

Management of infected TKR (total knee replacement) and results of two stage surgery for infected TKR

Mohit M. Patel¹, Kaushal R. Patel^{2,*}, Zulfikar M. Patel³, Kalpesh A. Mehta⁴

¹3rd Year Resident, ²2nd Year Resident, ^{3,4}Assistant Professor, B.J. Medical College, Ahmedabad

***Corresponding Author:**

Email: kaushal71190@gmail.com

Abstract

Background: Total knee Replacement is one of the common surgery for knee Osteoarthritis. Infection after total knee replacement is uncommon but disastrous complication.

Purpose: Main purpose of study is to determine functional results of two stage surgery in infected TKR, compare the results of two stage surgery with other modalities of treatment, risk factors for infections, role of laboratory and clinical markers for early diagnosis of infection in TKR.

Methods: This is retrospective study of 40 patients who operated for infected TKR through two stage revision arthroplasty.

Inclusion criteria: All patients operated for infected TKR by two stage revision arthroplasty.

Exclusion criteria:

- Less than 12 months follow up
- Expired patients

Results: The average age of patients was 62.1 years. With youngest patient were being 40 years old and the oldest being 82.

Average BMI in our series was 27.07. It varied with a range from 19.9 to 38.67. 15 patients had diabetes mellitus (DM), 7 patients had hypertension and 1 patient had hypothyroidism. The average WOMAC score improved from 37.525 to 56.3 with a minimum pre op score of 30 and maximum of 45. The mean clinical knee society score (KSS score) improved from from 50.1 to 69.325. 97% of patients showed improvement in their preoperative pain.

The mean range of movement improved from 53.75 to 90.375. Pre op minimum ROM was 30 and maximum was 100.

The average extensor lag preoperatively was 6.65 degrees with a range of 0-15 degrees.

Patients showed improvement with average extensor lag reducing to 2.75 degree, with range of 0-10 degrees.

The failure rate of our study was 8% with persistent infection after treatment.

Conclusion:

- Pain is the most common indication for infected TKR.
- Two stage revision arthroplasty in Infected TKR leads to significant improvement in pain, Range of motion and KSS and WOMAC scores.
- Results of two stage revision arthroplasty are superior to any other treatment.
- Most common organism is staphylococcus aureus.
- Associated illness affects the results of treatment.

Key Word: Osteoarthritis, Total knee replacement, Infection, Kss score, Womac score

Access this article online	
Quick Response Code:	Website: www.innovativepublication.com
	DOI: 10.5958/2395-1362.2016.00026.8

Introduction

Total knee Replacement (TKR)/ Total Knee Arthroplasty (TKA) is one of the common surgery for severe knee Osteoarthritis that is associated with significant improvements in pain, function and quality of life. Outcomes following TKR are excellent in the majority of the patients.

Infection after a total knee replacement (TKR) is an uncommon but disastrous complication. The

diagnosis and treatment of an infected total knee has become quite standardized over the last few years. With an increasing number of total knee replacements being performed, the absolute number of patients with this complication is going to increase over time. It is associated with increased morbidity and mortality increasing the final costs. Gram positive *coccus* and *Staphylococcus coagulase-negative* and *Staphylococcus aureus* are the most common isolated organisms (>50% of the cases)¹.

Infections occur in 1-2% of primary TKRs and 3-5% of revision TKRs². It is also possible that certain aseptic TKR failures may actually not be truly aseptic but secondary to undiagnosed periprosthetic infections. An improvement in our ability to diagnose TKR infections with more sensitive diagnostic algorithms and tests could reveal more Periprosthetic infections than currently estimated³.

When the diagnosis of infection is established, treatment options include antibiotic suppression, debridement with prosthetic retention, resection arthroplasty, knee arthrodesis, one stage or two stage reimplantation and amputation. Treatment of the infected total knee arthroplasty depends on the duration of infection means the time of clinical presentation of the patients.

Early	<3 months
Delayed	3-24 months
late	>24 months

In our present study we tried to look out for results of two stage surgeries (initial prosthesis removal, antibiotic spacer implantation and debridement followed by a period of intravenous antibiotics and later re-implantation) in management of infected total knee replacement.

Aims and Objectives

Main purpose of the study is to identify and compare the different modalities of treatment for infected total knee arthroplasty and to evaluate the functional outcome and pain in different modalities by means of quality of life score and to identify the gold standard treatment for infected total knee arthroplasty.

