One Stage Sequential Bilateral Total Knee Arthroplasty. Is it Safe?

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ABSTRACT

Objective: Present study analyzed retrospectively the complications associated with one stage sequential bilateral Total Knee Arthroplasty.

Methods: A total of 107 bilateral knee osteoarthritis (OA) patients who underwent one stage sequential bilateral primary total knee replacement were included in this retrospective study. All the patients included were classified as American Society of Anaesthesiology (ASA) 1 or 2 with a pre operative Haemoglobin of 12gm/dl & were operated upon by the same surgeon. After six months follow up of patients were conducted and following parameters were recorded: the perioperative complications, mean operative time for knees and mean hospital stay.

Results: Three cases of deep vein thrombosis, two cases of post op delirium and superficial infection and one case each of myocardial infarction, suspected pulmonary embolism and cardiac dysrhythmia were reported but there were no perioperative deaths, neurological complications or revision procedures. Mean operative time was 143±10.27 min. Mean hospital stay was 4.6±0.94 days. The results were statistically significant ($p<0.05$).

Conclusion: Patients undergoing one stage sequential bilateral TKA tend to show better results due to shorter hospital stay, shorter operative time, faster recovery and early rehabilitation as well as with fewer complications depending on careful patient selection.

Keywords: Arthroplasty, Knee, One stage, Sequential

INTRODUCTION

Total knee arthroplasty (TKA) is now considered a safe treatment for patients with moderate to severe arthritis of the knee to alleviate pain, correct limb alignment and ultimately improving their quality of life [1]. Majority of these patients have involvement of both knee [2] and 20% ultimately end up in getting the second one operated within next 02 years of first TKA [3]. Whenever the disease is bilateral maximum benefit from TKA can be achieved after bilateral replacement [4].

In bilateral TKA cases there are two possible surgical strategies. Two stage bilateral TKA in which a gap is given between the two procedures, which may be of 05 days during same admission or up to 12 months with separate admissions. Single stage bilateral TKA, in which both knees are operated during same admission and anesthesia, which may be sequential done by a single team or simultaneous done by two separate teams. The number of single stage procedure has increased within the last 15 years [5]. In 2008 4% of the bilateral TKA done in USA were single stage [6] where as they comprised 11% of the bilateral TKA in New Zealand in 2009 [7].

The data available worldwide and nationwide is conflicting and inadequate to support or contradict one stage bilateral TKA. The main advantages of single stage bilateral TKA are shorter hospital stay & lesser costs [8,9'10] along with early functional recovery [11]. Further benefits include decreased total anaesthetic, decreased rates of superficial wound infection and higher rates of patient satisfaction and convenience [2]. Astonishingly a study reported higher 10-year survival rate in patients undergoing bilateral TKA in comparison to unilateral TKA [8]. The authors against one stage bilateral TKA have reported complications like cardiovascular for example congestive cardiac failure, myocardial infarction and arrhythmias of new onset; thromboembolic like pulmonary embolism, deep vein thrombosis; neurologic like transient ischemic attack, stroke, delirium; requirement for blood transfusion pointing towards blood loss which may be measured directly or indirectly and mortality [12].

Some studies indicate one stage bilateral TKA in patients with American Society of Anaesthesiology

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(ASA) 1 or 2 with no or minimal associated co morbidities [13, 14]. Age is not a significant factor in patient selection as reported by Severson 2009 [15] where as Lynch 1997 [16] reported complications in patients older than 80 years of age and contraindicated one stage TKA in them. Keeping these factors in mind we included them in our inclusion criteria.

Therefore for surgeons who want to give this option to their patients, it is important to outline and clarify the benefits and role of one stage sequential bilateral TKA.

In this study we analyzed retrospectively the complications associated with one stage sequential bilateral TKA along with mean operative time for knees and mean hospital stay.

METHODS

This was a retrospective secondary data analysis of cases operated upon during the period from January 2012 to August 2015 in Combined Military Hospital, Rawalpindi by a single surgeon.

