

The Effect of Obesity on Functional Outcome After Total Knee Arthroplasty

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ABSTRACT

Objective: To evaluate the effect of obesity on functional outcome of TKA in terms of range of motion and knee society score.

Methods: This is a prospective observational study. We included 350 consecutive patients in whom simultaneous bilateral total knee arthroplasty was done due to knee osteoarthritis from April 2014 to June 2015 by a single surgeon in a single centre. Patients' demographic data, weight, height, body mass index, preoperative range of motion and knee society score was taken from Pakistan National Joint Registry. Patients were divided into four groups according to BMI: (1) normal (2) overweight (3) obese and (4) severely obese. At 6 months, detailed assessment of the patients, which included range of motion and calculation of knee society score, was done. We evaluated the effect of obesity on functional outcome after TKR by comparing means and proportions of the outcome variables across these four groups.

Results: At the follow-up after 6 months, we found similar improvement in range of motion and knee society scores in obese and non-obese patients.

Conclusions: Obese patients should not be refrained from having TKA if indicated. The data reflects that after surgery, their mobility increases so they can reduce their weight as well as the chances of having associated morbidities.

Key words: Total knee arthroplasty, Body mass index, obesity

INTRODUCTION

Total knee arthroplasty is a well-known and common surgery done to alleviate the pain and disability of knee osteoarthritis [1]. Obesity is one of a predisposing factor for knee osteoarthritis. The role of obesity in causing knee OA seems to be mechanical [2]. As the obesity is becoming prevalent, the rate of total knee arthroplasty is increasing [3].

Obesity is defined and classified on the basis of body mass index as it reflects the amount of total body fat. BMI is calculated by dividing weight in kilograms with height in meter square [4]. BMI of 30 kg/m² or greater is categorized as obesity [5]. There are several studies evaluating the impact of BMI on functional status after total knee replacement. Some studies conclude negative effects of increasing BMI on functional outcome at follow-up of TKR [6-8]. On the

contrary, other studies stated comparable results for obese and non obese patients [9-12]. Most of these studies have been done in Western countries. As the incidence of obesity and the associated comorbidities in our region is increasing [13,14], there is a need of studies evaluating the effects of BMI on outcomes of TKA in our region to better address the expectations of our patients. In addition, the hesitation of orthopedic surgeons to perform TKA in obese patients in fear of having suboptimal outcome should be validated through these studies.

We evaluate in our study whether obesity adversely affects the postoperative functional status of the patients after TKA compared with non-obese patients.

The objective of this study is to evaluate the effect of obesity on functional outcome of TKA in terms of range of motion and knee society score (knee score and function score) [15].

METHODS

This is a prospective observational study. We included 350 consecutive patients in which simultaneous bilateral total knee arthroplasty was done due to knee

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osteoarthritis from April 2014 to June 2015 by a single surgeon. All patients had the similar operative technique and postoperative rehabilitation. The patients with rheumatoid arthritis or secondary OA were excluded as well as the patients in whom the femoral and tibial implants with long stems or wedges were used.

Before surgery, patient’s demographic details, height, weight, body mass index and comorbidities were reported in preoperative assessment clinic and documented in Pakistan National Joint Registry (PNJR). Range of motion and other assessments required to calculate knee society score were also done and documented in the registry. For our study, we took all this preoperative data from PNRJ.

Knee society score (KSS) has two components, knee score and function score. Both scores are calculated out of 100. Knee score reflects the condition of the joint and the parameters assessed are pain (50 points), range of movement (25 points) and stability (25 points) with deductions for flexion contracture, extension lag and mal-alignment. Function score rates the mobilization status of the patient and includes the walking distance (50 points) and the ability to climb stairs (50 points), with deductions for any walking aids used.

In all the patients, simultaneous bilateral posterior-stabilized TKA was done. Tourniquet was applied during the procedure. Midline incision was given. The approach was medial parapatellar. Standard tibial and femoral implant was used in all the patients included in the study. All patients had patellar resurfacing.