Materials and Methods

This is a retrospective study of 40 patients who have been operated for infected total knee replacement (TKR) through two stage revision arthroplasty, at civil hospital Ahmedabad between January 2014 to January 2016.

Inclusion criteria:

- Documented patients with operated for infected total knee replacement by two stage revision arthroplasty.

Exclusion criteria:

- Less than 12 months follow up
- Patients expired due to an unrelated cause

Diagnostic criteria: Following clinical, laboratory and radiological parameters used for diagnosis of infected total knee replacement in our study.

Clinical: Fever, pain, tenderness and redness over stitch line, swelling, discharge from the stitches and function deteriorate over time.

Laboratory and radiological: Raised WBC count, ESR and CRP, positive culture report, x rays in which findings like periosteal reaction, osteolysis, bone resorption. Bone scan Tc-99m (technetium) detects inflammation and leukocytes.

Postoperative varus-valgus was calculated from AP x-ray.

Different modalities of treatment for infected total knee arthroplasty.

1. Irrigation and Debridement with component retention
2. Two stage exchange arthroplasty
3. One stage exchange
4. Resection arthroplasty
5. Arthrodesis

Methods	Irrigation and Debridement with component retention	Two stage exchange arthroplas	One stage exchange	Resection arthroplasty	Arthrodesis
Implant	Not changed	Exchanged	Exchanged	Removed	Removal and nailing done
Clinical presentation	If infection occurs in 4-6 weeks(acute infection)	Chronic infection	Highly morbid	Low demanding patient with polyarticular rheumatoid arthritis	Failure of every treatment with high risk factors
Outcome	Good(10-20%)	Excellent	Good(5-10%)	Poor (reduced joint function)	Good
Cost	Cost effective	Costly	Cost effective	Cost effective	

Table 2: Concise Approach to Treatment of Prosthetic Joint Infections

Status of Prosthetic Joint Infection	Treatment
Duration of symptoms < 3wk and stable implant and absence of sinus tract and susceptibility to antibiotics with activity against surface-adhering microorganisms	Débridement with retention
Intact or only slightly damaged soft tissue	1-stage exchange
Damaged soft tissue, abscess, or sinus tract	2-stage exchange with short interval (2-4 wk), spacer
Microorganism resistant or difficult to treat*	2-stage exchange with long interval (6-8 wk), no spacer
Inoperable, debilitated, or bedridden	Long-term suppressive antimicrobial treatment
No functional improvement by exchange of implant	Implant removal without replacement

Discussion

This is a retrospective study of 40 revision total knee arthroplasty operated for infected TKR by two stage arthroplasty. Patients from multiple centres were included in our study. This study was mainly done at tertiary care center at civil hospital, Ahmedabad. where there is huge patients workload. so we included only patients those treated with two stage revision arthroplasty, which is gold standard for treatment of infected total knee replacement. Because with such huge no. of patients', we don't do any other procedure which is less effective as compare to two stage revision arthroplasty. Which ultimately increase failure rate and increase burden on tertiary care center also?

The results of two stage revision arthroplasty of our study is compared with the results of Gooding study done in 2011 performed in 110 patients of infected TKR managed with two stage revision arthroplasty^{46,47} and also with Van Thiel's study done in 2012 performed in 58 patients of infected TKR managed with two stage revision arthroplasty^{48,49,50}.

The average age of patients in our study was 62.1 years. With youngest patient were being 40 years old and the oldest being 82. Gooding's study having average age of 68 years (range 35–86 years) and Van thiel's study having 66 years (range 42-91 years).

Out of the total 40 patients in our study 24 were females and 16 were males. Gooding's study had 60 females and 50 males and Van thiel's study had 33 females and 25 males. In general females undergo total knee replacement more often than males.

BMI relates to general wellbeing of the patient. Also it affects the functional capabilities of an individual. Average BMI in our series was 27.07. It varied with a range from 19.9 to 38.67. Forans et al in their study on obesity and joint replacement found that obesity is associated with poorer outcomes primarily because of increased load on joint and difficulties in rehabilitation programme.

Associated illness may have correlation with comorbidity in operated TKR. In our study, 15 patients

had diabetes mellitus (DM), 7 patients had hypertension and 1 patient had hypothyroidism. Literature supports correlation of DM and infections and also with its outcome.