A total of 107 osteoarthritis (OA) patients who opted and underwent one stage bilateral primary total knee arthroplasty were included in the study. Inclusion criteria were patients who gave consent for one stage sequential bilateral TKA, who were classified as American Society of Anaesthesiology (ASA) class 1 or 2, pre operative haemoglobin of 12gm/dl or more & had non infective simple or complex bilateral gonarthropathy. Exclusion criteria were patients who had unilateral gonarthropathy, severe osteoporosis, who didn't give consent for one stage TKA, had history of knee septic arthritis, which had a body mass index (BMI) more than 35kg/m^2, classified as ASA class 3 or above or required revision TKA.

All patients were operated after consultation from an anesthesiologist & who were found suitable for the surgery with pre operative assessment. All patients were operated under epidural anaesthetic with sedation along with pre operative intravenous antibiotics: 2gm Cefoperazone + Sulbactam along with 500mg of Amikacin repeated every 12 hourly for 03 days.

All patients received similar cemented implants in both knees. The patients were operated using the medial para patellar approach using same instrumentation on both sides. A single experienced orthopedic surgeon performed all the TKAs.

Technique of bilateral sequential TKA: A tourniquet was applied on both sides with the one operated first inflated first to 100 mmHg above systolic blood pressure and after the implantation of components with antibiotic mixed bone cement was deflated. Midline skin incision in 90^o flexion from four fingers above patella till tibial tuberosity [14-17 cm long] was given. Using medial parapatellar approach, arthrotomy was done cutting up to 2.5 cm of quadriceps tendon in midline. After lateral subluxation of patella medial capsule from proximal tibia was released and was carried till mid coronal plane. After distal femoral and proximal tibial cuts and resection of patella, space was created for rest of resection. Further femoral cuts with necessary posterior release and tibial preparation were carried out. This was followed by trial placement and soft tissue balancing followed by final implant placement with bone cement.

The range of motion achieved at the end of the operation for all knees was from full extension till the calf met the posterior thigh. A 14 Fr drain was placed in the lateral gutter and closure of the capsule was carried out with interrupted sutures in extension proximal to patella and rest in 90^o flexion. The second knee was operated in the same sequence after closure and dressing of the first knee. The drains were kept for 24 hours after the surgery and the epidural catheter was used for a period of 48 hours. The operating time and length of incision were documented.

Patient was advised passive followed by active ankle pumps soon after they regained motor functions in lower limbs immediately after surgery. The next morning patient was made to sit up with legs dangling down the bedside and encouraged to stand up on first post-op day. Walking with walking frame was allowed on the second post op day. The urinary catheter was removed as soon as the patient was able to walk up to the washroom with support. The patient was ready for discharge fourth or fifth post-op day after necessary arrangements at home for patient mobilization were ensured. No chemical prophylaxis for DVT was given and all included patients were followed up to six months postoperatively.

The data was entered into SPSS v.14. For the continuous variables including age, duration of hospital stay and operative time, mean ± S.D. was calculated. For the categorical variables i.e. gender, post-operative complications of TKA, frequencies and percentages were presented.

The Pearson correlation test was applied to associate hospital stay and operative time with frequency of complications. P-value of 0.05 or less was statistically significant.

RESULTS

A total of 107 osteoarthritis (OA) patients fulfilling the inclusion criteria who underwent bilateral primary total knee replacement were included in the study. There were 71 females and 36 males with mean age of 66 years (SD± 4.23). The mean operation time for bilateral TKA was 143min (SD± 10.27). Mean hospital stay was 4.6 days (SD±0.94).

Three cases of deep vein thrombosis, two cases of post op delirium and superficial infection and one case each of myocardial infarction, suspected pulmonary embolism and cardiac dysrhythmia were reported.

