Outcomes of Unicompartmental Knee Arthroplasty Stratified by Body Mass Index

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Abstract: Patients who have high body mass indices can have disabling medial compartment knee osteoarthritis, which might benefit from unicompartmental knee arthroplasty (UKA). The purpose of this study was to compare clinical and radiographic outcomes of UKAs in patients with body mass indices (BMIs) greater and less than 35 kg/m^2. Thirty-four patients (40 knees) had BMIs of 35 kg/m^2 or greater, whereas the remaining 33 patients (40 knees) had BMIs below 35 kg/m^2, with 2-year minimum follow-up. In the high-BMI group, 5 knees were revised to total knee arthroplasty, compared with none in the lower BMI group. Knee Society scores were lower in the surviving high-BMI knees. All surviving components were radiographically stable. The results suggest that UKA should be approached with caution in patients who have high BMIs. **Keywords:** unicompartmental knee arthroplasty, UKA, high BMI, survivorship.
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High body mass index (BMI) has been identified as one of the major contributing risk factors for the development of osteoarthritis of the knee [1-5]. There has been a recently documented trend toward a rising prevalence of high BMI and osteoarthritis in younger patients [6,7]. In addition, some reports of total knee arthroplasty have described less than optimal outcomes in more obese patients, including higher revision rates and poorer clinical outcomes when compared with patients with lower body mass indices [8,9]. As a result, there is a need to find less invasive alternatives to total knee arthroplasty in these patients with degenerative joint disease resistant to nonoperative treatment.

Unicompartmental knee arthroplasty has been recommended by some authors as an excellent treatment modality for osteoarthritis confined to one tibiofemoral compartment in patients with intact ligaments and no symptomatic patellofemoral disease [10]. Although overall excellent clinical results and survivorship of more than 90% at follow-up times of 10 years of more have been reported by a number of investigators [11-14], some controversy remains about the use of this modality in higher BMI patients. Although some investigators have reported similar survival in comparison studies of high and normal BMI patients [15,16], others have reported an association between higher BMI and implant failure [17,18]. Recently, 2 studies have reported that a BMI of 35 kg/m^2 or more is strongly associated with a high level of disability and functional limitation in unicompartmental knee arthroplasty than lower BMI patients [19,20], suggesting that this may be a more appropriate cutoff for investigating the association between BMI and outcomes.

The purpose of this study was to compare the overall survival, clinical and radiographic outcomes, and complication rates of unicompartmental knee arthroplasty in patients with a BMI of less than 35 kg/m^2 to those greater than or equal to 35 kg/m^2.

Methods

A review was conducted to identify the a series of consecutive unicompartmental total knee arthroplasties performed at a single institution by an experienced joint surgeon between July 2000 and June 2007 and who had a minimum of 2-year follow-up. These patients were then stratified by BMI, with 35 kg/m^2 used as a cutoff value. Forty knees in 34 patients who had a mean age of 65 years (range, 45-81 years) were identified who had a BMI of 35 kg/m^2 or greater. There were 16 men and 18 women who had a mean BMI of 38 kg/m^2 (range, 35-47 kg/m^2) and a mean follow-up time of 3 years (range, 2 -6 years). At final follow-up, the BMI increased in 8 patients,

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Table 1. Comparison of Patient Demographics and Preoperative Clinical Scores

	BMI ≥35 kg/m^2 (n=40)	BMI <35 kg/m^2 (n=40)	*P*
No. of patients (knees)	34 (40)	33 (40)	–
Sex (men/women)	16:18	17:16	.898
Mean age (range) (y)	65 (45-81)	68 (48-79)	.253
Mean BMI (range) (kg/m^2)	38 (35-47)	28 (23-34)	<.001
Mean preoperative Knee Society pain score in points (range)	54 (23-72)	54 (23-85)	.923
Mean preoperative Knee Society function score in points (range)	50 (30-70)	49 (20-70)	.760
Mean follow-up (range) (y)	3 (2-6)	3 (2-7)	.204

decreased in 9, and had no change in 9. All patients remained above 35 kg/m^2 except for 1 patient who had a reduction in their BMI from 35 to 33 kg/m^2. The mean value remained unchanged, however, at 38 kg/m^2 (range, 33-48 kg/m^2). There were 40 knees in 33 patients who had a BMI less than 35 kg/m^2, a similar age, sex distribution, and length of follow-up and who underwent unicompartmental knee arthroplasty during the same time period (Table 1). The lower BMI group patients had a mean age of 68 years (range, 48-79 years) and a mean BMI of 28 kg/m^2 (range, 23-34 kg/m^2). There were 17 men and 16 women. The mean follow-up time for this group was 3 years (range, 2-7 years). Institutional review board approval was obtained for this study.

