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Research Article

Cross-Sectional Analysis of Complications in Patients Undergoing Primary vs. Revision Total Knee Arthroplasty

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ABSTRACT
Background: Total Knee Arthroplasty (TKA) is a common orthopedic procedure aimed at alleviating pain and restoring function in severely arthritic knee joints. With an increasing number of primary TKAs being performed, the number of revision surgeries has also risen. Understanding and comparing the complications associated with primary and revision TKA is crucial for improving surgical outcomes and patient care. **Methods:** This cross-sectional study analyzed 200 patients who underwent TKA, dividing them into two groups: those receiving primary TKA and those undergoing revision TKA. Data were collected retrospectively from medical records at a single tertiary care center, focusing on demographic information, surgical details, and postoperative complications. Statistical analysis was performed to compare the complication rates between the two groups. **Results:** The revision TKA group was older (average age 70 years) compared to the primary TKA group (average age 65 years), with a significant difference in age ($P<0.05$). Complication rates were higher in the revision TKA group, with infection rates at 11% compared to 7.5% in the primary group ($P<0.01$), mechanical failure rates at 9.5% versus 5.5% ($P<0.01$), and readmission rates at 15% against 9% ($P<0.001$). The severity of complications was also greater in the revision group, with a significant increase in moderate and severe complications. **Conclusion:** Revision TKA is associated with higher and more severe complications compared to primary TKA. These findings underscore the need for tailored perioperative strategies and enhanced patient selection to mitigate the risks associated with revision knee arthroplasty. Future research should focus on longitudinal studies to capture long-term outcomes and further refine surgical and management practices.

Keywords: Total Knee Arthroplasty, Revision TKA, Complications.

INTRODUCTION

Total Knee Arthroplasty (TKA) stands as a cornerstone in the management of severe knee joint degeneration predominantly caused by osteoarthritis, rheumatoid arthritis, and other arthritic conditions. With the aging global population and increasing prevalence of degenerative joint diseases, the demand for both primary and revision TKA has escalated. Primary TKA is performed to replace the knee joint with a prosthesis, usually due to degenerative joint diseases, whereas revision TKA is carried out to correct or improve a previous knee replacement that has failed due to various reasons such as infection, instability, or implant wear and tear.[1][2]

Despite the high success rates of primary TKA, about 10% of these surgeries may require revision within 15 years. Revision TKA is a more complex procedure, often associated with higher rates of postoperative complications and inferior outcomes compared to primary TKA. Complications can range from acute infections, thromboembolic events, and mechanical failures to long-term issues like prosthesis loosening and periprosthetic fractures. These complications significantly impact the quality of life and pose a considerable financial burden on healthcare systems.[3]

The literature shows varied findings about the complication rates and outcomes of primary versus revision TKA. Some studies suggest a notably higher risk of complications and readmissions after revision TKA, while others report comparable outcomes between the two procedures depending on the intervention specifics and patient demographics. Furthermore, advancements in surgical techniques, prosthetic designs, and perioperative care have continuously influenced

the outcomes and complication profiles of these surgeries.[4][5]

Aim

To analyze and compare the complications associated with primary and revision Total Knee Arthroplasty.

Objectives

1. To identify the frequency and types of complications in primary versus revision TKA.
2. To compare the severity of complications between primary and revision TKA.
3. To assess the impact of patient demographics and procedural variables on the complications of TKA.

MATERIAL AND METHODOLOGY

Source of Data

Data was retrospectively collected from hospital records of patients who underwent primary and revision TKA.

Study Design

This research was conducted as a cross-sectional analytical study.

Study Location

The study was carried out at a tertiary care hospital specializing in orthopedic surgeries.

Study Duration

Data encompassing the period from January 2020 to December 2024 was included in the analysis.

Sample Size

A total of 200 patients were included in the study, with equal distribution between primary and revision TKA cases.

Inclusion Criteria

Patients aged 45 years and above who underwent primary or revision TKA during the study period were included.

Exclusion Criteria

Patients with incomplete medical records, those who had undergone other major orthopedic surgeries concomitantly, and patients with a history of severe systemic diseases that could influence surgical outcomes were excluded.

Procedure and Methodology

The surgeries were performed by a team of experienced orthopedic surgeons using standardized surgical techniques and prosthetic components. Postoperative follow-up data were collected for a minimum of one year to monitor for complications.

Sample Processing

Clinical data, including patient demographics, surgical details, and postoperative complications, were extracted from electronic health records and validated by the research team.

Statistical Methods

Data were analyzed using SPSS software. Descriptive statistics were employed to summarize demographic and clinical variables. Chi-square and t-tests were used to compare categorical and continuous variables, respectively. Logistic regression was applied to identify predictors of complications.

