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Outcome of Simultaneous Bilateral Total Knee Replacement in Patients Compared to Unilateral Knee Replacement: A Comparative Study

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ABSTRACT

Background & Objectives: Joint replacement for the treatment of large joint arthritis has proven very successful. Total Knee Replacement (TKR) improve mobility, reduces pain and overall positive effect on quality of life. With changing trends in current orthopedics and a balance between patient satisfactions with cost effective procedures, simultaneous bilateral TKR is gaining popularity. We aim to look at the outcome of simultaneous bilateral TKR in our study

Methodology: We looked at TKAs performed at a private institution during a period of 3 years by one surgeon. Total 140 joints were replaced by Dr Muhammad Bilal during April 2021 to April 2024. Primary outcome measures were any need for re-admission to hospital within 2 months and secondary complications such as infection, manipulation for stiffness, revision, or any other procedure performed.

Results: Out of total 135 joint replaced, 61% (n=51/84) patients had Simultaneous Bilateral Knee Replacement while 39% (n=33/84) patients had one side knee replacement. Out of 84 patients, 64% (n=54) were females and 36% (n=30) were male patients. Our primary outcome measures show none of the patients in either group needed re-admission within 2 months after surgery. None of the patients developed stiffness or need for manipulation under anesthesia. One patient in unilateral knee replacement group developed painful patella which was replaced, one patient developed delayed infection and one patient developed peri prosthetic fracture.

Conclusion: Our study has clearly shown that simultaneous bilateral TKR group has better Patient reported Outcome Measures (PROMs), low rate of infection, stiffness and anesthetic complications. Economically it has only one hospital episode and lower overall costs. Patient selection criteria are not well defined yet but we recruited patients of 75 years or younger, and fewer or at least well controlled associated medical conditions for simultaneous bilateral TKR. Meticulous surgical technique, strict adherence to protocols and involvement of multi disciplinary team are of utmost importance for higher success rates.

KEY WORDS: Knee Replacement, Joint Arthroplasty, Simultaneous Bilateral Knee Replacement

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INTRODUCTION

Joint replacement for the treatment of large joint arthritis such as Hip, Knee, Shoulder and Ankle joint have proven successful over period of time. Among these Hip and knee replacement are most commonly performed to improve quality of life, pain relief and effective treatment of end stage arthritis. Joint replacement is also performed for Trauma, infection, deformity correction especially in younger population and inflammatory arthritis.[1-2]

Total Knee Replacement (TKR) improve mobility, reduces pain and overall positive effect on quality of life. With increasing age, demand for better life style and improved outcomes, demand for Arthroplasty is increasing.[3, 4] Health-Related Quality of Life (HRQOL) has been very important consideration in recent literature to decide for treatment and its outcomes in any procedure. This is true for knee replacement as well. Quality of life is considered poor if patient if unable to perform activities of daily living (ADLs), making an impact on one's mental and physical health.[5,6] Joint replacement has significantly improved quality of life and knee replacement is among this and that's why considered as gold standard treatment. A plethora of research papers is available showing various aspects of TKR outcomes, patient satisfaction, longevity recovery and many other aspects. Recently an increasing trend of Simultaneous Bilateral Total Knee replacement is gaining popularity in a selected patient category.[7,8]

Incidence of both knee osteoarthritis is variable among population and has been reported between 20% to 85 % in at least one joint however, this incidence is higher among patients with inflammatory arthritis especially younger patients are presenting with end stage arthritis with back ground of rheumatoid arthritis, hemophilia and other inflammatory arthropathies. When dealing with these patients involving both knee end stage arthritis, TKR can be performed

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either staged or simultaneous.[9,10] When performing staged TKR, minimum of one week and upto one year interval is reported between both sides surgery. Simultaneous Bilateral Total knee replacements is defined as when both knee joints are replaced in same patient, under one hospital admission and same anesthesia. In United States 6% of total surgeries are performed as simultaneous bilateral TKR.[11,12]

With changing trend in current orthopedics and a balance between patient satisfactions with cost effective procedures, simultaneous bilateral TKR is gaining popularity and lot of research work is done to measure outcomes. With simultaneous bilateral TKR concerns exist regarding high risk of complications such as infection, deep vein prosthesis, poor functional recovery but more recent literature is showing promising results and fewer complications.[13,14] And literature also shows proven benefit of simultaneous bilateral TKR such as cost effective, better recovery, and improved satisfaction levels among patients. Some recent evidence has also proven rather increased rates of complications such as cardiac arrest, Pulmonary Embolism, deep vein thrombosis, urinary and chest infection with staged TKA, especially if second joint TKA is done after short interval.[15] This literature encourages more focus and shift to simultaneous bilateral TKA.

