The Journal of Arthroplasty 31 (2016) S217–S220

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Complications - Other

Obesity is Associated With Early Total Hip Revision for Aseptic Loosening

Ali J. Electricwala, MD [a, b], Rapeepat Narkbunnam, MD [a, c], James I. Huddleston III, MD [a], William J. Maloney, MD [a], Stuart B. Goodman, MD, PhD [a], Derek F. Amanatullah, MD, PhD [a, *]

[a] Department of Orthopaedic Surgery, Stanford University, Redwood City, California
[b] Department of Orthopaedic Surgery, Sancheti Institute of Orthopaedics and Rehabilitation, Pune, Maharashtra, India
[c] Department of Orthopaedic Surgery, Siriraj Hospital, Bangkok, Thailand

ARTICLE INFO

Article history:
Received 7 December 2015
Received in revised form
8 February 2016
Accepted 23 February 2016
Available online 15 March 2016

Keywords:
obesity
total hip arthroplasty
survival
complications
aseptic loosening

ABSTRACT

Background: Obesity affects more than half a billion people worldwide, including one-third of men and women in the United States. Obesity is associated with higher postoperative complication rates after total hip arthroplasty (THA). It remains unknown whether obese patients progress to revision THA faster than nonobese patients.

Methods: A total of 257 consecutive primary THAs referred to an academic tertiary care center for revision THA were retrospectively stratified according to preoperative body mass index (BMI), reason for revision THA, and time from primary to revision THA.

Results: When examining primary THAs referred for revision THA, increasing BMI adversely affected the mean time to revision THA. The percentage of primary THAs revised at 5 years was 25% for a BMI of 18-25, 38% for a BMI of 25-30, 56% for a BMI of 30-35, 73% for a BMI of 35-40, and 75% for a BMI of greater than 40 ($P < .001$). The percentage of primary THAs revised at 15 years was 70%, 82%, 87%, 94%, and 100%, respectively ($P < .001$). A significant increase in early revision THA for aseptic loosening/osteolysis in obese patients (56%, 23/41) when compared with the nonobese patients (12%, 10/83, $P < .001$, relative risk ratio = 4.7).

Conclusion: Preoperative BMI influences the time of failure of primary THAs referred to an academic tertiary care for revision THA as well as the mechanism of failure. Specifically, obesity increased in the relative risk of early revision THA due to aseptic loosening/osteolysis by 4.7 fold.

Obesity affects more than half a billion people worldwide, including one-third of men and women in the United States [1,2]. The World Health Organization defines a person as obese and at risk of health impairment with a body mass index (BMI) greater than 30 kg/m^2 and nonobese with a BMI less than 30 kg/m^2. Obesity is further subcategorized into class 1 (BMI 30-34.9 kg/m^2), class 2 (BMI 35-39.9 kg/m^2), and class 3 (morbidly obese, BMI greater than 40 kg/m^2) [3].

Over half a million primary THAs are projected to be performed in 2030 in the United States alone [4]. Unfortunately, some of these primary THAs will require revision THA [5]. Mean hospitalization costs were slightly higher for revision THA than revision total knee arthroplasty, with infection and fracture associated with the greatest length-of-stay and cost [6].

Obesity is associated with a higher rate of postoperative complications after THA, including poor wound healing, periprosthetic joint infection, instability, and aseptic loosening [7-17]. Increasing BMI is estimated to have a significant association with the risk of revision THA [18]. Although there is mounting evidence that obesity is associated with higher postoperative complication rates resulting in revision, it remains unknown whether patients with obesity progress to revision THA at a faster rate than nonobese patients. This study seeks to identify whether BMI affects (1) the duration of primary THA implant survival before revision THA and (2) indication for revision THA.

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2016.02.073.

* Reprint requests: Derek F. Amanatullah, MD, PhD, Department of Orthopaedic Surgery, Stanford University, 450 Broadway Street, Pavilion C, 4th Floor, Redwood City, CA 94063-6342.

http://dx.doi.org/10.1016/j.arth.2016.02.073
0883-5403/

Materials and Methods

Using the total joint registry of our institution (a tertiary care center), we retrospectively reviewed 273 primary THAs (261 patients) referred to Stanford Healthcare for a revision THA performed in a 3 year interval between January 2011 to December 2014. Sixteen patients were excluded from this study because they did not have a preoperative BMI or date of primary THA. As such, 257 primary THAs (245 patients) were reviewed for the final analysis. Age, gender, American Society of Anesthesiology score, reason for revision THA (eg, aseptic loosening/osteolysis, infection, instability, adverse reaction to metal debris [ARMD], periprosthetic fracture, and miscellaneous), preoperative BMI, and time from primary to revision THA in years were identified. One hundred forty revision THAs were performed in women (54%) and 117 in men (46%) with a mean age of 67 ± 13 years (range, 30-92). The mean BMI was 28.3 ± 5.7 kg/m^2 (range, 16-48). Then mean American Society of Anesthesiology grade was 2.6 ± 0.6 (range, 1-4). Ninety-two patients were obese (36%, >30 kg/m^2) and 165 were nonobese (64%, <30 kg/m^2). Seventy-one patients (27%) had a BMI <25 kg/m^2 (normal), 94 patients (37%) between 25-30 kg/m^2 (overweight), 54 (21%) patients between 30 and 35 kg/m^2 (obese class 1), 30 patients (12%) between 35 and 40 kg/m^2 (obese class 2), and 8 patients (3%) with a BMI >40 kg/m^2 (morbidly obese). Of the 257 hip revisions, 124 (49%) were performed for aseptic loosening/osteolysis, 51 (20%) for infection, 36 (14%) for instability, 20 (7.5%) for ARMD, 10 (4%) for periprosthetic fracture, and 16 (6%) for a miscellaneous cause.

