The Knee 21 (2014) 784–788

Contents lists available at ScienceDirect

The Knee

Intra-operative and short term outcome of total knee arthroplasty in morbidly obese patients

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ARTICLE INFO

Article history:
Received 22 May 2013
Received in revised form 12 February 2014
Accepted 17 February 2014

Keywords:
Knee replacement
Morbid obesity
Outcome
Intra-operative

ABSTRACT

Background: Longer operation times, poorer patient outcomes and increased early post-operative complications are reasons cited for not undertaking Total Knee Arthroplasty (TKA) on morbidly obese patients. This study tests the hypothesis that there is no difference in intra-operative parameters between morbidly obese and non-obese patients, and no difference in patient outcome.
Methods: Intra-operative parameters, post-operative complications, patient outcomes and knee range of motion were compared between morbidly obese patients (BMI > 40 kg/m^2) and individually age and gender matched non-obese patients (BMI < 30 kg/m^2) undergoing cementless rotating platform TKA.
Results: Anaesthetic times and length of hospital stay were not significantly different between the morbidly obese and non-obese patients. Surgical time was significantly greater in morbidly obese patients. Improvements in patient outcomes following TKA were not significantly different between the morbidly obese and non-obese patients at early and short-term follow-up.
Conclusions: In contrast to previous studies, post-operative complication rates within three months of surgery and up to one year post-operatively were not significantly higher for morbidly obese patients.
Level of evidence: III

1. Introduction

As obesity becomes more prevalent in the developed world, increasing numbers of obese patients will present for orthopaedic surgery. Body Mass Index (BMI) is the most commonly used index of obesity and is defined as an individual's weight divided by their height squared [1]. BMI has been found to correlate with the amount of total body fat [1,2]. Patients with a BMI > 40 kg/m^2 are considered morbidly obese, those with a BMI > 30 kg/m^2 are considered obese while those with a BMI between 25 and 30 kg/m^2 are considered overweight but not obese. Obesity has been associated with knee osteoarthritis in particular [3,4], and the increasing numbers of morbidly obese (MO) in the general population will undoubtedly lead to an increased demand for knee replacement surgery for these patients.

Previously, studies which report on post-operative patient outcomes for MO patients following TKA have produced conflicting results [5–8]. An early study of MO patients following TKA surgery highlighted significantly lower post-operative mean knee and functional scores for the MO patients [8]. Recently, Amin et al. and Krushell et al. reported significantly reduced function scores for MO patients but no significant difference between post-operative knee scores measured at 6–60 months [5] and 5–14 years [6] respectively. The most recent study by Rajgopal et al. reports no difference between the outcomes of MO TKA patients compared to non-obese (NO) patients [7].

Obese patients and, in particular, MO patients have been considered poor candidates for TKA in the past. This was often due to concerns regarding greater post-operative complications and poorer patient outcomes in the obese and MO patient group. However, a disinclination for surgeons to perform longer and more difficult surgical procedures was also a major factor [9]. Previous studies investigating MO TKA patients have examined post-operative outcomes and complications but have not reported intra-operative parameters [5–8] despite the importance of these factors in the decision to proceed with TKA surgery in the MO patient. Post-operative complications have been reported to be greater for MO TKA patients compared to NO patients in other studies [5,6].

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http://dx.doi.org/10.1016/j.knee.2014.02.016
0968-0160/

This study tests the hypothesis that there is no difference in anaesthetic time and surgical time between MO and NO patients. In addition, it tests the hypotheses that there is no difference in changes or improvement in various patient outcome measures and knee range of motion or in patient complication rates or patient contact three months or one year post-operatively between MO and NO patients.

2. Patients and methods

Fifty TKAs from 49 MO patients and 50 TKAs from paired matched NO patients were retrospectively selected from our hospital database with each MO patient paired and matched for age, gender and pre-operative diagnosis with a patient with BMI between 18.5 and 29.9 kg/m^2. Associated co-morbidities for each group were reviewed, however patients were not matched for co-morbidities due to the practical difficulties in determining the severity, chronicity and level of medical optimisation of each condition. Patients presented for surgery between November 2003 and April 2010. Pre-operative and intra-operative, along with three month and one year post-operative clinical data were analysed. All patients received identical cementless LCS rotating platform TKA (DePuy International, Leeds, UK) without patellar resurfacing under the care of the senior author (DEB) who is responsible for over 500 knee replacement procedures per annum. All TKAs were performed using a tourniquet via a paramedian Insall approach in a clean air laminar flow theatre. Prophylactic antibiotics were given prior to tourniquet inflation. All patients received a spinal anaesthetic combined with a femoral nerve block. Local anaesthetic (60 ml Bupivicane 0.5%) infiltration into the posterior capsule prior to lavage with normal saline and implant insertion was performed in all cases. Routine closure without drains was completed and the knee was maintained in a position of flexion for six hours post-operatively to minimise blood loss. Urinary catheters were removed after 24 h and opiate based analgesics were avoided where possible. Patients were mobilised the day following surgery and all patients experienced identical post-operative physiotherapy protocols. All patients received Aspirin 150 mg for six weeks post-operatively for thromboprophylaxis unless they were prescribed warfarin pre-operatively, or had a history of a thromboembolic event, in which case warfarin was recommenced and a low molecular weight heparin was used only until a therapeutic range (INR >2) was achieved.

