Frequency of follow-up visits within six months of primary total knee arthroplasty impacts rates of revision

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INTRODUCTION:

A greater number of touchpoints between the patient and the surgical team may impact clinical outcomes. However, routine follow-up visits following primary total knee arthroplasty (TKA) vary among surgeons. This study sought to examine the effect of follow-up frequency within six months after TKA on rates of revision total hip arthroplasty (rTKA) for any reason.

METHODS:

All TKAs performed at a large, urban, academic institution between September 2015 and February 2024 were retrospectively reviewed. Data on demographics, perioperative factors, the number of follow-up visits post-TKA, and surgical outcomes were collected. Patients were stratified based on their number of in-office or video follow-up visits (zero, one, two, three or more) within six months of TKA. Patients who required a revision before six months postoperatively or who were lost to follow-up were excluded. Univariate analysis was used to assess differences between the follow-up cohorts. Multivariate logistic regression was performed to understand the effect of follow-up frequency on revision rate. Predictor variable multicollinearity was assessed using adjusted Generalized Variation Inflation Factor (GVIF).

RESULTS:

A total of 12,942 patients were included in the study, with 1,144 patients in the no-follow-up cohort, 1,071 in one-follow-up, 4,219 in two-follow-ups, and 6,508 in three-or-more-follow-ups. The mean follow-up time was 34 months (range 6-114 months). The revision rates were 7.1, 2.1, 1.7, and 3.4%, respectively. Age, sex, body mass index (BMI), smoking status, English-as-preferred-language, American Society of Anesthesiologists (ASA) classification, and operative time differed between the cohorts (P<0.001 for all comparisons). However, there was no difference in distribution of septic and aseptic revisions between the follow up groups (P=.54).

Multivariate regression, which controlled for all variables shown in the univariate analysis besides and English-as-preferred-language, showed that follow-up visit frequency within six months postoperatively significantly impacted revision rates. Patients who had at least three follow-ups were 57% less likely to require revision compared to those who did not follow up at all. For patients with two follow-ups the risk reduction was 78%, and for one follow-up, 74% (P<0.001 for all three comparisons). Black/African-American and Latino patients also had higher odds of revision compared to White patients (P<0.05). Additionally, men were more likely to require revision than women (OR=1.37 P=0.005), former smokers were more likely to require revision than never-smokers (OR=1.25, P=0.045), and patients who were younger at the time of index TKA were more likely to require revision than those who were older, with the odds of revision decreasing by 5% year-over year (OR 0.95, P<0.001).

DISCUSSION AND CONCLUSION: While univariate analysis showed significant differences for all variables included, multivariate regression, which distinguished the individual impact of each variable on revision rate demonstrated that frequency of follow-ups significantly and independently impacts revision rates six months or more postoperatively. Patients who follow up with their surgeon at least once within six months after primary TKA experience reduced odds of requiring revision at least six months after surgery. For patients doing well postoperatively, one visit in the global period may be sufficient to assess their radiographs and progress. Additionally, Black/African-American and Latino patients and former smokers may benefit from ensuring that they have at least one post-operative follow-up in order to mitigate the post-operative risk profile.

