

Causes and rates of revision total knee arthroplasty: Local results from Isfahan, Iran

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Abstract

Background: Knee replacement is one of the most frequently performed surgical procedures in the world. Local data on revision total knee arthroplasty (TKA) are limited. This study aims to assess the rates and causes of revision TKA in Kashani Hospital (Isfahan, Iran) from 2011 to 2013.

Materials and Methods: We assessed all primary TKA and revision TKA procedures performed from 2011 to 2013 for the rate and causes of failures. Demographic data, duration from primary TKA to revision TKA and underlying diagnosis for primary TKA were also assessed.

Results: Overall, 353 primary TKA procedures carried out in this period. The overall revisions following primary TKA in this period was 24 cases, indicating a revision burden of 6.8%. The most common cause of revision TKA was infection, which was in 16 cases (44.4%). Other causes included patellar complications, mechanical loosening of both tibia and femur, mechanical loosening of tibia, instability, and periprosthetic fracture. The main revision procedures were all component revision, tibial component revision, isolated tibial insert exchange and patellar tendon repair. The most common revision procedure was two stage all component revision, which was carried out in 13 subjects (36.1%).

Conclusion: Local indications for revision TKA are mainly similar to those in other large centers. As compared with other centers, with considering the follow-up time, revision burden is relatively higher in this center.

Key Words: Revision causes, revision rate, total knee arthroplasty

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INTRODUCTION

Arthritis is described by progressive degeneration of articular cartilage that manifests ultimately as stiffness, joint pain, and/or dysfunction.^[1] Surgical choices for treatment of knee arthritis are arthroscopic joint debridement, distal femoral osteotomy, high

tibial osteotomy, unicompartmental knee arthroplasty, and total knee arthroplasty (TKA).^[2,3] TKA is one of the most common reconstructive procedures which is performing in adult, and its frequency continues to increase.^[4,5] It is a common, safe and successful treatment for end-stage knee arthritis that achieves a high rate of satisfaction in patients.^[6,7] Because of this success, its indications have broadened to include more active and younger patients, which has increased the demand for this procedure.^[8,9]

In spite of the ability of TKA to improve function and reduce pain in patients with arthritis, it can incur significant cost and is a resource-intensive procedure, which is related to the cost of hospital stay, of the implant, and of rehabilitation needs

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postoperatively.^[10,11] In the other hand, the prosthesis lifespan is ultimately limited, and a significant number of subjects face the prospect of knee arthroplasty revision eventually.^[12,13] Regardless of the type of the initial surgery, revisions are typically to a TKA and often need stemmed components and additional augments, which must address bone stock and soft tissue integrity, which are often compromised.^[3,9] The most common reasons for revision are infection, mechanical wear, aseptic loosening, pain, instability, arthrofibrosis, malalignment and periprosthetic fractures.^[12,14] The revision procedure is not an enviable task because the surgeon often encounters difficulties in handling soft tissue insufficiency and bone loss. Thus, the overall outcome is not as good as primary arthroplasty.^[9,15]

Considering the economic burden and technical complexity of the revision TKA procedure, it would be important to investigate predictors for TKA failure, by focusing efforts to address these failure mechanisms, and improve the final outcome of TKA. Hence knowing about rates and causes of revision has been focused by many literatures on TKA.^[10,11,16,17] With improvements in surgical technique, prosthesis design and measures to prevent infection, revision rates have declined; based on the recent joint registers worldwide, the revision rate for the TKA is on average 6–12% over a period of 10-year.^[18,19]

The survival National registries have been done in certain European countries, Canada, United States, New Zealand, and Australia to monitor the causes and rates of revision replacement surgery.^[8,9] In Iran, Local data on revision knee arthroplasty are limited. This paper aims to present local registry data on the rate and causes of revision TKAs in Isfahan, Kashani Hospital, over 3 years.

MATERIALS AND METHODS

Study design and participants

This study was carried out between January 1, 2011 and December 30, 2013. The study followed the Declaration of Helsinki on Biomedical Research Involving Human Subjects and was approved by the Ethics Committee from the Isfahan University of Medical Sciences. All participants provided written informed consent.

Subjects were selected from patients who were admitted to the orthopedic ward of Kashani Hospital (Isfahan, Iran) and had a TKA. All subjects met the following inclusion criteria: (1) Patients who undergo a TKA between 2011 and 2013; (2) patients who had a revision of TKA between 2011 and 2013; and (3) willing

and able to provide written informed consent. Subjects also had not any serious medical condition that may interfere with safe study participation.

Procedures and variables assessment

The hospitals database was used to identify primary, and revision knee arthroplasty procedures performed between 2011 and 2013. We used the registered data on documents and surgery reports after primary and revision TKAs. Eligible subjects also asked for an interview and physical examination.

Demographic data included age and sex; and clinical data included: (1) Date and cause of TKAs; (2) date and cause of revision TKAs; (3) type of revision TKAs; (4) mechanical lateral distal femoral angle (MLDFA) before and after TKA and (5) mechanical medial proximal tibial angle (MMPTA) before and after TKA.

