

Investigating Total Knee Arthroplasty Failure Factors and Evaluating Functional Outcomes After Revision Surgery

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Keywords: arthroplasty, infection, knee arthroplasty

Abstract

Objective: This study aims to identify the causes of total knee arthroplasty (TKA) failing and evaluate the operational results for those who had revision total knee arthroplasty.

Methods: From April 2022 to March 2023, descriptive research was carried out at the orthopedic department of the Mayo Hospital in Lahore, Pakistan. This research included all patients with original total knee replacements who had revision total knee arthroplasty. There is documentation of the need for revision arthroplasty. The functional result of a revision total knee replacement was evaluated using the WOMAC questionnaire at 6 months. Using a student t-test for comparing the

WOMAC score before and after the surgery, a P value was determined. A p-value of 0.05 or less was deemed significant.

Results: The 29 patients who received revision arthroplasty on 33 knees were included in the research. The patients had an average age of 60.60 years with ± 6.78 standard deviations, with 25 out of 29 participants (86.20%) being women. Revision arthroplasty was performed unilaterally in 25 patients (86.20%) and bilaterally in 4 patients (13.79%). Aseptic loosening occurred in 14 knees which were 42.42% of the total knees, infection occurred in 45.45% of knees (15), and periprosthetic fractures occurred in 4 knees

(12.12%) as the most frequent causes of revision arthroplasty. Patients' before-revision WOMAC discomfort, rigidity, and functional scores were 18.4, 8.1, and 72.5, respectively, prior to revision arthroplasty. With a WOMAC discomfort score of 2.2 ± 1 , rigidity score of 3.4 ± 6 , and a functional score of 10.4 ± 4 at Six months after revision arthroplasty, there was a substantial improvement in WOMAC score as the p-value was less than 0.05.

Conclusions: In our study, infection was the primary factor leading to revision arthroplasty. In most of the participants, revision arthroplasty had a functional result that was satisfactory.

Introduction:

Total knee arthroplasty (TKA), often known as a surgical knee joint swapping, is one of the most frequently carried out orthopedic surgeries globally. With a satisfactory result with regard to after-surgery alleviation of pain, reinstating physical activity, and satisfaction among patients, it is the preferred therapy for end-stage degenerative osteoarthritis. [1,2] Additionally, there has been a sharp increase in the total number of operations

carried out after the initial effective TKA in 1968, and this has inevitably led to an increase in unsuccessful TKAs. [3,4]

An estimated 76,000 total knee arthroplasty procedures (TKAs) are carried out annually in the UK, and 5% of these procedures need revision 10 years following the initial surgery. [5-6] A meta-analysis found that after 4.1 years of follow-up, the revision rate of knee arthroplasty was 3.8%. [30-49] The most frequent reasons for TKA failure that results in revisions include infection, aseptic releasing, malalignment, destabilization, rigidity, mechanical wear out, breakage of the extensor system, and persistent discomfort and rigidity. [7-12] There are several types of knee prostheses now in use, and most of them have a set lifespan. The longevity of a knee prosthesis depends on a number of variables, including the patient's weight, age, underlying health conditions, level of activity, and lifestyle. [13] Nevertheless, the overall results of revision knee arthroplasty are not as favorable as those of main TKA, and revision is a challenging treatment where surgeons often struggle to manage the loss of bone and soft tissue inadequacy. [14]

