The Knee xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

The Knee

Body mass index as a predictor of outcome in total knee replace: A systemic review and meta-analysis

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ARTICLE INFO

Article history:
Received 18 November 2016
Received in revised form 10 January 2017
Accepted 30 May 2017
Available online xxxx

Keywords:
Body mass index
Total knee arthroplasty
Postoperative complications
Meta-analysis

ABSTRACT

Background: To conduct a meta-analysis with randomized controlled trials (RCTs) published in full text to demonstrate database to show the associations of perioperative, postoperative outcomes of normal and high body mass index (BMI) to provide the predictive diagnosis for clinic.
Methods: Literature search was performed in PubMed, Embase, Web of Science and Cochrane Library for information from the earliest date of data collection to February.
RCTs comparing the benefits and risks of normal BMI with those of high BMI in primary total knee arthroplasty (TKA) were included. Statistical heterogeneity was quantitatively evaluated by X2 test with the significance set $P < 0.10$ or $I^2 > 50\%$.
Results: Seven RCTs consisting of 33,778 patients were included. (6065 normal BMI patient; 27,713 high BMI). The results showed that high BMI was related to a greater increase in operative time, post-operative range of motion (ROM), post-operative Knee Society and function scores (KSS), infection rate ($P < 0.1$). No differences in pulmonary embolism and perioperative mortality rates were found between normal and high body mass index patients with follow-up ≥ 5 years ($P > 0.1$).
Conclusions: Compared with normal BMI patients, high BMI patients demonstrated an increased risk of perioperative and postoperative complications and clear difference about complications between normal and high BMI about TKA.

1. Introduction

Worldwide, the prevalence of obesity is increasing and has been a serious health challenge [1]. The prevalence of obesity in industrialized and emerging countries is reaching epidemic proportions [8]. The increase in the population of individuals with a high body weight is particularly relevant in the United States [9]. In the US, the so-called 'obesity epidemic' is almost wholly a product of tens of millions of people with BMIs formerly in the 23–25 range gaining a modest amount of weight and thus now being classified as overweight over the past 2005–2016 years [8,9]. This movement of population cohorts from just below to just above the formal definitions of overweight and obesity is what public health officials are referring to when they point out that rates of obesity have exploded over the course of the last generation [8]. According to the World Health Organization (WHO) Guidelines, a body mass index of ≥30 kg/m^2 is defined as obese, ≥35 kg/m^2 as highly obese and ≥40 kg/m^2 as morbidly obese [2]. There are close associations between obesity and diabetes, hypertension, coronary artery disease and cancer [2]. Because of the close relationships with obesity, it is thought to be an important risk factor for postoperative complications. There

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http://dx.doi.org/10.1016/j.knee.2017.05.022
0968-0160/

Please cite this article as: Sun K, Li H, Body mass index as a predictor of outcome in total knee replace: A systemic review and meta-analysis, Knee (2017), http://dx.doi.org/10.1016/j.knee.2017.05.022

have been several recent studies in the orthopaedic literature examining the link between joint replacement, BMI and operative morbidity [1,2]. However, the findings of these studies are at best, inconclusive with no consensus regarding the effect of BMI on perioperative period complication, postoperative function and implant survival [3–5], and studies [6,7] demonstrated that normal BMI could reduce the incidence of post-operative complication with better clinical outcome in KSS and ROM compared with high BMI [8]. Consequently, it is necessary to perform a comprehensive systematic review and meta-analysis that consists of all the RCTs to determine the effect of high BMI in primary TKAs. Therefore, the purpose of this study was to evaluate the association between obesity and: (1) perioperative, and (2) postoperative outcomes of TKA.

2. Materials and methods

2.1. Literature and search strategy

Two different reviewers independently searched the following electronic databases: PubMed, Embase, Web of Science and the Cochrane Library for information from databases inception to February 2016. The following related terms were searched: Body Mass Index; Total Knee Arthroplasty; Perioperative period complication; Postoperative Complications; Meta-analysis; TKA; TKR (total knee replace); RCTs. Searching strategy was constructed by combining the above terms with “AND” or “OR”. No restrictions were imposed on the language of studies. We had also screened reference lists of retrieved articles, so that relevant studies were not missed.

2.2. Study selection criteria

Two different reviewers independently assessed the retrieved articles to determine whether they met the inclusion criteria. In case of disagreements, a third reviewer was involved in the discussion until a consensus was reached. Exclusion criteria included: (1) non-randomized trials, cohort studies and case-control studies, animal studies, cadaver studies, single case reports, comments, letters, editorials, protocols, guidelines, publications based on surgical registries, and review papers; (2) patients with the following characteristics: (i) haemophilia arthritis, non-degenerative arthritis or inflammatory arthritis; (ii) revision or re-operation of TKA; (ii) tumours.

2.3. Data extraction and quality assessment

Two different reviewers independently performed data extraction and methodological quality assessment. Data extracted from the included studies consisted of authors, publication date, study design, number of patients and knees, surgical approach, follow-up duration and outcome data in both normal BMI with high BMI groups. The outcome measures comprised of operative time, range of motion, KSS, Total incidence of revisions or re-operation was also measured. The methodological quality of study was evaluated in six domains, including sequence generation, allocation concealment, participants' blinding, assessors' blinding, incomplete data, selective reporting and other bias. Each included study could be considered as unclear, low risk or high risk of bias for each domain on the ground of Cochrane Handbook 5.1.0.

2.4. Studies, patients and TKAs

The retrieval strategy is displayed in Figure 1. Totally, 150 titles and abstracts were preliminarily reviewed, potentially eligible citations were searched online. Of which seven RCTs satisfied the eligibility criteria (6065 normal BMI patient; 27,713 high BMI). No other apparent bias was found among the included studies. Figure 1B and C shows the risk of bias summary.

D.D.M. investigated 326 TKRs in with BMI greater than 30 kg/m^2 were compared with the results of a matched group of 425 TKRs in with BMI less than 30 kg/m^2 [1]. G. Wallace studied 5396 patients with normal BMI who were compared with 26,951 patients with BMI greater than 30 kg/m^2 [2]. Ai li Rehei reported 159 TKRs with BMI greater than 30 kg/m^{2}were compared with 188 TKRs in with BMI less than 30 kg/m^2 [3]. Hui Gao found 439 TKRs with high BMI were compared with 81 TKRs in with normal BMI [4]. Zhimin Lai analyzed 31 TKRs with high BMI were compared with 49 TKRs with normal BMI [5]. Hongyu Song evaluated 46 patients with high BMI who were compared with 18 patients with normal BMI (total 64 TKRs) [6], and Zhiyong Zhu reported 27 patients with high BMI who were compared with 27 patients with normal BMI (total 102 TKRs) [7], and we independently reviewed the literature to identify relevant articles for full-text review. The reviewers independently applied the criteria described above and below to the full text of these articles to select articles for inclusion in this review. The reviewers are orthopaedic surgeons who are familiar with total knee arthroplasty surgery and are also trained and experienced in performing metaanalyses. Disagreement regarding the search was resolved by consensus, with arbitration by a third author (J.A.M.B.) if differences remained.

2.5. Statistical analysis

Statistical analyses were performed using the procedure Review Manager Software 5.3 (International Cochrane Collaboration, West China Hospital of Sichuan University, Si Chuan, China). For dichotomous outcomes, odds ratio (OR) with 95% CI (confidence interval) were calculated to estimate a pooled average difference between normal BMI with high BMI; WMD (weighted mean differences) and 95% CI were calculated for continuous outcomes. Statistical heterogeneity was quantitatively evaluated by Chisquare

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