

Outcome of revision in comparison with primary total knee arthroplasty in Iran

Hossein Farahini¹,MD; Ehsan Akbarian²,MD. Mehdi Moghtadaei³,MD.
Siroos Malekpoor⁴,MD.

Department of Orthopedic Surgery. Iran University of Medical Sciences. Tehran, Iran.

Abstract

Background: In the recent decade, many primary total knee arthroplasties have been carried out in Iran and the number of revision cases is expected to rise with the aging population. The aim of this study was to report the outcome of revision surgery in the country and make a comparison between the outcome of revision and that of the primary arthroplasty.

Methods: Retrospectively, each case of 19 consecutive revision total knee arthroplasties was matched individually with two cases of primary total knee arthroplasty based on gender and age (within 5 years) in order to compare the outcome in the two groups of revision and primary arthroplasties. Detailed demographic data, underlying diagnosis, patient-reported pain severity, and Knee Society score were recorded pre-operatively and in the third month after the surgery for each patient in the two groups. Using chi-square, fisher's exact, one-way ANOVA, independent, and paired t-tests, we compared the outcomes in two groups as well as in each group before and after the arthroplasty.

Results: Knee pain was significantly decreased after the surgery in the two groups of revision ($p = 0.031$) and the primary ($p < 0.001$) arthroplasty. There was no statistically notable difference of post-operative pain between the two groups of revision and primary TKA. The Knee Society score remarkably increased in both groups after the surgery (both $ps < 0.001$). The differences of Knee Society scores before and after the surgery were calculated separately in each group and compared to show that the primary group had a better outcome ($p < 0.001$) rather than the revision arthroplasty group.

Conclusion: Conclusion: Satisfactory outcomes were obtained in our revision total knee arthroplasties; however, the primary arthroplasties had better results. The results of surgery appear to be closely related to the technical demands placed on surgeon. Because we have to deal with more cases of revision total knee arthroplasty in near future, more comprehensive risk factor assessment studies with large sample size are required for gaining better results.

Keywords: revision total knee arthroplasty, primary total knee arthroplasty, knee society score, pain, outcome

Introduction

Various factors may be responsible for failed primary total knee arthroplasty (TKA) proce-

dures which increasingly seen due to a great number of younger and more active population with a longer life expectancy. Revision of TKA may be required if the patient experiences loosening of prosthesis, infection, and chronic pro-

1. Associate Professor and Orthopedic Surgeon and Fellowship of Knee and Arthroscopy, Rasool-e-Akram General Hospital. Iran University of Medical Sciences.

2. **Corresponding author**, General Practitioner, Shahid Beheshti University of Medical Sciences. Tel: +98 (912) 172-5275. Email: eakbarian@gmail.com.

3&4. Assistant Professor of Orthopedic Surgeon. Rasool-e-Akram General Hospital. Iran University of Medical Sciences.

gressive joint disease which result in continued bone loss, improper implant placement, and alignment or traumatic injuries to the knee. Furthermore, particulate debris from the original implant may cause an inflammatory response and could lead to osteolysis. On the other hand, poor bone quality, poor skin coverage, unresolved infection, limited function of the quadriceps or extensor tendons, and peripheral vascular diseases are some of the contraindications for this surgery. The procedures needed to be performed for the revision TKA were more complex than those of primary TKA and associated with greater potential complications for the patient, less favorable implant survival profiles, and greater surgical complexity and expenses along with a longer surgical time; in addition, most of the patients who underwent this operation were older than patients having the primary TKA.

Previous studies reported that the result of primary TKA was more favorable than revision TKA. Hanssen and Rand reported primary TKA had 92% good and excellent results, whereas the revision TKA had a lower rate (81%) of good and excellent results [1]. Moreover, a systematic review by Ethgen et al revealed that primary TKA develops greater improvement than the revision TKA [2]. On the contrary, Saleh et al [3] evaluated the results of revision total joint arthroplasty by using a meta-analysis and found out that both primary and revision TKA led to significant improvement in knee scores after surgery. Hartley et al. [4] prospectively examined the hypothesis that revision TKA is effective and they showed that pain, stiffness, and function scores had no significant difference between the revision and primary TKA groups. The strengths of this recently mentioned study were due to the use of one implant system and the presence of only one surgeon. However, the primary implant used was not particularly successful, which could have lowered the success rate in the primary group.