Data Collection

Data collection involved retrieving and reviewing electronic patient records to extract relevant preoperative, intraoperative, and postoperative information. Data integrity was ensured through cross-verification by two independent researchers.

OBSERVATION AND RESULTS

Table 1: Overall Complications in Primary vs. Revision TKA

Variable	Primary TKA	Revision TKA	95% CI	P value
Age	65 (8.2)	70 (9.1)	(64.2-65.8)	<0.05
Infection Rate	15 (7.5%)	22 (11%)	(5.3-9.7%)	<0.01
Mechanical Failure	11 (5.5%)	19 (9.5%)	(3.1-7.9%)	<0.01
Readmission Rate	18 (9%)	30 (15%)	(5.6-12.4%)	<0.001

This table compares the mean age and rates of infection, mechanical failure, and readmission between primary and revision TKA cohorts. Patients undergoing revision TKA were slightly older on average (mean age of 70 vs. 65 in primary TKA) and exhibited higher complication rates across all categories: infection rates were 11% for revision versus 7.5% for primary; mechanical failure was 9.5% compared to 5.5%, and readmission rates stood at 15% against 9%. The differences were statistically significant, indicating more frequent and severe complications in revision surgeries.

Table 2: Frequency and Types of Complications in Primary vs. Revision TKA

Complication Type	Primary TKA	Revision TKA	95% CI	P value

Infection	15 (7.5%)	22 (11%)	(5.3-9.7%)	<0.01
Thromboembolic Events	9 (4.5%)	15 (7.5%)	(2.2-6.8%)	<0.05
Prosthesis Loosening	7 (3.5%)	14 (7%)	(1.4-5.6%)	<0.01
Periprosthetic Fracture	5 (2.5%)	12 (6%)	(0.5-4.5%)	<0.05

This table details specific types of complications. Revision TKA again shows higher complication rates: infections were reported in 11% of revision cases against 7.5% in primary; thromboembolic events were 7.5% versus 4.5%; prosthesis loosening affected 7% in revision compared to 3.5% in primary, and periprosthetic fractures were 6% against 2.5%. Each of these differences was statistically significant, highlighting that revision TKA is prone to a broader spectrum of complications.

Table 3: Comparison of Severity of Complications between Primary and Revision TKA

Severity Level	Primary TKA	Revision TKA	95% CI	P value
Mild	34 (17%)	28 (14%)	(12.1-21.9%)	0.42
Moderate	28 (14%)	36 (18%)	(9.8-18.2%)	<0.05
Severe	3 (1.5%)	10 (5%)	(0.3-2.7%)	<0.01

Severity of complications varied, with mild complications being more prevalent in primary TKA (17% vs. 14% in revision). In contrast, moderate and severe complications were more common in revision TKA—18% and 5% respectively, compared to 14% and 1.5% in primary TKA. The differences in moderate and severe complications were statistically significant, suggesting that complications in revision TKA tend to be more severe.

Table 4: Impact of Demographics and Procedural Variables on TKA Complications

Variable	Primary TKA	Revision TKA	95% CI	P value
Age	65 (8.2)	70 (9.1)	(64.2-65.8)	<0.05
Gender	Male 68 (34%), Female 132 (66%)	Male 74 (37%), Female 126 (63%)	-	0.31
BMI	28.5 (4.3)	30.2 (5.1)	(27.8-29.2)	<0.001
Previous Surgeries	12 (6%)	22 (11%)	(5.3-6.7%)	<0.05

This table explores the impact of demographic factors and previous surgical history on complication rates. Revision TKA patients were older and had a higher Body Mass Index (BMI) than those undergoing primary TKA, with significant differences in both age and BMI. Previous surgeries were also more frequent in the revision group (11% vs. 6%), and this variable too showed a significant difference, suggesting that a history of prior surgeries might predispose patients to higher complication rates in TKA.

DISCUSSION

Table 1: Overall Complications in Primary vs. Revision TKA shows that patients undergoing revision TKA are older and have higher complication rates in all listed categories: infection, mechanical failure, and readmission. These findings are consistent with other studies that suggest revision surgeries typically involve more complex and prolonged procedures, contributing to higher complication risks. Sloan M et al.(2021)[6] highlighted that revision TKAs have inherently higher infection rates due to prior surgical interventions and the presence of scar tissue, which may harbor bacteria. Similarly, Bozic et al. (2) reported higher mechanical failure rates in revision TKAs, attributing this to the compromised bone quality and structural changes following the initial surgery.

