

Comparative Study of Simultaneous or Staged Bilateral Total Knee Arthroplasty for Symptomatic Severe Bilateral Osteoarthritis Knee Joint-A prospective Study.

¹Ram Prasad Meena, Medical Superintendent NMCH, Senior Professor and HOD, Department of Orthopaedics, GMC Kota, Rajasthan

²Tarun Audichya, Final Year Resident, Department of Orthopaedics, GMC, Kota, Rajasthan

³Nitin Bairwa, Senior Resident, Department of Orthopaedics, GMC, Kota, Rajasthan

⁴Chetan Mehra, Senior Resident, Department of Orthopaedics, SPMC, Bikaner, Rajasthan

⁵Amit Gupta, Assistant Professor, Department of Orthopaedics, GMC, Kota, Rajasthan

Corresponding Author: Chetan Mehra, Senior Resident, Department of Orthopaedics, SPMC, Bikaner, Rajasthan

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Abstract

Introduction: Osteoarthritis of bilateral knee joints is a leading cause of disability worldwide. Bilateral total knee arthroplasty (TKA) is a common procedure nowadays. Although, staging of surgery is a subject of discussion. We conducted a study to compare safety and functional outcomes of simultaneous and staged bilateral TKA.

Materials and Methods: Our study included total 40 patients of severe bilateral end stage osteoarthritis, who underwent simultaneous or staged bilateral TKA during 2020 to 2022 at Government Medical college, Kota. 20 patients were randomly selected for each procedure. An interval ranging from three to six months was taken between the two surgeries in group B (staged bilateral TKA) in order to allow functional recovery and rehabilitation. The postoperative evaluations were done according to Knee Society Score at one, three, six and 12 months and yearly thereafter for 2 years following a simultaneous bilateral TKA (group A) and the second

procedure in the staged bilateral TKA (group B). In the staged group, the patients were followed at monthly intervals until the second procedure. The categorical variables were statistically significant when p –value < 0.05.

Results: As compared to staged procedure (group B), estimated blood loss was less in simultaneous TKA (group A) but the difference was not statistically significant. Although, blood transfusion rate was significantly higher in group A. The length of hospital stay was significantly shorter in group A. Overall complication rate was not significantly higher in group A. Knee infection rate was significantly lower in simultaneous TKA group. There was no revision of surgery and no mortality within 2 years of follow-up.

Conclusion: Simultaneous bilateral TKA is as safe as staged procedure and cost-effective with acceptable complication rates for symptomatic chronic osteoarthritis of bilateral knees with ASA grade 1 and 2.

Keywords: Bilateral Total Knee Arthroplasty, Simultaneous, Staged, Knee Society Score.

Introduction

Osteoarthritis (OA), rheumatoid arthritis and trauma-related arthritis are common causes of joint damage. Osteoarthritis is the most common cause of knee pain and one of the leading causes of disability worldwide [1,2].

Degenerative arthritis is a progressive disease that ultimately damages the entire joint hence conservative treatment cannot stop the process of degeneration. Degenerative arthritis causes pain, functional restriction, and deformities. With increasing life expectancy and prevalence of obesity, the incidence of osteoarthritis is likely to keep increasing [3,4] and has an increased incidence and prevalence in people over the age of 40 years; around 10% of all people older than 60 years of age have radiological signs of knee osteoarthritis, and about half of those complain of clinical symptoms.

Treatment of knee osteoarthritis begins with conservative management including physical therapy, anti-inflammatory medications and modification of daily activities which usually fails to provide long term relief and surgical treatment is considered. Total Knee Arthroplasty is considered superior to other surgeries like high tibial osteotomy, dome tibial osteotomy and other radical surgeries like arthrodesis or excision arthroplasty. Patients with degenerative disease of knee joint having triad of pain, stiffness and deformity are suitable candidates for Total Knee Replacement. Knee replacement provides a way to overcome all afflictions of arthritis.

In severely deformed bilateral knees, unilateral TKA does not fully restore a patient's function, and results in poorer outcome. These patients frequently require bilateral TKA. Based on clinical and patient factors,

bilateral TKA can be performed simultaneously under same anaesthesia and one time hospitalization or as staged procedures under separate anaesthesia and separate hospital admissions. Although, the staging or optimal timing of surgery in patients requiring bilateral TKA is controversial and continues to be debated. The aim of our study was to compare outcomes of simultaneous versus staged bilateral TKA in severe end stage bilateral symptomatic knee osteoarthritis and to access relative risks and benefits, indications, and contra-indications of each procedure.