In recent years, many primary total knee arthroplasties were performed in Iran.

Nonetheless, rapid advances are occurring in the field of the revision TKA. Procedures improvements in revision TKA are important since the number of revision cases is expected to rise with the aging population and many more cases are yet to come due to growing number of primary TKA surgeries in the past decade. Scientific developments in the revision total knee replacements have led to improved results and understanding of the technical aspects of failed revision surgery. The purpose of current study was to report the outcome of revision surgery in Iran and make a comparison between the two outcomes of the revision and primary TKA.

Methods

Nineteen consecutive patients indicated for revision TKA, were reviewed retrospectively in the first author's practice, who did all surgical procedures, between June 2007 and October 2008. Furthermore, we matched each revision TKA case individually to two cases of primary TKA by the first author. Detailed demographic information, underlying diagnosis, patient-reported pain severity, and the Knee Society score [5] were also recorded pre-operatively and three months after the surgery for both revision and primary TKAs. The pain questions were the same as those suggested by American Knee Society: "do you have pain in the knee in which the joint was replaced or needed to be replaced?" but the possible answers suggested to be one of the no pain, mild (occasional), moderate (continuous), and severe choices. Subjective and objective data pre and post operatively were gathered under direct supervision of the first author and clinical exams or radiologic diagnostics were performed by him as well.

We categorized age of the patients into four groups: less and equal to 60, between 61 and 70, between 71 and 80, and more than 80 year old. Underlying diagnoses of the revision TKAs

were categorized into five groups of loosening or wear, dislocation or instability of prosthesis, infection, failed primary TKA with components removed, and osteolysis. Underlying diagnoses were categorized into three groups of osteoarthritis, rheumatoid arthritis, and other situations, in the primary TKA group. The cause of failure was determined by the pre-operative evaluation and intra-operative findings at the time of revision TKA. Preoperative computed tomography scans were obtained to evaluate mal-rotation of the femoral and tibial components if patellar tilting or subluxation was present. Instability of the prosthesis was considered the cause of failure if the patient reported pain and swelling after activity; there was more than 1 cm of laxity to mediolateral stress testing at 30° of knee flexion, and no other causes of failure were identified. Prosthetic wear or loosening was considered as the cause of failure if the patient had weight bearing pain and either osteolysis or a change in implant position on serial radiographs. The wear and loosening were included in the same group because these two processes often occurred together and difficult to separate clinically in many cases.

Infected TKA

Infections might occur early, within 4 weeks of surgery, or late, more than 4 weeks post-operatively. Symptoms consisted of fever, the presence of fluid, inflammation, and persistent pain, not relieved by rest. A combination of physical examination, x-rays, and laboratory analysis helped us to come to a definitive diagnosis along with diagnostic tests suggested in protocols [6,7]. We performed sedimentation rate, white blood cell count with differential, and C-reactive protein. Suspected patients for infection underwent joint aspiration to determine the causative organism of deep infection. Antibiotic therapy was stopped 10 days before the aspiration to ensure that accurate cultures were obtained. Fungal, aerobic, and anaerobic cultures were then prepared from the aspirate.

Most infected TKA implants required to eradicate infection and the most preferred procedure was two-stage exchange of the prosthesis. However, in case of presence of Gram-positive infections, absence of sinus formation, the use of antibiotic impregnated cement for the new prosthesis, and 12 weeks of antibiotic therapy, direct exchange would be successful [8].

This study had a retrospective matched case-control design for comparing the revision and primary TKA; moreover, it was a before-after clinical trial for making a comparison between before and after revision TKA as to pain and Knee Society score. We used chi-square, fisher's exact test, independent samples t-test and one-way ANOVA to compare the outcomes for revision and primary TKA, and paired t-test to compare Knee Society score before and after the surgery in the revision group. Statistical analysis was carried out by SPSS Statistical Software (SPSS Version 16, Chicago, IL, USA).

