

Evaluating the effect of obesity on total knee arthroplasty: A longitudinal study

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Abstract

Objectives: To evaluate the effect of obesity on total knee arthroplasty, and on patient-reported outcomes.

Methods: The longitudinal study was conducted from September 2013 to August 2015 at The Second Hospital of Jinlin University, Changchun, Jinlin, China, a tertiary hospital. Using universal sampling method, all patients who underwent elective total knee arthroplasty were included in the study. Data was collected using a semi-structured questionnaire, Oxford Knee Score, and Short Form 12 Questionnaire. SPSS 19 was used for statistical analysis.

Results: Of the 183 patients, 104(57%) were obese and 79(43%) were non-obese. The mean age was 63.7 ± 8.4 years and 65.0 ± 8.8 years in obese and normal patients respectively ($p=0.31$). A statistically significant association was observed with regard to Oxford knee score in both groups of patients ($p<0.05$). Overall, 7(8.9%) patients from the non-obese category and 23(22.1%) from the obese category presented with local complications, while another 7(3.8%) patients had to undergo a revised surgery.

Conclusion: It is very important to equate the outcomes of the surgery in obese and normal individuals.

Keywords: Total knee arthroplasty, Obesity, Body mass index, Oxford Knee Score. (JPMA 67: 3; 2017)

Introduction

Total knee arthroplasty (TKA) has been ranked as one of the very common surgical procedures and can result in massive improvement in the functioning ability of patients with knee arthritis.¹ Owing to the increase in life expectancy and rising rates of obesity worldwide, a definite surge in the number of TKA has been observed.² Similar trends have been observed even among the Chinese population.^{3,4} In fact, the current trends give an impression that the incidence of TKA among the obese is expected to rise further.^{5,6}

This is of great importance as the success, failure and outcome of TKA among overweight or obese patients significantly differ from the clinical outcome in non-obese individuals.⁷⁻¹⁰ TKA in obese individuals is technically more challenging as the duration of surgery is longer,^{11,12} more number of intra-operative complications,^{9,12,13} slow post-operative recovery and thus longer duration of patient stay;^{14,15} more expenditure;¹⁵ high risk of post-operative complications;^{12,13,16} increased rates of revision;¹⁵ and increased incidence of implant failure.^{17,18}

The current study was planned to evaluate the effect of obesity on the outcomes of TKA, and on patient-reported outcomes.

Patients and Methods

The longitudinal prospective cohort study was conducted

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from September 2013 to August 2015 at The Second Hospital of Jinlin University, Changchun, Jinlin, China, a tertiary hospital.

The first year of the study period was meant for inclusion of patients, while the second year was for follow-up of patients at 6 and 12 months post-surgery. A longer follow-up might have resulted in loss to follow-up of many of the enrolled subjects, and was therefore avoided. Institutional ethics committee approval was taken before the study and all precautions were taken to maintain the confidentiality of responses.

Using universal sampling, all patients who underwent elective TKA during the study period were included to ensure that maximum number of subjects were included.

All non-obese and obese individuals (Body Mass Index [BMI] > 30kg/m²) who underwent elective TKA and were willing to undergo the follow-up were included. Those patients who were not willing were excluded.

Data was collected using a questionnaire to obtain details about socio-demographic details. Oxford Knee Score (OKS) was also used which consists of 12 questions to assess patients' knee function. The questions are allotted points from 1 (least score; least difficulty) to 5 (highest score; maximum functional difficulty).¹⁹ Short Form (SF) 12 questionnaire was used as well. It can measure the overall physical and mental health through 12 questions. It has a physical component summary (PCS), and mental component summary (MCS). The least score is 0, reflecting the worst health, and the maximum score is 100, reflecting the best health.²⁰

All the selected individuals had their BMI computed pre-operatively, and based on that they were categorised as obese (BMI ≥ 30 Kg/m²) and non-obese (BMI < 30 Kg/m²).

For each of these patients, the OKS and SF-12 were obtained thrice - 7 days before surgery, six months and 12 months after the operation. X-rays were taken for each of the patients in the pre- and post-operative period and patients were systematically assessed in the two categories of obese and non-obese.

