Research Article

Outcome in Patients with High Body Mass Index following Primary Total Hip Arthroplasty

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Obesity is becoming a critical problem in the developed world and is associated with an increased incidence of osteoarthritis of the hip. The Oxford Hip Score was used to determine if Body Mass Index (BMI) is an independent factor in determining patient outcome following primary total hip arthroplasty (THA). Using data from 353 operations we found that patients with BMI ≥ 30 had an absolute score that was lower preoperatively and postoperatively compared to those with a BMI < 30 . There was no difference in pre- and postoperative point score change within each group; Kendall's rank correlation was 0.00047 (95% CI, -0.073 to 0.074 ($p = 0.99$)) and demonstrated no trend. There was no statistically significant difference in change between those with BMI ≥ 30 and < 30 ($p = 0.65$). We suggest that those with a higher BMI be considered for THA as they can expect the same degree of improvement as those with a lower BMI. Given the on-going increase in obesity these findings could be significant for the future of THA.

1. Introduction

Obesity is becoming a critical problem for healthcare providers in developed nations. In England the proportion of obese adults (BMI ≥ 30) increased between 1993 and 2010 from 13.2% in 1993 to 26.2% in 2010 in men and from 16.4% in 1993 to 26.1% in 2010 in women [1]. Based on existing trends the prevalence of obesity is predicted to increase to 32.1% in men and 31.0% in women by the end of 2012 [2]. Body Mass Index (BMI) is commonly used to estimate body fat using an individual's weight and height [3]. The World Health Organisation defines obesity as a BMI ≥ 30 [4].

The current trend to perform arthroplasty in younger patients who may be overweight poses the question of whether any benefit is to be gained in operating on patients with a BMI ≥ 30 .

Cooper et al. and Oliveria et al. identified the association between increasing BMI and increasing incidence of osteoarthritis of the hip [5, 6]. This cohort of patients is, therefore, more likely to require treatment to manage their osteoarthritis, which includes surgical intervention.

The Oxford Hip Score (OHS12) is twelve-question functional outcome score [7]. It is utilised not only for research but also to determine pre- and post-op scores to ascertain

improvement in individual patients with zero being the worst outcome and 48 being the best. It has been ratified in previous independent studies and can be considered to be relevant in defining patient satisfaction in elective procedures [8–10]. It is designed to be joint specific minimising the effect of comorbidity [7].

The aim of this study was to observe any difference in Oxford Hip Score between patients undergoing THA with BMI ≥ 30 and < 30 and determine the change in Oxford Hip Score provided by surgery within each group.

2. Method

Between 2012 and 2014, 220 consecutive patients who had undergone THA with a BMI ≥ 30 were identified from Bluespier orthopaedic management software. Over the same time period, 220 consecutive THAs performed in patients with BMI < 30 were identified using the same system. All 440 THAs were performed in the same centre by four consultant surgeons. All were performed via the posterior approach. All implants used were manufactured by Zimmer. Postoperative management was in line with standard departmental protocol. All patients received VTE prophylaxis. Data was missing for 87 of the selected patients. As a result, 176 THAs

TABLE 1: Preoperative Oxford Hip Scores.

Group	Range	Standard deviation	Median
All	0–39	6.8	14
BMI < 30	0–39	6.8	15
BMI ≥ 30	0–33	6.7	12

(176 patients) were analysed in the group with a BMI ≥ 30 and 177 THAs (177 patients) were analysed in the group with a BMI < 30.

Patient demographics including age, BMI, and ASA grade were collected [11]. Pre- and postoperative Oxford Hip Scores were collected prospectively and data was analysed retrospectively. Preoperative hips scores were recorded in the preoperative assessment clinic up to six weeks prior to surgery. Postoperative hip scores were taken at one year. A change in hip score from pre- and postoperative scores was calculated. All patients underwent elective primary THA. Patients were excluded if they had bilateral hip replacements. All patients that had previously undergone lower limb joint arthroplasty were excluded from the study. All cases were for primary hip osteoarthritis.

The ASA grade was assigned before surgery and relates to the systemic condition of a patient. It is graded from one to five, with one indicating a fit patient, two indicating mild systemic disease, three indicating severe systemic disease, four indicating imminent risk of death due to illness, and five indicating a moribund patient with death as the expected outcome.

Descriptive and statistical analysis was performed using StatsDirect (StatsDirect Ltd., 2013). Mann-Whitney *U* tests were performed to determine if there was a difference between the two BMI groups with regard to age difference, before and after Oxford Hip Scores and ASA grade. Kendall's rank correlation was calculated for BMI and ASA grade. Statistical significance was set at $p < 0.05$.

3. Result

The median age in the BMI < 30 was 68 (range 56–60) and BMI ≥ 30 was 66 (range 52–74). There was no statistical difference between the two groups ($p = 0.35$).

There were 90 males and 86 females in the <30 BMI group. There were 85 males and 92 females in the ≥30 BMI age group. There was no statistically significant difference in ages between the two BMI groups ($p = 0.55$).

3.1. Preoperative Oxford Scores. The median scores were 14, 15, and 12 for all BMI < 30 and BMI ≥ 30 groups, respectively (Table 1). There was a statistically significant difference between the two BMI groups and preoperative Oxford Hip Score ($p = 0.0002$). A negative correlation exists between BMI and preoperative Oxford Hip Score; Kendall's rank correlation is -0.15 (CI 95%: -0.22 to -0.80 ($p \leq 0.0001$)). This was statistically significant, indicating that an increase in BMI is associated with a worse preoperative Oxford Hip Score (Figure 1).

FIGURE 1: BMI versus pre-op Oxford score.

TABLE 2: Postoperative Oxford Hip Scores.