Results

Retrospectively, data of 19 revision TKAs along with 38 primary TKAs have been recorded pre-operatively and three months after the surgery. Among the revision group, 8 (42.1%) males and 11 (57.9%) females, and among the primary group, 16 (42.1%) males and 22 (57.9%) females underwent total joint arthroplasty. Mean age and standard deviation of the revision TKA group were respectively 64.2 and 8.5, ranging from 48 to 83 years; while, those of the primary TKA group were 66.1 and 10.3, ranging from 45 to 87 years. Most of our patients who underwent the revision surgery (eight cases, 42.1%) were between 65 to 75 years old. Since each revision TKA was matched individually with two primary TKAs in terms of sex and age (within 5 years), there was no remarkable difference as to sex proportion and age distribution in the two groups. Detailed demographic data are listed in table 1. All patients from the revision TKA group returned

	Revision TKA group (19 cases)				Primary TKA group (38 cases)			
	Mean SD							
Age	Mean SD	64.2	8.5			66.1	10.3	
Gender	Male Female	8	11			16	22	
Body mass index	Mean SD	33.4	4.2			30.7	3.2	
Age distribution	Less than 61 years	6	31.6%			14	36.8%	
	61 to 70 years	5	26.3%			9	23.7%	
	71 to 80 years	7	36.8%			12	31.6%	
	More than 80 years	1	5.3%			3	7.9%	
Underlying diagnosis	Loosening / wear	9	47.4%		Osteoarthritis	34	89.5%	
	Dislocation / instability	4	21%		Rheumatoid arthritis	3	7.9%	
	Infection	3	15.8%		Other situations	1	2.6%	
	Failed primary TKA	2	10.5%					
	Osteolysis	1	5.3%					

Table 1. Demographic data of both revision and primary TKA groups.

to the follow-up clinic and their data in the third month after the operation were recorded. From the primary TKA group, two patients missed the third month post-operative follow-up; hence, they were excluded from the analysis.

In the revision TKA group, underlying diagnosis for nine (47.4%) patients was loosening or wear, four (21%) patients was dislocation or instability, three (15.8%) patients was infection, two (10.5%) patients was failed primary TKA with components removed, and for one (5.3%) patient was osteolysis. In the primary TKA group, underlying diagnosis for 34 (89.5%) patients was osteoarthritis, three (7.9%) patients was rheumatoid arthritis, and one (2.6%) patient was other situations.

Table 2 shows 15 patients in the revision TKA group complained moderate or severe pain, pre-operatively; whereas, there were just 6 cases with the same complaint post-operatively. Pre-operative knee pain significantly decreased (p-value = 0.031) after the revision TKA cases. Table 2 also reveals 30 patients in

the primary TKA group complained moderate or severe pain, pre-operatively; while, there were just 9 cases with the same complaint three months after arthroplasty. Pre-operative knee pain remarkably reduced (p-value < 0.001) after the primary TKA in patients. There was no notable difference of post-operative pain between the two groups of the revision and primary TKA.

As demonstrated in Table 3, means of the Knee Society score, before and after the arthroplasty, in the revision TKA group were 31.2 and 62.7, respectively. The difference of Knee Society score between pre-operative and post-operative conditions in this group was significant with a p-Value less than 0.001 (95% confidence interval = 17.06-45.94). Pre-operative and post-operative means of the Knee Society score in the primary TKA group were 34.5 and 79.4, respectively. There was a remarkable difference between the mean scores before the arthroplasty and that of the post-operation in the primary TKA group with a p-Value less than 0.001 (95%

	Revision TKA group				Primary TKA group			
	Pre-operative		Post-operative		Pre-operative		Post-operative	
None	2	10.5%	4	21%	3	7.9%	7	19.4%
Mild	2	10.5%	9	47.4%	5	13.2%	20	55.6%
Moderate	8	42.1%	3	15.8%	17	44.7%	5	13.9%
Severe	7	36.8%	3	15.8%	13	34.2%	4	11.1%

Table 2. Knee pain in the two groups, before and after arthroplasty.

