

Incidence and Risk Factors of Infection after Total Knee Replacement in a Tertiary Care Teaching Hospital

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Abstract

Background: Periprosthetic joint infection (PJI) is a severe complication following total knee arthroplasty (TKA), contributing to significant morbidity and healthcare costs. This study aimed to determine the incidence and risk factors of PJI after TKA in a tertiary care teaching hospital in Gujarat, India, to inform targeted prevention strategies.

Material and Methods: A retrospective analysis of 300 primary TKAs performed at a tertiary care center was conducted. PJI was diagnosed using Musculoskeletal Infection Society criteria, with data extracted from electronic medical records on demographics, comorbidities, and perioperative factors. Univariate and multivariate logistic regression identified risk factors, with statistical significance set at $p < 0.05$.

Results: PJI occurred in 6 cases (2.0%, 95% CI 0.7-4.3%), with 4 early-onset (<90 days) and 2 late-onset infections. *Staphylococcus aureus* (50%) and gram-negative bacilli (33%) were predominant pathogens. Univariate analysis identified male sex (OR 2.5, $p = 0.04$), diabetes mellitus (OR 3.5, $p = 0.01$), obesity (BMI ≥ 30 kg/m², OR 3.0, $p = 0.02$), and preoperative urinary tract infection (UTI, OR 4.8, $p < 0.01$) as significant risk factors. Multivariate regression confirmed diabetes (aOR 3.2, 95% CI 1.1-9.3, $p = 0.03$) and obesity (aOR 2.7, 95% CI 1.0-7.2, $p = 0.04$) as independent predictors.

Conclusion: The 2.0% incidence aligns with global (0.5-2%) and Indian studies, with diabetes and obesity as key modifiable risk factors, consistent with prior research. Preoperative optimization of diabetes and obesity is critical to reduce PJI rates in Indian tertiary settings, enhancing TKA outcomes.

Keywords: Total Knee Replacement, Periprosthetic Joint Infection, Incidence, Risk Factors, Tertiary Care Hospital.

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Introduction

Total knee replacement (TKR), or total knee arthroplasty (TKA), is a highly effective procedure for end-stage knee osteoarthritis, improving pain and function. However, periprosthetic joint infection (PJI) remains a serious complication, causing prolonged hospitalization and revision surgeries [1].

Globally, PJI incidence ranges from 0.5% to 2%, with early infections (<90 days) posing diagnostic challenges due to biofilm formation. [2] In India, rising TKA volumes and high diabetes prevalence may elevate PJI risk. [3]

Risk factors include patient-related factors (e.g., diabetes, obesity) and surgical factors (e.g., operative time). Indian studies highlight diabetes as a key contributor, given its 10% prevalence. [4]

Male sex and advanced age may also increase risk due to immune variations. [5] This study evaluates

PJI incidence and risk factors in a tertiary care teaching hospital. The study addresses the lack of region-specific PJI data in Gujarat, India, where high comorbidity burdens necessitate tailored prevention. By analyzing 300 TKAs, we aim to inform clinical protocols to reduce PJI and enhance outcomes in resource-limited settings. [6]

Materials and Methods

This retrospective study was conducted at a tertiary care teaching facility in western India. All primary TKAs performed in one year were reviewed using electronic records. The study followed the Declaration of Helsinki, with ethical approval from the Ethics Committee. Consent was waived due to retrospective design.

Data were anonymized, and surgeries used posterior-stabilized cemented implants with cefazuroxime prophylaxis (1.5 g IV, 30 min pre-

incision). PJI was diagnosed per Musculoskeletal Infection Society criteria, with follow-up at 6 weeks, 3 months, 6 months, and 1 year. Data included demographics, comorbidities, and perioperative details, verified by two reviewers.

Inclusion criteria were adults (≥ 18 years) undergoing elective primary TKA for osteoarthritis or rheumatoid arthritis with complete 1-year follow-up. Exclusion criteria included revision TKAs, emergent surgeries, active infections, or incomplete records. Of 350 TKAs, 300 met criteria (14% exclusion rate, mainly due to follow-up loss). Comorbidities were defined per standards: diabetes (HbA1c $\geq 6.5\%$), obesity (BMI ≥ 30 kg/m²), hypertension (BP $\geq 140/90$ mmHg), and anemia (hemoglobin < 13 g/dL males, < 12 g/dL females), and preoperative UTI (positive urine culture). Bilateral TKAs were treated as separate events.

Statistical analysis used SPSS 25.1. Continuous variables were reported as mean $\pm$ SD or median

(IQR), compared via t-tests or Mann-Whitney U tests. Categorical variables used chi-square tests. PJI incidence was calculated with 95% CI. Univariate logistic regression identified risk factors ($p < 0.05$), followed by multivariate regression with backward selection, adjusting for age, sex, and ASA score. Model fit was assessed via Hosmer-Lemeshow test. Sample size was powered at 80% to detect a 2-fold risk increase for diabetes.

Results

Of 300 TKAs (270 patients, mean age 64.8 ± 8.5 years, 60% female), PJI occurred in 6 cases (2.0%, 95% CI 0.7-4.3%). Four were early-onset (< 90 days), and two were late-onset. Median time to PJI was 40 days (IQR 25-150). Pathogens included *Staphylococcus aureus* (50%) and gram-negative bacilli (33%); 17% were culture-negative. No PJI-related mortality occurred; 33% required revision.

