

Evaluating the Aetiology of Tka Failure and Postoperative Function in Revision Knee Arthroplasty Patients

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ABSTRACT

Objective: This study investigates the aetiology of Total Knee Arthroplasty (TKA) failure and assesses the functional outcomes of patients undergoing revision Total Knee Arthroplasty (rTKA).

Methods: A retrospective cohort study was conducted on 56 patients who underwent revision TKA due to failure of primary TKA. The study assessed the reasons for TKA failure, patient demographics, comorbidities, and preoperative and postoperative functional outcomes. Functional outcomes were measured using the Knee Society Score (KSS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Statistical analysis was performed to identify the factors associated with improved functional outcomes.

Results: The most common reasons for TKA failure were aseptic loosening (42.9%), infection (21.4%), instability (17.9%), and polyethylene wear (10.7%). The average KSS improved from 42.3 to 79.4, and the average WOMAC score decreased from 53.2 to 21.3 following revision surgery. A significant correlation was found between the preoperative KSS and postoperative KSS ($p < 0.05$).

Conclusion: Aseptic loosening remains the leading cause of TKA failure. Revision TKA results in significant improvement in functional outcomes, although some patients still experience moderate functional deficits. Factors such as the patient's preoperative condition and comorbidities must be considered for improved postoperative success.

Keywords: Total Knee Arthroplasty, Revision Total Knee Arthroplasty, TKA Failure, Functional Outcome, Knee Society Score, WOMAC, Aseptic Loosening, Infection, Instability, Polyethylene Wear.

INTRODUCTION

Total Knee Arthroplasty (TKA) is a highly successful surgical intervention for patients suffering from end-stage knee osteoarthritis and other debilitating knee conditions. The success of TKA in alleviating pain and restoring function has been well-documented, with patient satisfaction rates exceeding 90% in many studies¹. However, despite its successes, TKA failure can occur, leading to the need for revision surgery, commonly referred to as Revision Total Knee Arthroplasty (rTKA). The failure of primary TKA can be attributed to a variety of causes, including infection, instability, loosening, and mechanical failure of the prosthesis²⁻³.

The rate of revision TKA has been steadily increasing due to the aging population and increased life expectancy⁴. According to a study by Kurtz et al., the projected number of TKA procedures is expected to increase by 673% from 2005 to 2030, contributing to a significant rise in revision surgeries⁵. Understanding the causes of failure and the outcomes of revision surgery is crucial in improving both the design of implants and the surgical techniques employed in TKA.

Aseptic loosening remains the most common cause of TKA failure, particularly in older prosthetic designs. It occurs when the cement or bond between the prosthesis and the bone breaks down, leading to instability⁶. Infections, though less frequent, represent a significant challenge, particularly due to their association with poor outcomes and the need for aggressive management⁷. Instability and polyethylene wear are other common reasons for failure, often linked to implant design and the wear patterns of the artificial joint⁸.

The primary objective of this study is to assess the aetiology of TKA failure and evaluate the functional outcomes of patients undergoing revision TKA. We aim to identify common causes of failure and evaluate whether revision surgery results in meaningful improvements in functional outcomes, as measured by the Knee Society Score (KSS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)⁹⁻¹⁰. Additionally, the study will assess the impact of preoperative factors such as comorbidities on postoperative success¹¹.

METHODOLOGY

This retrospective cohort study was conducted at Department of Orthopaedics, Lady Reading Hospital MTI Peshawar over a period of 5 years, from July 2018 to June 2023. A total of 56 patients who underwent revision TKA due to failure of primary TKA were included in the study. Inclusion criteria were: age ≥ 18 years, history of primary TKA with failure leading to revision, and availability of complete preoperative and postoperative data. Exclusion criteria included patients with a history of malignancy, severe cognitive impairment, or those unable to provide informed consent.

Data Collection: Patient demographics (age, gender, body mass index), comorbidities (e.g., diabetes mellitus, hypertension), and the aetiology of TKA failure were recorded. The causes of TKA failure were classified into the following categories: aseptic loosening, infection, instability, polyethylene wear, and other mechanical failures.

Functional outcomes were measured preoperatively and postoperatively using the Knee Society Score (KSS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). The KSS evaluates knee function and pain, while the WOMAC measures pain, stiffness, and physical function in patients with osteoarthritis.

Surgical Technique: All revision surgeries were performed by senior orthopedic surgeons with expertise in TKA. The surgical approach and prosthetic selection were individualized based on the specific cause of failure. In cases of aseptic loosening, new components were implanted with bone grafting when necessary. In cases of infection, the infected components were removed, and a two-stage revision procedure was employed.

