up was performed at a similar rate between Medicare and Medicaid patients, so there was a relationship between economic level and outpatient follow-up rate. This was different from the result of another study

in which approximately 45% of patients did not follow-up on an outpatient clinic due to cost concerns [18]. This difference is thought to be due to the relatively low cost, which is approximately \$10 per outpatient follow-up in South Korea due to the national health insurance system. In this study, the distance to the hospital and the presence or absence of a family living together did not affect outpatient follow-up. Five patients (11.1%) mentioned that they could not visit the hospital because of the distance, but two of five patients lived within 30 km of the hospital. Therefore, it is thought that the follow-up rate will be affected more by the existence of various public transportation means, the convenience of transportation, and the manpower that can accompany outpatient follow-up rather than the absolute distance and family.

This study has several limitations. First, there may be differences in surgical outcomes due to the nature of the phone interview. However, this was minimized by matching the doctor who measured the clinical score before TKA with the doctor who was interviewed over the phone. However, clinical KSS could not be measured. Second, whether or not to visit a hospital can be affected in various ways, but private insurance other than national health insurance was not considered. However, since the cost of outpatient treatment itself is not high, it was thought that the impact would be small. Third, the absolute distance it takes to get to the hospital is important, but it can also be affected by the convenience of a helper and transportation that can come to the hospital. Therefore, it cannot simply be mentioned that the time it takes to get to the hospital represents the distance. Fourth, the hospital fee reduction system of the hospital where this study was conducted may also have an effect on the outpatient follow-up rate. Although this may affect the overall follow-up rate, since the reduction itself is applied to all patients visiting this hospital, it was thought that the effect on follow-up would be small.

Conclusion

The clinical outcomes of patients lost to follow-up after TKA did not show a difference from those who were followed up. Age, sex, unilateral or bilateral TKA, distance from hospital, the presence or absence of a family living together, health insurance status, and postoperative clinical symptoms did not affect the follow-up rate.

Abbreviations

TKA: total knee arthroplasty, WOMAC: Western Ontario and McMaster Universities Osteoarthritis, KSS: knee society score

Declarations

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Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

SHL & JRY designed this paper and performed critical revision of the manuscript. SHL coordinated the clinical study and PSP and THY initiated and performed the study, analyzed the data, and wrote the manuscript. SHL & JRY helped to draft the manuscript and all authors read and approved the final manuscript.

Ethics approval and consent to participate

All methods were performed in accordance with the relevant guidelines and regulations. This article was performed under the IRB permission (Veterans Health Service Medical Center International Review Board No: BOHUN 2021-07-015-002) and informed consent was waived due to the retrospective nature of this study.

Consents for publication

All presented cases in this report had written consents for publication

Competing interests

The authors declare that we have no conflict of interest.

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