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Obesity is associated with higher complication rates in revision total hip arthroplasty

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Abstract

Background: Obesity represents a growing global health issue. With revision total hip arthroplasty (THA) rates rising, the number of obese patients undergoing this procedure can be expected to increase. At present, there is limited evidence regarding complication rates for obese patients undergoing revision THA.

Methods: A comparative cohort study was performed between patients with a body mass index (BMI) ≥ 30 kg/m^2 and a separate group with a BMI < 30 kg/m^2 who underwent revision THA between 2005 and 2015. Patients undergoing revision for infection, periprosthetic fracture, recurrent dislocations and hip resurfacing failure were excluded. Primary outcome recorded was complications graded 2 or more by the Dindo classification. Secondary outcomes were radiographic assessment and revision. The null hypothesis was that there would be no difference between the two groups.

Results: Sixty-five patients with a BMI ≥ 30 kg/m^2 and 54 patients with a BMI of < 30 kg/m^2 were identified. We found obese patients were 2.5 times more likely to suffer a complication than non-obese (38.4% *cf* 14.8%, p=0.02, 95% CI 1.11, 5.6). Obese patients were more likely to experience dislocation, leg length discrepancy, fracture, implant loosening, infection and pulmonary embolus. There was an association between ASA and complication rate (p=0.009). Age (p=0.454), pre-operative diagnosis (p=0.588) and gender (p=0.651) were not predictive of a complication. The obese group had a significantly higher revision rate (12.3% *cf* 1.8%, p=0.039).

Conclusion: This study utilises the largest cohort in the literature to demonstrate obese patients can expect higher complication and revision rates compared to the non-obese when undergoing revision THA. These patients should be counselled pre-operatively on their elevated risk.

Introduction

Obesity is becoming increasingly prevalent [1] and is associated with multiple other conditions including coronary artery disease and hypertension [2]. Furthermore, osteoarthritis of the hip is common in these patients [3], many of who will subsequently undergo total hip arthroplasty (THA). Despite improved functional status post-operatively, obese patients generally do not lose weight [4,5]. Although obese patients have greater forces acting across their hips due to increased weight, previous revision rates have been reported to be comparable with non-obese patients [6]. This may be due to the associated lower activity levels. As the number of

primary THA being performed increases, revision rates will also rise, with many of these procedures being performed in obese patients. Revision THA involves greater operative time, higher blood loss and a greater number of complications [7]. Obesity has been associated with higher complication rates including periprosthetic joint infection [8] and respiratory compromise [9]. The effects of obesity on outcomes of revision THA is uncertain given the paucity of evidence within the literature. The few studies existing have reported functional outcomes and satisfaction to improve significantly post-operatively, and often be either comparable or only slightly lower in obese patients compared to non-obese [6,10]. However, variability in complication rates are not well understood with wide disparities reported. This may be a result of these studies having small patient cohorts [6,7,10] and variable body mass index (BMI) categorisations of obesity [7]. This therefore limits our ability to adequately inform obese patients of appropriate complication rates. This study aimed to establish the complication rate in obese patients undergoing revision THA and determine if this differs from a non-obese group.

Methods

Two cohorts were identified with a mean BMI difference of 9 kg/m^2 over a 10 year period. The records of our prospectively collected arthroplasty database were reviewed to identify patients undergoing revision THA between 2005 and 2015. All procedures were performed at a single tertiary referral unit with follow-up at regular intervals for life. Two hundred and eighteen patients were available for review. Patients undergoing revision for infection, periprosthetic fracture, recurrent dislocations and hip resurfacing failure were excluded to provide a more homogeneous group. This left 119 patients for analysis. A power calculation was performed which determined 114 patients were required to produce a power of 0.8. Our sample size was therefore sufficient to adequately power the study. All cases were revisions of primary THA. BMI as calculated by weight (kg) / height (m)^2 was documented for all patients. Obesity was defined by a BMI ≥ 30 kg/m^2 [11]. An age, gender and American Society of Anesthesiologists (ASA) score matched comparator group was established consisting of patients with a BMI < 30 kg/m^2 performed during the same time period and with the same pre-operative diagnoses as the obese group. All complications were recorded in our arthroplasty database by independent practitioners. Documentation in the database was rigorous and we therefore only presented complications graded 2 and above based on the classification by Dindo *et al* [12], which excludes any problems treated with antiemetics, antipyretics, analgesics, diuretics, electrolytes or physiotherapy. Radiographic analysis was performed on annual anteroposterior and lateral radiographs for implant loosening and failure.