There is an increasing trend in our country towards this technique. In our experience patients from low income background, compliance issues with post operative rehabilitation, remote urban areas with basic health facilities have better results with simultaneous bilateral TKR. Therefore we aim to look at the outcome of simultaneous bilateral TKR by analysis of complications, readmission rate within 2 months of surgery and any other complications up to one year follow up.

METHODOLOGY

We looked at TKAs performed at a private institution during a period of 3 years by one surgeon. Total 140 joints were replaced during April 2021 to April 2024. Out of 140 cases, 82 cases were performed as Bilateral. Most of the patients received the either PFC Sigma CR cemented (DePuy, USA) or Zimmer NexGen PS cemented (zimmer,USA) total knee implant. We do not use patella button in routine patients.

Inclusion criteria for our patients were, grade four osteoarthritis (OA), significant impact on activities of daily living (ADL), night pain and regular use of analgesics without relief.

Exclusion criteria were existing knee infection, previous surgery performed elsewhere and collateral ligament instability.

Surgical technique

Patients ready for simultaneous bilateral TKR went through a detailed health check, anesthesia review and fitness assessment before surgery. Surgery was performed under spinal anesthesia and local infiltration during operation. Pre-op IV antibiotics are given. Both legs were prepared simultaneously. Two scrubbed assistants held the feet while surgeon and main assistant did all draping and then unilateral tourniquet was inflated. Midline skin incision, medial parapatellar approach and joint were exposed. Tourniquet was used in all cases. No esmarch is performed as per surgeon preference. Bone cuts were made using standard jigs. Author's preference is cruciate retaining design unless there is clear indication to perform posterior stabilized design. Once all cutes are made, trial reduction is performed to check flexion extension gaps, patella tracking and stability. Next patella trimming is done. Joint is generously washed and local infiltration applied at this stage around posterior capsule, periosteum and into muscles. Bone surfaces are dried and cemented implants of femur and tibia are inserted. Trial tibial tray is used to reduce the joint and assess stability, gap, patellar tracking. Next trial tray removed, excess cement removed and final tibial tray inserted. Aim is to insert prosthesis in neutral mechanical alignment. Once cement is dry, tourniquet is deflated and joint packed for 2 minutes. Before releasing the tourniquet anesthetist gives one gram Transamine IV stat. Then all bleeding points are cauterized and joint washed with copious amount of normal saline. Wound is closed in layers without drain and compression bandage is applied. Then second joint TKR is started without delay. Another layer of anti septic solution SterilliumR is applied, air dried and cohesive skin tape is applied. And same surgical technique repeated. Our average Tourniquet time is 50minutes each side and both sides are easily performed under one spinal anesthesia.

Data collection

Demographic variables were recorded from patient files: age, sex, BMI, co-morbidities, diagnosis, and American Society of Anesthesiologists (ASA) score. Tourniquet time for each side, post operative medical or surgical complications such as infection, bleeding, stiffness, readmission to hospital were also recorded.

RESULTS

Our Primary outcome measure was any need for re-admission to hospital within 2 months and any secondary complications such as infection, manipulation for stiffness, revision, or any other procedure performed. Re-Admission was divided into medical or surgical need of patient. Medical issues included any cerebral, cardiac, pulmonary, genitourinary or inflammatory problems.

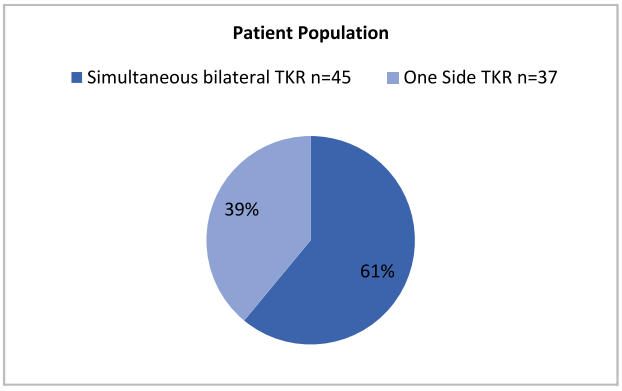

Figure 1: Patient Population

Minimum follow up was one year to assess the progress and any delayed complications from TKR. Regular clinical examination and x-rays were reviewed for any active complaints. Wound examination, range of motion in each TKR, x-ray analysis and patient reported outcome measure (PROM) were noted on each visit. Oxford Knee Score was also calculated before surgery at six weeks and at one year follow-up.

