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Comparison between Obese and Non-obese Cases after Total Knee Arthroplasty Regarding Their Short-Term Functional Outcome

Mohamed M. Safaa Eldin[1], Ahmed S. Kamal[1]*, Kamal S. Abdel Maguid[1], Mohamed S. Elazab[1]

[1]Department of Orthopedic Surgery, Faculty of Medicine, Fayoum University, Fayoum 63511, Egypt.

*Correspondence: Ahmed S. Kamal, asm15@fayoum.edu.eg, Tel: (002) 01003737975.

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Abstract:

Introduction: Obesity is considered one of the risk factors for developing knee osteoarthritis (OA). It may influence patient-reported outcomes regarding functional score after total knee arthroplasty (TKA) also; cases are at more risk of developing complications like infection and deep venous thrombosis (D.V.T).

Aim of the study: To compare obese and non-obese cases undergoing TKA regarding functional outcomes.

Subjects and Methods: This is a prospective case series study in which 30 cases were distributed between two equal groups according to their body mass index (BMI). The non-obese group are of BMI ≤ 30 Kg/m^2 while the obese group are of BMI > 30 Kg/m^2. Cases were done in Fayoum University hospitals between September 2020 and July 2022. Functional scores were assessed using the Western Ontario and McMasters Universities Osteoarthritis Index (WOMAC) score before and after surgery by nine months.

Results: The mean BMI in the non-obese group was 28.46 ±SD 1.54 while the mean BMI in the obese group was 36.97 ±SD 5.29. The mean postoperative WOMAC score in the non-obese group (14.6 ±SD 9.46) was less than that of the obese group (20.47 ±SD 8), and there was no statistical significance (P value=0.077). Correlation between both groups regarding the change in WOMAC score from before to after surgery does not show statistical significance (p =0.704).

Conclusion: Although the mean WOMAC score in the non-obese group is less than that of the obese group, the correlation does not show statistical significance. Obesity does not influence functional

1. Introduction

Elderly people with knee OA frequently experiences excruciating pain and disability. Approximately 360 million people worldwide suffer from knee OA. One

of the main risk factors for the development of knee OA is obesity. A 5 kg/m² increase in body mass index (BMI) raises the incidence of knee OA by 35% [1].

To relieve pain and restore knee function and range of motion in patients with severe OA, total knee arthroplasty (TKA) is considered the best treatment option [2]. Even though knee arthroplasty surgery has advanced significantly in the past decades, 11% to 18% of cases report disappointing outcomes. Unsatisfactory results following TKA may be caused by several patient-related factors, including obesity, which has been widely discussed in the literature [3].

Most research often addresses the functional outcomes of TKA patients during the mid-to-long-term follow-up phases after surgery. However, there aren't enough studies addressing immediate results post-surgery. This is of extreme significance, as the majority of improvements in functional outcomes occur within the first three months following surgery [4].

Additionally, obese individuals are more likely to require early hospital readmission following TKA, which may be related to the greater risk of infection and deep vein thrombosis (DVT) [5]. In patients with morbid obesity and OA, a lower degree of functional recovery during the postoperative rehabilitation phase may be linked to decreased physical activity [6].

By understanding the influence of obesity on patient satisfaction and functional outcomes after surgery in cases involving TKA, surgeons can identify and counsel patients who are at risk of dissatisfaction due to obesity. The main objective of this study was to assess the functional outcomes nine months following surgery between patients with a BMI of ≤30 kg/m² and those with a BMI of >30 kg/m².

2. Subjects and Methods

2.1.Subjects

A planned minimum sample size of 30 cases was distributed equally between the two study groups. The non-obese group included the first 15 cases with a BMI ≤ 30 kg/m², while the obese group included the first 15 cases with a BMI > 30 kg/m². All cases were conducted during the study period from August 2020 to June 2022.

Inclusion Criteria

Cases with advanced knee OA who were candidates for primary TKA.

Exclusion criteria

Cases undergoing revision TKA and cases with impaired cognitive function were excluded from the study.

2.2. Study Design

This study is an analysis of data retrieved from a prospective case series study conducted to investigate knee joint functional outcomes in patients with advanced knee OA undergoing TKA.

2.3.Methods

Preoperative Evaluation

Knee function was assessed using the WOMAC Knee Scoring Scale, a survey designed to provide information about how knee OA affects the ability to perform daily life activities, considering pain, stiffness, and difficulty in daily activities. BMI was measured on the same day as the operation, calculated by dividing weight in kilograms by the square of height in meters.

All cases provided informed consent after being informed of the study's purpose. The NexGen® Complete Knee Solution Legacy Knee Posterior Stabilized (LPS) fixed bearing system was used in all patients, with a median parapatellar approach.

Postoperative Care

Early mobilization with a full range of motion was recommended, with weight-bearing aided by crutches immediately after surgery. Physiotherapy was then allowed. Cases were followed up in the early postoperative period to detect complications such as DVT and infection, with functional assessment using the WOMAC score 9 months after surgery.

