

Evaluation of Functional and Radiological Outcome of Total Knee Replacement Surgery in Obese V/S Non-obese Patients

Ashish S Phadnis¹, Saurabh S Ranjalkar², Vijay Kumar³, Prathamesh Sangare²,
Shashank Gabhe⁴

Abstract

Introduction: Primary total knee replacement (TKR) is one of the most commonly performed orthopedic procedures. With the increasing prevalence of obesity and advancing age of the population, it is imperative to know whether the obese patients have inferior or equivalent outcomes as opposed to non-obese patients. Hence, this study was planned to learn the functional and radiological outcomes of TKR surgery in obese and non-obese patients.

Materials and Methods: This prospective observational study included 64 adult patients 32 obese (body mass index [BMI] >30) and 32 non-obese (BMI <30) operated for TKR surgery. Functional outcome was assessed by patient-reported outcome measures using Oxford knee score (OKS) and short form-12 (SF-12) quality of life questionnaires at 6 weeks postoperatively. Radiological outcomes were assessed using pre- and post-operative radiograph and bilateral lower limb scanogram.

Results: On comparing the mean hospital stay, that of obese patients was 8.16 days and that of non-obese patients was 6.72 days (significant). The OKS improved from 14.19 to 37.44 in the obese group and from 14.75 to 38.59 in non-obese group. In obese patients, the physical component of SF-12 score improved from 23.92 to 53.6 postoperatively, and that in non-obese patients went from 27.29 to 53.08. The mean mental component of SF-12 score improved from 48.59 to 56.37 postoperatively in obese patients, in non-obese patients it improved from 53.02 to 57.94 postoperatively (significant). Hip-knee-ankle axis in obese patients on the right side improved from 171.18° to 176.82° (significant), left side from 171.31° to 176.71° whereas in non-obese patients right side from 171.89° to 176.94°, left side from 171.82° to 176.66°. Comorbidities were seen more in obese patients (diabetes 21 of 32 cases, hypertension 17 of 32 cases) than in non-obese patients (diabetes 12 of 32 cases, hypertension 16 of 32 cases). Superficial surgical site infection (SSI) in about 3 of 32 obese patients, whereas no SSI was found in non-obese patients.

Conclusion: The present study assesses the patients' perception of their outcomes which are important in clinical decision-making. There was no significant difference found in patient perceived parameters, functional and radiological outcomes at end of 6 months following TKR surgery in both obese and non-obese patients.

Keywords: Total knee replacement, body mass index, obese.

Introduction

Primary total knee replacement (TKR) is one of the most commonly performed elective orthopedic procedures globally.

Many patients undergoing this type of surgery are overweight or obese [1]. It is widely acknowledged that TKR has revolutionized the quality of life for those who suffer from osteoarthritis and has been shown to be one of the most successful and cost-effective interventions in modern medicine [2]. The body mass index (BMI) for an individual is their weight in kilograms (kg) divided by their height in meters squared (m²), and this correlates with their total body fat [2]. Obesity is defined as a BMI >30 kg/m² [6-16]. There is general agreement that obesity contributes both to the initiation and progression of OA knee, rather than OA being the cause of the obesity [4]. The authors of several studies have shown that 50–60% of patients

¹Department of Orthopaedic Surgery, Jupiter Hospital Thane, Maharashtra, India,
²Department of Orthopaedic Surgery, HBT Trauma Hospital, Jogeshwari (E), Mumbai, Maharashtra, India,
³Department of Orthopaedic Surgery, ESIC hospital and Dental College, Rohini West, Delhi, India,
⁴Dr Gabhe's Bones and Joints Clinic, Thane, Maharashtra, India

Address of Correspondence

Dr. Saurabh S Ranjalkar,
Department of Orthopaedic Surgery, HBT Trauma Hospital, Jogeshwari (E), Mumbai, Maharashtra, India
E-mail: saurabh.ranjalkar93@gmail.com

Submitted Date: 16 Aug 2024, Review Date: 27 Sep 2024, Accepted Date: 12 Oct 2024 & Published Date: 10 Dec 2024