The primary advantage of a simultaneous procedure is that there is only one hospital stay, single anaesthesia session and one rehabilitation period to heal both knees. Thus, early return to work and lesser costs decreasing the economic burden on patients. However, rehabilitation may be slower, as it's more difficult to use both knees at the same time.

The main advantage of a staged procedure is the reduced risk of complications. It requires a shorter hospital stay. However, since this procedure requires two surgeries, the overall rehabilitation period can be much longer.

Material and Methods

This prospective study was based on patients of symptomatic severe bilateral osteoarthritis treated with simultaneous or staged bilateral total knee arthroplasty in Department of Orthopaedics, Government Medical College, Kota.

A sample size, of 40 patients with bilateral end stage knee osteoarthritis met with inclusion criteria, were taken for study. Study population was further divided randomly in simultaneous (Group A) or staged bilateral TKA (Group B). 20 patients were in each group. An interval ranging from three to six months were taken between the two surgeries in group B (Staged bilateral TKA) in order to allow functional recovery and rehabilitation.

Study was performed during the period Nov. 2020- Nov. 2022 after Ethical Committee clearance.

Inclusion Criteria

1. Severe end stage bilateral symptomatic knee osteoarthritis
2. Low risk of anaesthesia that was ASA Score (American Society of Anaesthesiologist) Grade 1 & 2
1. Willingness to participate in the study
2. Age > 40years, both male and female

Exclusion Criteria

1. H/o previous upper tibial osteotomy or any major knee surgery
2. Patients with ASA score-grade 3 & 4
3. Significant cardiac comorbidities, previous history of Thromboembolism, uncontrolled diabetes, malignant Hypertension, high grade COPD, and previous knee infection, Revision TKA
4. Serious associated bony injury to femur or tibia
5. Patient having an open injury to the site of incision at knee, making it prone to infections
6. Patient not consenting to participate in the study

The statistical analysis of whole data was done using the Wilcoxon nonparametric paired test to determine the significance of the results obtained.

Pre-Operative assessment

Thorough clinical and Radiological examination was performed. Anatomical and mechanical axes were drawn using the full-length X-rays to quantify the amount of varus or valgus deformity.

Preoperatively all the patients were explained about the life style modifications that they have to make, like avoiding squatting and sitting cross legs after TKA.

Written valid consent was obtained for all patients.

Procedure And Protocol

The Anterior midline skin incision was used with Medial parapatellar approach. Standard Procedure was used for TKR.

To reduce perioperative blood loss, tranexamic acid was given intravenously ½ hour before the incision (15 mg/kg) and then 6 hourly (10 mg/kg) for next 12 hours in both groups.

Each patient of both groups received cephalosporins intravenously 30 minutes prior to the surgical incision followed by cephalosporins twice daily postoperatively for one week and aminoglycoside twice daily for 5 days. Subcutaneous enoxaparin (40 mg once daily) is given to all patients from the day of surgery to one week postoperatively for the prophylaxis of deep vein thrombosis (DVT). Oral aspirin (150 mg once daily) is given for three to four weeks after the discontinuation of enoxaparin.

Follow-up

The patients were evaluated clinically and radiologically at one, three, six and 12 months and yearly thereafter for 2 years following a simultaneous bilateral TKA group (A) and the second procedure in the staged bilateral TKA group (B). Those patients in the staged group will be followed at monthly intervals until the second procedure. Functional outcome (ability to walk, sit cross-legged position and climb stairs) will be evaluated pre- and post-operatively using the Knee Society Score (KSS).

Results

Thirteen male patients and seven female patients in Group A and twelve male patients and eight female patients in Group B.

Table 1: Age distribution

Age Group (In Years)	Number		Percentage	
	Group A	Group B	Group A	Group B
41-50	2	3	10	15
51-60	11	10	55	50
61-70	7	7	35	35

In both Groups A and B had same Nineteen patients of varus knee deformity and one patient of valgus knee deformity.