2.4. Statistical Methods

Version 22 of the SPSS statistical software (SPSS Inc., USA) was used to arrange, tabulate, and statistically analyze the gathered data. For quantitative data, the mean and standard deviation (SD) were computed. Significance was tested using the paired t-test or the independent t-test. Pearson correlation was employed to evaluate the link between quantitative variables. Numbers and percentages represented the qualitative data, and the chi-square (χ^2) or Fisher's exact test was performed to determine significance. A significance level of $P < 0.05$ was chosen for interpreting the results of significance tests.

3. Results

Regarding whole cases participating in the study; thirty cases were enrolled. Twenty-four cases were females (80%) while only 6 cases (20%) were males. The mean age of all cases is = 60.87 ±SD 5.9 years. Mean BMI is = 32.7 ±SD 5.78 Kg/m^2. The mean preoperative WOMAC score is 80.07 ±5.78, while the mean postoperative WOMAC score is = 17.5 ±9.1 (p <0.05). The mean change of WOMAC score from before to after surgery is 62.53 ±10.3. It is worth mentioning that no cases suffered postoperative superficial or deep infections while only one obese case had D.V.T. detected in the first month after surgery.

Regarding the study groups, the following table summarizes the comparison between non-obese and obese cases in terms of age, sex, pre and postoperative WOMAC scores, mean change in WOMAC score from before to after surgery and incidence of postoperative D.V.T. (**Table 1 & Figure 1**).

Table 1: The difference between obese and non-obese patients regarding sex, age, BMI, and pre and post-WOMAC scores.

Variables	**Non-obese group (N=15)**	**Obese group (N=15)**	***P-value***
Sex	5 males (33.33%) – 10 females (66.7%)	1 male (6.7%) –	
BMI (Kg/m^2)	28.46 ±SD 1.54	14 females (93.3%)	
Age (years)	60.4 ±SD 5.6	36.97 ±SD 5.29	0.717
Preoperative WOMAC score	77.87 ±SD 11.44	61.27 ±SD 6.35	0.199
Postoperative WOMAC score	14.6 ±SD 9.46	82.27 ±SD 6.05	0.077
Change in WOMAC score from before to after surgery	63.27 ±SD 12.12	20.47 ±SD 8	0.704
Postoperative D.V.T.	No	61.8 ±SD8.48	

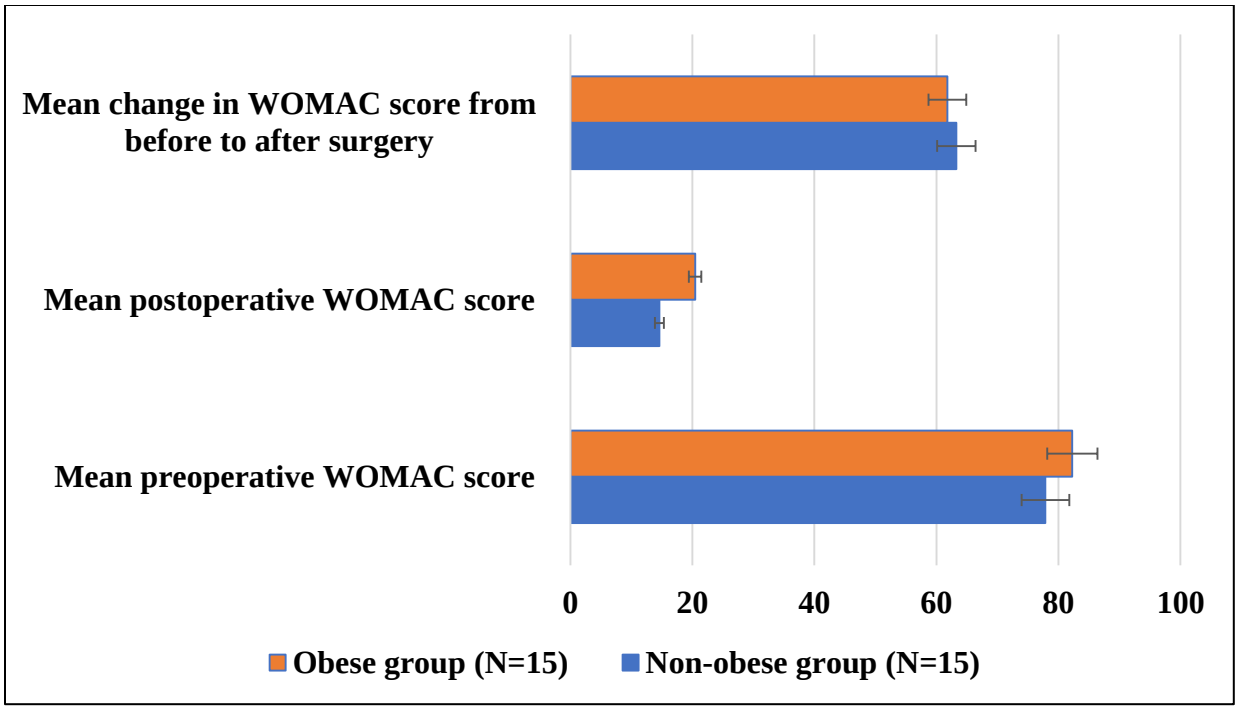

Figure 1: A chart showing the difference between obese and non-obese cases regarding mean pre, Postoperative WOMAC scores and mean change of WOMAC score from before to after surgery.