Journal of Clinical Orthopaedics | Available on www.jcorth.com | DOI: <https://doi.org/10.13107/jcorth.2024.v09i02.680>

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License (<https://creativecommons.org/licenses/by-nc-sa/4.0/>), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

undergoing TKR surgery are obese [7-9]. Several studies with large cohorts have demonstrated that the wound healing complication rate and not surprisingly, the post-operative infection rate is increased in the obese patient undergoing TKR [8,10]. It appears that those patients who have morbid obesity (BMI >40) are at the greatest risk for infection with odds ratios reported from 3.3 to 8.96 [10-13]. It is important to determine whether obese patients have inferior or equivalent outcomes compared with the non-obese. Hence, this study was planned to determine the functional and radiological outcomes of TKR in obese and non-obese patients.

Material and Methods

The present prospective data analysis has been carried out in the department of orthopedics in tertiary care center prospectively from February 2022 to March 2023. The relevant and required information pertaining to the study has been collected using self-designed pro forma. A total number of 64 cases were operated with Robotic TKR surgical technique. Of these, 32 were obese and 32 were non-obese patients. The statistical analysis is carried out and specific statistical test applied.

Place of study

Single site study conducted at out-patient department of orthopedics, Jupiter Hospital, Thane, Maharashtra, India. It is a multi-specialty tertiary care medical hospital.

Study population

Sixty-four patients were Kellgren-Lawrence Grade 4 osteoarthritis knee – 32 being obese (BMI >30) and 32 being non-obese (BMI <30).

Study design

This was a prospective study.

Inclusion criteria

Patients giving consent for surgery

1. Patients with OA knee with KL Grade 4
2. BMI <30 non-obese; BMI >30 obese.

Exclusion criteria

1. Revision TKR surgery
2. Patient not giving consent
3. Patients with OA knee Grade <4
4. Patient having fixed flexion deformity of knee joint more than equal to 20°.

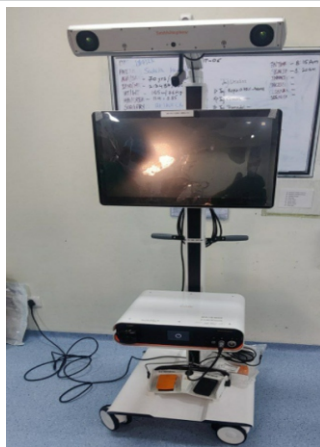


Figure 1: CORI robotic total knee replacement operational system.



Figure 2: Two-pin bicortical system installed to provide intraoperative total knee arthroplasty assistance.

Methodology

All surgical procedures were performed by a single experienced surgeon. They took place in one hospital with all the patients under spinal and epidural anesthesia. A tourniquet was applied and inflated before software registration. The tourniquet was deflated after implant insertion. A standard medial parapatellar incision and approach were used with patellar eversion. The TKR procedure was standardized and performed using the instrumentation in accordance with the operative technique of CORI robotic TKR assistance system. (Fig. 1).

All patients underwent TKR procedures with standard pre-operative antibiotics prophylaxis with use of 1 dose of 1500 mg cefuroxime– 30 min before incision; injectable and oral rivaroxaban (10 mg) once a day postoperatively for 10 days. The day following the surgery, all the patients had to have a control X-ray. During control visits (6 weeks follow-up), patients underwent an X-ray bilateral lower limb full-length scanogram to detect the radiographic accuracy of implanted components positioning and determination of hip-knee-ankle (HKA) angle. In addition, stabilization pins, trackers, and camera setup (Fig. 2) were installed to allow for navigation markers and bone movement monitors detection of the workspace within the joint. The patient was rigidly connected to CORI software through two transverse stabilization pins in the distal femur and proximal tibia. A detailed registration process was completed by the identification of 4 landmarks on the femur and the tibia (Fig. 2). Once registration was completed, the surgeon activated the system and conducted the surgery with robotic assistance described precisely in manuals available at the Smith and Nephew company (London, UK) website [17-20]. Post-operative management was identical for both groups.