	Revision TKA group	Primary TKA group
Pre-operative score	31.2±19.3	34.5±12.8
Post-operative score	62.7±24.3	79.4±18.6

Table 3. Mean and SD of Knee Society scores in the two groups.

confidence interval = 37.6 - 52.19). The differences of Knee Society scores before and after the surgery was calculated individually for each patient in the two groups and then these differences were analyzed to make a comparison between the two groups of the revision and primary TKA to realize that which one experienced a better improvement in terms of reducing knee pain and increasing knee function. The primary TKA group had a significant increase rather than the revision TKA group with regard to improvement of the Knee Society score with a p-Value less than 0.001 (95% confidence interval = 10.55 - 16.25).

Discussion

As total knee arthroplasty is increasingly performed in a younger and more active population with a longer life expectancy, the number of TKA revisions will inevitably increase as time-dependent implant failures occur. Approximately 6-10 percent of knee arthroplasties are revisions [9,10]. The revision TKA can be a technically challenging procedure with potential complications. It is therefore necessary to optimize patient, surgeon, and implant-dependent factors to obtain the best possible results. In many cases, obtaining adequate exposure is more difficult rather than primary TKA, and failure to do so can directly cause technical errors and complications. Thus, specific surgical techniques could help to improve the surgical exposure and minimize complications such as wound healing problems, component mal-position, and extensor mechanism disruption.

Underlying diagnosis in most of the revision TKA group was loosening or wear of the prosthesis (47.4%). Loosening of prosthetic components may eventually lead to pain, instability

and loss of function, and thereafter constitutes a failure. Nowadays, one third to half of all revisions are performed because of loosening or wear; however, this fraction is slowly declining and in a few reports, no cases of loosening have been reported within the first ten years [9,10]. Joint dislocation and flexion instability seem to be under-recognized cause of persistent pain and functional problems in patients who have undergone posterior cruciate ligament-retaining TKA. In our cases, 21% of the revision TKA group, suffered from prosthetic dislocation or instability. Although infection after total knee arthroplasty is a relatively infrequent complication, with a rate of 1% to 2.5% in most reports [11,12], but it can be devastating in terms of patient morbidity and instructional expenses. One third of the deep infections occur within the first 3 months after the surgery [12]. The risk of infection might increase in patients with rheumatoid arthritis, skin ulcerations, recurrent urinary tract infections, a history of previous knee joint infection, prior open surgical procedures, immunosuppressive therapy, poor nutrition, hypokalemia, diabetes, history of smoking, and the last but not least, surgical duration more than 2.5 hours [7]. Nonetheless, in our cases, there were three (15.8%) cases, out of 19 revision TKA candidates, who had deep infection of prior knee prosthesis. The small size of study group, as well as the fact that most of the patients had been referred to a sub-specialized knee surgeon might be the reasons for such a frequency.

The results of revision surgery have been reported in a number of series with excellent mid and long-term results [13-16]. However, the overall success rate of revision TKA is much lower than that of the primary TKA [17,18]. De-

spite the excellent long-term results of primary TKA, many revisions are performed within 5 years of the index procedure and although the rate of TKA is steadily rising, revision surgery is increasing at a much more rapid rate [19]. In our experience, 15 out of 19 cases came for the revision TKA with moderate or severe knee pain; while, three months after the surgery, the pain itself decreased in more than half of them. However, in a long-term study the results would be much better over time, after certain rehabilitation techniques. The pre-operative mean of the Knee Society scores of our revision TKA cases increased around two times after the surgery that means a significant improvement has been occurred with regard to boost function and lower pain in revised TKA. Nevertheless, the rate of this improved Knee Society score was considerably more in the primary TKA group than that of the revision TKA group.