Table I: Patient Demographics

Total Patient population	84
Male	30
Female	54
Age Range	40-80
Average Age	63
Treatment Received	
Simultaneous bilateral TKR	61% (n=45/82)
One Side TKR	39% (n=37/82)
ASA Grade	N=84
ASA Grade I	5
ASA Grade II	30
ASA Grade III	49
Indication for TKR	
Osteo Arthritis	75
Rheumatoid Arthritis	6
Post Traumatic Arthritis	2
Post Infective Arthritis	1
Co-Morbidities	95%(n=80)
Average BMI	33
BMI range	27-40
Profession	12%(n=10)
Retired or Non working	88%(n=74)
Sports	None
Exercise before Surgery	None
Exercise after Surgery	95%(n=80)

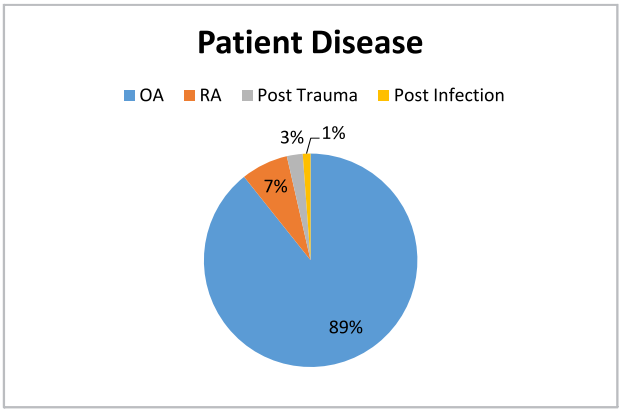

Figure 2: Patient Disease Ratio

In patients who received simultaneous bilateral TKR, pain scores and Oxford Knee score was completed for each knee separately. For assessment of patient satisfaction, data was collected as function after surgery, pain, return to routine activities and results. Every patient was also asked if they would prefer TKR one side at a time or simultaneous bilateral TKR.

We performed TKR for 84 patients in total with grade four OA of knee joint. Out of total patient population 61% (n=51) patients received simultaneous bilateral TKR while 39% (n=33) patients had one side TKR during one episode. Total number of knee joint replacements was 135. Out of 84 patients, 64% (n=54) were females and 36% (n=30) were male patients. Among the gender based distribution 59% (n=32out of 54) females had simultaneous bilateral TKR while 43% (n=13 out of 30) male had simultaneous bilateral TKR. Average Age range was 63 with youngest patient was a female with advance rheumatoid arthritis age 40 and received simultaneous bilateral TKR and oldest patient was male at 80 years old. Average female age was 61 year old and average male age was 66 year old. American Society of Anesthetist Grade was III I most of the patients. 95% (n=80) patients had at least one co-morbidity which indicates that TKR patient population has complex dynamics and need Multi disciplinary approach for best outcomes. Average BMI was also above normal range standing at 33. Highest BI was 40 in a female patient with a weight of 115kg.

Our primary outcome measures Table 2 was very satisfactory in both groups. None of the patients in either group needed re-admission within 2 months after surgery. None of the patients developed stiffness or need for manipulation under anesthesia. One patient 3%(n=1/33) from Unilateral Knee Replacement developed painful patella femoral joint and received patella button replacement 7 month after surgery and went on to full recovery.

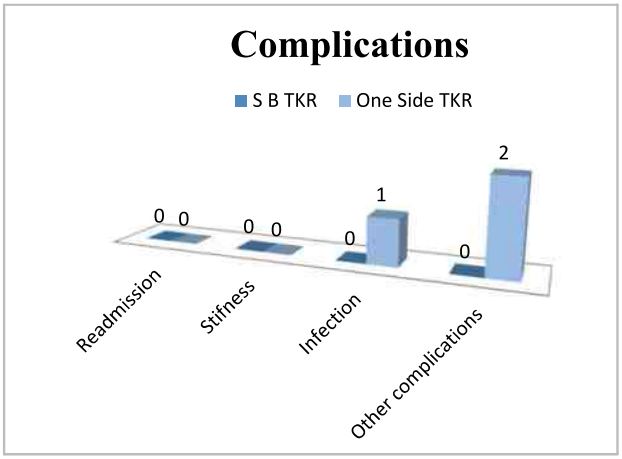

Figure 3: Rate of Complications in each Group

Regarding the professional and sports life of patients, only 12% (n=12) patient population was working or in active business. Remaining 88% (n=80) patients were either retired or no active job / business. All patients were unable to do any meaningful sports or exercise before surgery and that was a big factor in the decision making process for TKR.

Table II: Primary Outcome Measure of both Groups

Outcome measure	Simultaneous bilateral TKR n = 51	Unilateral TKR n=33		p-Value
Readmission	0	0		NS
Stiffness	0	0	0	NS
Infection	0	1 (3 %) Delayed Onset		0.1
Any other complication	0	2 (6%) 1= PFJ Pain and Patella Replacement. 1=Peri -pro sthetic fracture Tibia, Revision Implant)		0.23

After surgery 95%(n=76) patients were able to do walk for at least 20 minutes, shopping or other recreational activity in daily life. This was a big and positive impact on their life after TKR.

