Body mass index related clinical outcomes after knee replacement in overweight and obese patients

Aşırı kilolu ve obez hastalarda diz protezi sonrası klinik sonuçların vücut kitle indeksi ile ilişkisi

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Öz

Amaç: Aşırı kilolu ve obez hastalarda total diz protezi (TDP) sonrası vücut kitle indeksinin (VKİ) fonksiyonel sonuçlara etkisini ortaya koymak. Gereç ve Yöntem: Ocak 2002 ve Aralık 2010 arasında primer TDP yapılan hastalar geriye dönük incelendi. Ortalama takip süresi 7 yıldı. Dizler vücut kitle indeksleri baz alınarak Dünya Sağlık Örgütü sınıflamasına göre gruplara ayrıldı ve aşırı kilolu, 1. derece obez ve 2. derece obez hastalar değerlendirildi. Grupların klinik sonuçları Oxford Diz Skoru (OKS), Görsel ağrı skalası (VAS) ve Kısa Form-36 fiziksel skoru (SF-36 PCS) ile Kısa Form-36 mental skoru (SF-36 MCS) hesaplanarak karşılaştırıldı. Bulgular: En düşük skorlar 2. derece obez hastalarda elde edildi. Fakat gruplar arasında OKS, SF-36 PCS, SF-36 MCS ve VAS skorları arasında istatistiksel olarak anlamlı farka rastlanmadı. Grupların ortalama yaşları sırasıyla 67, 64 ve 62 idi ($p<0.05$). Diğerleri ile karşılaştırıldığında 2. derece obez grubundaki hastaların daha erken yaşta ameliyat edildiği görüldü. Tartışma: Aşırı kilolu, 1. derece obez ve 2. derece obez hastalarda TDP sonrası klinik sonuçların ortalama 7 yıllık takipte VKİ'nden etkilenmediği görüldü.

Anahtar Kelimeler

Artroplasti; Diz; Vücut Kitle İndexi; Klinik Sonuç; Fonksiyonel Skor

Abstract

Aim: To analyze the influence of body mass index (BMI) on functional outcome in overweight and obese patients after total knee replacement (TKR). Material and Method: The patients who underwent primary TKR between January 2002 and December 2010 were retrospectively reviewed. The mean follow-up period was seven years. The knees were divided into the groups according to the World Health Organization classification based on BMIs and overweight, class 1 obese, class 2 obese patients were assessed. The clinical outcomes of the groups were compared by evaluating the Oxford Knee Score (OKS), visual analog scale (VAS), and Short Form-36 physical component summary (SF-36 PCS) and mental component summary (SF-36 MCS) scores. Results: The lowest scores were obtained in class 2 obese group. However, the differences of OKS, SF-36 PCS, and SF-36 MCS and VAS between the groups were not found to be statistically significant. The mean ages of the groups were 67, 64 and 62 respectively ($p<0.05$). Class 2 obese group underwent surgery at a younger age compared to the others. Discussion: Clinical outcome after TKR was not affected by BMI at a mean seven years follow-up in overweight, class 1 obese and class 2 obese patients.

Keywords

Arthroplasty; Knee; Body Mass Index; Clinical Outcome; Function Score

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Introduction

Obesity is a significant health condition associated with multiple comorbidities, including diabetes mellitus, metabolic syndrome, hypertension and coroner artery diseases [1]. The prevalence of obesity has been increasing in both emerging and industrialized countries [2]. It was stated that a 33% increase in obesity prevalence and a 130% increase in severe obesity prevalence are estimated over the next two decades [3].

Obesity is also defined as a risk factor for the development of hip and knee osteoarthritis [4-6]. Recently, the prevalence of overweight and obese individuals has been increasing among orthopedic patients who underwent total knee replacement (TKR) [7]. Furthermore, need for having TKR has been increasing due to increased body mass index (BMI) [8]. Thus, it is not surprising that obese patients are undergoing surgery at a younger age compared with their non-obese counterparts [9,10].

The current literature has divided in opinion of the influence of BMI on clinical outcomes after TKR. Several studies reported that obesity adversely affected the functional scores [11-14]. Others claimed that the effect of BMI on clinical outcomes was not significant after TKR [15-17]. Most of them compared the obese (BMI>30) and non-obese (BMI<30) individuals [13,16,17], or intercalarily morbidly obese (BMI>40) patients [11,12,17]. However, only a few studies have reported subgroup analysis by classifying the overweight and obese patients as recommended by World Health Organization (WHO) [10,18].

The aim of this study was to determine the influence of body mass index on functional outcome among overweight and obese patients after TKR. It was hypothesized that higher BMI is associated with poorer functional scores.

