

# Aetiology of Total Knee Arthroplasty (TKA) Failure and Assess the Functional Outcome of Patients Who Underwent Revision Total Knee Arthroplasty

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## ABSTRACT

**Objective:** To identify the causes of total knee arthroplasty (TKA) failure and assess the functional results of patients who received revision TKA.

**Study Design:** Descriptive Study

**Place and Duration:** Orthopedic department of Khyber Teaching Hospital Peshawar in the duration from 1st June, 2022 to 30 November, 2022

**Methods:** The study included all patients who had undergone initial TKA and subsequently underwent revision TKA. Functional outcomes following revision TKA were assessed at six months using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire, and the revision arthroplasty criteria were validated. Statistical significance was determined using a t-test that compared patients' WOMAC scores before and after surgery.

**Results:** A total of 312 revision TKAs were performed on 200 patients in the study, with 89.6% of them transferred to our center. Sixty-nine percent of patients who underwent TKA required a further revision procedure. Over four fifths (73.7%) of all revisions were made after the event. 122 (38.1%) of the cases had been resolved in some fashion. The most common reason for a second surgery after an initial replacement was infection (36.1%), followed by aseptic loosening (21.9%) and periprosthetic fracture (13.7%). The majority of our patients who underwent a second arthroplasty were happy with the functional outcomes.

**Conclusion:** The three most common reasons for a TKA to fail are infection, periprosthetic fracture, and aseptic loosening. Significant improvements in functional outcomes were seen with revision TKA, albeit a sizable proportion of patients still suffered or required additional intervention.

**Keywords:** TKA, Infection, Revision of surgery

## INTRODUCTION

Whole knee arthroplasty, often known as TKA, is a surgical technique that has been shown to enhance pain management, mobility, and overall patient satisfaction in patients who have sustained knee injuries. The growing number of first-time TKA operations that are unsuccessful has resulted in an increase in the number of patients who require a second TKA operation. In the United Kingdom, there are around 76,000 total knee arthroplasty procedures performed each year. It is anticipated that fewer than 5 percent of the initial TKAs will need to be performed as a result of complications once 10 years has passed.

Despite the fact that both the primary TKA and the revision TKA are extremely successful and predictable, the success rate for the revision TKA is lower. There are a variety of reasons for this, such as the requirement for bigger and more constrained prostheses, challenges caused by bone loss and an inadequate supply of soft tissue, etc. Hence, it is essential for any patient who is contemplating a revision TKA to give considerable thought to both the positive and negative aspects of the treatment. Because of the additional expenses associated with implants and allografts, as well as the increased hospital stays, increased complication rates, and extended recovery durations, the cost of a revision TKA can be approximately twice as high as the cost of a conventional TKA.

The most common causes of TKA failure include infection, aseptic loosening, malalignment, instability, rigidity, mechanical wear, rupture of extensor mechanisms, persistent discomfort, and stiffness. Because of this, an adjustment of some kind will need to be made. When compared to an initial TKA, a revision knee arthroplasty has a lower likelihood of being successful as a surgical procedure. This is as a result of the fact that medical professionals have a more challenging time managing concerns such as a lack of tissue and bone loss. Inadequate surgical expertise, choosing the inappropriate component size, failing to adequately balance the ligaments, and lack of patient compliance

are other important factors that contribute to TKA failure. It is more difficult to do a revision knee arthroplasty since it needs treating the underlying causes of failure while still fulfilling the patient's desires.

We examined the functional outcomes of individuals who received a second total knee arthroplasty treatment in order to gain a better understanding of the factors that lead to the failure of total knee arthroplasty (TKA). Surgeons need to be well-versed on the challenges of revision TKA as well as the variables that lead to TKA failure in order to achieve better outcomes for their patients and perform TKA revisions less often.

## METHODS

We conducted this descriptive study in Orthopaedic department Khyber Teaching Hospital Peshawar in the duration from 1st June, 2022 to 30 November, 2022. Our research included patients of both sexes who had undergone total knee replacement for osteoarthritis, but who afterwards developed issues that necessitated revision surgery. The study was sanctioned by our hospital's board of ethics. All patients gave their consent before undergoing revision surgery, and everyone gave their OK for the results to be made public.

All relevant inquiries were made and a complete history was taken from the individuals who were used as examples. Depending on the extent of bone loss and the state of the ligaments and soft tissues, several revision arthroplasty procedures were used, such as rotating hinge, limited condylar knee prosthesis, augmentation, wedging, and augmentation. Infected patients had gradual removal of the primary TKA, debridement, or cement spacer implantation until clinical and biochemical criteria proved the infection had been eradicated. Patients were strongly urged to take part in physical therapy sessions under supervision after surgery. Once a minimum of 6 months had passed after surgery, the patients' functional outcome was assessed using the WOMAC questionnaire, which

had been created by scientists from Western Ontario and McMaster Universities.