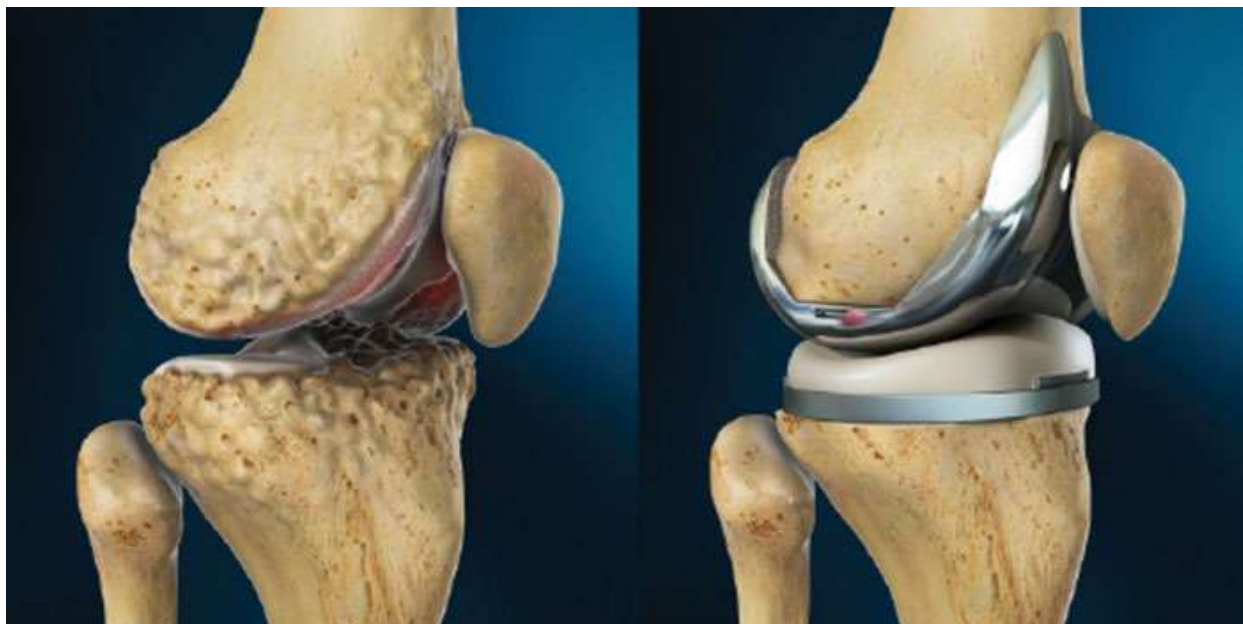


Figure 1: Total Knee Arthroplasty

The goal of our research was to identify the cause of total knee arthroplasty (TKA) failure and evaluate the functional results for patients who had revision total knee arthroplasty.

Methods:

Study Design: Design: From April 2022 to March 2023, we carried out this descriptive research at the orthopedic department of the Mayo Hospital in Lahore, Pakistan. Patients who received total knee replacement surgery for osteoarthritis during the previous 10 years and experienced issues necessitating revision surgery were included in the research, regardless of their gender or age. Patients who received knee replacement surgery for osteoarthritis and experienced issues requiring revision during the previous 10 years were specifically excluded from the study. Patients who received knee replacement surgery for reasons other than osteoarthritis or who did not have difficulties necessitating revision surgery were, on the other hand, disqualified from the research. Patients who had revision surgery for conditions unrelated to post-knee replacement problems, as well as those unable or unwilling to provide informed permission for research participation, were also excluded.

The ethical review board of our hospital gave the research its approval. All patients provided informed permission prior to revision surgery and publication of the data. Complete histories, physical examinations, and pertinent investigations were done on the subjects included. Revision arthroplasty differed from case to case and depended on the degree of bone loss, the condition of the ligaments, and the soft tissue. Rotating hinge, confined

condylar knee prostheses, augmentation, wedging, and augmentation were all employed in the revision. (Figures 2-4). Staged procedures were carried out for infectious patients, which included removing the main TKA, debridement, or cement spacer implantation until clinical and biochemical data guaranteed the eradication of infection. All patients received recommendations for postoperative supervised physical therapy. Following surgery, all patients were closely monitored, and at the six-month mark, the functional result was evaluated using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire.

Statistical Analysis: With the use of a Student-t test and a P value calculation, the pre-and post-operative WOMAC scores were compared. A p-value less than 0.05 was deemed significant. SPSS 26 was used to analyze the data. For categorical data, frequency and percentage were computed, and mean and standard deviation were determined for quantitative variables.

Results:

33 knees that had revision arthroplasty were treated by 29 patients for the research. The average patient age was 60.60±6.78 years, and 86.20% of the patients were female. Twenty-five patients had unilateral revision arthroplasty, and four had a bilateral revision. 15 knees had infections, 14 had aseptic loosening, and 4 had periprosthetic fractures. These three issues accounted for the majority of revisions. (Table 1) It took an average of 48±4 months from the first total knee replacement to the revision procedure.

Table 1: Demographic information of the participants included in the study

		n	%	Mean	SD
	Age (Years)			60.6	6.78
Gender	Female	25	86.21		
	Male	4	13.79		
Arthroplasty Type	Unilateral	25	86.21		
	Bilateral	4	13.79		
Etiology	infection	15	45.45		
	aseptic loosening	14	42.42		
	periprosthetic fractures	4	12.12		

Wedging and augmentation, confined condylar knee prosthesis, rotating hinge, augmentation and wedging, and augmentation with concomitant distal femoral plate were among the several revision procedures that were carried out. (Table 2)

Table 2: Type of revision surgery

Type	n
Augmentation	12
Constrained Condylar Knee Prosthesis	11
Rotating Hinge	8
Wedging and Augmentation	1
Distal Femoral Plate with Augmentation	1

The patients' WOMAC discomfort, rigidity, and functional scores were each 18.4, 8.17, and 72.5, respectively, before to the revision surgery. With a pain score of 2.2±1, a stiffness score of 3.4±6, and a function score of 10.4±4 at six months after revision surgery, there were notable improvements in the WOMAC score (p-value < 0.05). (Table 3)

