

Risk Factors for Early Total Knee Replacement after Ipsilateral Knee Arthroscopy in Patients over 55 Years of Age

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ABSTRACT

Arthroscopic knee surgery (AKS) is often not successful in elderly patients with osteoarthritis and degenerative meniscus tears. Many patients require subsequent total knee replacement (TKR). We performed a case-control study to identify risk factors for early TKR following AKS in patients over 55. Data were collected on patients in an integrated healthcare system who underwent AKS between January 2010 and December 2012, and then had ipsilateral TKR within one year. Controls were matched from patients who did not have TKR within one year. Of the 7,301 AKS patients, 453 (6.2%) went

on to TKR. We matched 390 cases with controls (780 total subjects); 186 subjects were excluded due to inadequate radiographs or medical records resulting in a cohort of 594 patients. Statistical analysis showed that a Kellgren-Lawrence score of 3 or 4 (OR 1.9 CI 1.3-2.8, $p < 0.01$), age greater than 65 (OR 2.2, CI 1.5-3.2, $p < 0.01$), contralateral TKR (OR 2.3, CI 1.1-5.0, $p < 0.04$) were associated with a higher likelihood of early TKR. Sex, race, diagnosis of diabetes, prior ipsilateral knee surgery, and prior contralateral knee surgery were not associated with early TKR. When considering AKS for older patients with degenerative arthritis and meniscus tears, care providers should consider the risk of early TKR.

Key Words: Knee; Arthroscopy; Arthroplasty; Osteoarthritis; Meniscus

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INTRODUCTION

Despite numerous articles on the subject, arthroscopic knee surgery (AKS) for degenerative arthritis and degenerative meniscus tears remains controversial. Some studies have demonstrated short-term benefits of AKS for knee osteoarthritis and degenerative meniscus tears^[1-5]. However, more recent studies have reported little to no long term benefit from AKS for knee degenerative joint disease (DJD) when compared to non-operative treatment^[6-13] or placebo surgery^[14-16].

Since the long-term benefits of AKS for DJD are questionable, this procedure has been used as a “temporizing measure” to decrease pain, swelling, loss of motion, and mechanical symptoms^[4]. Relieving the symptoms associated with osteoarthritis may delay total knee replacement (TKR), and avoid problems associated with TKR in younger patient^[17-19]. The decision to use AKS as a means of delaying TKR may be influenced by studies that show a relatively low AKS complication rate (range 0.27%-5.0%)^[20-24] and relatively short

recovery time^[25,26]. If AKS fails to relieve symptoms, many patients proceed to TKR^[27-34]. However, some studies suggest that the patients who have undergone previous AKS have increased postoperative complications and worse outcomes at subsequent TKR^[33,35-37].

Given the questionable outcomes of AKS for knee DJD, the risk of complications with AKS, and the potential adverse effect of AKS on subsequent TKR, identifying those patients most likely to benefit from AKS and avoid early subsequent TKR would be helpful. Our hypothesis is that there are specific demographic and radiographic factors in patients age 55 and over who undergo AKS that are associated with early TKR. Our study was designed to identify those risk factors for early TKR, with “early” defined as TKR within one year of ipsilateral AKS.

METHODS AND MATERIALS

This was a case-control study of Kaiser-Permanente Northern California (KPNC) patients. KPNC is a large, integrated health care delivery system caring for more than 4 million patients. These patients are broadly representative of the local and statewide population^[38].

KPNC databases were used to identify 20,998 patients who had undergone simple knee arthroscopy between January 1, 2010 and December 31, 2012. These cases included partial or complete meniscectomy, meniscus repair, debridement, synovectomy, microfracture, and lateral release. Patient with sepsis, fractures, previous knee replacement surgery, complex ligament surgery, and surgeries lasting longer than 120 minutes were excluded. There were 20,998 patients who underwent simple knee arthroscopy during the study period. Of these patients, 7,301 (34.8%) were 55 years of age or older. Of these older patients, 453 (6.2%) underwent TKR within one year of the index AKS.