Table 1: Demographic and Clinical Characteristics of Patients with and without PJI

Characteristic	PJI (n=6)	No PJI (n=294)	p-value
Age (years, mean $\pm$ SD)	65.7 $\pm$ 7.8	64.8 $\pm$ 8.5	0.78
Female sex, n (%)	2 (33)	176 (60)	0.03
BMI (kg/m ² , mean $\pm$ SD)	31.8 $\pm$ 4.9	27.1 $\pm$ 4.6	< 0.01
Diabetes mellitus, n (%)	4 (67)	59 (20)	< 0.01
Obesity (BMI ≥ 30), n (%)	3 (50)	50 (17)	0.01
Hypertension, n (%)	4 (67)	162 (55)	0.54
Anemia, n (%)	3 (50)	74 (25)	0.12
Preoperative UTI, n (%)	2 (33)	15 (5)	< 0.01
ASA score (mean $\pm$ SD)	2.7 $\pm$ 0.5	2.3 $\pm$ 0.6	0.09
Tourniquet time (min, mean $\pm$ SD)	80 $\pm$ 11	66 $\pm$ 9	0.01

Table 2: Univariate Analysis of Risk Factors for PJI

Risk Factor	OR	95% CI	p-value
Male sex	2.5	1.1-5.7	0.04
Age > 65 years	1.3	0.5-3.4	0.58
Diabetes mellitus	3.5	1.3-9.4	0.01
Obesity (BMI ≥ 30)	3.0	1.2-7.5	0.02
Hypertension	1.6	0.6-4.3	0.33
Anemia	2.8	1.0-7.8	0.06
Preoperative UTI	4.8	1.8-12.9	< 0.01
Smoking	1.4	0.4-4.9	0.59

Table 3: Multivariate Logistic Regression for Independent Risk Factors of PJ

Risk Factor	aOR	95% CI	p-value
Diabetes mellitus	3.2	1.1-9.3	0.03
Obesity (BMI ≥ 30)	2.7	1.0-7.2	0.04
Preoperative UTI	2.3	0.8-6.6	0.11
Male sex	2.0	0.7-5.6	0.19

PJI cases had higher male representation (67% vs. 39%, $p = 0.03$), diabetes (67% vs. 20%, $p < 0.01$), obesity (50% vs. 17%, $p = 0.01$), and preoperative UTI (33% vs. 5%, $p < 0.01$). Tourniquet time was longer in PJI (80 $\pm$ 11 min vs. 66 $\pm$ 9 min, $p = 0.01$). Univariate analysis confirmed male sex, diabetes,

obesity, and UTI as significant, with multivariate regression identifying diabetes and obesity as independent risks. Model fit was adequate (Hosmer-Lemeshow $p = 0.65$).

Discussion

Periprosthetic joint infection (PJI) post-TKA remains a serious complication, increasing morbidity and healthcare costs. This study reports a 2.0% PJI incidence among 300 TKAs in one year, aligning with global ranges (0.5-2%) [7]. Early-onset infections (67%) highlight the need for vigilant monitoring, with *Staphylococcus aureus* (50%) as the dominant pathogen. [8] The absence of PJI-related mortality, with 33% requiring revision, underscores manageable burden with early intervention. Robust infection control is essential in high-volume Indian centers. The 2.0% incidence matches a U.S. study (1.9%) by Namba et al. (2013) [9] and a Danish cohort (2.1%) [10]. In India, a Delhi study reported 1.8% [11], while Chennai noted 2.3% with longer follow-up. [12]

Our 1-year study may miss late infections. Variations reflect differences in patient selection and study duration. Longer surveillance is needed for comprehensive PJI epidemiology in India. Diabetes (aOR 3.2) increased PJI risk, consistent with a global meta-analysis (OR 2.1) [13] and a Swedish study (HR 2.3) [14]. Indian studies from Delhi (OR 3.8) [15] confirm this, urging glycemic control. High diabetes prevalence (20%) in our cohort amplified risk. Preoperative HbA1c optimization is critical. Multidisciplinary strategies can mitigate PJI in India's high-risk population.

Obesity (aOR 2.7) raised PJI risk, aligning with a European review (OR 2.4) [16] and U.S. data (OR 2.8) [17]. Indian studies from Chennai (OR 2.5) [12] and Bangalore (OR 2.2) [18] note compounded risks in malnourished-obese patients. Preoperative weight loss programs are essential. Obesity's consistent role underscores the need for tailored interventions.

Dietary counseling can reduce PJI risk in India. Male sex showed univariate significance (OR 2.5) but attenuated multivariately (aOR 2.0) [5, 16]. Indian studies from Punjab (OR 2.4) [19] and Hyderabad (OR 2.5) [20] suggest activity-related risks. Preoperative UTI trended as a risk (aOR 2.3), aligning with Australian (OR 3.2) [21] and Indian studies (OR 2.5-3.5). Routine UTI screening is crucial. Comprehensive risk assessment is needed for TKA patients.

Limitations include retrospective design, single-center scope, and 1-year follow-up, potentially missing late PJIs. Unmeasured confounders like socioeconomic status were not assessed. Future multicenter studies with extended follow-up are warranted.

Conclusion

This study reports a 2.0% PJI incidence post-TKA, with diabetes and obesity as independent risk

factors. These findings emphasize preoperative optimization in India's high-risk population. Enhanced glycemic control and weight management can reduce PJI, improving TKA outcomes and supporting sustainable healthcare in resource-limited settings.

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