All patients were operated on by a single surgeon (P.M.B.), using minimally invasive surgical techniques, with a fixed-bearing unicompartmental prosthesis. The indications for the procedure were degenerative joint disease confined to the medial compartment as confirmed by clinical and radiographic evaluation and no evidence of symptomatic patellofemoral disease. These indications remained constant over the duration of this study. Preoperative and postoperative clinical outcomes were evaluated using Knee Society pain and function scores. Following the index arthroplasty, patients were followed clinically and radiographically at intervals of 6 weeks, 3 months, 6 months, 1 year, and annually thereafter. At the first follow-up visit, standing 4-ft films were used to assess the mechanical tibiofemoral axis. Anteroposterior, lateral, and merchant views of the knee were obtained at each visit to access component position, fixation, and evaluation of the zonal interface for radiolucency (Table 2).

Failure was defined as actual or recommended revision surgery, or the presence of progressive radiolucencies or evidence of component loosening on radiographic evaluation. The incidence of medical and surgical complications such as postoperative knee stiffness or patellofemoral pain requiring a return to the operating room was noted.

The mean preoperative Knee Society pain and function scores were similar between the 2 groups, with scores of 54 points (range, 23-72 points) and 50 points (range, 30-70 points), respectively, in the high-BMI group and 54 points (range, 23-85 points) and 49 points (range, 20-70 points) in the lower BMI group (P = .923 and P = .760, respectively).

Data were recorded in an Excel spreadsheet (Microsoft Corporation, Redmond, Wash), and statistical analysis was conducted using SigmaStat version 3.0 (Systat Inc, San Jose, Calif). The groups were compared using parametric and nonparametric testing including the Student t test and the Wilcoxon-Mann-Whitney test to compare preoperative and postoperative Knee Society scores in the 2 groups and the Pearson χ^2 test to compare the overall survival rates. Ninety percent confidence intervals (CIs) were reported on both the obese and nonobese cohorts.

Results

The implant survival rate was lower in the high-BMI group compared with the lower BMI group. Five implants were revised in the high-BMI group (88% survival rate; 90% CI, 76%-95%), whereas there were no revisions (90% CI, 93%-100%) in the lower BMI group over a similar follow-up period (P = .05). The mean time to revision of the failed implants was 33 months (range, 9-54 months) following the index surgery. The overall failure rate of all unicompartmental knee arthroplasties performed in this time period was 7% (5 of 80).

Clinical outcome scores for patients with surviving implants were significantly lower at final follow-up in the high-BMI group. The mean Knee Society pain scores were 96 points (range, 80-100 points) in the high-BMI group, compared with 98 points (range, 84-100 points) in the lower BMI patients (P = .017). Similarly, the mean Knee Society function scores were 95 points (range, 50-100 points) in the high-BMI group compared with a mean score of 97 points (range, 80-100 points) for the lower BMI patients (P = .127). All of the unrevised patients in the high-BMI group had postoperative Knee

Table 2. Comparison of Patient Outcomes

	BMI ≥35 kg/m^2 (n=40)	BMI <35 kg/m^2 (n=40)	*P*
Implant survival (%)	88	100	.055
Mean time to revision in months (range)	33 (9-54)	–	–
Mean postoperative Knee Society pain score in points (range)	96 (80-100)	98 (84-100)	.017
Mean postoperative Knee Society function score in points (range)	95 (70-100)	97 (80-100)	.127
Mean tibiofemoral alignment (range) (deg.)	3 val (2 var to 9 val)	3 val (4 var to 8 val)	.101

Val indicates valgus; var, varus.

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