

Functional and Radiological Outcome of Simultaneous Bilateral Total Knee Replacement in a Tertiary Care Centre : A Quasi-prospective Study

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Learning Point of the Article:

In a series of simultaneous bilateral TKR, significant improvement in the functional outcome was noted on restoring the mechanical axis to near normal values.

Abstract

Introduction: Osteoarthritis (OA) is the most frequent joint disease with a prevalence of 5313 per 100,000 persons in India. OA of the knee is a major contributor to mobility impairment, particularly among women. In these patients, total knee replacement (TKR) is widely accepted as the gold standard treatment for pain relief and restoration of function. Now, patients have the option of undergoing either a simultaneous bilateral TKR or a staged TKR. The former has shown significant advantages such as shorter rehabilitation, cost efficacy and shorter hospital stay. This study aimed to assess the functional and radiological outcome of simultaneous bilateral TKR in a tertiary care centre.

Materials and Methods: 30 adult patients above the age of 55 years with severe OA knee who underwent simultaneous bilateral TKR between 2022-2023 were included in this prospective study. Preoperatively, they were assessed with radiographs including full length scannograms. Mean Anatomical Axis, Mean Mechanical Axis and Mechanical Axis Deviation (Varus) were calculated based on the scannograms by a single observer. The same observer administered the oxford knee score (OKS) preoperatively to all patients. Regular clinical and radiological follow up was done. After 1 year follow up, the same observer administered the Oxford Knee Score (OKS) to the operated knee.

Results: With a female preponderance among the study subjects (56.7%), the majority of the cases in our cohort were characterised as Grade IV Kellgren-Lawrence radiological grade of Osteoarthritis (76.66%) and were found to have tricompartmental involvement (70%). The mean anatomical axis for the right and left lower limb were 4.56 ± 5.17 and 9.68 ± 1.72 respectively. The mean mechanical axis deviation (Varus) for the right and left lower limb were 31.6 ± 15.1 and 52.0 ± 13.9 respectively. Preoperatively, mean mechanical axis for the right and left lower limb were 9.95 ± 4.31 and 14.2 ± 0.67 respectively. Postoperatively, mechanical axis was restored to near-normal values (3-5 degrees). Significant improvement in mean OKS from a preoperative value of 18.30 ± 3.46 to postoperative value of 33.50 ± 5.32 was noted at 1 year.

Conclusion: Treatment of severe bilateral OA knee with simultaneous single staged bilateral TKR ensures good functional outcome, early mobility with minimal complications.

Keywords: Simultaneous bilateral TKR, oxford knee score (OKS), mechanical axis deviation

Introduction

Osteoarthritis (OA), also known as degenerative arthritis, is the second most common rheumatologic problem and the most frequent joint disease with an age-standardised prevalence of

5313 per 100,000 persons (95% uncertainty interval: 4799-5898) in India.[1,2]. It is a chronic degenerative condition of complex, multifactorial etiology, characterized by articular cartilage loss, subchondral sclerosis, osteophyte formation, and a variety of biochemical and morphological changes of the

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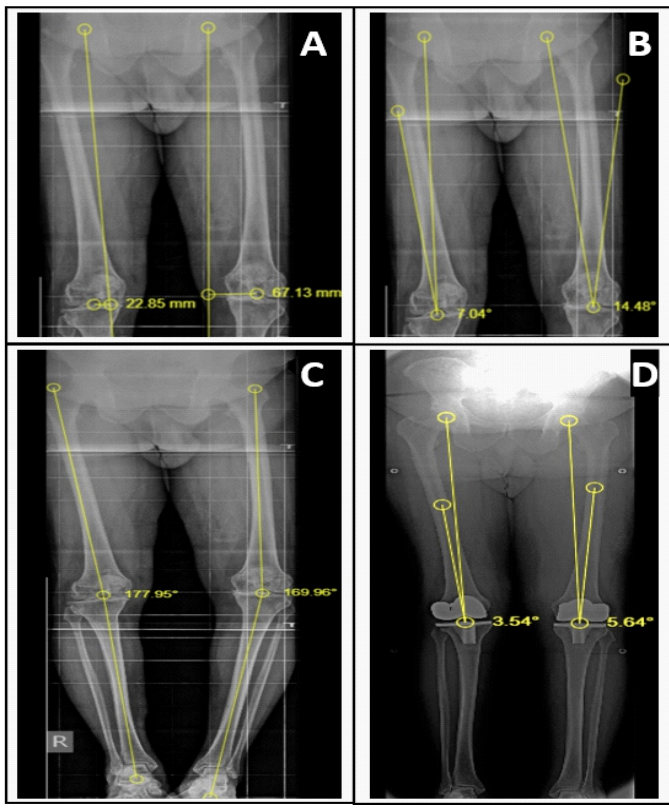


Figure 1: Illustration of radiological parameters assessed: (A) mechanical axis deviation (Varus) (B) mean mechanical axis (C) mean anatomical axis (D) post-operative restored mechanical axis.

synovial membrane and joint capsule.[3]

With its prevalence increasing dramatically with age[4], OA of the knee is a major contributor to impairment of mobility, particularly among women[4]. For severe cases of OA knee, total knee replacement (TKR) is widely accepted as the gold standard treatment for pain relief and restoration of function in patients with advanced degenerative OA[5]. In spite of being estimated to be among the leading causes of non fatal burden [6], controversy exists concerning the timing of the definitive treatment for OA knee, i.e., total knee replacement (TKR).