Material and Method

The study was approved by the local Ethics Committee. The patients who underwent primary TKA in a single clinic between January 2002 and December 2010 were reviewed retrospectively. The inclusion criteria for the study were patients with primary osteoarthritis who underwent primary TKA at least five years before their most recent follow-up visit and overweight or obese patients according to their BMIs. Patients who were over 80 years old on their last visit, had prior knee surgery or had <5-year follow-up period were excluded.

The clinicodemographic data including sex, age, operation side and follow-up periods were collated for each patient. The BMIs were calculated for each patient as body weight(kg)/height2(m2) at their most recent follow-up visit, then Function scores and life-quality assessment were obtained. Function assessment was performed using the Oxford Knee Score (OKS). To determine the relief of pain and quality of life, the visual analog scale (VAS) and Short Form 36 (SF-36) health survey questionnaire—both physical component summary (PCS) and mental component summary (MCS)—were used. In bilateral cases, each knee was included into the belonged group according to the BMI. OKS and VAS which reflect the related knee were measured separately for each knee. However, SF-36 scores which reflect the general condition of the patient were the same for both of the knees.

The knees were divided into the groups according to the WHO classification based on BMIs as overweight (25 to 29.99), class 1 obese (30 to 34.99), class 2 obese (35 to 39.99) and class 3 obese (>40) [19]. The function scores of each group were compared using the OKS, VAS, SF-36 PCS, and SF-36 MCS.

Surgical technique

All operations were performed using a conventional approach with applying a tourniquet by three different senior orthopedic surgeons. A standard surgical approach with a medial parapatellar incision and arthrotomy was used. Femoral cuts were performed by intramedullary guides, and extramedullary guides were used for tibial cuts in all cases. Cemented cruciate ligament retaining modern implant designs were used without patellar resurfacing. All patients received antibiotics prophylaxis for 24 hours and, low molecular weight heparin and full-length anti-embolic stockings were applied for deep venous thromboembolism prophylaxis after surgery. The patients were mobilized the next day after surgery, and all patients underwent standardized rehabilitation programs.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 24.0. Armonk, NY: IBM corp., USA. Different categorical data were compared using the chi-square test and Fisher–Freeman–Halton test. The results of normal distributions were compared using one-way ANOVA test, and non-normal distributions were compared using the Kruskal–Wallis test. Statistical significance was set as $p < 0.05$.

Results

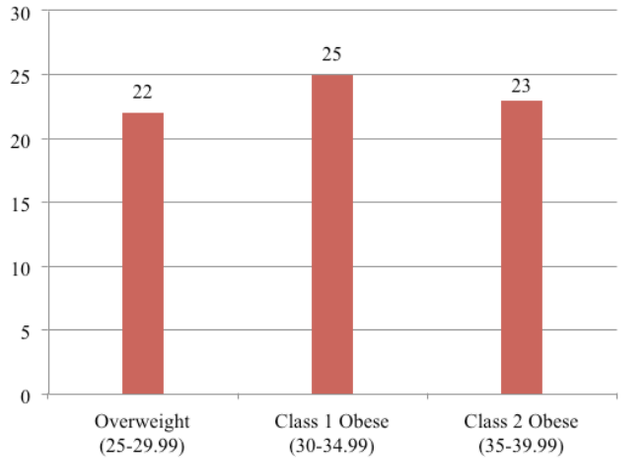
Sufficient data of 237 patients were obtained (preoperative clinicodemographic data, phone number, etc.) from the hospital archives who had proper follow up. Fifty-three of them were over 80 years old at the last follow-up, and 17 of them died. Eighteen patients underwent surgery for seconder osteoarthritis etiology, and 16 of the patients had prior knee surgery. These patients were excluded according to the inclusion and exclusion criteria. Thirty-five patients stated that they had no complaint and did not want to continue follow-ups. The other 45 patients rejected to participate in the study. Remaining 53 patients were included in the survey.

Because there were only two morbidly obese (class 3 obese) patients and the number was not sufficient for statistical comparison, these patients were excluded. A Total of 70 knees of 51 patients were evaluated, and the comparison was performed between overweight (n=22 knees), class 1 obese (n=25 knees) and class 2 obese (n=23 knees) patients. The distribution of the groups based on BMIs are shown in Table 1.

There were no complications, such as wound problem, deep infection, deep venous thrombosis, periprosthetic fracture, or component loosening.

The mean age of the patients at surgery date was 64.8 (range; 56–73), and mean follow-up period was 84.9 months (range; 60–144). The mean ages of the groups were 67, 64 and 62 respectively. The difference in the ages between the groups was statistically significant. It was demonstrated that obese patients underwent surgery at a younger age compared to overweight patients as estimated. On the other hand, the differences were not significant between the groups according to the

Table 1. Distribution of the number of the groups based on BMIs



follow-up periods, gender distribution, or operation sides. The clinicodemographic data of each group was shown in Table 2. The mean OKS of the groups were 35.8, 37.1 and 33.5 respectively (p>0.05). The mean VAS of each group was 2.9, 2.8 and 3.8 respectively (p>0.05). The mean SF-36 PCS of the overweight group was 38.5, and class 1 obese group was 39.9. Class 2 obese group had the lowest SF-36 PCS (35.9). However, the differences were not statistically significant. The SF-36 MCSs of the groups were 46.2, 45.4 and 44.4 respectively (p>0.05). The differences of OKS, VAS, SF-36 PCS and SF-36 MCS between the groups were not found to be statistically significant. The function scores of each group were shown in Table 3.