Medial parapatellar approach was used for the surgery and the line of management was kept uniform for all patients irrespective of their BMI. The subjects were followed up for one year after the surgery at periodic intervals to assess clinical outcome. All measures were taken to prevent any attrition and were monitored during their follow-up for improvement in clinical outcome.

Socio-demographic parameters of the patient, pre-existing chronic illnesses, functional aspects using OKS (viz. walking distance, etc.), local and systemic complications, and need for revision surgery were taken as study variables.

SPSS 19 was used for statistical analysis. Frequency and percentages were calculated for the study variables. Association between the two groups was assessed using one-way analysis of variance (ANOVA), Chi-square test, and Fisher's test.

Results

During the first year of the study, 230 TKA surgeries were performed; 132(57%) obese and 98(43%) non-obese. Of them, 47(20.4%) patients were lost to follow-up; 28(21.2%) from the obese and 19(19.4%) from the non-obese category. Thus, the final sample size was 183(79.5%), consisting of 104(57%) obese and 79(43%) non-obese patients.

The mean age was 63.7 \pm 8.4 years and 65.0 \pm 8.8 years in obese and normal patients respectively. Among the 104 obese patients, 67(64.4%) were men and 37(35.5%) were females. There was significant relationship between the two groups with regard to OKS in the pre-operative period ($p < 0.05$). A positive relationship was observed between SF score and obesity ($p < 0.05$), suggesting that obese patients in the pre-operative phase had more functional disabilities and physical complaints as opposed to their non-obese counterparts. In addition, 66(63.5%) obese patients were hypertensive (Table-1). Obese patients stayed in the hospital for 7 \pm 0.9 days while non-obese patients stayed for 6.2 \pm 0.8 days following TKA.

During follow-up, a statistically significant association was

Table-1: Socio-demographic attributes of the study subjects.

Socio-demographic attributes	Non-obese Mean \pm SD (N=79)	Obese Mean \pm SD (N=104)	P-value
Age (years) \S	65.0 \pm 8.8	63.7 \pm 8.4	0.31
Males \S	36 \pm 45.6	67 \pm 64.4	0.005
OKS (pre) \S	42.1 \pm 8.0	45.7 \pm 7.3	0.001
SF-12 PCS (pre) \S	27.5 \pm 6.4	29.6 \pm 6.8	0.03
SF-12 MCS (pre) \S	50.7 \pm 10.2	49.1 \pm 11.1	0.31
Diabetes Mellitus n (%)#	11 (7.6%)	12 (11.5%)	0.31
Hypertension n (%)#	36 (45.6%)	66 (63.5%)	0.01
Cardiac disease n (%)#	6 (7.6%)	8 (7.7%)	0.49
Previous TKA n (%)#	5 (6.3%)	11 (10.6%)	0.15
Previous THR n (%)*	8 (10.1%)	2 (1.9%)	0.01

\S One-way ANOVA test

Chi-square test

*Fisher Exact test

OKS: Oxford knee score

SF: Short form

PCS: Physical component summary

MCS: Mental component summary

TKA: Total knee arthroplasty

THR: Total hip replacement.

Table-2: Scores comparison in the post-operative period among groups.

Parameters*	Non-obese Mean \pm SD (N=79)	Obese Mean \pm SD (N=104)	P-value
OKS 6 months	32.2 \pm 11.1	41.2 \pm 8.6	0.001
OKS 1 year	26.5 \pm 9.0	37.8 \pm 7.5	0.001
SF12 PCS 6 months	26.2 \pm 9.4	29.0 \pm 11.2	0.07
SF12 PCS 1 year	24.7 \pm 8.6	28.9 \pm 8.3	0.001
SF12 MCS 6 months	49.0 \pm 7.8	47.7 \pm 7.5	0.25
SF12 MCS 1 year	47.8 \pm 9.2	45.7 \pm 9.6	0.13

* One-way ANOVA test

OKS: Oxford Knee Score

SF: Short form

PCS: Physical component summary

MCS: Mental component summary.

observed with regard to OKS at 6 months and 1 year in both groups ($p < 0.05$). Persistent improvement was observed in the physical component of SF12 in the pre-operative and at 6 months and 12 months after the surgery. However, similar improvement was not observed among the obese category. Although, no significant association was observed in the mental component of the SF12 score ($p > 0.05$) but patients from both the group showed improvement in the follow-up period (Table-2).