Table 3: WOMAC Score

WOMAC Score	Pre-Revision	Post-Revision
Pain	18.4±3	2.2±1
Stiffness	8.1±7	3.4±6
Function	72.5±4	10.4±4

According to gender, age, or side of revision, no significant change in WOMAC score was detected. However, patients who had revision surgery due to aseptic loosening fared better overall on the WOMAC scale than patients who underwent revision surgery for other reasons (p-value < 0.05). 9.09% was the total complication rate that was recorded, which is a really low number. Injuries to the lateral collateral ligament, the extensor mechanism, and the femoral condyle were among the problems in one knee each. (Table 4)

Table 4: Complications after the surgery

Complications	n
Extensor Mechanism Injury	1
Lateral Collateral Ligament Injury	1
Femoral Condyle Fracture	1

When patients with knee joint issues had revision arthroplasty, their WOMAC scores significantly improved. Irrespective of gender, age, or the side of the revision, surgery was successful. The greatest improvement in WOMAC score following revision surgery was seen in patients with aseptic loosening. There were not many complications overall.

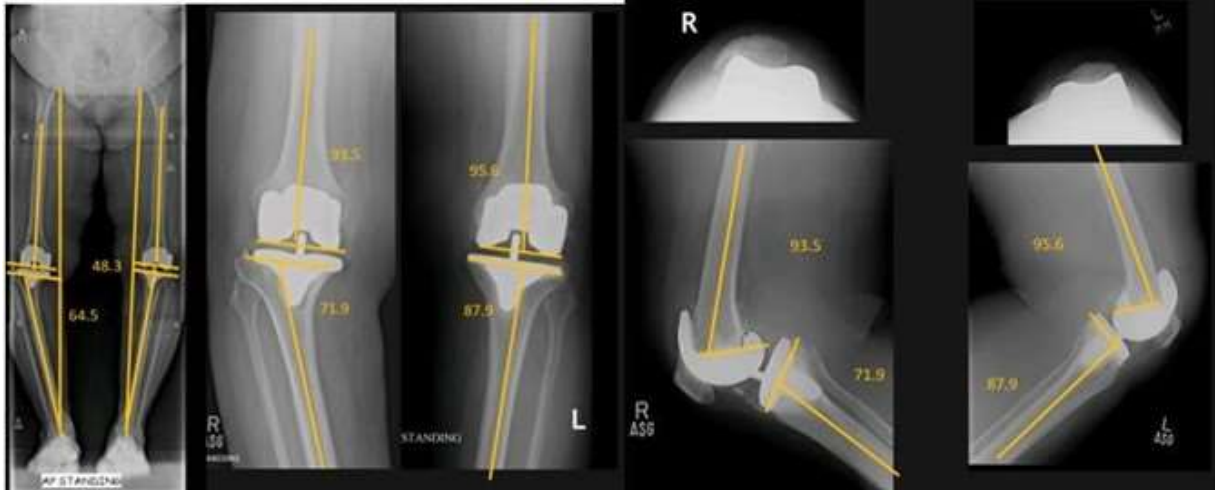


Figure 2: Radiographs from a 50-year-old patient's bilateral TKA eight years ago, which reveal osteolysis and a misaligned prosthesis.