Statistical Analysis

To compare proportions obese (BMI ≥30 kg/m^2) and nonobese (BMI <30 kg/m^2) patients in the cohort, a 2-sided, 2-sample z-test for proportions was used. To compare age at the time of operation (primary and revision) between obese and normal BMI, a 2-sided, 2-sample *t*-test was used. Survivorship was compared by stratifying patients by BMI into 5 groups (normal <25 kg/m^2, overweight 25-30 kg/m^2, obese class I 30-35 kg/m^2, obese class II 35-40 kg/m^2, morbidly obese >40 kg/m^2). Differences in survivorship between BMI groups were compared using the chi-square test and a *P*-value of less than or equal .001 was considered statistically significant after Bonferroni correction for multiple comparisons. All calculations were performed using Microsoft Excel (version 2008, Bellevue, WA) and GraphPad software (La Jolla, CA). To compare complication rates between patients with and without obesity, we stratified patients by time to revision THA and by BMI with a cutoff of 30 kg/m^2. Each cause of failure was compared within a given time to revision group and as an aggregate using a Fisher exact test and a *P*-value of less than or equal to .001 after Bonferroni correction for multiple comparisons.

Results

When examining primary THAs referred for revision THA, the mean time from primary to revision THA was 8.7 ± 8.1 years. The time from primary THA to revision THA was directly correlated with increasing BMI (Fig. 1). The percentage of primary THAs revised at 5 years was 25% for a BMI of 18-25, 38% for a BMI of 25-30, 56% for a BMI of 30-35, 73% for a BMI of 35-40, and 75% for a BMI of more than 40 ($P < .001$). The percentage of primary THAs revised at 15 years was 70%, 82%, 87%, 94%, and 100%, respectively ($P < .001$). Mean age at revision THA for obese patients was 65.8 ± 13.7 years and for nonobese patients 65.8 ± 12.3 years ($P = .622$).

When examining primary THAs referred for revision THA, 112 (44%) primary THAs were revised before 5 years (early), 65 (25%) primary THAs were revised between the first 5 years and subsequent 10 years (midterm), and 80 (31%) primary THAs were revised after 10 years (late) (Table 1). There was a significant increase in early revision THA with obese patients (56%, 23/41) for aseptic loosening/osteolysis when compared to the nonobese patients (12%, 10/83, $P < .001$, relative risk ratio = 4.7, Table 1, Fig. 2). There was no significant difference in reason for early revision THA between the groups for instability ($P = .041$), infection ($P = .577$), ARMD ($P = .249$), and periprosthetic fracture ($P = 1.000$), or miscellaneous causes ($P = 1.000$, Table 1). There was no significant difference in midterm revision THA between the groups for any complication type (Table 1). There was a significant increase in late revision THA with nonobese patients (66%, 55/83) for aseptic loosening/osteolysis when compared with the obese patients (27%, 11/41, $P < .001$, Table 1, Fig. 2).

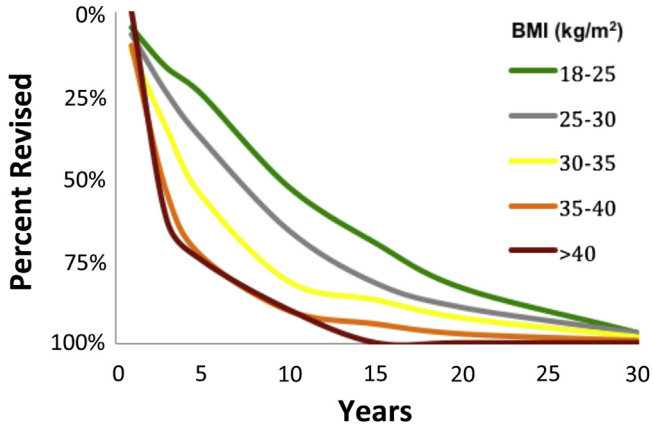

Fig. 1. Correlation of BMI to time to revision of the primary total hip arthroplasty (normal: green, overweight: gray, obese class I: yellow, obese class II: orange, morbidly obese: red). BMI, body mass index.

Discussion

The increasing number of patients undergoing primary THA coupled with the obesity epidemic should increase the number of

Table 1
Reason for Revision THA in Nonobese and Obese Patient Cohorts at Early, Midterm, and Late Intervals After Primary THA.

Reason for Revision	Nonobese	Obese	*P* Value
Early (before 5 y)			
Aseptic loosening/osteolysis	10/83	23/41	<.001[a]
Infection	13/29	12/22	.577
Instability	9/21	12/15	.041
ARMD	9/13	7/7	.249
Periprosthetic fracture	8/9	1/1	1.000
Miscellaneous	4/10	2/6	1.000
Midterm (between 5 and 10 y)			
Aseptic loosening/osteolysis	18/83	7/41	.639
Infection	12/29	9/22	1.000
Instability	8/21	1/15	.051
ARMD	3/13	0/7	.521
Periprosthetic fracture	1/9	0/1	1.000
Miscellaneous	2/10	3/6	.299
Late (after 10 y)			
Aseptic loosening/osteolysis	55/83	11/41	<.001[a]
Infection	4/29	1/22	.374
Instability	4/21	2/15	1.000
ARMD	1/13	0/7	1.000
Periprosthetic fracture	0/9	0/1	1.000
Miscellaneous	4/9	0/6	.233

Nonobese = BMI less than 30, obese = BMI greater than or equal to 30.
BMI, body mass index; ARMD, adverse reaction to metal debris.
[a] Statistically significant.