Controls for these 453 cases were selected from the cohort of patients who had simple AKS but did not have TKR within one year, and who had at least 12 months of KPNC membership following the AKS. Controls were matched 1:1 to cases, first with the AKS primary surgeon and then to the control with the nearest AKS date. If a case could not be matched based on the primary surgeon, a case from a surgeon in the same medical facility and with the closest AKS date was used. There were 63 cases that could not be matched, resulting in 390 cases matched to controls (780 total subjects). Of these 780 patients, 88 cases or their controls did not have adequate medical records or radiographs for review, and both the case and the control were excluded. Also excluded were 5 cases of meniscus repair, microfracture, isolated synovectomy, or isolated lateral release, and their matched controls. There were a total of 186 exclusions, with a final cohort of 594 patients, consisting of 297 cases and matched controls.

The preoperative radiographs of both the cases and controls were reviewed by a single board-certified musculoskeletal radiologist who assigned a Kellgren-Lawrence (KL) score^[39] from 0-4. The radiologist was blinded to whether the AKS patient subsequently underwent TKR.

Baseline demographic and clinical characteristics of the cases and controls were collected from KPNC databases, and included patient age, sex, race, body mass index (BMI), diabetes, and American Society of Anaesthesiologists (ASA) score. A chart review was performed on cases and controls. Data collected included the time from first onset of the patient’s symptoms to the AKS and whether the patient had an ipsilateral or contralateral knee surgery (including TKR) prior to the AKS.

Descriptive statistics were compiled for the cases and controls.

Multiple conditional logistic regression was used to identify independent risk factors associated with TKR in the 12 months after AKS. The primary exposure of interest was the presence and/or severity of pre-operative arthritis based on the KL Grade (0, 1-2, 3-4). Potential confounders included BMI, gender, race, age at AKS, diagnosis of diabetes, ASA rating, chronicity of symptoms prior to AKS, and prior knee surgery. Odds ratios and Wald 95% confidence intervals were calculated and likelihood ratio tests for p-values. The tests were two sided with a p-value < 0.05. The statistical analysis was performed using SAS 9.3 (SAS Institute, Cary, NC, USA). The Kaiser Foundation Research Institute’s Institutional Review Board approved this study with a waiver of consent.

RESULTS

The patient and clinical characteristic for the cases and controls are shown in Table 1. The crude and adjust odds ratios (ORs) and p-values from the conditional logistic regression models predicting TKA within year of AKS are shown in Table 2.

Men were less likely to undergo early TKR following simple AKS when compared to women [OR 0.7, CI 0.5-1.0, $p = 0.05$]. Age was found to be a risk factor for early TKR. Patients over age 65 were two times more likely to have early TKR when compared to patients age 65 and under [OR 2.0, CI 1.3-3.0, $p < 0.01$]. A KL score of 3 or 4 was also associated with a higher likelihood of early TKR [OR 1.9, CI 1.3-2.8, $p < 0.01$] compared to patients with a score of 0, 1, or 2. Another predictor of early TKR prior TKR of the contralateral knee [OR 2.3, CI 1.1-5.0, $p = 0.04$]. Race, BMI, diabetes, ASA score, and prior ipsilateral or contralateral knee surgery were not found to be predictors of early TKR. Similarly, the likelihood of early TKR for patients with knee symptoms less than 6 months before undergoing AKS was not significantly different than those who had symptoms for more than 6 months before AKS.

DISCUSSION

Several clinical cohort and registry studies have reported on the incidence rate and potential risk factors for early TKR following ipsilateral AKS in patients with knee DJD^[4,15,27,30-32,40-43]. The incidence of TKR following AKS in these studies ranges from 2% to 14% at 1 year and from 5% to 17% at 2 years.

Table 1 Patient Demographics and Clinical Characteristics.

