Outcome of Total Knee Arthroplasty in Obese Patients
Chin Tat Lim, Puang Huh Bernard Lau, Heng Hee Li, Lingaraj Krishna
+1University Orthopaedic, Hand and Reconstructive Surgery Cluster, National University Health System, National University of Singapore
chintat_lim@yahoo.com.sg

Introduction
The efficacy of total knee arthroplasty in osteoarthritis of the knee is well reported. Total knee arthroplasty has been associated with excellent survival and functional results. However, total knee arthroplasty in obesity has been associated with increased wound infection, technical errors, medial collateral ligament avulsions, lower post-operative range of movement and lower clinical function scores. This prospective observational study aims to:

I. Explore the differences between obese and non-obese patients at baseline prior to total knee arthroplasty.
II. Compare objective and subjective clinical outcomes in both groups of patients after total knee arthroplasty.
III. Identify key aspects in the management of the obese patient so that the outcome of surgery can be optimized.

Methods
We prospectively analyzed all consecutive patients who underwent total knee arthroplasty in a tertiary university centre from December 2008 to July 2009. The patients were grouped according to their pre-operative body mass index (BMI) as follows: non-obese (BMI < 30 kg/m²) and obese (BMI ≥ 30 kg/m²). Demographic variables of age, gender, and comorbidity were retrieved. Preoperative and one-year postoperative Western Ontario McMaster University Osteoarthritis Index (WOMAC) score, Knee Society Score, Short Form 36, patient satisfaction survey and range of movement were compared across patients. Linear regression modelling was used to evaluate the effects of baseline clinical characteristics in predicting postoperative changes in the WOMAC, KSS and SF 36 scores.

Results
There were a total of 142 patients with 39 obese patients and 103 non-obese patients. Baseline clinical characteristics of the obese and non-obese groups are shown in Table 1. There were no significant differences in age, gender, side of operation, diabetes mellitus, stroke and ischaemic heart disease between the obese and non-obese groups. There was however significantly higher proportion of hypertensives (87.2 vs. 64.1, p = 0.007) and varus- (87.2 vs. 66, p=0.012) aligned knees in the obese population. Both obese and non-obese groups obtained statistically significant improvements in clinical scorings and range of movement post-operatively (P<0.001).

Pre-operative maximum extension, KSS scores, WOMAC scores and SF36MCS were similar between obese and non-obese patients. The non-obese group has significantly superior pre-operative range of movement and SF36PCS (p < 0.05). This superior range of movement in non-obese group is maintained post-operatively, but the SF36PCS is similar between the 2 groups post-operatively. Post-operatively, the non-obese group also attained superior KSS Function scores and maximum flexion (p<0.05).

There was significantly more improvement in the non-obese group in KSS function score (p = 0.017). Absolute improvements in SF36, KSS Knee score, WOMAC score and range of movement were not significant.

Linear regression analysis taking into account patient characteristics of age, gender, co-morbidities) and corresponding preoperative SF36-PCS, preoperative range of movement and preoperative dependent parameter continue to show significantly more improvement in non-obese group than the obese group in KSS function score (p=0.002). Improvements in SF36, KSS Knee score, WOMAC score and range of movement were not significant.

Post-operative complications were also analyzed. The three most common complications of deep vein thrombosis, wound infection and cardiac events are presented. There was a non-significant trend towards higher rates of DVT, wound infection and cardiac complications in the obese group.

Length of stay was defined as day of admission to the day of discharge. Mean length of stay was also statistically significantly higher in obese patients than non-obese patients (7.77 vs. 6.29, p = 0.043).

Discussion
Based on the results of our study, we have achieved the objectives as outlined in the introduction.

Firstly, both study groups were generally well matched except for alignment, prevalence of hypertension, pre-operative SF 36 PCS scores and pre-operative range of movement. This is not unexpected as the increased load leads to excessive medial knee joint cartilage wear and varus deformed knee. Obesity is also commonly associated with increased risk of hypertension and diabetes mellitus. Obesity is a known risk factor for osteoarthritis due to increased loading as well as adipocytes-induced activation of pro-inflammatory agents. Thus our obese subjects have lower SF 36 PCS scores and reduced pre-operative range of movement. We factored these differences into our study by adjusting for these variables in the multivariate analysis.

Secondly, we have demonstrated changes in objective and subjective clinical outcomes between the obese and non-obese groups. Overall, both groups of patients have statistically significant improvements in all parameters post-operatively. Consistent with other studies, the excellent result of TKR is shown in both obese and non-obese groups in our centre. However, our obese patients performed inferiorly post-operatively in KSS Function scores, range of movement and maximum flexion. Our study showed the obesity influence adversely both the post-operative KSS Function Score as well as the absolute improvement in KSS Function Score. KSS Function Scores consider walking distance, stair climbing and need for walking aids in the assessment of the patient. On the other hand, short-term studies of obesity did not short any differences between obese patients and non-obese. Mid-term analysis by Spicer et al and Jackson et al however do show inferior clinical scoring in obese patients. All these studies are performed in the United States and Europe. To our knowledge, there are no studies evaluating obesity and arthroplasty in the Asian population.

Finally, there was no difference in maximum flexion between the obese group and the non-obese group pre-operatively. However, the post-operative maximum flexion is significantly better in the non-obese group. We felt that the improvement in maximum flexion within the obese group may be restricted secondary to possibly large amount of thigh and calf soft tissues opposition. Although there was no difference in the absolute improvement in range of movements between the 2 groups, non-obese patients has significantly superior range of movement compared to obese patients. We postulate that the limitations in maximum flexion might have restricted the improvement in range of movement in obese group. For future studies, it may be useful to collect thigh and calf circumferences in order to identify and address the underlying reason for inferior results among obese patients.

Total knee arthroplasty is a safe and efficacious operation in obese patients with no significantly greater risk of complications. However, post-operative clinical scores and absolute improvement in the scores are statistically superior in non-obese patients at one year follow-up. Obese patients should be started on weight loss programs and counseled about possible inferior results for total knee replacement.

Significance
In view of the rising prevalence of obesity and predisposition of obese patients for osteoarthritis of the knee, we performed a prospective cohort study of obese patients and their one-year outcomes following total knee arthroplasty. We report both objective and subjective components of their one-year outcomes.