Patients suffering from severe OA knee have the choice of undergoing either a single stage bilateral total knee replacement or a staged total knee replacement, within the same or two separate hospital stays. Between the two, Single stage bilateral knee replacement has the advantage of shorter hospital stay, shorter rehabilitation and reduced patient management costs.[7]

Both prospective[8] and retrospective [7] studies have been conducted exploring single-stage bilateral total knee replacement. Literature has shown that opting for bilateral rather than two unilateral replacements result in a reduction in

expenses ranging from 18% to 50%.[9] However, there are differing views concerning complication rates with studies concluding lower[10], similar[11] and higher morbidity rates[12] compared to staged TKR.

The purpose of this study was to assess the functional and radiological outcome of simultaneous single stage bilateral total knee replacement in a series of 30 patients, all treated at a tertiary care center with a follow-up of 1 year.

Materials and Methods

We conducted a prospective analysis of patients with bilateral knee OA who underwent a simultaneous bilateral knee replacement between 2022 and 2023. This study was initiated after obtaining the institution ethics committee's approval. Adult patients above the age of 55 years with Primary / secondary Osteoarthritis of Knee, who underwent simultaneous bilateral TKR and had a follow-up of minimum 1 year post operatively were included in the study. Patients with rheumatoid arthritis or other inflammatory arthritis, and patients who underwent staged procedures were excluded from the study.

Patients were assessed preoperatively using radiographs including Full length Lower limb scannograms and classified as per Kellgren-Lawrence grade[13]. Mean Anatomical Axis, Mean Mechanical Axis and Mechanical Axis Deviation (Varus) were calculated based on the scannograms by a single observer. A single observer administered the oxford knee score (OKS)[14] preoperatively to all included patients. Regular clinical and radiological follow up was done. At the 1 year follow up mark, a single observer administered the Oxford Knee Score (OKS) to the operated knee.

Developed in 1998, Oxford Knee Score (OKS) is a primary outcome measure of choice following knee replacements.[14] It is a patient reported outcome measure that consists of 12 questions about an individual's level of function, activities of daily living, and how they have been affected by pain over the preceding four weeks. Total scores range from 0 (poorest function) to 48 (maximal function).

The patients were then explained about the pros and cons of undergoing single stage bilateral total knee replacement and an informed consent was obtained.

Surgical procedure

The surgical procedure was carried out by the same senior orthopaedic surgeon. Patients were administered prophylactic injection cefuroxime (1.5 gm) + sulbactam during induction of anaesthesia and another dose just before second knee incision was made. Following which the patients received 2 more doses

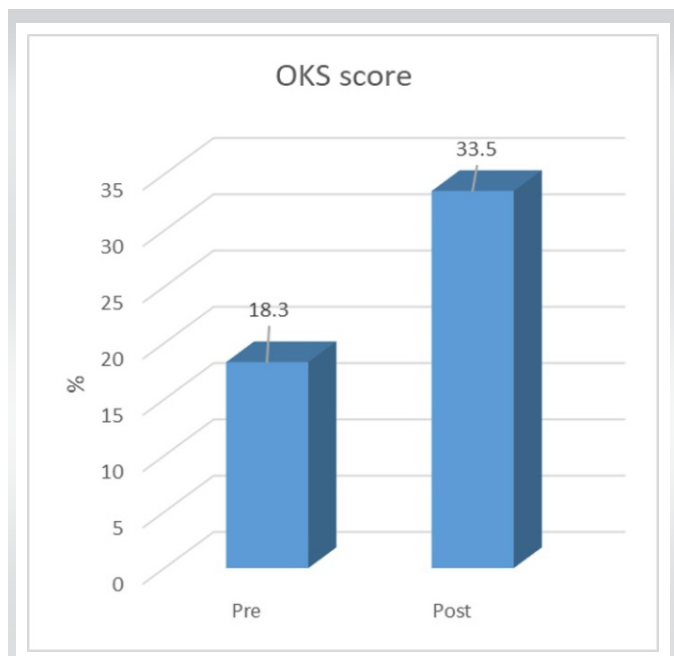


Figure 2: Comparison of mean oxford knee score: Pre-operative (18.3) versus post-operative (33.5).

of antibiotic every 8th hour postoperatively.

All patients were operated by standard medial parapatellar approach. Soft tissue balancing and bone cuts were made using standard techniques. In all cases, cemented posterior stabilising system was used.

A bilateral pneumatic tourniquet was used in all cases. Only when the 1st knee skin was closed and tourniquet released, the pneumatic tourniquet in the 2nd knee inflated. Haemostasis was achieved before skin closure. Preventive anticoagulant therapy with oral novel anticoagulant started within 12 h after surgery and continued for 15 days.