N=594		Cases N(%) N=297	Controls (%) N=297
Sex	Male	127 (42.8)	153 (51.5)
	Female	170 (57.2)	144 (48.5)
Age (years)	55-65	151 (50.8)	198 (66.7)
	>65	146 (49.2)	99 (33.3)
Race	White	205 (69.0)	218 (73.4)
	Non-white	92 (31.0)	79 (26.6)
Body Mass Index	< 30	162 (54.6)	170 (57.2)
	30-35	91 (30.6)	73 (24.6)
	>35	44 (14.8)	54 (18.2)
Diabetes		46 (15.5)	46 (15.5)
American Society Anesthesiology Score*	1 / 2	205 (69.3)	221 (74.4)
	3 / 4	91 (30.7)	76 (25.6)
Kellgren-Lawrence Grade	1 / 2	162 (54.6)	211 (71.0)
	3 / 4	135 (45.4)	86 (29.0)
Time from symptoms to surgery	≤ 182 days	97 (32.7)	111 (37.4)
	> 182 days	195 (65.7)	181 (60.9)
Prior Knee Surgery	Any Contralateral	40 (13.5)	56 (19.0)
	Any Ipsilateral [^]	40 (13.5)	47 (15.8)
Contralateral TKR		25 (8.4)	11 (3.7)

Missing Patients: *1 patient, [^]4 patients.

In our study, 6.2 %of patients who underwent AKS subsequently had TKR replacement within one year. We found that increasing age was a risk factor for early TKR. Patients over age 65 2.0 times more likely to have TKR within one year compared to patients age 55-65. Our results are similar to findings from previous studies. Steadman found that 62% of patient who had undergone AKS converted to TKR at an average of 4.4 years post-op^[41]. Patients who subsequently underwent TKR were older (59.8 years) than those who did not undergo TKR (52.8 years) ($p = 0.013$). Wai reported that patients 70 years and older were 4.7 times more likely to have TKR within one year of AKS than those less than 60 years of age^[43]. Jameson found that in patients 60 years and older who had AKS there was a 7.3% increased risk of early knee replacement for each year of age ($p < 0.001$)^[44].

We also found that female sex was a risk factor for early TKR following AKS. In our study, women were 1.4 times more likely than men to have knee TKR within one year of AKS. This finding is also consistent with previous studies. Jameson found that females had a 33% higher risk than men for early TKR following AKS^[44]. Hawker studied patients who had TKR following AKS in England and reported that females were 1.2 more likely to have early TKR than males^[30]. Zikria found that females were 86% more likely [HR:1.86 (1.30-2.68, $p < 0.001$)] more likely to have a TKR after AKS^[45].

Higher KL scores have been associated with early TKR after AKS in several studies. Zikria reported that the mean KL score in AKS patients with early TKR was 2.31 compared to 1.46 in AKS who did not go on to TKR ($p < 0.001$)^[45]. Steadman found that patients who went on to TKR were more likely to have a KL 4 score at the time of AKS than those who had a KL 3 score 9 ($p = 0.015$)^[41]. Raaijmakers noted that a higher KL score was associated with a higher risk of TKR following AKS; 48% of AKS patients with KL grade 4 went on to TKR during the study period, while only 10% of patients with KL grade 0 went on to TKR^[42]. In our study, we found that patients with a KL score of 3 or 4 were 90% more likely to have early TKR after AKS than patients with a KL score of 0, 1, or 2.

We also compared AKS patients whose symptoms had been present longer than 6 months prior to those whose symptoms had been less than 6 months. We speculated that patients with symptoms 6 months or longer were more likely to have arthropathy, and a higher risk of early conversion to TKR. while those with symptoms less than 6 months were more likely to have had an injury, such as a meniscus tear, and a lower risk of early TKR. Ghislain found that patients with traumatic meniscus tears had better outcomes following AKS than those with degenerative meniscus tears^[46]. However, in a more

recent study, Thorlund found that AKS patients with degenerative meniscus tears had greater improvement in their KOOS score than those with traumatic tears, although the difference in outcomes was not considered clinically meaningful^[47]. In the bivariate analysis, we found that there was no significant difference in the likelihood of early conversion TKR between those patients who had symptoms 6 months or longer and those with symptoms less than 6 months.