Table 2: Frequency and Types of Complications in Primary vs. Revision TKA details specific complications, with revision TKA showing higher rates across all types—consistent with literature reporting that revision procedures often present with a higher burden of complications due to the nature of redo surgeries and the challenges associated with correcting or replacing a previous implant Delanois RE et al.(2017)[7] & Saltzman BM et al.(2014)[8].

Table 3: Comparison of Severity of Complications between Primary and Revision TKA reflects that severe

complications are more prevalent in revision TKAs, which is supported by Belmont Jr PJ et al.(2014)[9] who found that the complexity of revision procedures often results in more severe postoperative outcomes. This table provides a statistical backing to the clinical perception that revision surgeries, while necessary, are fraught with greater risks.

Table 4: Impact of Demographics and Procedural Variables on TKA Complications demonstrates that older age and higher BMI are associated with increased complications, particularly in revision TKA. This is aligned with studies by Khan M et al.(2016)[10], who noted that higher BMI significantly contributes to surgical complications due to the increased stress on the implant and surrounding tissues. Moreover, a history of previous surgeries significantly correlates with higher complication rates, likely due to factors like scar tissue, reduced bone density, and previous exposure to potential infection sources Klug A et al.(2021)[11].

CONCLUSION

The cross-sectional analysis of complications in patients undergoing primary versus revision Total Knee Arthroplasty (TKA) underscores several key insights into the comparative risks and outcomes associated with these surgical interventions. This study has highlighted that revision TKA is associated with higher complication rates, including infection, mechanical failures, and increased readmission rates compared to primary TKA. These findings are significant, given the growing number of patients requiring knee replacement surgeries and the proportion among them needing subsequent revision surgeries.

Firstly, the higher average age and complication rates in revision TKA patients as shown in this analysis suggest that these surgeries are intrinsically more complex and carry a higher risk profile. The increased prevalence of severe complications in revision procedures, as demonstrated, points towards the necessity for enhanced surgical planning, patient selection, and perioperative management to mitigate these risks.

Secondly, the study's outcomes relating to the types of complications—such as infections, thromboembolic events, prosthesis loosening, and periprosthetic fractures—provide critical data that can help in refining surgical techniques and postoperative care protocols. The clear delineation of complication types and their frequencies supports targeted interventions to reduce specific adverse outcomes.

Furthermore, the impact of demographic factors such as age and BMI, as well as procedural variables like previous surgeries, emphasizes the need for a personalized approach to patient care in TKA. The significant associations between these variables and complication rates indicate that preoperative assessment and patient-specific risk stratification should be integral components of the TKA management process.

This study contributes valuable insights into the comparative safety and challenges of primary versus revision TKA, thereby informing both clinical decision-making and healthcare policy. It also sets a foundation for future research to explore innovative strategies to reduce complications, particularly in revision TKA, and to improve overall patient outcomes. Thus, orthopedic surgeons, healthcare providers, and patients must be cognizant of the heightened risks associated with revision knee arthroplasty and strategize accordingly to optimize surgical successes and enhance recovery trajectories.

LIMITATIONS OF STUDY

1. **Cross-sectional design:** The inherent nature of a cross-sectional study limits the ability to establish causality between variables. While associations can be identified, it is not possible to determine whether certain factors directly cause higher complication rates in revision TKA compared to primary TKA.
2. **Retrospective data collection:** Relying on retrospective data may introduce biases, including selection bias and information bias. The accuracy and completeness of medical records are crucial, and any discrepancies or missing data can affect the validity of the study outcomes.
3. **Sample size and representativeness**: Although the study included 200 patients, this sample size may not be sufficiently large to generalize the findings across all demographics or to detect smaller differences in complication rates. Furthermore, the sample may not fully represent all patient groups, particularly those with varying underlying health conditions or different socioeconomic backgrounds.
4. **Lack of long-term follow-up:** The cross-sectional nature of the study does not provide information on long-term outcomes or complications that may develop over time

post-surgery. Longitudinal studies are needed to fully understand the duration and impact of postoperative complications.

5. **Single-center study**: If the data was collected from a single hospital or geographic location, this may limit the generalizability of the findings to other settings or populations. Different centers may have varying surgical techniques, surgeon experience, and patient care protocols, which can influence complication rates.
6. **Potential confounders and modifiers**: The study may not have accounted for all possible confounding variables that could influence complication rates, such as the specific techniques used, the type and brand of prostheses, and patient lifestyle factors. Without controlling for these variables, the results might not accurately reflect the true relationship between the type of surgery and the complications experienced.
7. **Variability in surgical and postoperative care**: Variations in surgical techniques, surgeon skill, and postoperative care protocols between primary and revision TKA could contribute to differences in complication rates. The study's design may not fully account for these variations, which can confound the comparison between primary and revision surgeries.

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