Postoperative care was similar in all patients with epidural analgesia for first 3 days in addition to

appropriate I/V and oral analgesia, subcutaneous injection Enoxaparin for thromboprophylaxis from the first postoperative day and oral agent (Aspirin or Rivoraxaban) on discharge for total two weeks after surgery. All patients started full weight bearing mobilization on 1st postoperative day under the supervision of physiotherapist with assisted active range of motion of knee from 3rd postoperative day. On discharge, patients were followed in OPD at 2 weeks for removal of skin staples, 6 weeks, 3 months and 6 months. At 6 months, detailed assessment of the patients, which included range of motion and calculation of knee society score, was done. We used this range of motion and outcome scores of 6 months follow up for our study as functional status at six months has been reported to be a reflection of long-term functional outcome after TKA [18].

Patient’s demographic details and all preoperative and postoperative data were recorded in a questionnaire.

In order to divide the patients in groups, we used the categories of obesity according to BMI as per World Health Organization: underweight (< 18.5 kg/m²), normal (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obesity class 1 (30.0–34.9 kg/m²), class 2 (35.0–39.9 kg/m²), and class 3 (≥ 40.0 kg/m²). We merged class 2 and 3 into one group due to small number of patients. So, we finally divided the patients into four groups: (1) normal (< 25.0 kg/m²); (2) overweight (25.0–29.9 kg/m²); (3) obese (30.0–34.9 kg/m²); and (4) severely obese (≥ 35.0 kg/m²).

Statistical analyses were done through Statistical Package for the Social Sciences (SPSS) version 20.

Table 1: Demographic details and BMI of the patients

Demographic variables	Normal (BMI<25kg/m ²) n=72	Overweight (BMI 25-29.90kg/m ²) n= 116	Obese (BMI 30-34.90kg/m ²) n=93	Severely obese (BMI≥35kg/m ²) n= 69	p-value
Mean age in years (± SD)	65 (±2.8)	66 (±3.71)	63 (±0.83)	62 (±1.74)	<0.001
Gender :Female (%)	48(67)	75(65)	63(67)	47(68)	0.965
Mean BMI in kg/m ² (± SD)	24.33 (± 0.47)	27.33 (±1.11)	32.80 (±1.14)	35.86 (±0.26)	
No of Patients with comorbidities					
a) Diabetes (%)	5 (7)	19 (16)	23 (24)	25 (36)	<0.001
b) HTN(%)	13 (18)	56 (48)	62 (67)	54 (79)	<0.001
c) IHD(%)	6 (8)	32 (28)	38 (41)	43 (62)	<0.001

Table 2: Preoperative (baseline) range of motion and functional status

Variables	Normal (BMI<25kg/m ²) n=72	Overweight (BMI 25-29.90kg/m ²) n= 116	Obese (BMI 30-34.90kg/m ²) n=93	Severely obese (BMI≥35kg/m ²) n= 69	p-value
Mean range of motion of right knee (±SD)	100 (±0.64)	90 (±0.54)	83 (±4.27)	80 (±0.61)	<0.001
Mean range of motion of left knee (±SD)	94 (±4.79)	90 (±9.02)	88 (±4.25)	83 (±9.40)	<0.001
Mean knee score of right knee (±SD)	27 (±2.47)	26 (±2.23)	23 (±1.00)	21 (±0.95)	<0.001
Mean knee score of left knee (±SD)	25 (±1.12)	26 (±2.67)	24 (±2.48)	21 (±2.18)	<0.001
Mean function score (±SD)	35 (±4.11)	32 (±2.46)	29 (±4.15)	28 (±2.07)	<0.001

Table 3: Range of motion and outcome scores at 6 months follow up

Variables	Normal (BMI<25kg/m ²) n=72	Overweight (BMI 25-29.90kg/m ²) n= 116	Obese (BMI 30-34.90kg/m ²) n=93	Severely obese (BMI≥35kg/m ²) n= 69	p-value
Mean range of motion of right knee (±SD)	110 (±0.98)	104(±4.78)	*100(±0.62)	*100(±1.16)	<0.001
Mean range of motion of left knee (±SD)	107(±4.76)	108(±4.02)	107(±4.51)	103(±4.98)	<0.001
Mean knee score of right knee (±SD)	65(±0.00)	65(±1.47)	*62(±1.66)	*61 (±1.89)	<0.001
Mean knee score of left knee (±SD)	65(±0.94)	66(±0.89)	*63(±2.30)	*63(±2.51)	<0.001
Mean function score (±SD)	78(±2.37)	73(±2.46)	69(±2.17)	67(±2.37)	<0.001

*There was statistically insignificant difference between obese and severely obese groups in the mean values of range of motion of right knee ($p=0.944$) and knee score of both the knees. (right knee: $p=0.882$, left knee: $p=0.055$)

Results: Out of 350 patients, 72 had normal BMI, 116 were overweight, 93 were obese and 69 were severely obese. Severely obese patients were younger than others

($p<0.001$). However, the comorbidities were more prevalent in those patients.

