Early Failure of Total Knee Arthroplasty in the Function and Outcomes Research for Comparative Effectiveness in Total Joint Replacement Registry: Incidence, Etiology, and Risk Factors

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INTRODUCTION:

It is estimated that there will be over 5 million TKA performed annually in the US by 2030 with an increase in the percentage of younger patients. Understanding the causes of early failure of total knee arthroplasty (TKA) and identifying associated risk factors are crucial ways to improve outcomes and decrease revision burden. The aim of this study is to determine the failure rate of TKA during the first 2 years in the US, and to identify the etiology and risk factors associated with early failure.

METHODS:

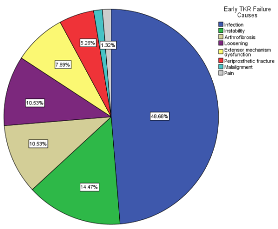
A prospective, multi-center cohort of 12,294 primary unilateral TKA patients were enrolled in a comparative effectiveness consortium. Surgeons' practices varied in size, reimbursement models (private, health maintenance organizations, employed, academic), and geographic setting ensuring that the cohort included diverse patient populations and delivery models. Surgeons agreed to invite all TKA patients to participate and sporadic audits of surgical logs validated that all patients were invited and > 90% of patients were included. Demographic data, comorbidities, and patient-reported outcome measures (PROMs) were collected preoperative and postoperative at 6, 12, and 24 months using an internet-based platform including the Knee injury and Osteoarthritis Outcome Score (KOOS) and the 36-item short-form (SF-36) physical (PCS) and mental component scores (MCS). CMS billing data were matched for Medicare patients. Chart review was performed to verify etiology of revision, risk factors, and comorbid conditions. Patient attributes for revised patients were compared to nonrevision patients. Multivariate regression models were used for KOOS pain and ADL scores with 95% confidence interval (CI) to evaluate the impact of revision.

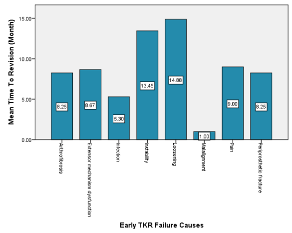
RESULTS:

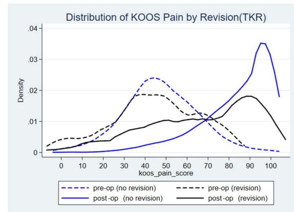
A total of 168 among 12,294 patients (1.29%) underwent revision TKA within the first 2 years. Compared to nonrevised patients, age at TKA was 65.4 ±8.4 years (P=0.2) and BMI was 31.4±8 (P=0.7) in revision group. They were 55.3% female and 44.7% male (P=0.04). Preoperative Charlson comorbidity index (CCI) was 0 in 37.7%, 1 in 27.5%, 2-5 in 17.4%, and ≥6 in 17.4% (P=0.002). They were non-smoker in 47.7%, former smoker in 44.6%, and current smoker in 7.7% (P=0.4). They achieved post high school education in 71.9% and high school education or less in 28.1% (P=0.3). They were white in 93.1% (P=0.4). The most common cause of revision was infection in 48.7% followed by instability in 14.9%, stiffness in 10.5%, and loosening in 10.5% (**Figure 1**). The mean time to revision was 8.2±6.6 months. Different causes of revision had different mean time to revision (**Figure 2**). Number of revision surgical procedures was 1.4±0.8 per patient. The number of revision surgeries per patient were one surgery in 76.3%, two surgeries in 13.1%, three surgeries in 5.3%, and four surgeries in 5.3%. The time from revision surgery to the definitive surgical procedure was 0.9±1.9 months ranging from 0 to 8 months. Revisions included one-component in 53.9%, two-component in 6.6%, three-component in 39.5%. The most common time to revision was during the first month (18.4%). There was a shorter time to revision TKA in infection cases (P=0.01). Number of revision surgeries was higher in infection cases (P<0.001). Infection was higher in male patients while instability was higher in females (P=0.02). The preoperative SF-36 PCS of revision patients was 31.7±8.5 (P=0.1). The KOOS pain score was 46.5±16.6 (P=0.7). The KOOS ADL was 52.2±16.9 (P=0.9). The 2-year SF-36 PCS, KOOS pain, and KOOS ADL improved significantly at two-year using Wilcoxon test with P-value equals 0.02, <0.001, and <0.001, respectively, but the SF-36 MCS did not (P=0.5). However, they were all significantly lower when compared to the nonrevision control group (P<0.001).The KOOS pain scores in revision patients were significantly lower by 16.9 with 95% CI (11.46 - 22.34) compared to nonrevised patients (P<0.001) (**Figure 3**) and similarly, KOOS ADL scores were significantly lower by 12.75 with 95% CI (7.73 -17.77) (P<0.001) (**Figure 4**) using a multivariate regression model.

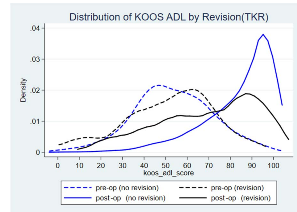
DISCUSSION AND CONCLUSION:

The incidence of early failure of TKA is 1.29% at two years. Infection is the predominant cause of failure (48.7%), followed by instability, and stiffness. Increased Charlson comorbidity index was associated with higher risk for early TKA failure. The mean time to revision was 8.2 months and the typical patient requiring revision TKA had 1.4 surgical procedures. Although the 2-year PROMs improved when compared to preoperative scores, PROMs were all significantly lower than the nonrevision control group. Future research to decrease early revisions after primary TKA should focus on preventing infection, preoperative patient optimization, and improvements in surgical technique to decrease postoperative instability.


Early TKR Failure Causes
Infection
Instability
Arthrofibrosis
Loosening
Extensor mechanism dysfunction
Periprosthetic fracture
Malalignment
Pain
48.68%
14.47%
10.53%
10.53%
7.89%
5.26%
1.32%


Mean Time To Revision (Month)
15.00
10.00
5.00
0.00
8.25
8.67
5.30
13.45
14.88
1.00
9.00
8.25
Arthrofibrosis
Extensor mechanism dysfunction
Infection
Instability
Loosening
Malalignment
Pain
Periprosthetic fracture
Early TKR Failure Causes


Distribution of KOOS Pain by Revision(TKR)
Density
.04
.03
.02
.01
0
0 10 20 30 40 50 60 70 80 90 100
koos_pain_score
pre-op (no revision)
pre-op (revision)
post-op (no revision)
post-op (revision)


Distribution of KOOS ADL by Revision(TKR)
Density
.04
.03
.02
.01
0
0 10 20 30 40 50 60 70 80 90 100
koos_adl_score
pre-op (no revision)
pre-op (revision)
post-op (no revision)
post-op (revision)