Discussion

In the present study out of 64 cases, 82.82% were female which was similar to those of many other studies [21-25]. In the present study, the mean BMI of obese patients is 34.02 and that

of non-obese patients is 26.10, which is very similar to the study conducted by Amin et al. [17]. In the present study, we found that the mean hospital stay for obese patients was 8.16 and that for non-obese patients was 6.72, giving a statistically significant relationship, whereas in the study conducted by Dowsey, the mean hospital stay was the same for both obese and non-obese patients.

In the present study, the HKA angle in obese patients went from 171.18° on the right side and 171.31° on the left side preoperatively to postoperatively 176.82° on the right and 176.71° on the left side, respectively, an insignificant change. Whereas in the study conducted by Raj Kanna et al. in obese patients, a significant change in mean HKA angle was observed. The improvement in Oxford knee score (OKS) in obese patients was from 14.19 to 37.44, whereas it was 14.75–38.59 in non-obese group when checked at 6 weeks follow-up. These are very encouraging results for this particular subset of patients. Similar to our study, Stevens-Lapsley et al. [26] and Bin Abd Razak et al. [27] found no significant difference in Oxford knee score in obese patients after TKA at 6 and 12 months postoperatively, respectively.

In a study conducted by Ayyar et al. [14], recorded a change in short form-12 (SF-12) physical component score (PCS) in obese patients from 30.0 to 36.8, and in non-obese patients it went from 28.8 to 38.2. In another study conducted by Dowsey et al. [9], the PCS witnessed a rise from 25.10 to 36.3 in obese group and in non-obese group from 25.41 to 35.84 postoperatively. In the present study, the PCS in obese patients improved from 23.92 to 53.6 and that in non-obese patients from 27.29 to 53.08. This is a big improvement in both obese and non-obese patients but is statistically not significant to our study.

In a study conducted by Ayyar et al. [14], recorded a change in SF-12 mental component score (MCS) in obese patients from 48.3 to 52.6; in non-obese patients it went from 51.1 to 52.3. In another study conducted by Dowsey et al. [9], the MCS witnessed a fall in obese patients from 52.8 to 52.07 and in non-obese patients from 53.51 to 52.8 postoperatively. In the present study, findings were similar to the study by Ayyar et al. [14] as MCS in obese patients improved from 48.59 to 56.37 and that in non-obese patients from 53.02 to 57.94 which is a statistically significant improvement.

In a study conducted by Ayyar et al. [14], 18 out of 98 obese patients (18.36%) were found to be diabetic, while 5 out of 73 non-obese (6.84%) were found to be diabetic; similarly, 72 out of 98 obese patients (73.46%) and 34 out of 73 non-obese patients (46.57%) were hypertensive. In a study conducted by Dowsey et al. [9] 31 out of 211 non-obese patients (14.69%) were diabetic, whereas 61 out of 261 obese patients (23.37%) were found to be diabetic. In our study, a diabetic and hypertensive predominance was seen in the obese group, with

diabetic patients being 21 in the obese (65.62%) and 12 in non-obese group (37.5%), whereas 17 patients were found to be hypertensive in obese group (53.125%) and 16 hypertensive in non-obese group (50.0%) giving an impression that obesity along with it brings comorbidities, increasing the risk of complications.

In a study conducted by Amin et al. [17], they found 6 out of 210 non-obese patients (2.85%) had superficial infection and 2 out of 210 non-obese patients (0.95%) had deep joint infection who went for revision surgery later whereas 7 out of 160 obese patients (4.375%) had a superficial infection and 1 out of 160 obese patients (0.625%) to have deep joint infection who required a washout surgery but not revision surgery. In a study conducted by Dowsey et al. [9], it showed 18 out of 261 obese patients had superficial infection (6.89%); 3 out of 261 obese patients (1.14%) had deep joint infection; 6 out of 211 non-obese patients (2.84%) had superficial infection and 1 out of 211 non-obese patients (0.47%) had deep joint infection. In our study, three cases of superficial surgical site infection (9.375%) from the obese group and no infection in non-obese group were found. The superficial infections were treated with antibiotics as per the surgical site swab culture. The antibiotics were administered intravenously for 3 days and the decision to shift on oral antibiotic was taken depending on inflammatory markers erythrocyte sedimentation rate and C-reactive protein levels.