Aseptic loosening may be obvious on radiograph as a complete radiolucent line of 2 mm or more around the prosthesis at the bone cement interface in cemented arthroplasty. If there was a suspicion for infection, erythrocyte sedimentation rate/C-reactive protein (ESR/CRP) were assessed and if either was positive, then joint aspiration was done for cell count/differential and culture to decide that whether or not there is an infection. Positive ESR/CRP plus positive cell count/differential or culture was considered as possible infection. If cell count and culture were both negative, frozen section and/or synovial fluid white blood cell count during surgery were determinant.^[20] Instability can be defined as abnormal and excessive displacement of a knee prosthesis accompanied by clinical failure. The AP and lateral views are taken with the X-ray beam directed parallel to the base plate of the tibial component to identify any changes between bone cement and prosthesis.^[21,22]

The MLDFA was measured between following drawn lines. The distal femoral joint orientation line and the line from the center of the hip to the center point of the knee on the femoral knee joint line (femoral mechanical axis). The normal range was considered as 85°–90°.^[23]

The MMPTA was measured between following drawn lines. The proximal tibial joint orientation line and the line from the center point of the ankle to the center point of the knee on the tibial knee joint line (tibial mechanical axis). The normal range was considered as 85°–90°.^[23]

After exclusion, we were left with 353 primary TKAs. There were 24 revision TKAs out of 353 primary TKAs and overall 36 revision TKAs, without considering time of primary TKA, during 3 years follow-up.

Statistical analysis

The data were analyzed by paired sample *t*-test and repeated measure of ANOVA. All analyzes were performed using Statistical Package for the Social Sciences version 20.0 (SPSS Inc., Chicago, Illinois, USA) and a $P < 0.05$ was considered as statistically significant for all analyses.

RESULTS

Overall, 353 primary TKA procedures carried out between January 1, 2011 and December 30, 2013 in Kashani Hospital (Isfahan, Iran). The mean (standard deviation [SD]) age of patients was 61.3 (6.7) years. The utilization rates for primary TKA was 252 (71.4%) for women, and 101 (28.6%) for men; which was higher in women significantly ($P < 0.001$).

In this 353 patients, the most common cause of primary TKA was osteoarthritis with 320 cases (90.6%).

The revisions following this 353 primary TKAs in this center and this period (3-year), were 24 cases which indicate a revision burden of 6.8% for this center. The mean (SD) of patient age was 68.5 (7.1) years ranging from 57 to 79 years. The mean follow-up time was 18.3 (2–35) months. Mean (SD) duration from primary TKA was 9.5 (9.6), ranging from 1 to 31 months. 5 (20.8%) of patients were male and 19 (79.2%) were female. The utilization rates for revision TKA were higher for women significantly ($P < 0.004$). Mean (SD) duration from primary TKA was not different significantly between men and women ($P = 0.44$).

On the other hand, the overall revision TKA procedures in this 3 years, without considering time of primary TKA, were 36 cases. For analyzing of overall causes of revision TKAs, we included all of this 36 revision. The mean (SD) age of patients was 68.2 (7.9) years, ranging from 47 to 83 years. Mean (SD) duration from primary TKA was 37.2 (58.6), ranging from 1 to 294 months. 9 (25%) of patients were male and 27 (75%) were female. The utilization rates for revision TKA was higher for women significantly ($P < 0.003$). Mean (SD) duration from primary TKA was not different significantly between men and women ($P = 0.999$).

In this 36 revisions, the most common cause of primary TKA was osteoarthritis with 31 cases (86.1%), [Table 1].

The most common cause of revision TKA was infection, which was in 16 cases (44.4%). The predominant noninfectious causes were patellar complications (fracture or tendon tearing), with 9 cases (25%). Other causes included mechanical

loosening of both tibia and femur, mechanical loosening of tibia, instability and fracture [Table 2].

The mean (SD) age was 65.6 (7.9) years for patients with infection and 70.4 (7.6) years for patients with patellar complications.

Between 9 patients with patellar complications, after revision surgery, one had 20° lag of extension and others had full extension in physical examination. The mean degree of flexion was 104.4°.

The main revision procedures were all component revision, tibial component revision, isolated tibial insert exchange and patellar tendon repair [Table 3]. The most common revision procedure was two stage all component revision, which was carried out in 13 subjects (36.1%); that is, antibiotic loaded cement spacers for an interval period, with intravenous antibiotics and also antibiotic loaded cement for prosthesis fixation at the time of re-implantation.

Causes of revision TKA associated with revision TKA procedures is presented in Table 4.

In 36 patients with revision TKA, the mean (SD) of MLDFa before and after surgery were 96.2 (3.7) and 90.3 (2.1), respectively; which was reduced significantly ($P < 0.001$). And the mean (SD) of MMPTA before and after surgery were 80.25 (4.4) and 84.3 (2.03), respectively; which was increased significantly ($P < 0.001$).