Postoperative protocol

Patients were started on active ankle pump and quadriceps strengthening exercises immediately following surgery. Full weight bearing mobilisation was initiated for the operated patients on post operative day 1. Knee range of movement exercises were started on day 1. All patients included in the study achieved knee flexion of 90 degrees and were comfortably ambulating full weight bearing by the end of 1 week postoperatively. They were discharged on day 12 after the removal of sutures.

Statistics

We used IBM SPSS (Version 20.0, Armonk, NY: IBM Corp, USA) Statistics software for the analysis of our results. Pre and post operative OKS were compared using paired t test. The

statistical significance value (P) was set to 0.05.

Results

Thirty patients, who satisfied the inclusion criteria were analysed. The mean age at presentation was 64.2 years (range 57-71 years SD: 3.78) with a female preponderance (17/30, 56.7%). The majority of the cases in our cohort were characterised as Grade IV Kellgren-Lawrence radiological grade of Osteoarthritis (23/30; 76.66%) and were found to have tricompartmental involvement (21/30; 70%). (Table 1)

The mean anatomical axis for the right and left lower limb were 4.56 ± 5.17 and 9.68 ± 1.72 respectively. The mean mechanical axis deviation (Varus) for the right and left lower limb were 31.6 ± 15.1 and 52.0 ± 13.9 respectively. Preoperatively, the mean mechanical axis for the right and left lower limb were 9.95 ± 4.31 and 14.2 ± 0.67 respectively. Postoperatively, the mechanical axis was between 3-5 degrees, according to the standard protocol. (Figure 2)

The Oxford Knee Score (OKS) was administered at variable duration for each individual but only after 1 year of the surgical procedure. There was a significant improvement in the mean OKS from a preoperative value of 18.30 ± 3.46 to a postoperative value of 33.50 ± 5.32 at follow-up of 1 year. (Figure 1)

All the patients were examined for any postoperative complications. Of the 30 patients, 1 was noted to have stitch abscess and 1 had persistent pain on ambulation. Patients improved with oral antibiotics, physiotherapy, knee range of motion exercises. Not a single case of fixed flexion deformity of the knee or restricted range of motion was noted. In our study, complications such as DVT / PE, MI, deep infection, Periprosthetic fracture were not noted. There was no post operative ICU admission or mortality in our cohort.

Discussion

Review of literature over the years has shown significant benefits of a simultaneous bilateral knee replacement in terms of patient hospital stay, total cost of the treatment and rehabilitation. In our study we noted an increase in mean oxford knee score from 18.30 preoperatively to 33.5 which is statistically significant (P value <0.05). The mean duration of hospital stay in our study population was 12.03 days as per the institution's protocol. Our results were in conjunction with a recent study carried out by Krishnamoorthy et al [15] exploring the functional outcome of single-staged simultaneous bilateral total knee replacement, exhibiting an improvement in OKS from 11.47 to 46.31. Hence, we found our results reassuring.

In this study none of the patients developed major

Parameter	Frequency (%)
Mean age (in years) (range; SD)	64.20 (57–71; 3.78)
Gender (M:F)	13:17
Mean BMI (range; SD)	27.5 (19.2–39.1)
Kellgren –Lawrence grade	
3	7 (23.3)
4	23 (76.7)
Compartments involved	
2	9 (30)
3	21 (70)
Post-operative complications	1
Stitch abscess	1
Pain on ambulation	0
Fixed flexion deformity of the knee	0
Restricted range of motion	0
Deep vein thrombosis	0
Pulmonary embolism	0
Deep infection	0
MI	0
Periprosthetic fracture	0
Mortality	0
SD: Standard deviation, BMI: Body mass index	

Table 1: Descriptive statistics.

complications like deep infection requiring secondary surgical procedures, symptomatic deep vein thrombosis/pulmonary embolism or mortality. We had one patient with a stitch abscess

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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which was managed medically with oral antibiotics and another with persistent pain on ambulation which improved with physiotherapy.

Literature review revealed contradicting evidence regarding complications associated with simultaneous bilateral total knee replacement. Girish et al.[16] noted an increase in the incidence of neurological complications, particularly disorientation, in the postoperative phase. However, none of the patients in our study were found to have such a complication. Acute renal injury and urinary tract infection have also been reported in a few studies but none were reported in the current study. For patients with unilateral and bilateral single-stage TKR, the perioperative death rate is comparable[17]. However, severe complications such as perioperative mortality were not observed in our study.

Our research has certain limitations that must be addressed. The sample size and follow-up period of this study were limited. The relationship between the comorbidities of included patients and the functional outcome was not addressed. Further large-scale prospective trials are vital for assessing the clinical and radiological outcome of simultaneous single staged bilateral TKR.

Conclusion

Treatment of severe bilateral OA knee with simultaneous single staged bilateral TKR ensures good functional outcome and early mobility with minimal complications.

Clinical Message

In a series of simultaneous bilateral TKR, significant improvement in the functional outcome was noted on restoring the mechanical axis to near normal values.



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