Statistical analysis

Survival analysis was done to determine the predictors of complications with age, gender, ASA score and BMI as possible predictors. Fisher's exact test was used to test for an association between obesity and the need for a further revision operation. All analyses were done using SPSS (version 22).

Results

Sixty five patients with a BMI ≥ 30 kg/m^2 and 54 patients with a BMI of < 30 kg/m^2 were identified. Patient demographics of both groups are presented in **table 1**. Reasons for revision are presented in **figure 1**. Mean follow-up period was 3.6 years (range 1 – 11.1) for the obese group and 2.8 (range 1 – 11.1) for the non-obese.

The obese group experienced 27 complications in 25 patients (38.4%). Eight patients (12.3%) underwent further revision surgery at a mean of 1.9 years post-operative. Reasons for further revision were recurrent dislocation (n=4), periprosthetic fracture (n=3) and infection (n=1). One patient who underwent a second revision for periprosthetic infection developed a deep infection requiring a Girdlestone procedure. Two patients (3.1%) died at 1.5 and 6.9 years post-operative for causes unrelated to their surgery.

The non-obese group had eight complications in eight patients (14.8%). One patient (1.8%) underwent a further revision following a periprosthetic fracture. There were four deaths (7.4%) between 1.3 and 3.5 years post-operative for causes unrelated to surgery.

Complications are listed in **table 2**. The obese group suffered higher rates of dislocation, leg length discrepancy, fracture, implant loosening, periprosthetic joint infection and pulmonary embolus. The difference in complication rate (p=0.02) and revision rate (p=0.039) was statistically significant. No difference in individual complication, e.g. dislocation, reached statistical significance due to small numbers. There was no association between obesity and death (p=0.208). There was evidence of an association between higher ASA scores and complication rate (p=0.009). Age (p=0.454), gender (p=0.651) and pre-operative diagnosis (p=0.588) were not predictive of a complication.

Table 1

	Obese	**Non-obese**
Mean BMI (kg/m^2)	34 (range 30 – 44)	25 (range 16 – 29)
Mean age	67	70
Male:female	1:1.2	1:1.1
Median ASA	2	2

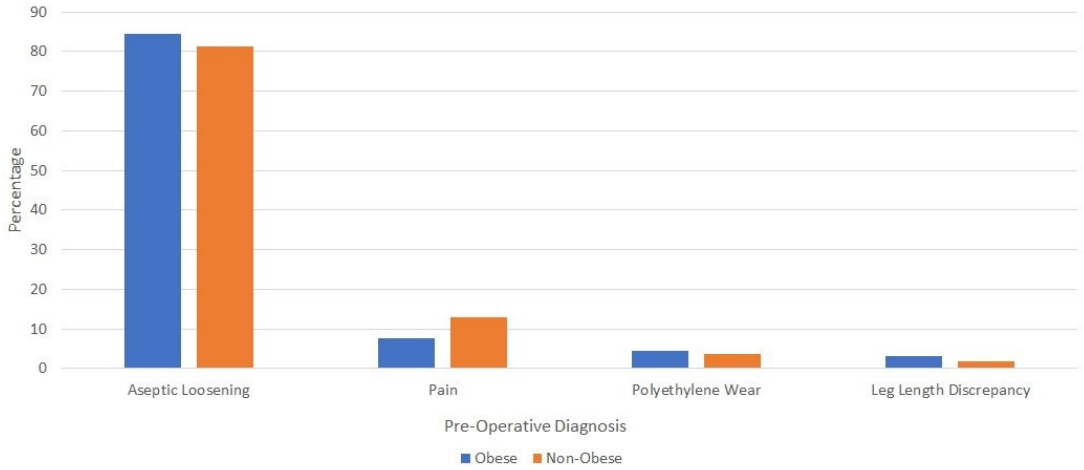

Figure 1: reason for revision in both groups. There was a comparable spread of pre-operative diagnoses between the obese and non-obese group.