The mean duration of follow up of patient was 1.7years with a minimum follow up of 12 months and a maximum of 5 years. Average follow up duration of Gooding's study was 2.8 years and of Van thiel's study was 1.4 years.

We used all poly variety of prosthesis in 6 knees and hiflex variety in 34 knees. Choice of implant was based on preoperative knee deformity and laxity. Additional consideration was given to economic affordability of patients and their desire for future cross leg sitting and squatting.

Patients were followed-up and compared for survival, range of motion, flexion deformity, extension lag, knee society score (KSS), WOMAC score, and function outcome or any other complication and radiological evaluation.

The **Western Ontario and McMaster Universities Arthritis Index (WOMAC)** is a widely used, proprietary set of standardized questionnaires used by health professionals to evaluate the condition of patients with osteoarthritis of the knee and hip, including pain, stiffness, and physical functioning of the joints. The WOMAC measures five items for pain (score range 0–20), two for stiffness (score range 0–8), and 17 for functional limitation (score range 0–68). Physical functioning questions cover everyday activities such as stair use, standing up from a sitting or lying position, standing, bending, walking, getting in and out of a car, shopping, putting on or taking off socks, lying in bed, getting in or out of a bath, sitting, and heavy and light household duties⁵¹.

In our study, the average WOMAC score improved from 37.525 to 56.3 with a minimum pre op score of 30 and maximum of 45 and follow up score ranging from 47 to 64. Similar results were found in Gooding's study. The mean postoperative WOMAC function ($p = 0.001$), WOMAC pain ($p = 0.02$), and

WOMAC global ($p = 0.002$) scores as well as the Oxford ($p = 0.0003$) and the SF-12 (mental) ($p = 0.008$) scores all improved.

The Knee Society Score (KSS) has been around for over 20 years, with its most recent version released in 2011. It was designed specifically to measure function before and after total knee replacement surgery. The KSS has both patient reported and a clinician reported components. There are five components of the score: patient demographics, objective knee score patient expectations, patient satisfaction score, and functional knee score⁵².

We used Knee society score for evaluation of the knee pre operatively and post operatively. The mean clinical knee society score improved from 50.1 to 69.325 statistically significant improvements was seen in KSS scores. 94% of patients showed good to excellent results at final follow up. Van thiel et al reported an average KSS improved from 32 (range: 20-65) preoperatively to 88 (range: 44-96) at final follow-up evaluation.

Pain is the most common indication for a total knee replacement surgery. Pain was graded as 0 for no pain. Grade 1 mild pain while stair climbing only. Grade 2 for mild pain on walking and stair climbing, grade 3 for moderate occasional pain in knee, grade 4 for moderate continual pain and grade 5 for severe knee pain. 97% of patients showed improvement in their preoperative pain. And 85 percent of patients had no pain or just mild pain. Similar results were found in Gooding's study and Van theil's study.

In our study 5 patients had moderate pain post operatively while 1 patient had severe pain. Those with persistent moderate pain were mostly the ones with complications post TKA, of these 5 patients 3 patients had persistent infection, 1 patient had disabling anterior knee pain and 1 patient had periprosthetic fracture.

Infection in any joint leads to restriction of joint movements and decrease in activity of daily living. Post primary TKR infection leads to decrease Range of movements of affected joint by tenderness and local fibrosis and adhesion. There was statistically significant improvement (p value $<.05$) was found in our study in activity level in infected TKR after two stage revision arthroplasty.

Activity of a patient was graded as per knee society system. Grade 0 was given to bed ridden non ambulatory patients. Patients who were just barely able to carry out house hold work were classified under grade 1. Grade 2 was given to those who indulged in less than 500 meters walking per day. Grade 3 for 500-1000 meters, grade 4 if patient was walking upto 2 kilometers (Kms) and grade 5 if more than 2 Kms. Patients with complications continued to have poor activity level. However none of the patients with complication were bedridden at follow up. All were

able to do household work with or without assistive devices.

Van theil et al in their study concluded that though activity of two stages managed infected TKR improved dramatically post re-implantation, activity level of an individual was near same as before operation.