**Inclusion criteria:** The following were the requirements for inclusion in the study:

Subjects included (1) patients who had RTKR (relief of all primary variables) performed by the senior author (RR) at Khyber Teaching Hospital Peshawar using the PFC prosthesis (Depuy Synthes) and had at least a 6-month follow-up after the procedure.

Second, patients who underwent a posterior revision by a different surgeon were not included in the RTKR success or survival rates, but they were in the functional and satisfaction rates.

Third, the patient's observation of a TKR surgery that needed redoing was indicative of failure. Hence, the patient underwent a second TKR procedure, which may have been unneeded.

**Exclusion Criteria:** Patients with morbid obesity or a lack of willingness to undergo revision surgery were not considered.

**Study Design:** Individuals of either sex who had undergone a primary total knee replacement for osteoarthritis over the last decade and subsequently required a revision were included in the descriptive analysis. Individuals who required a revision due to problems following a complete knee replacement were chosen for the study. The study set out to understand these issues and their origins. The type of revision arthroplasty done was determined by the degree of bone loss and the health of the ligaments and soft tissues. Debridement or cement spacer implantation was employed to treat infections until clinical and biochemical criteria showed that the infection had been eradicated. All patients were encouraged to join a supervised fitness program soon following surgery.

**Statistical Analysis:** Using the Student t test, we compared the patients' WOMAC ratings prior to and following surgery and observed a statistically significant improvement after. Statistical significance was assumed when the P-value is much less than 0.05. SPSS version 20 was used to derive the mean and standard deviation. Standard deviations, not merely frequencies, should be taken into account when analyzing numerical data. Importance ranking for grouped info.

## RESULTS

Two hundred patients with 312 knees and an average age of 60.60 to 6.78 years underwent surgery. There were 210 female patients, accounting for 67.30% of the total, while only 102 male patients, representing 32.70%. 265 (84.90%) patients had unilateral revision arthroplasty, while 47 (15.10%) had contralateral revision arthroplasty. Infection was the leading cause of repeat arthroplasty in 220 (70.50%) of the knees, aseptic laxity in 75 (24.00%), and periprosthetic fractures in 17 (5.50%). On average, it took four and a half years and four months from the first total knee arthroplasty to the second surgery.

Table 2: Revision of surgery with respect to age and BMI

Patients		All revision surgeries (n = 312)	First revision surgeries (n = 200)	Re-revision surgeries (n = 112)	p
Gender	Male	102 (32.70%)	84 (26.92%)	48 (24.00%)	n.s.
	Female	210 (67.30%)	180 (57.69%)	65 (32.50%)	n.s.
Age [years]		72.3 (48.2 – 95.4)	72.2 (48.2 - 95.4)	72.6 (54.4 - 92.5)	n.s.
BMI [kg/m <sup>2</sup> ]		30.6 (SD 5.7)	30.5 (SD 5.8)	30.9 (5.4)	n.s.

The overall complication rate in our study was 9.09%(n=3) with extensor mechanism injury in 1(3.03%) knee, lateral collateral ligament injury in 1(3.03%) and femoral condyle fracture in 1(3.03%) knee.

## DISCUSSION

When compared to patients of the same age who have total knee arthroplasty, younger patients tend to have a more active lifestyle, higher functional demand, and a longer life expectancy. Because of this, younger patients have a substantially higher rate of prosthesis failure than older patients do. The failure rate for

Table-1: Characteristics of included cases

Variables	Frequency	Percentage
Gender		
Female	210	67.30
Male	102	32.70
Mean Age (Years)	61.50±4.45	
Mean BMI (kg/m <sup>2</sup> )	26.31±7.42	
Side Of Knee		
Left	235	75.3
Right	77	24.7

Revision surgery included augmentation in 12(36.36%) knees, constrained condylar knee prosthesis in 11(33.33%) knees, rotating hinge in 8(24.24%), wedging and augmentation in 01(3.03%) and distal femoral plate along with augmentation in 01(3.03%) knee.

The most prevalent cause of the alteration we established was infection (27/45 instances), followed by stiffness (15/25), loosening (13/21.7), and periprosthetic fracture (5/8.3).