Although all patients were having severe pain, rest pain was found to have significant prognostic value. Seven patients presented with rest pain and thirteen patients without rest pain on admission in Group A. Eight patients presented with rest pain and twelve patients without rest pain on admission in Group B.

Patients had been classified into three types as described by The Arthritis Foundation and Wheelless Textbook, mild, moderate and severe based on the symptoms and severity. Six patients had moderate arthritis and fourteen patients had severe arthritis in Group A. Four patients had moderate arthritis and sixteen patients had severe arthritis in Group B.

We also evaluated the presence of other comorbid conditions. We found that four patients were having Diabetes Mellitus (DM), five patients were having systemic Hypertension (HTN), one patient was having COPD, two patients were having Polyarthropathy and one patient was having CAD in group A. Four patients were having DM, three patients were having HTN, three patients were having COPD and two patients were had Polyarthropathy in Group B.

Table 2. Knee Society Score (KSS)

Knee Society Score	Pre-Operative		P-Value	Post-Operative		P-Value
	Group A	Group B		Group A	Group B	
Mean Functional Score	30.25	29.75	0.8217	90.5	89.5	0.4485
Mean Knee Score	24.7	24.1	0.5208	87.7	87.1	0.8356

Knee Society Functional score mean in simultaneous group (Group A) was 90.5 and in staged group (group B) was 89.5 at 1 year post operatively.

Knee Society Score mean in group A was 87.7 and in group B was 87.1 at 1 year post operatively.

In all four cases, the p-values are greater than 0.05, indicating that there is no significant difference between Group A and Group B in terms of their Knee Society Scores. This means that the two groups had similar scores before and after the surgery.

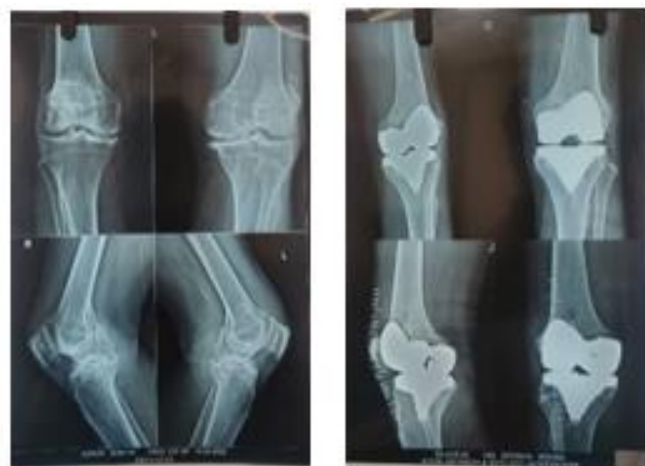


Fig.1: Pre and Post Operative X-rays

Complications

Around 10% of our patients in both the groups had developed knee stiffness. Knee stiffness had decreased the overall functional outcome of the knees.

Table 3: Complications

COMPLICATIONS	Number		Percentage	
	Group A	Group B	Group A	Group B
Knee Stiffness	2	2	10	10
Infection	1	2	5	10
Deep Vein Thrombosis	3	2	15	10
Pulmonary Embolism	1	1	5	5
Neurological Complications	2	1	10	5
No Complications	11	12	55	60

One patient with infection in Group A and two patients with infection in Group B. A patient had infection on right side in the early post operative period in Group A and another patient had infection on right side which was operated first in staged group (Group B) for which re-exploration was undertaken and thorough joint lavage was done. The patient’s symptoms subsided, and they recovered from their symptoms. Later the patient in group A had developed knee stiffness for which manipulation under anaesthesia was done but the knee stiffness persisted. Another patient presented with persistent pain in left knee which was operated four months after right knee in Group B, on doing a bone scan we identified low grade infection which improved with long term oral antibiotics.

Neurological complication was another special set of complication encountered in this study. Two of our patients from group A and one patient from group B had developed foot drop postoperatively, both the patient had

a valgus knee preoperatively. Peroneal nerve neuropraxia was found to be the causative factor. The patients were managed with foot drop orthotic support and they recovered within a period of two to three months.

Deep vein thrombosis (DVT) was rare complication as routine DVT prophylaxis was given to patients in our study. Three of our patients from group A and two of our patients from group B had developed DVT. Out of which one patient from each group had pulmonary embolism for which appropriate therapy was initiated and regular follow up was done. The patients had uneventful recovery.