Table 1: Demographic characteristics, mean operative time & hospital stay in One stage sequential Bilateral TKA

Demographics	**One Stage Bilateral TKA (n=107)**
Gender, no. (%)	
Male	36 (33.6)
Female	71 (66.4)
Age, years	
Mean ± SD	66.08 **±** 4.23
Range	56-71
Operative time, minutes	
Mean ± SD	143 **±** 10.27
Range	121-167
Hospital stay, days	
Mean ± SD	4.60 ± 0.94
Range	4-8

Table 2: Complications in patients undergoing one stage sequential bilateral TKA

Complication	**No. of cases (%)**
Deep Vein Thrombosis	3 (2.8)
Pulmonary Embolism (Suspected)	1 (0.9)
Myocardial Infarction	1 (0.9)
Confusion syndrome (Postop delirium)	2 (1.8)
Superficial Infection	2 (1.8)
Mortality	0 (0)

The relationship between longer operative time and development of complications was found to be significant (p<0.05) by applying Pearson test. Similarly a significant relationship was also seen between longer duration of hospital stay and development of complications (p<0.05).

Fig 1: A, B, C: X-rays of 65 year male with bilateral Osteoarthritis knee anteroposterior & lateral view. **D, E**: Post operative x-rays anteroposterior & lateral view after one stage sequential bilateral TKA. **F, G**: One month post operative x-rays. **H, I:** 1 month post op pictures showing healed scar and complete flexion. **J, K:** Six months post operative x-rays.

Detailed data of important outcomes of the study regarding mean hospital stay and mean operative time is presented in Table 1. Data regarding complications is given in Table 2.

We did not observe peri operative deaths, deep tissue infection, implant notching or revision procedures.

DISCUSSION

TKA is one of the most effective & safest orthopaedic procedures for gonarthropathy. No research has been carried in this context in our country. The number of one-stage bilateral TKA cases in Pakistan has increased within the past decade. The advantages of one stage bilateral TKA such as shorter hospital stay, lesser overall costs, early functional recovery and patient satisfaction are well proven [2,8,11]. The complications reported in literature to some extent are not well established and seem to support as well as contradict one stage bilateral TKA [17,18,19].

The reported cases of Deep Vein Thrombosis (DVT) in literature vary from 0.4-71% [12]. The studies, which showed higher incidence, tend to use radiological diagnosis for DVT where as the ones with lower incidence relied on clinical diagnosis [16,20]. Spicer et al found it around 2.9% in bilateral one stage TKA [2]. We used clinical evaluation for diagnosis of DVT & recorded three cases. One study even showed that the patients undergoing one stage bilateral TKA and those undergoing unilateral TKA have no statistical difference for developing DVT, which may be due to higher consumption of coagulation factors during surgery [21].

Pulmonary Embolism (PE) is a major complication reported from 0-3% in literature [12]. Studies have shown that the risk of developing PE is 80% more in one stage than in staged or unilateral TKA but the sum of risk in staged procedures ultimately came out to be equal or greater than the single stage one [22]. One patient in our study developed breathlessness on the 3rd postoperative day. We investigated him with the suspicion of PE but his Spiral CT and V/Q lung scan came out be negating the suspicion. Later on the patient was discharged on 8th postoperative day.

Cardiac complications are one of the life threatening ones in TKA & it has been observed that patients undergoing one stage bilateral TKA tend to have increased risk of cardiac complications due to increased intra operative blood loss reported by Lynch 1997 [16]. He reported that 22% of patients with one stage bilateral TKA tend to have cardiovascular complications as compared to 06% seen in patients undergoing unilateral TKA [16]. Bullock 2003 reported a 4.38 times relative risk for myocardial infarction (MI) in patients undergoing bilateral one stage TKA as compared to unilateral ones between the age of 70-79 years where as this figure was 6.76 for ones 80 years or elder. He observed no incident of MI in patients younger than 70 years of age [23]. So we can consider age to be a vital factor in patients with cardiac complications. We saw one case of cardiac dysrhythmias. One of our patients, a 69 years old female, had extensive inferior wall MI immediately postoperatively but later on she recovered after 4 days of treatment in intensive care and discharged on 8th post operative day.