Table 1: Causes of primary TKA in patients with revision (n=36)

Cause of primary TKA	Number (%)
Osteoarthritis	31 (86.1)
Rheumatoid arthritis	2 (5.6)
Others	3 (8.3)

TKA: Total knee arthroplasty

Table 2: Causes of revision in patients with revision TKA (n=36)

Cause of revision TKA	Number (%)
Infection	16 (44.4)
Patellar complications (fracture or tendon tearing)	9 (25)
Mechanical loosening of tibia and femur	7 (19.4)
Mechanical loosening of tibia	2 (5.6)
Instability	1 (2.8)
Fracture	1 (2.8)

TKA: Total knee arthroplasty

Table 3: Types of revision in patients with revision TKA (n=36)

Types of revision TKA	Number (%)
All component revision (two stage)	13 (36.1)
All component aseptic revision	8 (22.2)
Tibial component revision	2 (5.6)
Isolated tibial insert exchange	4 (11.1)
Patellar tendon repair	9 (25)

TKA: Total knee arthroplasty

Table 4: Causes of revision TKA associated with revision TKA procedures

Causes of revision TKA	All revisions	Infection	Patellar complications	Mechanical loosening of tibia and femur	Mechanical loosening of tibia	Instability	Fracture
Revision TKA procedures	36	16	9	7	2	1	1
All component revision (two stage)	13	13	-	-	-	-	-
All component aseptic revision	8	-	-	7	-	-	1
Tibial component revision	2	0	-	-	2	-	-
Isolated tibial insert exchange	4	3	-	-	-	1	-
Patellar tendon repair	9	-	9	-	-	-	-

TKA: Total knee arthroplasty

DISCUSSION

In spite of the good functional outcomes that have been reported with primary TKA, revision TKA remain an important clinical challenge for surgeons and patients. In this study, with 3 years follow-up, revision burden was 6.8% which is more than some previous studies with 1.4%, 2.2%, 2.8% and 3.3% for 3, 10, 8 and 5 years follow-up, respectively.^[15,24-26] In a recent systematic review, Pabinger *et al.* reported that overall 10 years worldwide revision rates of TKA was 6.2% (range: 4.9–7.8%),^[19] which is near to revision rates in our 3-year follow-up study. This shows that considering the follow-up time, revision burden is higher in Kashani Hospital.

This matter could have different reasons and is affected by various items such as indications for primary TKA; age, gender and race of patients; and also length of hospital stay after TKA. In the other hand, in our study the most common reason for revision was infection. The infection is related to the increased operative time for surgery, poor wound healing, the increased age of our patient population and perioperative care methods. Understanding of these reasons are essential to improving implant performance and long-term patient outcomes, so should be assessed in future studies.

Several causes are well-defined for failure of TKA in previous studies, including mechanical wear, aseptic loosening, infection, instability, osteolysis, pain, stiffness, malalignment, patellar complications and periprosthetic fractures.^[12,24,27-29] In our study, the causes of failure leading to revision are similar to recent series.^[9,12,24]

In this study, the most common reason for revision was infection, which was similar to Julin *et al.* and Bozic *et al.* studies.^[24,29] However in others, mechanical loosening had been the major cause of revision.^[25,27] It is very important because the cost of surgery and treatment of infected TKA is much more than that of nonseptic revision TKA and that of primary TKA,^[30] and also the patient outcomes is relatively poor with

revision TKA for infection compared with revision TKA for aseptic causes of failure.^[29] In our study, most of patients with infection (13 subjects) had two stage all component revision (the most expensive revision type), and also all of two stage all component procedures were done for patients with infection. Infection was the most common reason for isolated tibial insert revision (3 of 4 cases); this was the same as Bozic *et al.* study.^[29]

Patellar complications were predominant noninfectious causes of revision TKA in our study which is similar to Julin *et al.* study.^[24]

The most common type of revision TKA reported during the time period under study was all component revision (one or two stage); it is similar to Bozic *et al.* study.^[29] This procedures were done mainly for infection and mechanical loosening of tibia and femur.

Advantages and limitations

These data provide an understanding of the risk and causes of revision after primary TKA in the local population. This study is particularly important from a local standpoint because according to our researches, the causes of revision knee arthroplasty in local setting have not been previously described. Therefore, it gives valuable data in this aspect. More understanding of current causes by which TKA fail may help surgeons to prevent these problems and improve outcomes for TKA. Our findings are also limited by a relatively small sample size and short-time period of data collection and hence this study can be improved by working on a larger sample size, which would allow for more accurate subgroup analysis.

CONCLUSION

In this study, local indications for revision TKA are mainly similar to those in other large centers. Also, in comparison with other centers, with considering the follow-up time, revision burden is relatively higher in this center. Increasing the follow-up time will enable us to clarify the survivorship of implants in the longer term.

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