The mean range of movement improved from 53.75 to 90.375. Pre-op minimum ROM was 30 and maximum was 100. Post operatively the maximum ROM was found to be 125. Patients who had good pre op range of movement did not show significant ROM improvement post operatively. 2 patients did not show improvement in ROM all others had well to excellent range of motion.

In Gooding's study, Postoperative knee flexion of 93.2 (range, 30-140) and preoperative knee flexion of 86.2 (range, 15-140) noticed. Van theil et al evaluate the mean pre-treatment flexion of 90.6 (range, 10-125) improved to a mean of 101.3 (range, 0-130) at final follow-up (mean, 35 months; range, 24-51 months).

Preoperatively the mean FFD in our series of patients was 9 degrees, with a range from 0 to 40. At final follow up we observed that though most knees had achieved complete extension, however in some the flexion deformity persisted. Average flexion deformity at follow up was 3 degree, with a range of 0-20 degrees. Patient with periprosthetic fracture and quadriceps rupture had high degrees of FFD at follow up.

The average extensor lag preoperatively was 6.65 degrees with a range of 0-15 degrees. Patients showed improvement in these scores at follow up with average extensor lag reducing to 2.75 degree, with a range of 0-10 degrees.

The mean deformity pre operatively was 3.5 degree valgus. With a range of 15 degree valgus to 15 degree varus. Post operatively the mean was 0.875 valgus with a range of 5 degree valgus to 5 degree varus. At follow up majority of patients had an alignment ranging from -5 to 5 degrees.

Gooding et al recommended that they had preoperatively 22 patients with FFD more than 20 degrees. None of the patients had >20 degree deformity post operatively. Only one patient had a contracture of more than 10 degree.

Van thiel et al reported an average pre-operative extensor lag of 15 degrees post-operative extensor lag of > 5 in only those patients who had severe pre-operative flexion contracture⁵².

Persistent infections were the most common unwanted outcome noted in our study with an incidence of 7 percent. They were a direct cause of failure of implant requiring removal of implant and revision surgery or arthrodesis. Superficial infections were seen in 1 patient all these patients responded to regular dressing. There was no cases nerve palsy, pulmonary embolism or deep vein thrombosis.

Christopher E. Pelt, Ray Grijalva, Lucas Anderson et al noticed Two-Stage Revision TKR Is Associated with High Complication and Failure Rates. Despite two-stage revision remaining the gold standard in treating periprosthetic infection of total knee arthroplasty (TKR), there remains uncertainty regarding the actual success rate and the risk factors for failure. We retrospectively reviewed 58 knees with mean follow-up of 38 months who underwent two-stage revision TKR from 1998 to 2012 by a single surgeon. Failure was defined as persistent infection or reoperation after two-stage revision TKA surgery. Failure occurred in 36%. The overall mortality was 22%. The mean time to reinfection was 26 months. Polymicrobial infection was associated with a higher risk of failure (RR 3.31, $p < 0.0001$). Knees requiring soft tissue coverage were also at a greater risk of failure (RR 2.67, $P = 0.0001$), as were knees that underwent four or more additional surgeries after the primary TKA and prior to stage-one explanation (RR 2.25, $P = 0.020$). Thus, opportunities exist for improvement in management of infected TKA.^{53,54}

Microorganisms isolated most commonly are *Staphylococcus* spp, *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus mirabilis* in decreasing order and mixed infection frequently found.

No case of implant loosening was seen.

Summary

1. This is a retrospective study of 40 revision total knee arthroplasty operated for infected TKR by two stage arthroplasty.
2. The average age of patients in our study was 62.1 years. With youngest patient were being 40 years old and the oldest being
3. 82.
4. Out of the total 40 patients in our study 24 were females and 16 were males.
5. Average BMI in our series was 27.07. It varied with a range from 19.9 to 38.67.
6. Associated illness may affect outcome. 15 patients had diabetes mellitus (DM), 7 patients had hypertension and 1 patient had hypothyroidism.
7. The average WOMAC score improved from 37.525 to 56.3 with a minimum pre op score of 30 and maximum of 45 and follow up score ranging from 47 to 64.
8. The mean clinical knee society score (KSS score) improved from from 50.1 to 69.325
9. 97% of patients showed improvement in their preoperative pain. And 85 percent of patients had no pain or just mild pain.
10. The mean range of movement improved from 53.75 to 90.375. Pre-op minimum ROM was 30 and maximum was 100.
11. The average extensor lag preoperatively was 6.65 degrees with a range of 0-15 degrees. Patients showed improvement in these scores at

follow up with average extensor lag reducing to 2.75 degree, with a range of 0-10 degrees.