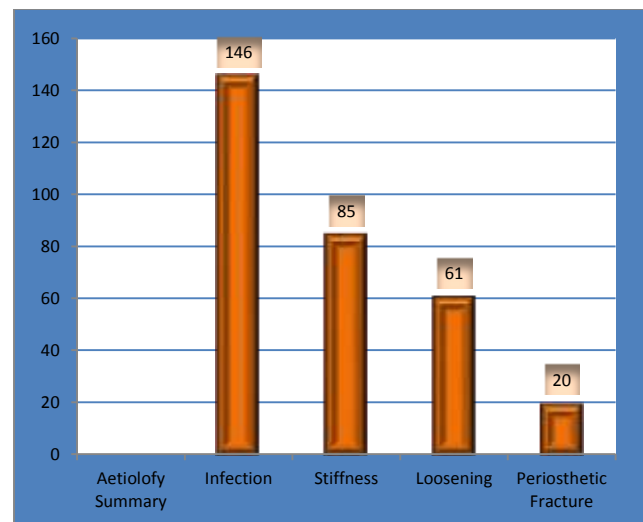


Figure-1: Causes of revision

Revision arthroplasty yielded significant improvement in WOMAC score at 6 months with WOMAC pain score of  $2.2 \pm 1$ , stiffness  $3.4 \pm 6$  and function  $10.4 \pm 4$  ( $P < 0.05$ ). No significant difference in WOMAC score was noted when data was stratified for gender, age and side of revision. Patients of aseptic loosening however had significant better overall WOMAC score after revision than others ( $P < 0.05$ ).

patients younger than 55 years old was 7% in the Kim2 study, whereas the failure rate for patients older than 55 years old was 2%. After a 10-year follow-up, the survival rate for primary TKA was 81%, according to a study by Laski and O'Flynn<sup>15</sup>. Prosthesis durability is impacted by both the underlying condition and treatment. During 10 years of follow-up, the prosthesis survival percentage for original TKA in patients with rheumatoid arthritis ranged from 81% to 97%,<sup>16</sup> whereas the failure rate for revision TKA in rheumatoid arthritis was found to be between 19% and 28%. 17 Revision total knee replacements (TKAs) are more common in morbidly obese patients (BMI 40 kg/m<sup>2</sup>) than in people

who are not fat (34.5 vs. 16.1%). 18 Patients with morbid obesity have been reported to have a greater infection rate after primary TKA, as well as poorer KSOS and KSFS scores when compared to individuals of a normal weight. 19 Fifteen (45.45%) of the knees in our study had infections, fourteen (42.42%) had aseptic loosening, and four (12.12%) had periprosthetic fractures as the cause of their second arthroplasty. 25% of polyethylene wear, 24% of aseptic loosening, 21% of instability, and 17.5% of infection were reported in the Sharkey 20 study. After primary TKAs, Fehring<sup>21</sup> found that 38% of patients developed infections, 27% developed instability, and 7% developed osteolysis. According to Bae<sup>22</sup>, polyethylene wear is the leading cause of TKA failure. Deep infection and aseptic loosening also contribute significantly to TKA failure rates. According to Kasahara<sup>23</sup>, 40% of revisions were caused by mechanical loosening, 24% were caused by infection, 9% were caused by osteolysis, and 9% were caused by instability. Among the reasons Kim<sup>2</sup> cited for recommending knee revision surgery, polyethylene wear (44.1%), infection (38.7%), and loosening (12.1%) were all mentioned. Among the patients who underwent primary TKA, 58.2% had septic complications and 41.8% had aseptic problems, as reported by Lee<sup>24</sup>. With the help of the WOMAC questionnaire, we were able to evaluate the functional results of our revision surgery. A considerable improvement was seen at the six-month follow-up for patients who had had revision total knee arthroplasty using this scale by Mulhall<sup>25</sup> and colleagues. After revision, Sheng<sup>26</sup> found that the knee score increased from 49 to 84 throughout a meta-analysis involving 1356 patients. The bulk of our revisions were caused by infection, whereas loosening was the primary explanation for revision in his series. We found that patients who experienced aseptic loosening following revision had a significantly higher total WOMAC score than those who did not (P<0.05). Van Kempen<sup>27</sup>, who examined 150 revision complete knees, found that patients were more satisfied with the results of aseptic loosening in terms of pain relief and overall knee score than those who had undergone other types of revisions. Post-revision scores for the International Knee Society Knee and Function were 81 and 79, respectively; the Hospital for Special Surgery score was 84; and the mean range of motion was 121 degrees, as shared by Vasso<sup>28</sup>, who has undergone 60 revisions of total knee arthroplasty. We had a limited time frame and a small sample size for our investigation. More research is needed to corroborate our findings.

## CONCLUSION

The three most common reasons for a TKA to fail are infection, periprosthetic fracture, and aseptic loosening. Significant improvements in functional outcomes were seen with revision TKA, albeit a sizable proportion of patients still suffered or required additional intervention.

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