Table 2

Complication	Obese (%)	Non-obese (%)
Dislocation	11 (16.9)	3 (5.5)
Leg length discrepancy	2 (3.0)	0.0
Implant loosening	3 (4.6)	2 (3.7)
Periprosthetic fracture	4 (6.1)	1 (1.8)
Intra-operative fracture	4 (6.1)	0.0
Pulmonary embolus	2 (3.0)	0.0
Periprosthetic joint infection	1 (1.5)	0.0
Nerve injury	0.0	2 (3.7)

Discussion

Obesity represents a growing healthcare problem globally. Equally, the number of primary and revision hip arthroplasties being performed has been increasing over time [13]. It is therefore crucial that we have a clear understanding of the impact of increased BMI on morbidity following joint replacement. This is particularly relevant given recent plans to delay offering hip and knee arthroplasty to patients with an increased on the National Health Service. Previous studies have reviewed the effect of increased BMI in primary THA [14,15], demonstrating a higher risk of early complications in the obese. At present, there is only limited and contradictory evidence relating to the role of obesity in revision arthroplasty. To our knowledge, this study represents the largest cohort of obese revision THA patients and demonstrates that this group have a significantly higher complication rate and are more likely to require a further revision when compared to non-obese individuals.

Revision THA can successfully restore function and reduce pain in cases of failed primary hip arthroplasty. However, it has been shown to have greater operative time, blood loss [6] and key complications including dislocation [16] and infection. We report a dislocation rate of 16.9% in obese patients, compared to 5.5% in the non-

obese. This higher rate was also noted by Kim *et al* [6] who proposed this was related to extraarticular soft tissue impingement during hip adduction and flexion. The authors recommended large diameter femoral heads to reduce the risk of dislocation. Given the larger soft tissue dissection generally required in obese patients, Lübbeke *et al* [10] also proposed muscle weakness as a responsible factor for higher dislocation rates. In contrast to these studies, Perka and colleagues [7] found only an increase in operative time, with no difference in complication rates or mortality between obese and non-obese patients. This study included patients with a BMI of 25 – 29.9 kg/m^2 in the obese category, however, in contrast to the World Health Organisations definition of ≥ 30 kg/m^2 [11] which may have influenced their results.

Performing revision THA is more technically challenging than primary hip arthroplasty. Obesity can further increase the complexity of the procedure owing to difficulties with exposure, implant position and closure. Such difficulties may in turn be responsible for higher complications. In our study, we found higher rates of intra-operative fracture, leg length discrepancy and periprosthetic joint infection, all of which may be related to technical challenges. Higher post-operative infection rates were also demonstrated by Houdek *et al* [17]. This may result from associated comorbidities, prolonged operative time, greater trauma from exposure and relative immune deficiency. Weight loss has the potential to correct some of these factors [18] and so represents an important factor in risk stratification.

In the context of recurrent dislocation, infection and periprosthetic fracture, there is a clear case for early revision regardless of BMI. However, in the population we studied, consisting mainly of aseptic loosening, the timing of surgery may be less urgent. Given that this study has demonstrated a higher complication rate in obese patients, postponing surgery to facilitate weight loss may be justified. At the least, obese patients should be counselled that they are 2.5 times more likely to experience a complication than non-obese individuals.

There are limitations to our study. Firstly, our sample size was not large. Our data was obtained from a tertiary referral centre over a 10 year period to maximise the number of available obese patients for inclusion however we were only able to obtain 65 patients. This may lead to other factors such as comorbidities influencing the results. However, this prospectively collected arthroplasty database provided a gender, age, ASA score and pre-operative diagnosis matched cohorts. The follow-up period was also relatively short which may have resulted in late complications not being identified for all patients. However, this factor was adjusted for in the statistical analysis and the majority of complications following hip arthroplasty tend to occur early [14, 15, 19].

Conclusion

Although revision THA can successfully manage a failed primary hip arthroplasty, obese patients who undergo this procedure can expect higher complication rates, particularly dislocation, and revision rates when compared to a non-obese cohort.

Obese patients should be counselled on these risks pre-operatively and the potential benefits of weight loss.

Acknowledgements

The authors would like to thank the orthopaedic outpatient department and audit team for their contribution.

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