12. The failure rate of our study was estimated 8% with persistent infection after two stage revision arthroplasty.
13. There was no case of loosening of implant noted in our study.

This may be due to short duration of follow up in our study which was a major limitation of our study.

Conclusion

1. Pain is the most common indication for total knee replacement surgery. One of the most serious complications of knee replacement surgery is infection.
2. Two stage revision arthroplasty in Infected TKR leads to significant improvement in pain severity, activity level, Range of motion and KSS and WOMAC scores except in cases which suffered from complications.
3. The failure rate of two stage revision arthroplasty was estimated 8%. There was no case of loosening of implant noted in our study. This may be due to short duration of follow up in our study which was a major limitation of our study.
4. Results of two stage revision arthroplasty are far superior to one stage revision surgery and debridement surgery.
5. Microorganism isolated most commonly is *staphylococcus aureus*.
6. Associated illness like diabetes may affect the results and outcome of management of infected TKR.
7. Limitation of study is small sample size. Larger sample size is required for further studies.

Bibliography

1. Blom AW, Brown J, Taylor AH, Pattison G, Whitehouse S, Bannister GC. Infection after total knee arthroplasty. *J Bone Joint Surg Br* 2004;86(5):688-91.
2. Bauer TW, Parvizi J, Kobayashi N, Krebs V. Diagnosis of periprosthetic infection. *J Bone Joint Surg Am* 2006;88(4):869-82.
3. Ghanem E, Parvizi J, Burnett RS, *et al*. Cell count and differential of aspirated fluid in the diagnosis of infection at the site of total knee arthroplasty. *J Bone Joint Surg Am* 2008;90(8):1637-43.
4. Cui Q, Mihalko WM, Shields JS, Ries M, Saleh KJ. Antibiotic impregnated cement spacers for the treatment of infection associated with total hip or knee arthroplasty. *J Bone Joint Surg Am* 2007;89(4):871-82.
5. Trampuz A, Osmon DR, Hanssen AD, Steckelberg JM, Patel R. Molecular and antibiofilm approaches to prosthetic joint infection. *Clin Orthop Relat Res* 2003;(414):69-88.
6. Nickel JC, Ruseska I, Wright JB, Costerton JW. Tobramycin resistance of *Pseudomonas aeruginosa* cells growing as a biofilm on urinary catheter material. *Antimicrob Agents Chemother* 1985;27(4):619-24.

7. Stewart PS. Mechanisms of antibiotic resistance in bacterial biofilms. *Int J Med Microbiol* 2002;292(2):107-13.
8. Hall-Stoodley L, Costerton JW, Stoodley P. Bacterial biofilms: from the natural environment to infectious diseases. *Nat Rev Microbiol* 2004;2(2):95-108.
9. Costerton JW. Biofilm theory can guide the treatment of device related orthopaedic infections. *Clin Orthop Relat Res* 2005;(437):7-11.
10. Gooding CR, Masri BA, Duncan CP, Greidanus NV, Garbuz DS: Durable infection control and function with the PROSTALAC spacer in two-stage revision for Infected knee arthroplasty. *Clin Orthop Relat Res* 2011, 469:985–993.
11. Insall JN. Infection of total knee arthroplasty. *Instr Course Lect.* 1986;35:319–324.
12. Insall JN. Surgical technique and instrumentation in total knee arthroplasty. In: Insall JN, Windsor RE, Scott WN, Kelly MA, Aglietti P, eds. *Surgery of the Knee*. New York, NY: Churchill Livingstone;1993:739–804.
13. Insall JN, Thompson FM, Brause BD. Two-stage reimplantation for the salvage of infected total knee arthroplasty. *J Bone Joint Surg Am.* 1983;65:1087–1098.
14. Insall JN, Thompson FM, Brause BD. Two-stage reimplantation for the salvage of infected total knee arthroplasty. *J Bone Joint Surg Am.* 2002;84:490.
15. Jacobs MA, Hungerford DS, Krackow KA, Lennox DW. Revision of septic total knee arthroplasty. *Clin Orthop Relat Res.* 1989;238:159–166.