We did not find an association between ipsilateral knee surgery prior to the index AKS and subsequent early TKR (OR 0.8, CI 0.5 -1.4, $p = 0.5$). Brophy reported that patients with previous knee surgery undergo TKR at younger age than those without previous knee surgery ($p < 0.0001$)^[48]. In their report, the most common previous surgery in these TKR was AKS (86%). However, they did not report on whether prior surgery was associated with early TKR in AKS surgery patients. Also, we were not able to categorize the types of prior ipsilateral knee surgeries that were performed in our study patients. Further studies would be needed to determine whether complex, invasive knee surgery followed by arthroscopy increases the risk of early TKR when compared to simple AKS followed by a subsequent AKS.

We found that a prior contralateral TKR increased the likelihood of early ipsilateral TKR in AKS patients. We could find no other reports on this association, and the reason for the association is unclear. Sanders reported that patients with total hip replacement (THR) had a 2.6-fold higher risk of subsequent contralateral TKR than ipsilateral TKR^[49]. They noted this may be due to gait changes and increased stresses in the contralateral knee, leading to accelerated degenerative changes. Similarly, AKS may induce gait changes that leads to increased stress and symptoms in the contralateral knee, potentially leading to early TKR. Another possibility is that patients who have already experienced a TKR have a lower threshold for accepting a subsequent contralateral TKR. Further investigation on this subject is warranted.

A strength of our study is that our patients were from a large, community based population, which allows the findings to be generalized to similar practices. Also, our short term outcomes were all validated by both administrative and clinical record reviews. Limitations of the study include the number of patients exclude from the cohort due to inadequate radiographic or medical records, and the lack of long-term patient follow-up. In addition, TKR after AKS is only one clinical endpoint, and patients with osteoarthritis or degenerative meniscus tears may have continued symptoms following AKS yet elect not to proceed with TKR.

Table 2 Conditional logistic regression of variables predicting TKR within 1 year of AKS: Crude and Adjusted Odds Ratios.

	Crude OR (95% CI)	p-value	Adj. OR (95% CI)	p-value
Sex: Male (REF Female)	0.7 (0.5 - 1.0)	0.03	0.7 (0.5 - 1.0)	0.05
Age: > 65 (REF 55-65)	2.2 (1.5 - 3.2)	<0.01	2.0 (1.3 - 3.0)	<0.01
Race: White (REF Non-White)	0.8 (0.5 - 1.1)	0.21	--	
Body Mass Index: 30-35 (REF<30)	1.3 (0.9 - 1.9)	0.21	--	
Body Mass Index: >35 (REF <30)	0.8 (0.5 - 1.3)	0.34	--	
Diabetes (REF None)	1.0 (0.6 - 1.5)	1	--	
ASA Score 3 or 4 (REF 1 or 2)	1.3 (0.9 - 1.9)	0.17	--	
Kellgen-Lawrence Grade 3 or 4 (REF 0, 1 or 2)	2.0 (1.4 - 2.9)	<0.01	1.9 (1.3 - 2.8)	<0.01
Symptoms to AKS >182 days (REF ≤ 182 days)	1.2 (0.9 - 1.7)	0.25	--	
Prior Contra Knee Surgery (REF None)	0.7 (0.4 - 1.0)	0.08		
Prior Ipsilateral Knee Surgery (REF None)	0.8 (0.5 - 1.4)	0.5	--	
Prior Contra TKA (REF None)	2.4 (1.1 - 5.0)	0.02	2.3 (1.1 - 5.0)	0.04

ASA: American Society of Anesthesiologists

CONCLUSION

Patient risk factors for early TKR following AKS included age (over 65), sex (female gender), and advanced arthritis (KL score 3 or 4). Patients with prior contralateral TKR were also at greater risk for early TKR. Race, BMI, diabetes, ASA score, any prior ipsilateral or contralateral knee surgery, and chronicity of symptoms were not found to be risk factors for early TKR. An understanding of these risk factors should help providers as they discuss options available to patients with osteoarthritis and degenerative meniscus tears.

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