Mortality seems to be an important complication following one stage bilateral TKA. Urban 2006 [24] reported an in hospital mortality following bilateral TKA to be 0.5% as compared to 0.3% in unilateral one. On the other hand Spicer 2013 [2] showed a much lesser frequency of mortality of 0.3% in bilateral & 0.1% in unilateral groups during his study. Although literature shows a high mortality rate following bilateral procedures Urban 2006 [24] claimed them to be quite less in high volume institutions with experienced TKA surgeons. Ritter 1997 reported the 30 days mortality to be around 0.99% in one-stage TKA patients as compared to 0.30% in staged TKA [3]. We did not encounter any mortality in our cases.

We encountered two cases of superficial infection in one knee each in our study. Ritter 1997 [3] reported it to be twice as common when done in one stage as compared to two stages.

Although we did not measure blood loss but Trojani 2012 [5] reported need for postoperative transfusions in one stage bilateral TKA due to increased blood loss per operatively.

The mean hospital stay in our study came out to be 4.6 days (SD±0.94) which is far less than the ones reported by Spicer 2013 [2] i.e. 5.3 days (SD±2.1) and Trojani 2012 [5] i.e. 10 days (7-16 days). This shorter stay was practiced as majority of the patients started early aided ambulation in our cases.

The mean operative time in our study came out to be 143.75min (SD±10.27) with a range of 121 to 167 min. Trojani 2012 [5] reported in his study mean operative time of 98min with range from 70 to 145 min. The operative time in our analysis was comparatively longer as we operated on both knees

with a single team and did not start on the other knee until closure of skin in the first one.

Memtsoudis 2008 [6] came up to this conclusion that patients with ASA 3 & 4 tend to end up with serious complications in one stage bilateral TKA. Similarly Yoon 2010 [13] postulated that patients in ASA 3 & 4 tend to have 20 times more chances of complications as compared to ASA 1 & 2. Thus careful patient selection is also an important point in one stage bilateral TKA as shown in our study.

CONCLUSION

We conclude that careful patient selection can result in far better outcomes with better early functional results after one stage sequential bilateral TKA. Thus the key points of success in one stage sequential bilateral TKA include a precise operation technique and appropriate patient selection which ultimately results in few complications, shorter operative time and even shorter hospital stay. We need further evaluation in comparison to staged bilateral TKA to make further recommendations in this regard.