($p<0.001$). The difference in gender proportions among the four groups was not significant ($p=0.956$) [Table 1].

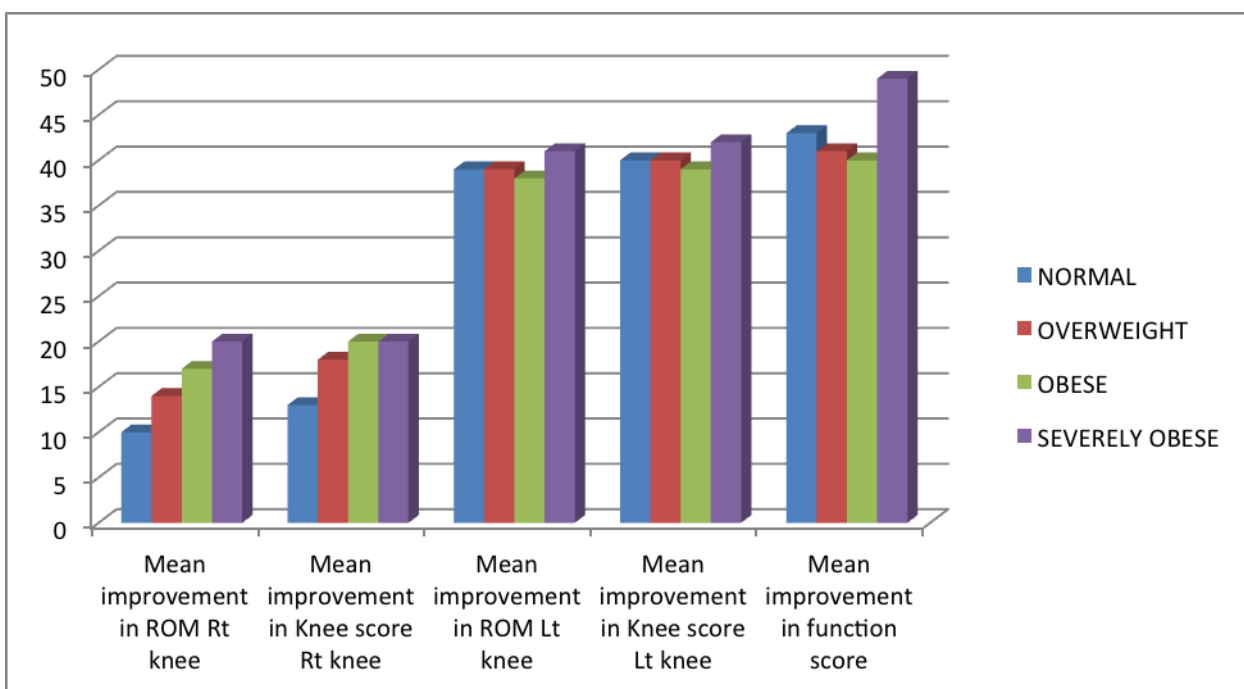
Preoperatively, severely obese patients had lower range of motion, knee score and function score ($p<0.001$) [Table 2].

At 6 months follow-up, obese and severely obese patients had lower range of motion and knee society scores ($p< 0.001$) [Table 3]. On comparing the improvements in ROM and outcome scores, obese and severely obese patients had similar increment in ROM, greater than other two groups. However, improvement in outcome scores was significantly greater in severely obese patients than that in the other three groups. [Table 4]