Discussion

The overall results of the current study support that clinical outcome after TKR is not related to the BMI in overweight and obese individuals at mid-term.

Table 2. Clinicodemographic data of groups

		Overweight	Class 1 Obese	Class 2 Obese	P value
Mean age		67±4.1	64.7±3.3	62.8±3.7	[a]0.02
Mean BMI		27.3±1.3	32.2±1.4	37.9±1	[b]<0.001
Mean Follow-up period (month)		90±13	80.9±13.6	84.5±19.8	[b]0.68
		n	n	n	
Gender	Female	19	21	23	[c]0.14
	Male	3	4	0	
Operation side	Right	11	13	13	[d]0.90
	Left	11	12	10	

[a]One way ANOVA Test, [b]Kruskal Wallis Test, [c]Fisher Freeman-Halton Test, [d]Pearson Chi-Square Test

Table 3. Function scores of the groups

	Overweight	Class 1 Obese	Class 2 Obese	P value
OKS (Mean±Sd)	35.8±7.7	37.1±8.2	33.5±7.4	[b]0.93
VAS (Mean±Sd)	2.9±2.3	2.8±1.8	3.8±2.1	[b]0.14
SF-36 PCS (Mean±Sd)	38.5±10	39.9±9.7	35.9±9.1	[b]0.33
SF-36 MCS (Mean±Sd)	46.2±10.1	45.4±11.5	44.4±11	[a]0.85

[a]One-way ANOVA Test, [b]Kruskal Wallis Test

There is a debate in the literature regarding the influence of BMI on clinical outcomes after TKR. Several short-term studies showed no difference in clinical outcomes between obese and non-obese individuals [20,21]. Other studies with a mid-term or longer follow-up were also unable to demonstrate inferior results in obese patients [15,16,22].

However, Foran et al. reported that obese patients with BMI >30 showed inferior Knee Society Score and higher revision rates at 15 years after TKR [13]. Similarly, Jackson et al. found significantly lower post-operative total clinical scores in obese patients after cementless TKR at mean 9.2 years [14]. On the other hand, a greater decrease in clinical scores was reported in the morbidly obese group, and these patients were advised to lose weight before the surgery [11].

To our knowledge only one study compared the clinical outcomes after TKR by classifying the patients as overweight, class 1 obese, class 2 obese and class 3 obese like our study method as recommended by WHO. O'Neill et al. reviewed 2180 TKR, and in contrast to our results, they demonstrated significantly inferior scores in class 2 obese patients compared to both overweight and class 1 obese patients [18]. Although a small number of the patients limits the power of our study, the results of our study are more reliable when considering our mid-term (84 months=7 years) follow-up period compared to their only mean 19 months follow-up.

Collins et al. also evaluated 445 TKR with considering the overweight patients in non-obese group and dividing the obese group as mildly obese (BMI 30 to 35) and highly obese (BMI>35), then they reported significantly poorer results in highly obese group compared to non-obese and mildly obese group [23]. They used only KSS for clinical evaluation, whereas multiple scores including OKS, VAS, and SF-36 were used for evaluation of clinical outcomes in our study.

The patients who had had a higher BMI needed TKR at a younger age in our study. Similarly, Guanther et al. reported that the overweight, class 1 obese and class 2 obese patients underwent total joint replacement surgery at the mean age of 68, 65 and 64 respectively [10]. Thus, can also provide the evidence that obesity is a risk factor for the development of knee osteoarthritis [4-6].

The major limitation of the current study is its retrospective design. The second limitation can be stated as our mid-term follow-up period. This is particularly important about the development of aseptic loosening, implant failures and subsequent need for revision surgery. Although similar revision rates and good clinical outcomes were reported in both obese and non-obese patients in 10 years follow-up, there is doubt in longer period results [22].

This study only included the obese patients with BMIs between 30 and 40. Our results would be more reliable and powerful whether we could perform the statistical comparison of class 3 obese patients with BMIs over 40. Nevertheless, we revealed that TKR can be carried out in obese whose BMIs between 30 and 40 with results similar to those performed in overweight individuals.

In summary, it was demonstrated that clinical outcome after TKR is not related to patient's BMI at mean seven years follow-up. We recommend starting diet programs with the surgery, instead of denying the obese patients for TKR.

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Conflict of interest

The authors declare that they have no conflict of interest regarding the submission and publication of this manuscript

Animal and human rights statements

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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