Overall, 7(8.9%) patents from the non-obese category and 23(22.1%) from the obese category presented with local complications following surgery. In addition, total 22(12%) patients even encountered systemic

Table-3: Post-operative complications and revision surgery.

Complications	Non-obese (%) (N=79)	Obese (%) (N=104)	P-value
Local complications#	7 (8.9%)	23 (22.1%)	0.007
Systemic complications#	3 (3.8%)	19 (18.3%)	0.001
Revisions*	1 (1.3%)	6 (5.8%)	0.1

Chi-square Test
*Fisher Exact Test.

complications following TKA. Further, 7(3.8%) patients had to undergo a second surgery, of which 6(86%) were obese. Finally, the rate of complications both local and systemic was significantly associated between the two groups ($p < 0.05$) (Table-3).

Discussion

Over the years, significant debate has been done on the effect of BMI on TKA. The present longitudinal study showed that the mean age was 63.7 years and 65 years in obese and normal patients respectively. Findings of another longitudinal study showed the mean age of the participants was on the lower side as 62.2 years (obese) and 62.8 years (non-obese).¹³ Although our study showed preponderance of male (56.3%) patients, findings of a four-year prospective study revealed high percentage of female (80.5%) patients.⁴

In the current study, a positive association was observed in the pre-operative phase between obesity and OKS or SF score. This is not a new finding. In fact, most of the studies in which comparisons have been made between obese and non-obese subjects, especially in the pre-operative phase, have shown more functional disabilities and physical complaints in the obese individuals.^{10,12} Further, around 140(76.5%) patients had one or more major coexisting illnesses like cardiovascular disease or diabetes or hypertension.

In our longitudinal study it was observed that the mean preoperative OKS was poorer for the obese (45.7) group of patient than the non-obese (42.1) category of patients. In fact, this association was statistically significant in our study ($p < 0.05$). However, no such relationship was evident in another study done in Edinburgh.¹ This could be probably because of the less number of subjects enrolled in the study.

Further, a statistically significant association was observed with regard to OKS at 6 months and 1 year in both groups. Similar results have been obtained in other cohort studies performed in Canada and United States of America using different scores.^{21,22} Although the follow-up of the

patients post-surgery revealed no positive relationship in the mental component of SF12, but patients from both the group showed improvement in the follow-up period. However, the findings of a systematic review revealed that most of the patients did not have a remarkable improvement in the mental component of the score post-operatively.²³ The findings of studies performed across various settings and under different circumstances has shown that the majority of the patients shows optimal improvement in their routine functioning after 26 weeks of the TKA.²⁴ Similar sort of trends were obtained in our study in both groups, especially pertaining to the physical component of the function.

Further, out of the 183 patients who underwent TKA, 7(8.9%) from the non-obese category and 23(22.1%) from the obese category presented with local complications like wound infection or wound leak following surgery. In fact, local infection is the most frequent complication following surgery.¹⁷ Not only that, the incidence of complication is definitely more among the obese group of patients.^{17,24} Moreover, 7(3.8%) patients had to undergo a second surgery, of which 6 were obese. This is a very frequent finding among the morbidly obese patients and, hence, the extent of obesity significantly determines the risk of revisions.^{17,18}

The strength of our study is the comprehensive nature of the study, in which most of the common variables were assessed, and the longer duration of follow-up of patients at periodic intervals to identify both early and late complications of the surgery. However, advanced statistical and research-based considerations need to be taken to conclusively establish the obtained results are due to obesity alone. However, the study had its limitations like almost none of the enrolled patients had a BMI in excess of 40kg/m² and the sample size was also small and came from a single institute. Hence, the results cannot be generalised to all the obese patients undergoing TKA.

Conclusion

As a major proportion of the obese patients had to undergo TKA, it is important to equate the outcomes of the surgery in obese and normal individuals. Based on the identified complications, adequate measures like motivating individuals to adopt healthy lifestyles can be implemented to not only improve, but make it comparable with the outcome among normal persons.

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Conflicts of Interests: None.

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