Table 4: Improvements in range of motion and outcome scores at 6 months

Variables	Normal (BMI<25kg/m ²) n=72	Overweight (BMI 25-29.90kg/m ²) n= 116	Obese (BMI 30-34.90kg/m ²) n=93	Severely obese (BMI≥35kg/m ²) n= 69	p-value
Mean improvement in range of motion of right knee(±SD)	10 (±1.24)	14 (±4.85)	17 (±4.15)	20 (±1.32)	<0.001
Mean improvement in range of motion of left knee(±SD)	13 (±4.83)	18 (±3.14)	*20 (±7.21)	*20 (±8.12)	<0.001
Mean improvement in knee score of right knee(±SD)	39 (±2.17)	39 (±7.64)	38 (±2.18)	41 (±2.50)	<0.001
Mean improvement inknee score of left knee(±SD)	40 (±1.26)	40 (±2.34)	39 (±2.40)	42 (±2.07)	<0.001
Mean improvement in function score(±SD)	43 (±2.37)	41 (±2.00)	40 (±3.53)	49 (±1.42)	<0.001

*There was insignificant difference among the obese and severely obese groups in improvement in range of motion of left knee (p=0.958)

**Figure 1:** Comparison of Improvements in range of motion and outcome scores of the four groups

DISCUSSION

The incidence of obesity is increasing in our region [13]. Obese patients are continuously at risk of having certain metabolic and degenerative disorders especially diabetes, cardiovascular disorders and osteoarthritis of weight bearing joints [16]. Health risks of obesity increase with its severity, which is predicted by calculating BMI [5].

As the obesity is becoming prevalent, the rate of total knee arthroplasty is increasing [3]. It is imperative to know the impact of obesity on outcomes of TKA. This knowledge will influence the patients' selection as well as aid in preoperative counseling and in better addressing the expectations and concerns of the patients. In addition, the hesitation of orthopedic surgeons to perform TKA in obese patients in fear of having suboptimal outcome should be validated through the studies.

Our study intended to evaluate whether obesity is linked with poorer functional outcome after TKA and lesser improvement from preoperative to postoperative state.

We found that patients with BMI of more than 30 kg/m² had greater increment in range of motion and in functional outcome than the patients having lesser BMI in short term follow up of 6 months after bilateral TKA. The result may influence the decision of the surgeons who are hesitant to operate on obese patients with the fear of not having expected improvement in the quality of life. The current literature search reveals several studies evaluating the impact of obesity on functional outcome after TKR. Some studies showed the worsening effect of obesity on outcome of TKA [6-8] while the authors of other studies concluded similar outcome among the obese and non-obese patients [9-12]. We divided the patients in four BMI groups as divided by Chong HC et al [9]. Concurring with Spicer et al [17], we also found the lower preoperative knee society scores in our study in obese and severely obese patients reflecting the worse effects of obesity on weight bearing joints [2]. The follow-up duration of our study was six months as functional status at six months has been reported to be a reflection of long term functional outcome after TKA [18].

Our study reported lower postoperative range of motion and knee society score of obese and severely obese patients (BMI>30kg/m²) similar to the finding reported by A.K. Amin et al [6] but the mean improvement in all the outcome measures of this study

in severely obese patients is more than the other patients. This partially coincides with Chong HC et al [9] who found greater improvement in range of motion in patients with BMI > 35kg/m². This result is partially comparable to the studies concluding that obesity is not associated with a worse functional outcome after TKA [9-12,19].

Our study has certain limitations. We had smaller number of patients with BMI of more than 35kg/m² (severely obese). Also, this group had poorer range of motion and outcome scores. So we were not able to match the features of all four groups to get a more valid result. This either reflects the distribution of our local population or usual selective referrals for TKA. Another limitation is that we evaluate and categorize the patients according to obesity preoperatively only. The patients might have gained or lost weight till follows up although literature suggests that BMI changes little during rehabilitation after TKA [20]. Third limitation is that we did not evaluate the effect of comorbidities on functional outcome. Fourth is that this study has not reported perioperative complications, although the literature revealed that the obese patients do develop more perioperative complications [6].

In the light of above results that the joint mobility and functional status of obese patients also improve after TKA at least similar to non obese patients, we believe and conclude that obesity or higher BMI should not be used as an obligatory excluding factor for TKA due to the fear of worse outcome. If obese patients with advanced OA or with clear indication of TKA are turned away from surgery till weight reduction, there is a very little chance of weight decrement due to severe pain and restricted mobility associated with severe OA. So our study is a continuation of the literature, which recommends that obesity alone should not be considered as a strong determinant of worse outcome of TKA. These patients should have a timely intervention so that they can reduce their weight by virtue of increased mobility and minimize the chances of having associated morbidities.

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