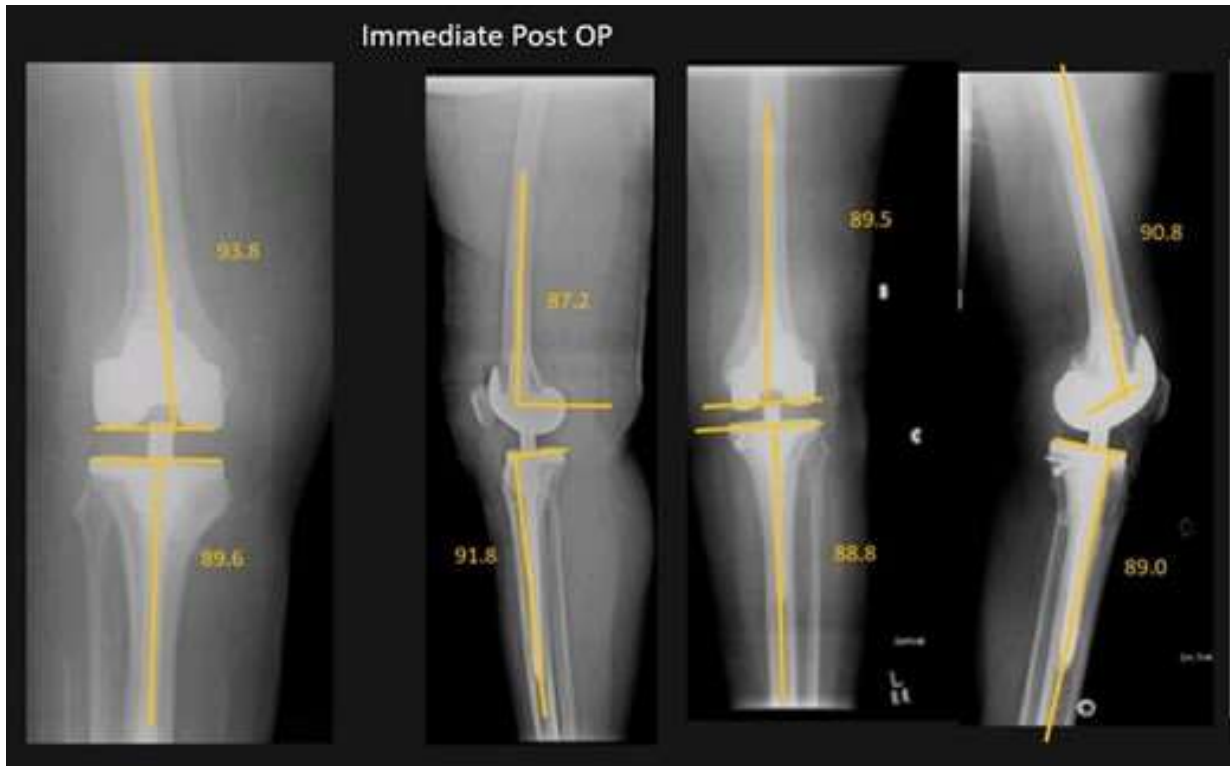


Figure 3: Following a revision arthroplasty, immediate postoperative radiographs



Figure 4: One year after a revision arthroplasty, postoperative radiographs

Discussions:

When total knee replacement surgery is performed on individuals who are younger than 65, it is often linked to a more active lifestyle, higher functional demands, and a longer lifespan. Thus, younger patients have a substantially higher lifetime prognosis for prostheses than older ones. According to a study, patients under the age of 55 had a 7% of failure rate while patients over the age of 55 had a failure rate of 2%. [15] In another study, the main TKA survival rate was 81% after 10 years of follow-up. The lifespan of the prosthesis is also influenced by the underlying illnesses. Patients with rheumatoid arthritis were found to have an initial TKA prosthesis survival rate of 81% to 97% after 10 years of follow-up, compared to a revision total knee failure rate of 19 to 28%. [16,17]

The likelihood of revision TKAs is higher in morbidly obese individuals with a BMI > 40 kg/m² compared to non-obese individuals (34.5 vs. 16.1%). [18,19,20] Additionally, it's been shown that morbidly obese patients had lower Knee Society Functional Scores (KSFS) and Knee Society Objective Scores (KSOS) after primary TKA than non-morbid patients, and their infection rates were also greater.[21]

In our investigation, aseptic loosening occurred in 14 knees (42.42%), infection occurred in 15 knees (45.45%), and periprosthetic fractures occurred in 4 knees (12.12%). According to a previous study, aseptic loosening, destabilization, and wear of polyethylene account for 25%, 24.1%, 21.1%, and 17.5% of all cases of infection. According to a study, 38% of patients with infections, 27% of patients with instability, and 7% of patients with osteolysis

required revision surgery after receiving original TKAs. [22] Another study found that aseptic loosening and deep infection were the two most frequent causes of failure following TKA, followed by polyethylene wear. [23] According to a previous study, mechanical loosening, infection, osteolysis, and instability were the most frequent causes of revision, accounting for 40%, 24%, 9%, and 9%, respectively. [24] According to another study, polyethylene wear in the knees was responsible for 44.1% of infections, 38.7% of loosening, and 12.1% of total knee replacement surgeries. [25] According to a different analysis, problems after primary TKA were aseptic in 41.8% of cases and septic in 58.2% of them. [26]

Our revision surgery's functional results were evaluated using the WOMAC questionnaire. In their investigations for revision total knee arthroplasty, other researchers used this measure and found a considerable improvement at the six-month mark. A meta-analysis of 1356 patients showed that the knee score improved after revision, going from 49 to 84. [27] While the bulk of our modifications were due to infection, the predominant reason for revision in his series was loosening.

Patients with aseptic loosening had significantly higher total WOMAC scores following revision than other patients, according to our research (P 0.05). Our position is reinforced by earlier studies that looked at 150 revision total knee replacements and found that aseptic loosening resulted in superior patient satisfaction, pain relief, and knee ratings than alternative procedures. [28] Another research described the results of 60 revision total knee arthroplasty procedures, showing that the average range of motion was 121 degrees and the post-revision International Knee Society Knee Score was 81. [29]

A few of the study's drawbacks were its limited sample size and brief follow-up time. It is thus advised to do further study to confirm the results.

Conclusions:

In our research, we discovered that infections were the main reason patients had to have a second joint replacement operation. But the majority of patients

who had revision surgery were happy with their functional outcomes.

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