Table 1: Descriptive Statistics for Total Knee Arthroplasty

	Follow-Ups Within 6 Months				
	0	1	2	3+	
Variables	N = 1,144	N = 1,071	N = 4,219	N = 6,508	***P*-value**[1]
Age at Surgery, Median (IQR)	68 (61 – 73)	68 (61 – 74)	67 (61 – 73)	67 (60 – 73)	**<0.001**
Women, n (%)	760 (66)	673 (63)	2,928 (69)	4,499 (69)	**<0.001**
Female					
Male	383 (34)	398 (37)	1,291 (31)	2,009 (31)	
BMI Category, n (%)					**<0.001**
Normal	138 (12)	118 (11)	417 (9.9)	556 (8.5)	
Underweight	0 (0)	1 (<0.1)	6 (0.1)	10 (0.2)	
Overweight	370 (32)	314 (29)	1,218 (29)	1,791 (28)	
Class I Obese	353 (31)	309 (29)	1,288 (31)	2,083 (32)	
Class II Obese	198 (17)	214 (20)	805 (19)	1,318 (20)	
Class III Obese	85 (7.4)	115 (11)	485 (11)	749 (12)	
Race, n (%)					**<0.001**
White	771 (67)	640 (60)	2,382 (56)	3,418 (53)	
Black or African American	170 (15)	185 (17)	814 (19)	1,403 (22)	
Unknown/Other	144 (13)	164 (15)	689 (16)	1,139 (18)	
Asian	29 (2.5)	48 (4.5)	181 (4.3)	254 (3.9)	
Latino	30 (2.6)	34 (3.2)	153 (3.6)	294 (4.5)	
Preferred Language is English, n (%)	1,054 (92)	907 (85)	3,587 (85)	5,448 (84)	**<0.001**
Smoking Status, n (%)					**<0.001**
Never	643 (56)	649 (61)	2,568 (61)	3,973 (61)	
Former	439 (38)	362 (34)	1,497 (35)	2,205 (34)	
Current	62 (5.4)	60 (5.6)	154 (3.7)	330 (5.1)	
ASA Classification, n (%)					**<0.001**
1	24 (2.1)	21 (2.0)	91 (2.2)	110 (1.7)	
2	663 (58)	557 (52)	2,391 (57)	3,442 (53)	
3	441 (39)	472 (44)	1,686 (40)	2,860 (44)	
4	16 (1.4)	20 (1.9)	50 (1.2)	92 (1.4)	
Operative Time, Median (IQR)	105 (90 – 124)	105 (90 – 121)	104 (89 – 120)	107 (91 – 127)	**<0.001**
Revision after 6 Months, n (%)	81 (7.1)	22 (2.1)	73 (1.7)	223 (3.4)	**<0.001**
Aseptic Revision, n (%)	*65 (80)*	*19 (86)*	*63 (86)*	*176 (79)*	*0.54*
Septic Revision, n (%)	*16 (20)*	*3 (14)*	*10 (14)*	*47 (21)*	

IQR, Interquartile Range; *BMI,* Body Mass Index; *ASA*, American Society of Anesthesiologists

[1] Kruskal-Wallis rank sum test; Pearson's Chi-squared test; Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Table 2: Multivariate Regression Analysis for Revision Knees after 6 Months

Characteristic	**OR (95% CI)**	***P*-value**	**GVIF**	**Adjusted GVIF**[1]
Follow-Up Visits Within 6 Months			1	1
0 Visits	—			
1 Visits	0.26 (0.16 to 0.42)	**<0.001**		
2 Visits	0.22 (0.16 to 0.31)	**<0.001**		
3+ Visits	0.43 (0.33 to 0.57)	**<0.001**		
BMI Category			1.3	1
Normal	—			
Underweight	0.00 (0.00 to 8.30)	0.96		
Overweight	0.97 (0.64 to 1.53)	0.9		
Class I Obese	1.14 (0.76 to 1.77)	0.55		
Class II Obese	1.16 (0.75 to 1.84)	0.51		
Class III Obese	1.14 (0.70 to 1.88)	0.61		
Sex			1.1	1.1
Female	—			
Male	1.37 (1.10 to 1.71)	**0.005**		
Age at Surgery	0.95 (0.94 to 0.96)	**<0.001**	1.2	1.1
Operative Time	0.99 (0.99 to 1.00)	**<0.001**	1	1
ASA Classification	1.26 (0.49 to 3.02)	0.61	1.2	1
Race			1.1	1
White	—			
Black or African American	1.86 (1.45 to 2.39)	**<0.001**		
Unknown/Other	1.14 (0.84 to 1.53)	0.39		
Asian	0.65 (0.28 to 1.31)	0.28		
Hispanic/Latino	1.85 (1.17 to 2.82)	**0.006**		
Smoking Status			1.1	1
Never	—			
Former	1.25 (1.00 to 1.56)	**0.045**		
Current	1.14 (0.74 to 1.68)	0.54		

OR, Odds Radio; CI, Confidence Interval; GVIF, Generalized Variance Inflation Factor; BMI, Body Mass Index; ASA, American Society of Anesthesiologists

[1] GVIF^[1/(2*df)]