Discussion

Our study was started with an aim of comparison between simultaneous and staged bilateral total knee arthroplasty in patients of severe bilateral osteoarthritis.

Our study was primarily confined to patients of chronic symptomatic osteoarthritis of bilateral knees. Our stringent criteria for inclusion were low risk population with ASA grade 1 & 2.

In our study, forty patients were operated in which twenty patients were in group A (simultaneous bilateral TKA) and twenty patients were in group B (Staged bilateral TKA) divided randomly prior to surgery. In our study, all demographic data (age, sex, BMI, comorbidity) were comparable in both the groups. Majority of the patients were in age group of 51-60 years. Males were predominant.

All the patients were subjected to a fair trial of conservative therapy in the form of physiotherapy, anti-inflammatory drugs, interleukin inhibitors, lifestyle modification and then considered for total knee arthroplasty after satisfying the inclusion criteria.

The mean surgical time in group A (Simultaneous Bilateral TKA) and group B (Staged Bilateral TKA) were

168.3 and 175.2 minutes, respectively and this difference was not statistically significant (p-value 0.0625).

The mean estimated blood loss was 670.75 ml in group A and 696.75 ml in group B. Although, the blood loss was less in group A, this difference was not statistically significant (p-value 0.061).

Although the difference in mean estimated blood loss was not statistically significant, the blood transfusion requirements were significantly higher in the group A (p value < 0.001). The need for a transfusion was estimated by the post-operative clinical and haematological parameters (haematocrit & haemoglobin levels) which were significantly lower in group A patients. Since the total estimated blood loss in the staged group was the sum of two values during two procedures, carried out with rehabilitation period of three to six months apart, it is easy to understand why the transfusion requirements were lower in these patients.

'In-patient' length of hospital stay was 5.3 mean days for simultaneous bilateral TKA group and 8.6 mean days for staged bilateral TKA group. The differences in 'In-patient' length of hospital stay were statistically significant (p-value <0.001).

In-hospital mortality rate (mortality due to any reason during hospitalization for Bilateral TKA) was zero in both groups within 2 years of follow-up.

Although, overall complication rate (inpatient and/or 90-day readmission) was higher in group A, but it was statistically not significant. In our study, incidence of DVT was slightly higher in simultaneous group. Longer time taken in bilateral procedure may increase the risk of DVT by causing stasis of blood. The incidence of perioperative knee infection (10% vs 5%) was significantly higher in the staged bilateral TKA group (p value <0.001). Previous studies assessed that multiple

hospitalizations and longer hospital stay were significant predictors for prosthetic joint infection.

The revision rate of TKAs, in both groups within 2 years of surgery, was zero.

Fewer systemic complications in our study can be explained in this way that most of the cases were ASA grade 1 or grade 2 in our inclusion criteria.

Conclusion

Total knee arthroplasty is a safe and effective treatment procedure for end stage knee osteoarthritis. It provides significant improvement in the daily routine activities of the patient by improving pain relief, and deformity correction. But in bilateral cases, controversy about the staging of treatment still remains. There are certain risks and benefits of each procedure.

We did not assess the combined surgical costs, but in the simultaneous group significantly shorter length of hospital stay and early rehabilitation would certainly have an impact in reducing the economic burden.

Thus, the advantages of simultaneous bilateral procedure are single hospital admission, shorter hospital stay, fewer anaesthesia complications, lower combined cost of surgery and fewer days of work loss. On the other hand, staged bilateral TKA has been associated with less morbidity and mortality, less cardiac and thromboembolic complications.

In this study, functional outcome evaluated by Knee society functional score and knee society score was nearly equal in both groups A and Groups B (P value >0.05). It shows that there is no significant difference in the outcomes in between simultaneous and staged bilateral total knee arthroplasty groups.

Limitation

1. The follow-up period of this study period was short.
2. The sample size of study population was small.

3. The Study population were only low risk group population (ASA grade 1 and 2). We did not take high risk group patients (ASA grade 3 and grade 4) into consideration for evaluation the results. According to Memtsoudis, ASA grade 3 and 4 patients have a higher risk of severe complications in simultaneous bilateral TKA.
4. A larger number of sample size, high risk group involvement, more objective data with longer follow-up is required to more authenticate the study.

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