Statistical Analysis: The data were analyzed using SPSS version 22.0. Descriptive statistics were used to summarize patient demographics and clinical outcomes. Paired t-tests were used to compare preoperative and postoperative KSS and WOMAC scores. A p-value of < 0.05 was considered statistically significant.

RESULTS

The mean age of patients was 68.2 years, and the majority were female (58.9%). A high percentage (45%) of patients had diabetes mellitus, which is a significant comorbidity known to impact the

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outcome of knee surgeries, particularly in the context of infection and wound healing. (Table 1)

Aseptic loosening was the most common cause, affecting 42.9% of patients. Infection, which requires a more complex treatment regimen, was responsible for 21.4% of failures. Other causes such as instability and polyethylene wear were less frequent.

A significant positive correlation ($r = 0.65, p < 0.05$) was observed, indicating that patients with better preoperative function tended to achieve better functional outcomes postoperatively. The improvement in KSS was statistically significant ($p < 0.001$), as was the reduction in WOMAC score. (Table 3)

Infection was the most common complication (5.4%), while no cases of deep vein thrombosis or nerve injuries were reported. The low complication rate in this study suggests that the revision surgeries were performed successfully with minimal adverse events.

Table 1: Demographics of Patients

Demographic Variable	Value
Total Patients	56
Mean Age (years)	68.2 ± 8.5
Gender (Male:Female)	23:33
Mean BMI (kg/m ²)	29.4 ± 4.2
Comorbidities	45% with Diabetes Mellitus
Mean Follow-Up (months)	24 ± 6

Table 2: Aetiology of TKA Failure

Aetiology	Number of Patients (%)
Aseptic Loosening	24 (42.9%)
Infection	12 (21.4%)
Instability	10 (17.9%)
Polyethylene Wear	6 (10.7%)
Other Mechanical Failures	4 (7.1%)

Table 3: Correlation Analysis (Preoperative vs Postoperative KSS)

Measure	Preoperative Mean ± SD	Postoperative Mean ± SD	p-value
Knee Society Score	42.3 ± 9.8	79.4 ± 8.3	<0.001
WOMAC Score	53.2 ± 12.4	21.3 ± 6.4	<0.001
Preop KSS vs Postop KSS	$r = 0.65 (p < 0.05)$		

Table 4: Postoperative Complications

Complication	Number of Patients (%)
Infection	3 (5.4%)
Deep Vein Thrombosis	0 (0%)
Nerve Injury	0 (0%)
Prosthetic Fracture	1 (1.8%)

DISCUSSION

This study revealed that aseptic loosening remains the most prevalent cause of failure following TKA, accounting for 42.9% of cases, consistent with the findings of other studies¹²⁻¹³. Infection was the second most common cause (21.4%), and our results align with previous research emphasizing the significant impact of infection on TKA failure¹⁴. Instability and polyethylene wear were also contributing factors, but to a lesser extent, as previously noted in other large cohort studies¹⁵.

The functional outcomes following revision TKA were significantly improved, with the average KSS improving from 42.3 to 79.4, and the WOMAC score decreasing from 53.2 to 21.3. This improvement is consistent with studies that have demonstrated the potential for significant improvement in pain and function following revision surgery¹⁶. The correlation analysis showed a positive association between preoperative KSS and postoperative outcomes, which suggests that patients with better preoperative knee function tend to have more favorable postoperative outcomes¹⁷.

The complications following revision TKA were relatively low, with infection occurring in 5.4% of patients. This is consistent with the literature, which reports a low but significant risk of infection after revision procedures¹⁸. No cases of deep venous thrombosis or nerve injuries were observed, which is a positive outcome, given the high-risk nature of revision TKA.

However, despite the overall positive outcomes, some patients continued to experience moderate functional deficits. This highlights the need for careful patient selection, especially in those with multiple comorbidities, as they may experience less favorable outcomes postoperatively¹⁹. Additionally, the success of revision TKA can be influenced by factors such as the timing of the surgery, implant design, and the experience of the surgeon²⁰.

CONCLUSION

The results of this study emphasize that aseptic loosening is the leading cause of TKA failure, while infection and instability also contribute to failure in a significant number of patients. Revision TKA offers substantial improvements in functional outcomes, as evidenced by improvements in the KSS and WOMAC scores. However, the success of revision surgery is influenced by various factors, including preoperative knee function, the underlying cause of failure, and patient comorbidities. These findings underscore the importance of careful surgical planning and patient selection in optimizing the outcomes of revision TKA.

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