The data in the table clearly shows that females represent the majority of the obese group, accounting for 93.3% of the participants. Regarding age, there was no significant relationship between the two groups (p =0.717). The mean preoperative WOMAC score in the non-obese group (77.87 ± 11.44) was lower than that of the obese group (82.27 ± 6.05); however, this difference was not statistically significant (p =0.199).

Similarly, the mean postoperative WOMAC score in the non-obese group (14.6 ± 9.46) was lower than that of the obese group (20.47 ± 8), but again, the difference was not statistically significant (p =0.077). The correlation between the two groups concerning the change in WOMAC scores from before to after surgery did not show statistical significance either (p =0.704).

4. Discussion

A major risk factor for advanced knee OA is obesity. According to reports, the likelihood of requiring a TKA doubles with a 5 kg/m^2 increase in BMI. The majority of research has demonstrated a correlation between obesity and increased rates of readmission and postoperative complications such as infection and DVT [7]. Additionally, aseptic loosening increases the likelihood of revision rates in obese individuals [8]. However, as obese patients still can benefit from TKA, those dangers should be balanced against the advantages of better functional outcomes [7].

According to Hai et al., a BMI cut-off value of 30kg/m^2 may indicate the point at which patients are more likely to require revision surgery, develop a superficial infection, and have DVT following original TKA. While profound infection may be more likely to develop in those with a BMI greater than 40 kg/m^2 [9]. In this study, the correlation between both groups regarding the age shows no statistical significance which may mean that obese cases are not necessarily liable to develop OA at a younger age. The same results were reported by Jarvenpaa et al who found no significance between both groups regarding age [10]. On the contrary, Gesa et al found that obese cases undergo TKA usually at a younger age than non-obese cases [1].

Although the mean WOMAC score in the non-obese group is less than that of the obese group, the correlation does not show statistical significance. This may suggest that obesity does not influence functional outcomes after surgery in the short-term follow-up. Among cases reported in the study, only one case had D.V.T. early after surgery that belonged to the obese group.

Three months following surgery, Jarvenpaa et al. monitored their cases. Obesity may hurt early postoperative outcomes, they reported Complications like DVT, infection, and nerve damage are more likely to occur in their cases [10]. Two months following surgery, Baum et al. used the WOMAC score to track the functional result. Researchers discovered that the non-obese group had considerably higher baseline and postoperative WOMAC scores, although there was little association between the two groups' changes in WOMAC scores before and after surgery [1].

Functional outcomes did not differ between the two groups, according to Ayyar

et al. Six months following surgery; they assessed function using the Oxford Knee Score. However, the obese group's preoperative functional score indicated diminished function [11]. At one year following surgery, Nunez et al., who classified their BMI groups as severely obese individuals weighing more than 35 kg/m^2 and less than 35 kg/m^2, discovered a comparable degree of improvement in both groups' functional outcomes. For assessment, they employed the WOMAC score [12].

During a 12-month follow-up period, Stickles et al. in a more expansive study demonstrated no significant difference in the change of WOMAC scores among five BMI groups (BMI <25, 25–30, 30-35, 35–40, and >40) [13]. According to Naghadehi et al., patients who were included in 3 groups (non-obese, obese, and morbidly obese) exhibited increased function. The improvement was the same for the obese group as for the non-obese cases. They claimed that surgeons have to discuss expectations with patients regarding their BMI following TKA [14]. According to Smith et al.'s meta-analysis, bariatric operations performed before total knee arthroplasty (TKI) in cases of morbid obesity did not improve functional results or lower the rate of complications [15].

This study was performed in the same institute, using the same implant with the same team of surgeons. This may add further precision to the results. Limitations of this study may include the decreased number of cases in each group. Cases could better have been stratified as non-obese, obese and morbidly obese groups. Adding the morbidly obese subgroup would render results more reliable.

For further studies, morbidly obese patients may be categorized into separate groups to compare their functional outcomes and complication rates with other groups. This would add more relevant data. Assessment of other factors that may influence patient-reported outcomes like range of motion may be needed to compare between study groups.

5. Conclusion

Despite the mean WOMAC score in the non-obese group is less than that of the obese group, the correlation does not show statistical significance. Obesity does not influence functional outcomes after surgery in the short-term follow-up.

Ethical approval: The institutional review board of the faculty of medicine at Fayoum University had ethically approved this study. Participating in the study was explained to all cases and their acceptance was approved.

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Conflicts of Interest: All authors declare they have no conflicts of interest.

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