Results

In a total number of 64 cases; 32 were obese and 32 were non-obese; 11 being male and 53 being female patients. Out of a total of 64 cases, 43.8% of obese patients were found in the age group 60–70 years, and 46.9% non-obese patients were found in the age group >70 years. A total of 31 cases (48.43%) were unilateral TKR (obese 16, non-obese 15) and 33 cases (51.56%) were bilateral TKR (obese 16, non-obese 17). On an average, obese patients had a longer hospital stay owing to difficulty in physiotherapy rehabilitation and wound complications than non-obese patients. Comorbidities were seen more in obese (diabetes 21 cases, hypertension 17 cases) than non-obese patients (diabetes 12 cases, hypertension 16 cases). At 6 weeks follow-up, a statistically significant difference was found in HKA axis of the right side only in obese patients but no statistically significant difference found on the left side. On comparing the OKS score which improved from 14.19 to 37.44 in the obese group and from 14.75 to 38.59 in non-obese group, statistically not significant. No statistically significant difference was found in mean SF-12 PCS score in obese (from 23.92 to 53.60) and non-obese (from 27.29 to 53.08); statistically significant difference was found in mean SF-12 MCS score in obese (48.59–56.37) and non-obese patients (53.02–57.94) which can be attributed to the pain relief postoperatively. In the

obese group, three cases were found to have superficial wound infection which due to timely action did not progress to a deep infection and did not warrant any surgical intervention.

Conclusion

With the increasing rate of obesity in patients undergoing TKR, it is important to understand if these patients have results comparable with non-obese patients. It is also of vital

importance to know if these patients have to live with compromised results after surgery. The present study assesses the patients' perception of their outcomes which are important in clinical decision-making. There was no significant difference found in patient-perceived parameters, and functional and radiological outcomes at the end of 6 months following unilateral or bilateral TKR in both obese and non-obese patients.