Our complication rate was very low in this small study. Infection rate was 0% at acute post op period. One patient presented at 6 month with infection prosthetic joint infection. Luckily he presented within 2 weeks of onset of symptoms and Single stage joint DAIR (Debridement, Antibiotics and Implant Retention) procedure was performed with successful resolution of his symptoms. He was 73 year old man and presented with acute red hot Right knee joint after a boil on ipsilateral foot which was scratched by patient leading to skin infection and haemtogenous spread to the prosthesis with one week. One female had a fall after 10 month and presented with peri-prosthetic fracture which was operated for revision implant of Tibia. Femoral implant was stable and not revised. Incidence of chronic pain was at 4% (n=3) at one year. Patient reassurance, physiotherapy and analgesia were advised with no further intervention needed.

Patient filled the outcome questionnaire at each visit and all the data was entered on Microsoft Excel Spreadsheet and results were calculated. Statistical comparison was made between the two groups and tables were inserted in the results.

DISCUSSION

We performed a retrospective study looking at the comparison of simultaneous bilateral TKR vs. one unilateral knee replacement. Primary outcome measures show promising results for simultaneous bilateral TKR.

With increasing health facilities, life expectancy is also getting better all over the world and this has led to age related wear and tear in the large joints. Knee is particularly prone to osteoarthritis and hence knee replacement is gaining popularity even for developing countries like Pakistan.[16] With advancing technique and improvement in surgeon skills, success rates of large joint Arthroplasty is 98 to 99%. With more patient population waiting for knee replacement and looking at economical ways to achieve similar higher success rates, simultaneous bilateral TKR is an attractive option. It has potential of quicker recovery, significant cost reduction through one hospital episode instead of two admissions for each knee replacement separately. There are always concerns about potential for higher complication rate and that's why we compared our practice to look at the outcomes.[17-20]

Several studies have been done all over the world showing varying results. Main concerns are rate of readmission to hospital within 2 months, infection, stiffness, anesthetic complications and revision rates. More studies are now coming up with evidence of higher rates of complications in unilateral knee replacement done in two episodes. Our study also shows all complications in unilateral knee replacement group only, mainly one each of infection (3%), Patella replacement (3%), and periprosthetic fracture (3%). None of the patients in either group developed deep vein thrombosis mainly due to strict prophylaxis policy. Some studies reported increased incidence of Respiratory issues such as pneumonia, dysnea in knee replacement patients undergoing two episodes of hospital admission.[21-23] Blood loss is always associated with any major joint Arthroplasty and many studies have been conducted on methods on measuring blood loss, how to control homeostasis and techniques on reducing blood loss.[24] There were concerns regarding risk of increased blood loss and need for blood transfusions in simultaneous bilateral TKR. But in our study we have used up-to date techniques, local blocks and no use of drain, leading to minimal blood loss. In our one side knee replacement population we don't give blood transfusion and in simultaneous bilateral TKR population we give one whole blood transfusion at end of surgery.

Some research articles have reported increased risk of neurologic injury the simultaneous bilateral knee replacement group; but in our study no such injury was reported in any group. Our findings are confirmed by other systemic reviews as well.[25]

We generated a proforma to assess patient satisfaction and outcome after surgery. Each patient in both groups filled out the proforma and Patient-Reported Outcome Measures (PROMs) shows promising results with simultaneous bilateral TKR. Many studies share our findings and show either no difference in PROMs in both groups or higher satisfaction and recommendation by patients in simultaneous bilateral TKR group. Range of movement in both groups at final visit was also satisfactory.[25]

CONCLUSION

Our study has clearly shown that simultaneous bilateral TKR group has better Patient reported Outcome Measures

(PROMs), low rate of infection, stiffness and anesthetic complications. Economically it has only one hospital episode and lower overall costs. Patient selection criteria are not well defined yet but we recruited patients of 75 years or younger, and fewer or at least well controlled associated medical conditions for simultaneous bilateral TKR. Meticulous surgical technique, strict adherence to protocols and involvement of multi disciplinary team are of utmost importance for higher success rates.

Limitations:

The non-randomized retrospective nature of our study and small sample size are limiting factors in our study and we recommend clinical randomized multi-centre trials to define clear guidelines for future patients.

Ethical approval:

Ethical approval was taken from institutional review board of of Al-Aleem Medical College, Lahore, with the IRB number AAMC/DME.Curr.28/2023, Dated 5-4-2023.

Conflict of Interest:

Authors declare no conflict of interest.

Financial Disclosure:

None

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Authors' Contributions:

MSB: Conceptualization & study design.

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MAA: Data Analysis and critical review.

MB, HAR: Supervision &Manuscript drafting & proof reading.

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