Group	Range	Standard deviation	Median
All	8–48	7.1	43
BMI < 30	11–48	4.74	44.5
BMI ≥ 30	8–48	7.29	42

TABLE 3: Change in Oxford Hip Scores.

Group	Range	Standard deviation	Median
All	–8 to 47	8.1	28
BMI < 30	–8 to 42	6.43	28
BMI ≥ 30	–7 to 47	8.35	28

TABLE 4: ASA grade.

Group	Range	Standard deviation	Median
All	1 to 4	0.47	2
BMI < 30	1 to 4	0.40	2
BMI ≥ 30	1 to 4	0.49	2

3.2. Postoperative Oxford Scores. The median scores were 43, 44.5, and 42 for all BMI < 30 and BMI ≥ 30 groups, respectively (Table 2). There was a statistically significant difference between the two BMI groups and postoperative Oxford Hip Score ($p = 0.0001$). There was statistically significant negative correlation between BMI and postoperative Oxford Hip Score; Kendall's rank correlation is -0.13 (95% CI, -0.19 to -0.06 ($p = 0.0008$)). This indicates that an increase in BMI is associated with a worse absolute postoperative Oxford Hip Score (Figure 2).

3.3. Change in Oxford Hip Scores. The median change for each group was the same at 28 points (Table 3). There was no statistical difference between the two BMI groups ($p = 0.65$). There was no correlation between BMI and change in Oxford Hip Score; Kendall's rank correlation is 0.00047 (95% CI, -0.073 to 0.074 ($p = 0.9902$)). This demonstrates that there is no relationship between BMI and change in Oxford Hip Score (Figure 3).

3.4. ASA Grade. The median ASA scores were 2 for all groups, respectively (Table 4). There was no statistically significant

FIGURE 2: BMI versus post-op Oxford score.

FIGURE 3: BMI versus difference in Oxford scores.

difference between the ASA grade and the two BMI groups ($p = 0.1$). There was a statistically significant correlation between increasing BMI and increasing ASA grade (higher ASA grade indicates worse systemic condition); Kendall's rank correlation is 0.13 (95% CI: 0.065 to 0.19 ($p = 0.007$)) (Figure 4).

Seven cases (1.98%) had a worse OHS12 postoperatively than preoperatively. Of these, 6 were in the BMI ≥ 30 group and only one was in the BMI < 30 group. In this subgroup of patients there was no statistically significant correlation between BMI and change in Oxford Hip Score.

4. Discussion

This paper demonstrates that patients in a higher BMI category have a significantly lower absolute Oxford Hip Score both before and after surgery. Patients with a BMI ≥ 30 experience the same change in Oxford Hip Score as patients with a BMI < 30 (median 28-point difference).

Judge et al. have analysed patient satisfaction with Oxford Hip Score and concluded a 97.6% satisfaction rate with a change of 14 points compared to 81.8% with a change below this threshold. At 6 months they found an absolute score of >35 associated with the highest satisfaction. They also noted that patients with a worse pre-op score still gained the highest satisfaction with a lower post-op score as long as the difference in change was 14 points or more [12]. Our paper did not look specifically at patient satisfaction; however, the improvement in score would suggest, based on current literature, greater satisfaction in our cohort with both groups scoring >35 at 12 months and >14 points increase post-op.

FIGURE 4: BMI versus ASA grade.

Existing evidence suggests that BMI should not be a discriminatory factor in patient selection for THA. Michalka et al. found that patients with a BMI ≥ 30 gain similar benefit from THA as patients with a BMI < 30 [13]. Andrew et al. assessed the influence of BMI on change in Oxford Hip Score pre- and postoperatively. They concluded that there was no difference between those patients in different BMI categories, suggesting that obese and morbidly obese patients have the same clinical benefit as nonobese patients. They do acknowledge increasing comorbidity such as ischaemic heart disease, diabetes, apnoeic sleep disorders, and hypertension in the obese category, all of which could increase the risk of anaesthesia. However, they conclude the perceived belief that patients with higher BMIs do not clinically benefit following surgery is a misconception. Higher BMIs should not deter the surgeon from performing a THR [14].

This study has several limitations. First, potential bias may exist as some surgeons were more willing to perform THA surgery on those with a higher BMI compared to their colleagues; however, with a relatively equal number of patients in each group we do not suspect bias at the primary care referral level. Second, the type of prosthesis used for each patient was not recorded; therefore, any potential difference in outcome which could be prosthesis-dependent is not known. However, all implants were Orthopaedic Data Evaluation Panel (ODEP) rated and approved for implant and have demonstrated performance within guidelines. Third, complication rates were not assessed in this study. Other papers have reported conflicting outcomes on this. Lübbecke et al. compared the incidence of complications in obese and nonobese patients undergoing primary THA. They found that obesity substantially increased the infection rate in women but not in men and that the incidence of dislocation was higher in obese women than in nonobese women [15]. Andrew et al. identified no difference in complication rate (dislocation, revision rates, increased haemorrhage, deep infection, deep-venous thrombosis, and pulmonary embolism) or radiological change at five years between obese and nonobese patients [14]. We would suggest that an RCT or a prospective cohort study comparing these two groups would go some way in reducing confounding bias and the limitations this study has.

Our study indicates that THA in patients with BMI > 30 does not lead to a reduction in improvement in Oxford Hip Score compared to those with BMI < 30 . Patients with

a BMI ≥ 30 showed the same increase in Oxford score as those with a BMI < 30 but had lower absolute Oxford Hip Scores both before and after surgery.

We, therefore, recommend that patients with a higher BMI be considered candidates for THA, as they can expect the same degree of change in improvement on Oxford Hip Score. The caveat is that absolute score should not be expected to equal that of patients with a lower BMI.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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