Short-term reports on the outcome of revision TKA have indicated that generally good results can be obtained, but mid or long-term results are not sufficiently documented. The results of surgery appear to be closely related to the technical demands placed on surgeons because of bone loss, ligamentous instability, and varying levels of compromise of the extensor mechanism. Because of the large number of factors that require to be taken into consideration, the number of revision TKRs in a study group, like the one we had in this research, is too small for any comparison between several predictors to be made. On the ground of the fact that we will see much more cases in the soon future in the country, well-designed, comprehensive outcome analysis is required to make definitive judgments in our coming research projects.

References

1. Hanssen AD, Rand JA. A comparison of primary and revision total knee arthroplasty using the kinematic

stabilizer prosthesis. *J Bone Joint Surg Am* 1988;70:491-9.

2. Ethgen O, Bruye`re O, Richey F, Dardennes C, Reingster JY. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. *J Bone Joint Surg Am* 2004;86:963-74.

3. Saleh KJ, Dykes DC, Tweedie RL, Mohamed K, Ravichandran A, Saleh RM, Gioe TJ, Heck DA. Functional outcome after total knee arthroplasty revision: a meta-analysis. *J Arthroplasty* 2002;17:967-77.

4. Hartley RC, Barton-Hanson NG, Finley R, Parkinson RW. Early patient outcomes after primary and revision total knee arthroplasty: a prospective study. *J Bone Joint Surg* 2002;84(7):994-9.

5. Insall JN, Dorr LD, Scott RD, Scott WN. Rationale of the Knee Society clinical rating system. *Clin Orthop Relat Res* 1989;248:13-14.

6. Roberts D. Degenerative disorders. In: Maher AB, Salmond SW, Pellino TA, eds. *Orthopaedic nursing*: Philadelphia, PA: Saunders; 2002:468-514.

7. Tsukayama DT, Goldberg VM, Kyle R. Diagnosis and management of infection after total knee arthroplasty. *J Bone Joint Surg Am* 2003;85:75-9.

8. Kilgus DJ, Howe DJ, Strang A. Results of periprosthetic hip and knee infections caused by resistant bacteria. *Clin Orthop Relat Res* 2002;404:116-24.

9. Knutson K, Lewold S, Robertsson O, Lidgren L. The Swedish knee arthroplasty register: A nation-wide study of 30,003 knees. 1976-1992. *Acta Orthop Scand* 1994;65:375-86.

10. Robertsson O, Lewold S, Knutson K, Lidgren L. The Swedish knee arthroplasty project. *Acta Orthop Scand* 2000;71:7-14.

11. Bengtson S. Prosthetic osteomyelitis with special reference to the knee: Risks, treatment and costs. *Ann Med* 1993;25:523-9.

12. Peersman G, Laskin R, Davis J, Peterson M: Infection in total knee replacement: A retrospective review of 6489 total knee replacements. *Clin Orthop Relat Res* 2001;392:15-23.

13. Grafton WT, Tsigaras H, Butler RA, Patterson JJ, Barrack RL, Rorabeck CH. Revision total knee arthroplasty: fixation with modular stems. *Clin Orthop Relat Res*. 2002; 404:158-68.

14. Whiteside LA. Cementless fixation in revision total knee arthroplasty. *Clin Orthop Relat Res* 2006;446:140-148.

15. Bottner F, Laskin R, Windsor RE, Haas SB. Hybrid component fixation in revision total knee arthroplasty. *Clin Orthop Relat Res* 2006;446:127-31.

16. Peters CL, Erickson J, Kloepper RG, Mohr RA. Revision total knee arthroplasty with modular components inserted with metaphyseal cement and stems with-

out cement. *J Arthroplasty* 2005;20:302-8.

17. Saleh KJ, Macauley A, Radosevich DM. The Knee Society Index of Severity for failed total knee arthroplasty: development and validation. *Clin Orthop Relat Res* 2001;392:153-65 .

18. North American Knee Arthroplasty Revision (NAKAR) Study Group. Predictive validity of the Knee Society Index of Severity: a prospective, multicenter cohort study. *J Arthroplasty* 2004.19:322-8 .

19. Sharkey PF, Hozack WJ, Rothman RH, Shastri S, Jacoby SM. Why are total knee arthroplasties failing today? *Clin Orthop Relat Res* 2002. 404:7-13 .