The principal intra-operative measures considered were surgery and anaesthetic times. (Anaesthetic time defined as the time from the anaesthetic team commencing intra-venous access until the conclusion of all regional anaesthesia. Surgical time defined as the time from the surgical team commencing final positioning with props until wound closure and dressed application). Pre-operative and post-operative knee Range of Motion (ROM) and length of hospital stay were also assessed. Knee ROM and Fixed Flexion Deformity (FFD) were measured using a goniometer with the patient in a supine position, with one arm of the goniometer positioned along the long axis of the femur (between lateral femoral condyle and greater trochcanter) and the other positioned along the long axis of the tibia (from lateral femoral condyle to lateral malleolus). Oxford Knee Score (OKS) [10], Bartlett Patellar Knee Score (BPKS) [11] and Short Form 12 Physical and Mental Component Summaries (SF12-PCS and SF12-MCS) were recorded pre-operatively along with three months and one year post-operatively. As well as considering post-operative outcomes at three months and one year, changes or improvements in these measures were determined relative to patients' pre-operative levels. Major and minor complications up to three months and one year post-operatively and patient contacts (telephone or clinic review) up to three months post-operatively were recorded. One MO patient who received bilateral TKAs 18 months apart had both limbs included in the assessment. Pre-operative OKS, BPKS or SF12 scores were not recorded for one MO patient. One MO patient did not have SF12 scores recorded three-months post-operatively. Local ethical approval for the study was achieved through the Office for Research Ethics in Northern Ireland (ORECNI).

3. Statistical analysis

Our primary outcome measure was surgical time. In order to detect an effect size of 0.4, corresponding to an anticipated mean difference between variables, with a power of 80% and a significance level of 5%, we calculated that 50 participants were required. Parametric assumptions were made for surgical time. Matched pairs t-tests were used to test for differences between the MO and NO patients for the various intra-operative parameters, pre and post-operative parameters and for changes to these parameters between the various time points (pre-operatively, three months post-operatively and one year post-operatively). A chi-squared test was used to test for any difference in complication rates and patient contact between the MO and NO patients. Statistical analysis was performed using SPSS version 13.0 (SPSS Inc., Chicago, IL) and Excel 2007 (Microsoft, Redmond, WA). The significance level for all tests was set at 0.05.

4. Results

Patient details are summarised in Table 1. Mean BMI of the MO group was 41.8 kg/m^2 (range, 40.0–50.1 kg/m^2) while mean BMI of the NO group was 27.2 kg/m^2 (range, 20.3–29.9 kg/m^2). Intra-operative parameters and length of hospital stay are summarised in Table 2. There were no significant differences in anaesthetic time or length of stay between the MO and NO patients. However the mean surgical time for the MO group was 6.6 minutes longer ($p = 0.02$) than the NO group.

Pre-operative FFD was significantly higher ($p = 0.04$) for the MO patients (mean = 6.9°) than the NO patients (mean = 4.0°). Pre-operative knee joint ROM was significantly reduced ($p = <0.001$) for the MO patients (mean = 99°) compared to the NO patients (mean = 113°). Pre-operative BPKS was significantly reduced ($p = 0.09$) for the MO patients (mean = 7.9) compared to the NO patients (mean = 9.5). There was no significant difference in pre-operative OKS and mental or physical components of the SF12 between the MO and the NO patients (Table 3).

Three months post-operatively there was no significant difference between any of the absolute measures: FFD, ROM, OKS, BPKS, or SF12-MCS/PCS between the MO and NO patients (Table 3). Three months post-operatively there was no significant difference between the change, relative to preoperative levels, in FFD, OKS, BPKS, or SF12-MCS/PCS between the two groups of patients (Table 4). However the change in ROM at three months was significantly different ($p = 0.008$).

One year post-operatively there was no significant difference between absolute measures of FFD, OKS, BPKS, or the mental aspect of the SF12 and physical SF12 scores between the MO and NO patients (Table 3). However, the NO patients displayed a superior ROM ($p = 0.03$) one year post-operatively (Table 3). One year post-operatively the MO patients displayed significantly greater improvements in FFD (mean change = 5.8°) compared to NO patients (mean change = 2.5°) and significantly greater improvements in ROM (mean = 0.2 gain of ROM) compared to the NO patients (mean = −7.9° loss of ROM) (Table 5). There was no significant difference between the change, relative to preoperative levels, in OKS, or mental or physical aspect of the SF12 between the two groups one year post-operatively. The change in BPKS was significant at one year ($p = 0.036$) (Table 5).

Although the MO group revealed an increase in the total complications rate (36% (18/50)) within the first three months of surgery compared to NO patients (22 % (11/50)) this difference was not significantly different (Pearson chi-square, $p = 0.17$). Prolonged wound ooze (>72 h) was observed in 10% (5/50) of cases in the MO cohort and in 2% (1/50) for the NO group. Within the first three months post-surgery the MO patients experienced four superficial infections and no deep infections compared with the NO group who experienced no superficial infections and two deep infections. All superficial infections were successful treated with oral antibiotics. The deep infections were successfully managed with a return to

Table 1
Summary patient details.

	Morbidly obese	Non-obese
Number of TKAs	50	50
BMI	41.8 [40.0–50.1]	27.2 [20.3–30.0]
Female: male	40: 10	40: 10
Age	65.5 [54–79]	65.5 [54–79]
Diagnosis	Osteoarthritis	Osteoarthritis