REFERENCES

1. Bullock DP, Sporer SM, Shirreffs TG Jr. Comparison of simultaneous bilateral with unilateral total knee arthroplasty in terms of perioperative complications. J Bone Joint Surg Am. 2003; 85A:1981-6.
2. Spicer E, Thomas GR, Rumble EJ. Comparison of the major intraoperative and postoperative complications between unilateral and sequential bilateral total knee arthroplasty in a high-volume community hospital. Can J Surg. 2013; 56(5): 311-317.
3. Ritter M, Mamlin LA, Melfi CA, Katz BP, Freund DA, Arthur DS. Outcome implications for the timing of bilateral total knee arthroplasties. Clin Orthop Relat Res. 1997; 345: 99-105.
4. Stanley D, Stockley I, Getty CJ. Simultaneous or staged bilateral total knee replacements in rheumatoid arthritis: a prospective study. J Bone Joint Surg Br. 1990; 72:772-4.
5. Trojani C, Bugnas B, Blay M, Carles M, Boileau P. Bilateral total knee arthroplasty in a one-stage surgical procedure. Orthop Traumatol Surg Res. 2012; 98: 857-862.
6. Memtsoudis SG, Della Valle AG, Besculides MC, Gaber L, Sculco TP. In-hospital complications and mortality of unilateral, bilateral, and revision TKA. Clin Orthop Relat Res. 2008; 466: 2617-27.
7. Hooper GJ, Hooper NM, Rothwell AG, Hobbs T. Bilateral total joint arthroplasty. The early results from the New Zealand national joint registry. J Arthroplasty. 2009; 24:1174-7.
8. Ritter MA, Harty LD, Davis KE, Meding JB, Berend M. Simultaneous bilateral and unilateral total knee arthroplasty. A survival analysis. J Bone Joint Surg Am. 2003; 85:1532-7.
9. Macario A, Schilling P, Rubio R, Goodman S. Economics of one stage versus two-stage bilateral total knee arthroplasties. Clin Orthop Relat Res. 2003; 414:149-56.
10. Reuben JD, Meyers SJ, Cox DD, Elliott M, Watson M, Shim SD. Cost comparison between bilateral simultaneous, staged, and unilateral total joint arthroplasty. J Arthroplasty. 1998; 13:172-9.
11. Liu PL, Li L, Zhang YK, Li M, Kane K, Wang YH, et al. A comparison of two rehabilitation protocols after simultaneous bilateral total knee arthroplasty: a controlled, randomized study. J Int Med Res. 2009; 37:746-56.
12. Burnett R, MacDonald S. Complications in bilateral total knee arthroplasty. Semin Arthroplasty. 2003; 14:245-62.
13. Yoon HS, Han CD, Yang IH. Comparison of simultaneous bilateral and staged bilateral total knee arthroplasty in terms of perioperative complications. J Arthroplasty. 2010; 25:179-85.
14. Memtsoudis SG, Ma Y, Chiu YL, Poultsides L, Gonzalez Della Valle A, Mazumdar M. Bilateral total knee arthroplasty: risk factors for major morbidity and mortality. Anesth Analg. 2011; 113(4):784-90.
15. Severson EP, Mariani EM, Bourne MH. Bilateral total knee arthroplasty in patients 70 years and older. Orthopedics 2009; 32:316.
16. Lynch NM, Trousdale RT, Ilstrup DM. Complications after concomitant bilateral total knee arthroplasty in elderly patients. Mayo Clin Proc. 1997; 72(9):799-805.
17. Sculco TP, Sculco PK. Simultaneous-bilateral TKA: double trouble - opposes. J Bone Joint Surg Br. 2012 Nov; 94(11 Suppl A):93-4. doi: 10.1302/0301-620X.94B11.30829.
18. Lombardi AV, Mallory TH, Fada RA, Hartman JF, Capps SG, Kefauver CA, Dodds K, Adams JB. Simultaneous bilateral total knee arthroplasties: who decides? Clin Orthop Relat Res. 2001 Nov; (392):319-29.
19. Restrepo C, Parvizi J, Dietrich T, Einhorn TA. Safety of simultaneous bilateral total knee arthroplasty. A meta-analysis. J Bone Joint Surg Am. 2007 Jun; 89(6):1220-6.
20. Cohen RG, Forrest CJ, Benjamin JB. Safety and efficacy of bilateral total knee arthroplasty. J Arthroplasty 1997; 12:497-502.
21. Patil N, Wakankar H. Pros and cons of simultaneous bilateral total knee arthroplasty including morbidity and mortality rates. Orthopedics 2008; 31:780-9.
22. Sabari Girish R, Gopalakrishnan KC, Subin Sugath, Anoop S. Simultaneous bilateral total knee arthroplasty- is it the final answer? Kerala Journal of Orthopaedics.2011; 24:15-22

23. Bullock DP, Sporer SM, Shirreffs TG Jr. Comparison of simultaneous bilateral with unilateral total knee arthroplasty in terms of perioperative complications. J Bone Joint Surg Am. 2003; 85(10):1981-1986.

24. Urban MK, Chisholm M, Wukovits B. Are postoperative complications more common with single-stage bilateral (SBTKR) than with unilateral knee arthroplasty: guidelines for patients scheduled for SBTKR. HSS J 2006; 2:78-82.