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

Conflict of Interest: NIL; **Source of Support:** NIL

References

- Jester R, Rodney A. The relationship between obesity and primary total knee replacement: A scoping review of the literature. *Int J Orthop Trauma Nurs* 2021;42:100850.
- Garellick G, Malchau H, Herberts P, Hansson E, Axelsson H, Hansson T. Life expectancy and cost utility after total hip replacement. *Clin Orthop Relat Res* 1998;346:141-51.
- Lau EC, Cooper C, Lam D, Chan VN, Tsang KK, Sham A. Factors associated with osteoarthritis of the hip and knee in Hong Kong Chinese: Obesity, joint injury, and occupational activities. *Am J Epidemiol* 2000;152:855-62.
- Felson DT, Lawrence RC, Dieppe PA, Hirsch R, Helmick CG, Jordan JM, et al. Osteoarthritis: New insights. Part 1: The disease and its risk factors. *Ann Intern Med* 2000;133:635-46.
- Cooper C. Occupational activity and the risk of osteoarthritis. *J Rheumatol Suppl* 1995;43:10-2.
- Bray GA. Overweight is risking fate. Definition, classification, prevalence, and risks. *Ann NY Acad Sci* 1987;499:14-28.
- Fehring TK, Odum SM, Griffin WL, Mason JB, McCoy TH. The obesity epidemic: Its effect on total joint arthroplasty. *J Arthroplasty* 2007;22(6 Suppl 2):71-6.
- Namba RS, Paxton L, Fithian DC, Stone ML. Obesity and perioperative morbidity in total hip and total knee arthroplasty patients. *J Arthroplasty* 2005;20:46-50.
- Dowsey MM, Liew D, Stoney JD, Choong PF. The impact of pre-operative obesity on weight change and outcome in total knee replacement: A prospective study of 529 consecutive patients. *J Bone Joint Surg Br* 2010;92:513-20.
- Pulido L, Ghanem E, Joshi A, Purtill JJ, Parvizi J. Periprosthetic joint infection: The incidence, timing, and predisposing factors. *Clin Orthop Relat Res* 2008;466:1710-5.
- Chesney D, Sales J, Elton R, Brenkel IJ. Infection after knee arthroplasty a prospective study of 1509 cases. *J Arthroplasty* 2008;23:355-9.
- Malinzak RA, Ritter MA, Berend ME, Meding JB, Olberding EM, Davis KE. Morbidly obese, diabetic, younger, and unilateral joint arthroplasty patients have elevated total joint arthroplasty infection rates. *J Arthroplasty* 2009;24:84-8.
- Dowsey MM, Choong PF. Obese diabetic patients are at substantial risk for deep infection after primary TKA. *Clin Orthop Relat Res* 2009;467:1577-81.
- Ayyar V, Burnett R, Coutts FJ, Van der Linden ML, Mercer TH. The influence of obesity on patient reported outcomes following total knee replacement. *Arthritis* 2012;2012:185208.
- Agur AM, Dalley AF. *Grant's Atlas of Anatomy*. 12th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2009.
- World Health Organization. *Obesity: Preventing and Managing the Global Epidemic Report of a WHO Consultation*; 2000. Available from: https://www.who.int/nutrition/publications/obesity/who_trs_894/en/index.html [Last accessed on 15 July 2011].
- Amin AK, Patton JT, Cook RE, Brenkel IJ. Does obesity influence the clinical outcome at five years following total knee replacement for osteoarthritis? *J Bone Joint Surg Br* 2006;88:335-40.
- Cobb J, Henckel J, Gomes P, Harris S, Jakopec M, Rodriguez F, et al. Hands-on robotic unicompartmental knee replacement: A prospective, randomised controlled study of the acrobot system. *J Bone Joint Surg Br* 2006;88:188-97.
- Foran JR, Mont MA, Etienne G, Jones LC, Hungerford DS. The outcome of total knee arthroplasty in obese patients. *J Bone Joint Surg Am* 2004;86:1609-15.
- CORI Surgical System: Smith+Nephew USA. Available from: <https://www.smith-nephew.com/en-us/health-care-professionals/products/orthopaedics/cori> [Last accessed on 2023 Jun 18].
- Foran JR, Mont MA, Rajadhyaksha AD, Jones LC, Etienne G, Hungerford DS. Total knee arthroplasty in obese patients: A comparison with a matched control group. *J Arthroplasty* 2004;19:817-24.
- Jiganti JJ, Goldstein WM, Williams CS. A comparison of the perioperative morbidity in total joint arthroplasty in the obese and nonobese patient. *Clin Orthop Relat Res* 1993;289:175-9.
- Miric A, Lim M, Kahn B, Rozenthal T, Bombick D, Sculco TP. Perioperative morbidity following total knee arthroplasty among obese patients. *J Knee Surg* 2002;15:77-83.
- Deshmukh RG, Hayes JH, Pinder IM. Does body weight influence outcome after total knee arthroplasty? A 1-year analysis. *J Arthroplasty* 2002;17:315-9.
- Stickles B, Phillips L, Brox WT, Owens B, Lanzer WL. Defining the relationship between obesity and total joint arthroplasty. *Obes Res* 2001;9:219-23.
- Stevens-Lapsley JE, Petterson SC, Mizner RL, Snyder-Mackler L. Impact of body mass index on functional performance after total knee arthroplasty. *J Arthroplasty* 2010;25:1104-9.

27. Bin Abd Razak HR, Chong HC, Tan AH. Obesity does not imply poor outcomes in Asians after total knee arthroplasty. Clin Orthop Relat Res 2013;471:1957-63.

Conflict of Interest: NIL

Source of Support: NIL

How to Cite this Article

Phadnis AS, Ranjalkar SS, Kumar V, Sangare P, Gabhe S. Evaluation of Functional and Radiological Outcome of Total Knee Replacement Surgery in Obese V/S Non-obese Patients. Journal of Clinical Orthopaedics July-December 2024;9(2):95-99.